

***ELECTRICAL
SPECIFICATIONS***

for

***AQUAVISTA CONDOMINIUM
EAST BAYSIDE
TORONTO, ONTARIO***

prepared for

Tridel Development Corporation

***Issued for Tender
October 30, 2015***

<u>SECTION</u>	<u>TITLE</u>
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16011	SHOP DRAWINGS, PRODUCT DATA AND SAMPLES
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16060	GROUNDING AND BONDING
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16088	ARC FAULT HAZARD STUDY
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PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- .1 Comply with the requirements of Tridel Development Corporation construction specifications and all documents referred to therein.

1.02 APPLICATION

- .1 This Section applies to and is a part of all Sections of Division 16.

1.03 DEFINITIONS

- .1 Wherever the term "This Sub-Contractor" is used in the Division 16 Drawings and Specifications, it means the firm having a subcontract with the "Contractor" to perform, supervise and co-ordinate all work of this Division.
- .2 Wherever the term "install" (and tenses of "install") is used in the Division 16 Drawings and Specifications, it means install and connect complete.
- .3 Wherever the term "supply" is used in the Division 16 Drawings and Specifications, it means supply only.
- .4 Wherever the term "Provide" or "Provision of" are used in relationship to equipment and other materials specified for the Work of Division 16 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 16, it means procure, supervise, take responsibility and pay for these services.
- .5 Whenever "Drawings and Specifications" are referred to herein, it means "the Contract Documents".
- .6 Wherever the terms "Authorities" or "Authorities having jurisdiction" are used in the Division 16, 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.
- .7 Wherever the term "Work" is used in the Division 16 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.
- .8 Wherever the term "Acceptable" is used in the Division 16 Drawings and Specifications it means acceptable to the Consultant.

1.04 WORK INCLUDED

- .1 Sections of Division 16 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 16010	Electrical General Requirements
Section 16011	Shop Drawings, Product Data and Samples
Section 16050	Basic Materials and Methods
Section 16060	Grounding and Bonding
Section 16075	Electrical Identification
Section 16087	Testing and Coordination Study of Distribution
Section 16088	Arc Fault Hazard Study
Section 16110	Elevator Requirements
Section 16114	Splitter Trough
Section 16120	Wire and Cable up to 600 Volts
Section 16130	Raceways and Boxes
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Section 16505	Lighting Luminaires
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Section 16575	Occupancy Sensor Lighting Controls
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Section 16615	Fire Alarm System
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Section 16920	Snow Melting System
Section 16921	Electric Pipe Heating Cables and Controls
Section 16923	Floor Warming and Heat Loss Replacement System
Section 16925	Carbon Monoxide Monitoring and Control System

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 16.
- 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 16 contractor has no financial obligation for permit application except for permits not covered in the "single permit".
- .2 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.

- .3 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.
- .4 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.
- .5 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.
- .6 This project will be undertaken to allow for LEED® PLATINUM certification. A number of specification sections in other contract documents outline important requirements that will affect Division 16 work associated with the LEED® certification process. Division 16 contractor must carefully review these sections in preparing their bid for this project and the successful Division 16 contractor must follow the requirements of all sections and bear all costs associated with services required to meet these requirements including;

01355 – Construction Waste Management
01360 – LEED Building Requirements
01362 – FSC Certified Wood
01363 – Indoor Air Quality Requirements
01364 – Construction IAQ Management
01810 – LEED Commissioning Requirements

A commissioning agent will be appointed to fully commission the lighting systems for this project. The commissioning agent will be involved in design stage, construction stage, performance testing stage, training stage, and operations and maintenance documentation stage. Division 16 contractor must carefully review the appropriate sections in preparing their bid for this project and the successful Division 16 contractor must follow the requirements of this section and bear all costs associated with services required to assist commissioning agent.

1.06 CONTRACT DRAWINGS

- .1 The Drawings for Electrical work are performance drawings, diagrammatic, intended to convey the scope of work 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.

1.9 RECORD DRAWINGS

- .1 The drawings for this Project have been prepared on a CAD system using AutoCAD 2006. For the purpose of producing record (as-built) drawings, copies of contract drawings may be purchased from the Consultant based on the following rates plus GST:

For 1 to 10 CAD files	\$550.00
For 11 to 20 CAD files	\$650.00
For 21 to 50 CAD files	\$850.00
For 51 to 100 CAD files	\$1,350.00
For greater than 100 CAD 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.

- .2 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.
- .3 At completion of the project, transfer all information from the white prints to the CAD files, and provide one CD with updated CAD files, to the Consultant as part of the close out documents.
- .4 The 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, manufacturers 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 warranty certificates, wherever given or required, in excess of the normal warranty period 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 Should relocations per outlet exceed 3000 mm from the original location the Contract Price will be adjusted accordingly.
- .3 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 ELECTRICAL LIST OF MANUFACTURERS, SUBTRADES AND PRICES

- .1 Submit with the tender the Electric List of Manufacturers, Subtrades and Prices appended to the Division 16 specifications.
- .2 At the time of tender closing, list the names of manufacturers or subtrades carried (one per item), the total cost of the Electrical Works, any separate, unit and alternative prices where indicated.
- .3 If this Subcontractor neglects to list the specified or acceptable manufacturers or lists more than one manufacturer per item, or lists manufacturers not specified, the Consultant will have the option of making the selection of the manufacturer.
- .4 There will be no substitutions of named manufacturers or subtrades after tender close except as approved by the Consultant.

1.25 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.

1.26 PHASING AND SCHEDULING OF WORK

- .1 Refer to Scope of work 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.

1.27 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.

1.28 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.

1.29 ELECTRICAL LEGEND & SCHEDULES

- .1 Refer to Electrical Drawings for Legend and Schedules

PART 2 - PRODUCTS

NIL

PART 3 - EXECUTION

NIL

END OF SECTION 16010

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PART 2 - PRODUCTS

NIL

PART 3 - EXECUTION

NIL

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.
- .6 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 co-ordinated 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 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 co-ordinated. 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.
- .3 Determine and verify:
 - .1 Field measurements.
 - .2 Field construction criteria.
 - .3 Catalogue numbers and similar data.
 - .4 Conformance with Specifications.

- .4 Co-ordinate each submittal with requirements of the Contract documents.
- .5 Each Shop Drawing will be stamped by the Consultant in the following format:

☐ NOT REVIEWED	☐ REVIEWED
☐ RESUBMIT	☐ REVIEWED AS MODIFIED
- .6 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.
- .7 Shop drawings shall be accompanied by a complete copy of the attached "Shop Drawing Submittal Sheet" Section 16011, Appendix 'A'.
- .8 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: Acceptable submissions are: reproducible transparency and one opaque reproduction, e-mail or CD-ROM. Faxed copies are not acceptable.
 - .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

NIL

PART 3 – EXECUTION

NIL

END OF SECTION 16011

Project:	AQUAVISTA CONDOMINIUM	Date:	
Project No.	8489D	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		

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PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, 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.
- .2 In waterproof concrete slabs and in other slabs where waterproof sleeves are required, provide Schedule 40 mild galvanized steel.
- .3 40 mild galvanized steel or suitable rigid, factory fabricated plastic sleeves.

2.02 ESCUTCHEON PLATES

- .1 One-piece chrome plated steel sized to completely cover sleeves and complete with set screws to secure the plates to the conduit. Split plates will not be acceptable.

2.03 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.

2.04 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:
 - .4 P25 caulk, Puty 303, penetration sealing system 7902 or 7904, composite sheet CS195 or wrap strip FS-195.
- .5 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.
- .6 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.
- .7 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.
- .8 "Gang" type sleeving will be permitted only with the Consultant's approval.
- .9 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.
- .10 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.
- .11 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 ESCUTCHEON PLATES

- .1 Provide escutcheon plates over all exposed conduit passing through walls, floors, ceilings, partitions, furrings, etc., in finished areas.

3.03 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.

3.04 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.

3.05 PLYWOOD

- .1 Provide all plywood indicated on the drawings required for the work of Division 16. The backboards shall be 19mm thick, good one side and shall be impregnated with fire retardant material.

3.06 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.

3.07 EXCAVATION AND BACKFILL

- 1. Do all excavating bedding backfill and related work for the work of Division 16 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.

3.8 CONCRETE

- 1. Do all concrete or related work required for the work of Division 16 as specified herein.
- 2. Division 16 shall be responsible for all co-ordination to meet authority having jurisdiction requirements for ducts, provision of ducts and fittings as specified.

3.9 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 16. Obtain the approval of the Consultant, before doing any cutting.

3.10 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.

3.11 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.

3.12 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.

3.13 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 16 to the acceptance of the Consultant.

3.14 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not 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.
 - .1a Local switches: 1150mm
 - .1b Local switches in suites: 1150mm
 - .2 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: 1150mm
 - .3 Panelboards (to top of panel trim): 1850mm
 - .4 Telephone and interphone outlets. 400mm

.5	Wall-mounted telephone and interphone outlets:	1150mm
.6	Fire alarm stations:	1150mm
.7	Fire alarm speakers:	2300mm or 150mm below ceiling
.8	Television outlets:	400mm
.9	Doorbell pushbuttons:	1200mm
.10	Pay Telephones:	1150mm

END OF SECTION 16050

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- 1.02 WORK INCLUDED

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- 2.01 MATERIALS

PART 3 – EXECUTION

- 3.01 INSTALLATION
- 3.02 TESTING

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, 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.
- .4 Ground buses - 7mm x 50mm x 915mm (1/4" x 2" x 36") solid copper. In the vault, provide ground bus around the entire room.
- .5 Ground electrodes - 3050mm x 20mm (120" x 3/4") copper clad steel ground rods.

PART 3 – EXECUTION

3.01 INSTALLATION

- .1 Bond the electrical system ground to the main water supply pipe on the street side of the main water valve. Ground conductors shall be a minimum 3/0 copper wire connected with approved fittings.
- .2 Provide electrodes to code requirements. Ground electrode to comprise three 3050mm x 20mm (120" x 3/4") copper clad steel ground rods with their tops driven 300mm (12") below grade. Space ground rods 3050mm (120") apart. Where required provide additional ground rods.
- .3 Provide a perimeter ground bus supported on the wall in electrical rooms, containing medium voltage switchgear, power transformer and secondary switchboards. Connect all electrical systems and equipment ground wires back to ground bus in the electrical rooms. Make connections to ground bus with cable lugs, bolted through the copper with shake-proof lock washers and nuts. This ground bus to be the sole interconnection point for ground connections to:
 - .1 Main secondary switchboards.
 - .2 High voltage switchgear.
 - .3 Power transformers.
 - .4 All exposed metal work.

- .4 Bond all interior non-electrical metallic piping systems to the electrical system ground including but not limited to water supply, waste water and gas systems.
- .5 Ground the neutral point of each secondary wye connected transformer.
- .6 Connect the ground bus inside each switchgear assembly to the grounding system.
- .7 Inside main secondary switchboards, connect the neutral bus to the ground bus with conductor rated minimum 25% main bus rating.
- .8 Final arrangement of grounding main secondary switchboards as approved by the ground fault system manufacturer.
- .9 Connect the ground bus in each 600 volt emergency distribution panel to the grounding system.
- .10 Ground all conduit, and all non-current carrying metal parts, equipment cases, frames, bases, brackets, frames of motors, duct systems, building steel, elevators, etc.
- .11 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, concrete encased conduit, conduit below grade and EMT conduit. Bond the ground wire to all boxes and luminaries.
- .12 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.
- .13 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.
- .14 Run a separate ground wire in all flexible conduits. Connect each end to ground bus or lug or connector.
- .15 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.
- .16 Provide weld connection or wrench type grounding connectors for:
 - .1 All connections between grounding conductors.
 - .2 All connections between grounding conductors and cable lugs.

- .17 Arrange grounding to provide the minimum impedance paths for ground fault currents. Provide any additional grounding required for approval by the inspecting authorities.
 - .18 Ground uninsulated metallic materials, which are located below surfaces heated by electric heating cable.
- 3.02 TESTING
- .1 Test the resistance of the grounding system. Add additional ground wires and ground rods if required as directed by the Consultant and retest. Repeat this process until ground resistance is 2 ohms or less. Conduct all tests using Megger Null Balance or Megger Universal ground resistance test equipment.
 - .2 Test all receptacles for proper connections with a neon lamp type polarity tester. Check that ground resistance is less than 0.2 ohms with an Edgecumbe Peebles Ltd., ground loop impedance tester.

END OF SECTION 16060

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- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS

PART 2 – PRODUCTS

NIL

PART 3 – EXECUTION

- 3.01 STANDARD IDENTIFICATION
- 3.02 PAINTING AND FINISHES

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, 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

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.
- .15 Use dymo tape to label each receptacle with its circuit number (e.g., UA-27).

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.

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- 3.01 EXTENT OF TESTING & INSPECTION
- 3.02 FIELD SETTINGS

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements and all documents referred to therein.

1.02 WORK INCLUDED

1. Retain the services of an independent (3rd party) firm to perform a short circuit and system coordination study including protection device evaluation.
2. The retained firm shall follow up with verification of settings on site before the system is energized.
3. The study shall begin at the 15kV utility service at the facility, continue through the corresponding 600V substation(s) and down through the 120/208V equipment. Include all downstream distribution and branch panelboards, motor control centres, and significant motor locations.
4. The study shall also include the generator and all associated emergency power distribution equipment, including automatic transfer switches and generator ground fault protection.
5. The studies shall be submitted to the Design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval from the Engineer may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.
6. The studies shall include all portions of the electrical distribution system from the normal power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.
7. The firm shall be currently involved in high- and low-voltage power system evaluation. The study shall be performed, stamped and signed by a registered professional engineer in the Province where the project will be constructed. A minimum of five (5) years of experience in power system analysis is required for the individual in charge of the project.
8. The firm performing the study shall demonstrate capability and experience and shall provide assistance during start up as required.
9. Contractor shall provide the required data for preparation of the studies. The Engineer performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.
10. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture

1.03 SUBMITTALS

- 1 The results shall be summarized in a final report. Submit report as per Section 16011.
- 2 The report shall include the following sections:

1. Descriptions, purpose, basis and scope of the study.
 2. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
 3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 4. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
 5. A one-line diagram of the system shall also be included.
- 3 Submit the study to;
- .1 Consultant
 - .2 Power Supply Authority
 - .3 Inspection Authority.

PART 2 – PRODUCTS

2.01 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY

1. The studies shall be performed with the aid of a digital computer programs and shall be in accordance with the latest applicable IEEE and ANSI standards.
2. The study shall provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations.
3. Highlight any equipment determined to be underrated as specified. Propose solutions to effectively protect the underrated equipment.
4. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low-voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
5. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
6. Include on the curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.
7. Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and

150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.

8. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.
9. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing and single line diagrams.
10. Include fault contribution of all motors in the study. Notify the Consultant in writing of circuit protective devices not properly rated for fault conditions.
11. Provide settings for the chiller motor starters or obtain from the mechanical contractor, include in the study package, and comment.
12. For the emergency generator, include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.
13. Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.
14. For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current and time to ensure protective devices will not trip during major or group start operation.

PART 3 – EXECUTION

3.01 EXTENT OF TESTING & INSPECTION

1. The engineering inspection and testing shall be done prior to the system being energized and shall include the following items where applicable:
 - .1 Testing, cleaning where necessary, and calibrating all relays and circuit breaker trip devices. (Calibration of all protective devices shall conform to requirements of approved co-ordination curves)
 - .2 Megger test interconnecting cables.
 - .3 Function test of associated control devices.
2. Transformers of 100 KVA and over shall be subject to the following tests:
 - .1 Insulation Resistance
 - .2 Ratio
 - .3 Polarity

.4 Phase Angle

3. Replace fuses destroyed or damaged during the testing.
4. Under a minimum of 50% rated load conditions perform an infra red scan of the main distribution equipment.

3.02 FIELD SETTINGS

1. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device evaluation study, and protective device coordination study.
2. The independent agency hired to carry out the studies as well as qualified and competent equipment service representatives for the applicable equipment shall be present for the length of the tests.
3. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.
4. Submit a copy of the study as part of the Operations and Maintenance Manuals signed by the retained firm confirming that all devices and protection relays have been left in accordance with the study requirements and recommendations.

END OF SECTION 16087

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PART 1 – GENERAL**1.01 SCOPE**

- .1 Furnish an Arc Flash Hazard Analysis Study. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in accordance with OESC.
- .2 The scope of the study shall include all new distribution equipment supplied by the equipment Manufacturer under this contract.

1.02 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements and all documents referred to therein.
- .2 Ontario Electrical Safety Code, Rule 2-306.
- .3 CSA Z462 Electrical Workplace Safety.
- .4 IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations.
- .5 ANSI/NEMA Z535.4 – Product Safety Signs and Labels.

1.03 SUBMITTALS FOR REVIEW/APPROVAL

- .1 The arc flash hazard analysis study shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.
- .2 The results of the arc flash hazard analysis study shall be summarized in a final report. No more than five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided.
- .3 For large system study with more than 200 bus locations, the contractor is required to provide the study project files to the Owner in electronic format. In addition, a copy of the computer analysis software viewer program is required to accompany the electronic project files, to allow the Owner to review all aspects of the project and print arc flash labels, one line diagrams, etc.
- .4 The report shall include the following sections:
 - .1 Executive Summary.
 - .2 Descriptions, purpose, basis and scope of the study
 - .3 Details of the incident energy and flash protection boundary calculations.
 - .4 Recommendations for system improvements, where needed.
 - .5 One-line diagram.

- .5 Arc flash labels shall be provided in hard copy and for large system study with more than 200 bus locations, a copy of the computer analysis software viewer program is required to provide arc flash labels in electronic format.

1.04 QUALIFICATIONS

- .1 The arc flash hazard analysis study shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- .2 The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.
- .3 The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.
- .4 The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis Study by submitting names of at least ten actual arc flash hazard analysis studies it has performed in the past year.

PART 2 – PRODUCTS

2.01 DATA COLLECTION

- .1 The Engineer performing arc flash hazard analysis study shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the study as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

2.02 ARC FLASH HAZARD ANALYSIS

- .1 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations..
- .2 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- .3 The Arc-Flash Hazard Analysis shall include all significant locations in 600 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.
- .4 Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².
- .5 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

- .6 The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- .7 The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
- .8 Fault contribution from induction motors should not be considered beyond 3-5 cycles.
- .9 Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- .10 For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- .11 When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- .12 Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- .13 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.03 REPORT SECTIONS

- .1 Arcing fault magnitude.
- .2 Protective device clearing time.
- .3 Duration of arc.
- .4 Arc flash boundary.
- .5 Working distance.
- .6 Incident energy.
- .7 Hazard Risk Category.
- .8 Recommendations for arc flash energy reduction.

PART 3 – EXECUTION

3.01 ARC FLASH WARNING LABELS

- .1 The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- .2 All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
- .3 The label shall include the following information, at a minimum:
 - .1 Location designation.
 - .2 Nominal voltage.
 - .3 Flash protection boundary.
 - .4 Hazard risk category.
 - .5 Incident energy.
 - .6 Working distance.
 - .7 Engineering report number, revision number and issue date.
- .4 Labels shall be machine printed, with no field markings.
- .5 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
 - .1 For each 600, 208 and applicable 120 volt panelboard, one arc flash label shall be provided.
 - .2 For each low voltage switchboard, one arc flash label shall be provided.
 - .3 For each switchgear, one flash label shall be provided.
 - .4 For medium voltage switches one arc flash label shall be provided
- .6 Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.02 ARC FLASH TRAINING

- .1 The contractor of the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours).

END OF SECTION 16088

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED

PART 2 – PRODUCTS

N/A

PART 3 – EXECUTION

- 3.01 INSTALLATION BY DIVISION 16

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide work required in conjunction with the installation of elevators as identified herein and in all other contract documents.

PART 2 - PRODUCTS

N/A

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Work required in conjunction with the installation and included in Division 16 for elevators will consist of the following items:
 - .1 In each machine room, provide a main line, fused disconnect switch located in view of each controller, rated and fused as per drawings and located adjacent to the lock side of the machine room door or as indicated on the elevator shop drawings.
 - .2 In the event the controller is NOT visible from the main line switch, provide a secondary fused switch near and in view of the controller.
 - .3 Provide power supply for each elevator capable of supplying the loads as identified on the contract documents. Wire between the disconnect switch and the elevator transformer / controller.
 - .4 The emergency power supply system shall be sufficient to start and run multiple elevator(s) at their full rated speed and capacity, together with necessary means for absorbing regenerated energy.
 - .5 The generator shall be able to run 1 elevator from each of the elevator banks.
 - .6 The emergency power will be provided on the same lines and the same disconnect as the normal power.
 - .7 Provide four wires from the transfer switch serving the respective elevators to connect two auxiliary contacts of the emergency power transfer switch to the elevator controller. One of these contacts will be so arranged that on normal power the two wires associated with it make a closed circuit and on emergency power present an open circuit. The other contact will be so arranged that the two wires associated with it present a closed circuit except for an adjustable period of time (a 5 to 50 seconds adjustment, set initially at 15 seconds) prior to power supply transfer in either direction, from normal to emergency or from emergency to normal.
 - .8 The cab lights to be so arranged as to be serviced from emergency power.
 - .9 In each machine room provide one 30/15 amp 120 volt, fused disconnect switch for each elevator, located adjacent to the lock side of the machine room door, to power cab ventilation and lighting equipment. The power for this circuit is to be derived from the emergency power supply.
 - .10 In each machine room, provide one 30/15 amp 120 volt, fused disconnect switch for each elevator, located adjacent to the lock side of the machine room door, to power cab exterior lighting.
 - .11 In each machine room, provide fluorescent lights, located in front of and behind each controller at approximately 2500mm from floor level and such additional fluorescent

- lighting as required to give a minimum illumination at floor level of 160 lux. The light switch is to be located adjacent to the lock side of the machine room door. The power for the lighting circuit is to be derived from the emergency power supply.
- .12 In each machine room provide duplex receptacles mounted on the wall and spaced at approximately 5000mm intervals.
- .13 In each machine room, provide a duplex receptacle (to power intercommunication equipment) mounted on a controller and connected to the emergency power supply.
- .14 In each pit, provide protected lights; locate clear of elevator equipment to give a minimum illumination at pit level of 160 lux. The light switch is to be located adjacent to the pit entrance and the power supply for the lighting circuit to be derived from the emergency power supply.
- .15 In each pit, provide duplex receptacles mounted on the wall, spaced at approximately 5000mm intervals and located clear of the elevator equipment.
- .16 Provide electric power during erection, for illumination, operations of tools and hoist, starting, testing and adjusting.
- .17 Provide fire alarm sensors in the machine room(s), hoistway(s) and pits connected to the fire alarm system.
- .18 Provide the following fire alarm signals to each elevator group controller(s) in the machine room(s) as listed below in order to initiate recall functions:
- .1 A signal from the smoke detectors in each elevator lobby;
 - .2 A signal from the pit detectors;
 - .3 A signal from the top of shaft detectors;
 - .4 A signal from the machine room detectors.
 - .5 Signals shall be tied only to the devices tied to that particular elevator group (ie, if the pit detector in West Tower goes off, only elevators in West Towers receives the signal).
- .19 Provide empty conduit from the nearest telephone room or closet for telephone line(s) to the CACF's and to each machine room.
- .20 Provide one 50mm empty conduit to interconnect from the hoistway of each elevator group to the CACF's. Terminated conduit in the hoistway at the main floor with a junction box, protruding no more than 70mm from the hoistway wall and to be so placed as not to interfere with the elevator equipment. Locate in the corner of the hoistway where the travelling cables are situated.
- .21 Provide one 50mm conduit from the CACF to the concierge desk.
- .22 All elevator wires outside the elevator shaft (from shaft to CACF and from CACF to concierge Desk) shall be pulled by Division 16.
- .23 Provide a dedicate circuit / receptacle in the CACF for elevator computer monitor.
- .24 Provide a building ground (2/0) from the main electrical room to each machine/control rooms.
- .25 All work associated with elevators shall be coordinated with the elevator equipment supplier prior to start of work.

END OF SECTION 16110

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED

PART 2 – PRODUCTS

- 2.01 SPLITTER TROUGH

PART 3 – EXECUTION

- 3.01 INSTALLATION OF SPLITTER TROUGH

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide all splitter trough(s) for a complete installation, as required by the contract documents.

PART 2 – PRODUCTS

2.01 SPLITTER TROUGH

1. Provide CSA approved splitter boxes, each complete with a formed, primed and painted steel box with knock-outs, hinged coverplate, suitable mounting provisions, porcelain blocks complete with one (1) main conductor lug and six (6) branch conductor lugs per block, and a nameplate giving its rating.
2. Splitter boxes ratings shall be as specified on the drawings.
3. Splitter boxes mounted outside the building or exposed to weather shall be weatherproof.

PART 3 – EXECUTION

3.01 INSTALLATION OF SPLITTER TROUGH

1. Install splitter trough wherever shown, and/or specified on the drawings.

END OF SECTION 16114

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 ACCEPTABLE MANUFACTURERS

PART 2 – PRODUCTS

- 2.01 BRANCH CIRCUIT CONDUCTORS
- 2.02 LOW VOLTAGE (24 VOLT) CONDUCTORS
- 2.03 MICC CABLE

PART 3 – EXECUTION

- 3.01 INSTALLATION OF BRANCH CIRCUIT CONDUCTORS
- 3.02 INSTALLATION OF LOW VOLTAGE (24) VOLT CONDUCTORS
- 3.03 INSTALLATION OF MICC & FIRE-RATED CABLES

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, 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 μ 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.
- .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 16120

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS

PART 2 – MATERIALS

- 2.01 HIGH VOLTAGE CABLE
- 2.02 STRESS CONES
- 2.03 PROTECTION AT TERMINATIONS
- 2.04 SPLICES AND SPLICING KITS
- 2.05 CABLE LUGS

PART 3 – EXECUTION

- 3.01 INSTALLATION
- 3.02 IDENTIFICATION
- 3.03 TESTING

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Provisions, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide power cables and all necessary components for a complete installation, as required by the contract documents.
- .2 Provide cables designed, assembled and tested in accordance with the latest IPCEA standard S-66-524, and of cable design to permit the following maximum conductor temperatures:
 - .1 Normal operation 90°C
 - .2 Emergency overload condition 130°C
 - .3 Short circuit condition 250°C
- .3 Provide cables suitable for installation in dry or wet conditions and where installed in underground duct banks capable of operating under continuous duty when immersed in water.

1.03 SUBMITTALS

- .1 Submit shop drawings of cables.
- .2 Submit cable short circuit withstand and damage curves, for co-ordination and system protection studies.

PART 2 – MATERIALS

2.01 HIGH VOLTAGE CABLE

- .1 Provide shielded single conductor cables meeting the following requirements:
 - .1 Rated: 15KV
 - .2 Insulation Level: 133%
 - .3 System Voltage: 13.8 KV, 3-phase grounded system.
 - .4 Construction: Stranded copper conductors; extruded semi-conducting crosslink polyethylene conductor shield; crosslink polyethylene insulation with extended semi-conducting polyethylene insulation shield and overall PVC jacket (90°C XLPE).

2.02 STRESS CONES

- .1 Provide stress cones as approved by the cable manufacturer and authority having jurisdiction.

2.03 PROTECTION AT TERMINATIONS

- .1 Provide Raychem or approved equal thermofit heat shrinkable high voltage terminations.

2.04 SPLICES AND SPLICING KITS

- .1 Provide splices and splicing kits to the approval of the cable manufacturer.

2.05 CABLE LUGS

- .1 Provide all cable lugs for all cable ends.

PART 3 – EXECUTION

3.01 INSTALLATION

- .1 Provide stress cones or fabricated slip-on terminators at cable terminations complete with thermofit heat shrinkable high voltage terminations. Where high voltage cables connect to metalclad switchgear insulate and seal the area between the high voltage cable terminations and the factory insulation on the bus bar.
- .2 Provide cables in one (1) continuous length between termination points where feasible. Where splices are required they shall be made only with the approval of the Consultant. Keep splices to a minimum and locate where they are readily accessible for inspection. Splices shall have physical strength, insulation values and resistance to moisture equal to or better than the cable construction. Have splices made by technicians in this work.
- .3 Verify the pulling and cutting lengths of cables with the cable manufacturer who shall confirm in writing that all pulling tensions, sidewall pressures and bending radii are in accordance with his recommendations.
- .4 Install cables in accordance with the manufacturer's recommendations and instructions, and pull through bends using pulley and sheaves having a minimum bending radius recommended by the cable manufacturer. Provide pulling irons, where required, to facilitate the installation of the cable.
- .5 Use only lubricants approved by the cable manufacturer for the installation.

3.02 IDENTIFICATION

- .1 Identify each feeder, pull pit or junction box with a lead tag showing the following information:
Feeder Circuit #
Coming From:
Going To:

3.03 TESTING

- .1 Factory Tests
 - .1 All factory tests shall be made by the manufacturer. Test each length of cable in accordance with the Specification under which it is manufactured. Submit three (3) copies of test report prior to shipment.
- .2 Site Tests
 - .1 Arrange to have cables tested on site after installation with a high potential test carried out by an approved testing specialist. Test cables in accordance with cable manufacturers recommendations.

END OF SECTION 16121

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED

PART 2 – PRODUCTS

- 2.01 CONDUITS
- 2.02 STANDARD OUTLET BOXES
- 2.03 PULLBOXES AND JUCTION BOXES

PART 3 – EXECUTION

- 3.01 INSTALLATION OF CONDUITS
- 3.02 INSTALLATION OF OUTLET BOXES
- 3.03 INSTALLATION OF PULLBOXES AND JUNCTION BOXES

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, 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 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 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 conduit connectors at terminations.
- 4. Galvanized steel flexible metallic conduit to CSA C22.2 No. 56, complete with suitable type 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 μ 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 octagonal boxes for lighting fixture outlets
 - .4 102mm 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 "Canadian Electrical 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 furrings 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 CEC Section 20.
11. Provide a separate ground conductor in all plastic and EMT conduit.
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 "Canadian Electrical 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 Canadian Electrical 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 Canadian Electrical 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 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 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 16130

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED

PART 2 – PRODUCTS

- 2.01 SUPPORT CHANNELS

PART 3 – EXECUTION

- 3.01 INSTALLATION

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements, and all documents referred to therein.

1.01 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 16134

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PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 ACCEPTABLE MANUFACTURER

PART 2 – PRODUCTS

- 2.01 STANDARD LINE VOLTAGE SWITCHES, RECEPTACLES AND PLATES
- 2.02 DIMMER SWITCHES

PART 3 – EXECUTION

- 3.01 INSTALLATION OF STANDARD LINE VOLTAGE SWITCHES, RECEPTACLES AND PLATES
- 3.02 INSTALLATION OF DIMMER SWITCHES

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with section 16010, Electrical General Provisions and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide all wiring devices and coverplates for a complete installation as required by the contract requirements.

1.03 SUBMITTALS

- .1 Submit shop drawings of all wiring devices.
- .2 Submit samples of receptacles, switches, dimmers and plates.

1.04 ACCEPTABLE MANUFACTURERS

- .1 The specifications are based on Hubbell wiring devices, unless noted otherwise. Acceptable alternates are Pass and Seymour, Leviton, Arrow Hart and Bryant.
- .2 Dimmer specifications are based on Lutron.

PART 2 - PRODUCTS

2.01 STANDARD LINE VOLTAGE SWITCHES, RECEPTACLES AND PLATES

- .1 Provide specification grade switches and receptacles as specified below:
 - .1 Provide CSA approved, specification grade switches and receptacles in all public areas to suit the intended function. Provide Hubbell "Style Line" or approved equal devices with white finish.
 - .2 Provide CSA approved, residential grade switches and tamper resistant receptacles in all residential suites. Provide Hubbell "homeSELECT" RRD15SxTR or approved equal devices with white finish.
 - .3 Provide CSA approved, residential grade tamper resistant 20 amp GFCI protected receptacles in residential suite kitchens as shown on plan. Provide Hubbell "homeSELECT" GFTR20x or approved equal devices with white finish.
- .2 Generally, faceplates for flush-mounted toggle switches and receptacles shall be in finished areas except residential suites; 0.04 inch thick type 302/304 non-magnetic stainless steel, smooth satin finish each supplied individually wrapped in a sealed protective envelope.
- .3 Residential Suites - White phenolic.
- .4 Unfinished areas - 0.06 inch thick impact resistant smooth ivory coloured nylon finish with captive screw feature for quick and easy installation.
- .5 Faceplates for surface-mounted switches and receptacles unless otherwise noted, shall be galvanised steel.
- .6 The colour of all devices must be approved by and confirmed with the Consultant prior to installation.

- .7 Receptacles located in all rooms, containing personal washing facilities such as washbasins bath tubs, showers, or similar devices and located within 3 metres of such devices shall provide GFCI protection (Hubbell Cat. No. GF5252IA).
- .8 All receptacles designated 'WP' (weatherproof) on the drawings shall be Hubbell GF5252IA receptacles and use Hubbell WP 26 weatherproof cover (WPFS26 for "FS/FD" box mount).
- .9 Special switches and/or receptacles are specified on the drawings and shall be complete with proper faceplates conforming to requirements specified herein before.
- .10 Dryer and range receptacles shall be supplied complete with suitable plug and cord connection.

2.02 DIMMER SWITCHES

- .1 Dimmers shall be UL listed for a broad range of dimmable CFL's, LED, halogen and incandescent sources.
- .2 The dimmers shall have adjustable low end trim to suit various dimmable sources.
- .3 Dimmers shall be provided with built in switch to turn off positively as dimmer is set to zero.
- .4 Dimmers shall be Lutron Maestro C L Series, rated for load and source based on proposed LED sources.
- .5 Provide dimming control system where show on plans and detailed on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION OF STANDARD LINE VOLTAGE SWITCHES, RECEPTACLES AND PLATES

- .1 Provide standard switches and receptacles in locations shown and/or specified on the drawings.
- .2 Equip each switch and receptacle with a faceplate with an opening or openings suitable for the device it conceals. Secure faceplates to the device frames with metal screws finished to match the faceplate.
- .3 The exact colour of switches and receptacles, and associated faceplates in any area must be approved by and confirmed by the Consultant prior to installation.
- .4 Furnish and turn over to the Owner, a sufficient quantity of keys for key lock switches.
- .5 Change location of outlets at no extra cost or credit providing distance does not exceed 3 m and information is given before installation.

3.02 INSTALLATION OF DIMMER SWITCHES

- .1 Provide dimmer switches in single and multiple ganged 3" deep outlet boxes as required for the application, shown on the drawings.
- .2 When grouping dimmers, refer to manufacturer's requirements regarding derating of dimming switches.

- .3 Provide matching line voltage switches, as specified, in rooms where dimmers and line voltage switches are shown.
- .4 Provide multi-gang coverplates where multiple dimmers/switches are used within the same area. Provide coverplates to suit dimmer line-up requirements.
- .5 Provide engraved identification for all slide controls. Exact description of zone designations to Consultant's approval.
- .6 The exact colour of dimmers and associated face plates shall be approved by and confirmed by the Consultant and Interior Designer prior to installation.

END OF SECTION 16140

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 REQUIREMENTS OF THE REGULATORY AGENCIES
- 1.03 WORK INCLUDED
- 1.04 SUBMITTALS
- 1.05 WARRANTY

PART 2 – PRODUCTS

- 2.01 ENGINE
- 2.02 ALTERNATOR
- 2.03 CONTROLS AND OPERATING SEQUENCE
- 2.04 TYPICAL/NORMAL OPERATING SEQUENCE
- 2.05 ENGINE/ALTERNATOR PACKAGING
- 2.06 LOOSE ITEMS
- 2.07 ADDITIONAL PROJECT REQUIREMENTS

PART 3 – EXECUTION

- 3.01 INSTALLATION
- 3.02 SERVICE
- 3.03 STARTUP & COMMISSIONING
- 3.04 TRAINING

PART 1 – GENERAL**1.01 REFERENCES**

- .1 Comply with Section 16010, Electrical General Requirements and all documents referred to therein.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- .1 The electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.
- .2 The generator set must conform to applicable CAN/CSA 282 requirements.
- .3 The generator set must be available with the Underwriters Laboratories listing (UL2200) for a stationary engine generator assembly.
- .4 The generator set must be pre-certified to meet EPA federal emission requirements for stationary standby. On-site emission testing & certification will not be acceptable for standby applications.
- .5 Obtain necessary information and prepare the appropriate documentation, make application to and obtain Ministry of Environment (M.O.E) certification for emissions and noise levels for the generator installation.

1.03 WORK INCLUDED

- .1 Provide, install, and acceptance test a complete and operable Emergency / Standby electric generating system, including all devices and equipment specified herein, as shown on the drawings, or required for the service. Equipment shall be new, factory tested, and delivered ready for installation.
- .2 Provide a standby power system to supply electrical power, capacity and system voltage as shown on the drawings. The generator shall consist of a liquid cooled spark-ignited engine, a synchronous AC alternator, with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.
- .3 The genset shall be applied at the listed ambient and elevation requirements for Toronto, Ontario.
- .4 The on-site gas pressure is 14 inches of water column.
- .5 Provide separate operating systems (for Condo and Artscape) as indicated on the contract documents.

1.04 SUBMITTALS

- .1 Submit the following information for review:
 - .1 Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
 - .2 Manufacturer's certification of prototype testing.
 - .3 Manufacturer's published warranty documents
 - .4 Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.

- .5 Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
- .6 Manufacturer's installation instructions.
- .7 Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

1.05 WARRANTY

- .1 The standby electric generating system components, complete generator set and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of two (2) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labor and travel.
- .2 The warranty period shall commence at the substantial completion date. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

PART 2 – PRODUCTS

2.01 ENGINE

- .1 ENGINE RATING AND PERFORMANCE
 - .1 The prime mover shall be a liquid cooled, spark-ignited, 4-cycle engine. It will have adequate horsepower to achieve rated kW output.
 - .2 The engine shall support a 100% load step.
 - .3 The system shall be sized and sequenced to allow emergency system loads as defined by CAN/CSA 282 to be transferred onto the generator(s) within 15 seconds. Non-emergency system loads will be sequenced onto the generator(s) as generator capacity comes on-line.
 - .4 The generator shall accept a load step of 100% of rated kW with a maximum frequency dip of 12 Hz.
- .2 ENGINE OIL SYSTEM
 - .1 Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).
 - .2 The engine shall operate on mineral based oil. Synthetic oils shall not be required.
- .3 ENGINE COOLING SYSTEM
 - .1 The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level. The radiator shall be designed for operation in 122 degrees F, (50 degrees C) ambient temperature.
 - .2 The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer.

- .3 Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must be provided to the outside of the mounting base for cleaner and more convenient engine servicing.
- .4 A radiator fan guard must be installed for personnel safety that meets UL and OSHA safety requirements.
- .4 ENGINE STARTING SYSTEM
 - .1 Starting shall be by a solenoid shift, DC starting system.
 - .2 The engine's cranking batteries shall be lead acid. The batteries shall be sized per the manufacturer's recommendations. The batteries supplied shall meet CAN/CSA 282 cranking requirements of 90 seconds of total crank time. Battery specifications (type, amp-hour rating, cold cranking amps) to be provided in the submittal.
 - .3 The genset shall have an engine driven, battery charging alternator with integrated voltage regulation.
 - .4 The genset shall have an automatic dual rate, float equalize, 10 amp battery charger. The charger must be protected against a reverse polarity connection. The chargers charging current shall be monitored within the generator controller to support remote monitoring and diagnostics. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.
- .5 ENGINE FUEL SYSTEM
 - .1 The engine shall be configured to operate on pipe line grade natural gas.
 - .2 The engine shall utilize a fuel system inclusive of carburetor, gas regulator, low gas pressure switch, and fuel shut-off solenoid. Generators larger than 80 kW are to include air-fuel-ratio control.
 - .3 The engines internal fuel connections shall be terminated to the generator frame via an NPT fitting for easy installation.
- .6 ENGINE CONTROLS
 - .1 Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.
 - .2 To support EPA emission requirements, gensets larger than 80 kW will incorporate an active air-fuel-ratio controller. The air-fuel-ratio controller shall be integrated into the generator controller to ensure security of settings and to support monitoring and remote diagnostics. External air-fuel-ratio controllers are not acceptable.
 - .3 Engine sensors used for monitoring and control are to be conditioned to a 4-20ma signal level to enhance noise immunity.
 - .4 All engine sensor connections shall be sealed to prevent corrosion and improve reliability.
- .7 ENGINE EXHAUST & INTAKE
 - .1 The engine exhaust emissions shall meet the EPA emission requirements for standby power generation.
 - .2 For generators larger than 80 kW, the engine will incorporate a 3-way catalytic convertor to meet EPA emission requirements.
 - .3 The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. A rain cap will terminate the exhaust pipe after the silencer. All components must be properly sized to assure operation without excessive back pressure when installed.
 - .4 The manufacturer shall supply a hospital grade exhaust silencer as standard.
 - .5 The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

2.02 ALTERNATOR

- .1 The alternator shall be the voltage and phase configuration as specified in section 1.03.2.
- .2 The alternator shall be a 4-pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.
- .3 The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating for 10 seconds.
- .4 The alternator shall support loads as indicated on contract drawings with a maximum voltage dip of specified in CAN CSA 282.
- .5 Three phase alternators shall be 12 lead, broad range capable of supporting voltage reconnection. Single phase alternators shall be four lead and dedicated voltage designs (600v) shall be six lead. All leads must be extended into a NEMA 1 connection box for easy termination. A fully rated, isolated neutral connection must be included by the generator set manufacturer.
- .6 The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment.
- .7 The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H" capable of withstanding 150 degrees C temperature rise.
- .8 The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel -- thermal magnetic breaker implementation are not acceptable.
- .9 An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings. A tropical coating shall also be applied to the alternator windings to provide additional protection against the entrance of moisture.

2.03 CONTROLS AND OPERATING SEQUENCE

- .1 GENSET CONTROLLER
 - .1 The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of CAN/CSA 282.
 - .2 The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation, synchronizing, load-sharing (real and reactive) and all related generator operations.
 - .3 Communications shall be supported with building automation via the Modbus protocol without network cards. Optional internet and intranet connectivity shall be available.

- .4 The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.
- .5 Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.
- .6 A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out to the local servicing dealer when maintenance is required.
- .7 Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and .2 msec data logging capabilities.
- .8 In addition to standard CAN/CSA 282 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.
- .9 The control system shall provide pre-wired customer use I/O: 4 relay outputs (user definable functions), 4 contact inputs, 2 analog inputs, communications support via RS232, and RS485. Additional I/O must be an available option.
- .10 Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.
- .11 The control panel shall include a touch screen to display all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per CAN/CSA 282.

2.04 TYPICAL / NORMAL OPERATING SEQUENCE

- .1 Upon the failure of utility power, the automatic transfer switch(es) (ATS) provides a two-wire start signal to the system controller. The system controller sends a start command to the generators via RS485 communication.
- .2 The emergency system transfer switch, shall transfer first.
- .3 The "non-life safety system" transfer switch shall transfer once the generator has stabilized and has adequate generator capacity.
- .4 Once utility power has returned, the two-wire start signal will be removed. The generator will run in a cool down mode, and then generator shuts down.
- .5 Transfer switches supplied shall be capable of being inhibited from transferring with a contact from the system controller. The transfer switches supplied shall also be able to shed load via trip-to-neutral feature -- the load is shed and does not re-close to a utility that may have a fault present. For applications in which load shedding with the transfer switch is not feasible, load shedding requirements will be evaluated and accommodated as necessary.

2.05 ENGINE / ALTERNATOR PACKAGING

- .1 The engine/alternator shall be mounted with internal vibration isolation onto a welded steel base. These units shall not need external vibration isolation for normal pad mounted applications.
- .2 A mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The breaker shall be rated between 100 to 125% of the rated ampacity of the genset. The line side connections are to feed from the alternator, and the load side of the breaker shall feed a paralleling switch. The breaker is to have aux contact and shunt trip. The breaker will function as a redundant tripping device in the system. If the paralleling switch fails to open, the generator breaker will be shunt tripped.
- .3 The generator shall include a unit mounted 120 volt convenience outlet.

2.06 LOOSE ITEMS

- .1 Supplier to itemize loose parts that require site mounting and installation.
- .2 Flexible fuel hose for use in gas piping installation.
- .3 Spare Parts:
 - .1 Fuses: One spare set
 - .2 Filters One spare set (air, fuel, oil)

2.07 ADDITIONAL PROJECT REQUIREMENTS

- .1 **Factory Testing**
 - .1 Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:
 - .1 Verify voltage & frequency stability.
 - .2 Verify transient voltage & frequency dip response.
 - .3 Load test the generator for 30 minutes.
 - .4 Verify paralleling and load sharing capabilities

.3 PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Contractor shall install the complete electrical generating system including all external fuel connections in accordance with requirements of CAN/CSA 282 and Ontario Electrical Safety Code, and the manufacturer's recommendations as reviewed by the Engineer.

3.02 SERVICE

- .1 Supplier of the genset and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of EGSA certified and factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

3.03 STARTUP AND COMMISSIONING

- .1 The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to check-out the completed installation and to perform an initial startup inspection to include:
 - .1 Ensuring the engine starts (both hot and cold) within the specified time.
 - .2 Verification of engine parameters within specification.
 - .3 Verify no load frequency and voltage, adjusting if required.
 - .4 Test all automatic shutdowns of the engine-generator.
 - .5 Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

3.04 TRAINING

- .1 Training is to be supplied by the start-up technician for the end-user during commissioning. The training should cover basic generator operation and common generator issues that can be managed by the end-user.
- .2 Training is to include manual operation of system.

END OF SECTION 16235

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PART 1 - GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 ACCEPTABLE – MANUFACTURERS

PART 2 - PRODUCTS

- 2.01 EMERGENCY POWER TRANSFER AND BYPASS ISOLATION SWITCH

PART 3 - EXECUTION

- 3.01 INSTALLATION OF EMERGENCY POWER TRANSFER SWITCH

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with section 16010, Electrical General Provisions, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide automatic transfer switches complete with all necessary auxiliaries required for a complete installation as per the contract requirements.

1.03 SUBMITTALS

- .1 Submit complete shop drawings.

1.04 ACCEPTABLE MANUFACTURERS

- .1 The specifications are based on Asco Electric.

PART 2 - PRODUCTS

2.01 EMERGENCY POWER TRANSFER AND BYPASS ISOLATION SWITCH

- .1 Provide transfer and bypass isolation switches of ampere capacity indicated on the drawings. The transfer and bypass isolation switches shall be 3-pole double throw for use on a 600/347V 3-phase, 4-wire, 60 Hertz system and shall be Asco 7000 Series. The transfer and bypass isolation switches shall be capable of withstanding without damage a short circuit of 200,000 amperes symmetrical when used in conjunction with current limiting fuses.
- .2 The automatic transfer switch shall be electrically operated, mechanically held and shall be rated for full load continuous duty on both tungsten filament and re-active loads. The switch shall be equipped with arc chutes and magnetic blow out coils.
- .3 In the event of a failure in any coil, the switch shall not be permitted to switch to a neutral position but shall always be maintained in a closed position. Failure of any continuously energized coil on the normal supply will cause the switch to automatically transfer to the emergency supply.
- .4 The switch shall contain an auxiliary contact which will close the automatic starting circuit of the emergency generator set on a normal power failure or if the normal voltage is reduced to 70% of the nominal rating or any phase.
- .5 The switch shall be equipped with the following feature:

Type 1	Time delay to override momentary normal source outages and delay all transfer switches and engine starting signals, adjustable from 0.5 to 6 seconds. Factory set at 3 seconds.
Type 2B	Transfer to emergency time delay. Adjustable from 0 to 1 minute for controlled timing of load transfer to emergency, factory set at 5 seconds.

Type 2E	Unloaded running time delay for emergency engine generator cool-down. Adjustable from 0 to 5 minutes factory set at 5 minutes.
Type 3A	Retransfer to normal time delay. Time delay is automatically bypassed if emergency source fails and normal source is available. Adjustable from 0 to 30 minutes. Factory set at 5 minutes.
Type 5A	Test switch to momentarily simulate normal source failure. Installed and connected on enclosure door.
Type 9A & 9B	Pilot lights to indicate switch positions. Green for connected to normal source and red connected to emergency source.
Type 14A & 14B	Auxiliary contacts, two contacts closed when the switch is in the normal position and 2 contacts closed when the switch is in the emergency position. The contacts should be rated 10 Amps and 600V.
Type 22	Fully rated solid neutral bar complete with lugs.
Type 27	In-phase monitor to ensure that on transfer and re-transfer motor load inrush currents do not exceed normal starting current.
Type 31	Elevator pre and post transfer signals.

- .6 The switch shall be mounted in NEMA 1 enclosure, complete with drip hoods.

PART 3 - EXECUTION

3.01 INSTALLATION OF EMERGENCY POWER TRANSFER SWITCH

- .1 Mount the switch where shown in accordance with the manufacturer's recommendations and connect complete as shown and detailed.
- .2 Provide from transfer switches, signal circuits to the elevator machine room controllers for pre-transfer signals (both directions); refer also to Section 16110.
- .3 Provide from the transfer switch a signal circuit to the fire alarm control panel to annunciate "Failure to start - generator".
- .4 Provide from each transfer switch (including fire pump transfer switch provided by others) a signal circuit to the generator control panel to initiate generator start up in the event of a normal power failure.
- .5 Obtain services from transfer switch manufacturer to commission each transfer switch.

END OF SECTION 16240

CONTENTS

PART 1 - GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.02 SUBMITTALS
- 1.03 CASH ALLOWANCE

PART 2 - PRODUCTS

- 2.01 MATERIALS

PART 3 - EXECUTION

- 3.01 INSTALLATION

PART 1 - GENERAL**1.01 REFERENCES**

- .1 Comply with Section 16010, Electrical General Provisions, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 The main electric service will be supplied for this project underground at 13,800 volts, 3-phase, 3-wire, 60 Hz by the Toronto Hydro Electric system (THES).
- .2 Supply all labour, tools, services and equipment and provide all the materials as required by the contract documents.

1.03 SUBMITTALS

- .1 Submit shop drawings and installation details to the consultant and supply utility for review.

1.04 CASH ALLOWANCE

- .1 A cash allowance will be carried by the owner to pay for THES charges. Co-ordinate all work with THES and draw from the allowance as required to pay the utility.

PART 2 - PRODUCTS**2.01 MATERIALS**

- .1 Duct bank shall be as shown on the plans.
- .2 Ducts to be Scepter Super Duct enclosed in a reinforced concrete envelope.
- .3 Duct spacers to be cast concrete or fibre, installed at maximum 1200mm (4'-0") centres to maintain a clear space of 51mm (2") between ducts.
- .4 Plastic duct spacers will not be acceptable.
- .5 Refer to Utility Standards for installation and obtain sign off prior to concrete pour.

PART 3 - EXECUTION**3.01 INSTALLATION**

- .1 Size and brace all primary cables and equipment to withstand the forces of the available fault current of 500 MVA.
- .2 Provide suitable lugs and stress cones for the termination of the incoming cables.
- .3 Provide suitable method of support in main electrical room for incoming cables.
- .4 Obtain approval from Toronto Hydro inspection prior to proceeding with the work.

- .5 On completion of installation, all ducts to be cleaned and all blocks cleared, to the approval of applicable authority.
- .6 Provide warning signs along the entire length of the concrete encased ductbank as required by the utility.
- .7 Provide warning signs on all doors leading to rooms with high voltage equipment as directed by the utility.
- .8 Provide cable tray and enclosure to the requirements of the utility from the end of the ductbank to the switchgear entry point.

END OF SECTION 16301

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 APPLICABLE STANDARDS
- 1.05 ACCEPTABLE MANUFACTURERS

PART 2 – PRODUCTS

- 2.01 15KV METAL CLAD SWITCHGEAR

PART 3 – EXECUTION

- 3.01 INSTALLATION
- 3.02 TESTS

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with section 16010 Electrical General Requirements and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide 15KV Indoor weatherproof CSA Type 3 Metal Clad Switchgear assembly and all labour, tools and services required to complete this section of the work.

1.03 SUBMITTALS

- .1 Submit shop drawings to the Utility for approvals.

1.04 APPLICABLE STANDARDS

- .1 All components shall be CSA and/or ULC approved listed, labelled and built to the following standards:
 - .1 CSA C22.2 #193 M1983
 - .2 CSA C22.2 #31-M89
 - .3 EEMAC G82
 - .4 ANSI C37.20.3, 1987
- .2 All equipment shall meet all requirements of Toronto Hydro as detailed and specified in their publication "Customer Owned 13.8 KV Switchgear". The Hydro specifications shall take precedence over these specifications.

1.05 ACCEPTABLE MANUFACTURERS

- .1 S&C Electric Company.

PART 2 - PRODUCTS

2.01 15KV METAL CLAD SWITCHGEAR

- .1 Enclosure: The enclosure shall be indoor weatherproof with front access only. Provide flat bolt-on covers on top, sides, and rear. Provide dished doors on front of cells with 135 degree opening. Provide full height and depth barriers between all sections. Seal all openings between sections with silicone based caulking. Welded frame, supports, barriers, doors, and covers to be fabricated by 11 gauge steel.
- .2 Finish: The switchboard shall be primed with (1) coat of rust resistant primer. Finish the interior in white and exterior in (2) coats of A.S.A # 61 Grey. Provide lamacoid mimic bus, nameplates, and all warning labels as required. Secure with self-tapping sheet metal screws.
- .3. Ratings of equipment shall be as follows:
 - .1 Rated voltage maximum: 15.0 KV
 - .2 Nominal operating voltage: 13.8 KV
 - .3 Frequency: 60 Hz
 - .4 Short circuit ratings: 25,000 amperes (sym), 500 MVA.
 - .5 Fault closing: 40,000 amps asymmetrical

- .6 Impulse withstand voltage (BIL): 95 kv
 - .7 Main copper bus: 600 Amp
 - .8 Corona extinction voltage to ground: 10.5kV RMS
 - .9 High potential test (one minute at 60 Hz: 36 kV).
- .4 Bay #1 and #2 each shall contain:
- .1 S&C "Alduty" interrupter switch, 3-pole, rated 600A, 40KA momentary, and 40KA fault closing at 13.2KV.
 - .2 Provide potheads to Toronto Hydro standards. Confirm requirements during shop drawing stage. Mount potheads to allow top terminations.
 - .3 Safety glass viewing window.
 - .4 Hinged front door with provision for padlocking.
 - .5 Provide connection to ground bus with a minimum 2/0 AWG copper wire.
 - .6 Provision for Airco indicators.
 - .7 Red mimic bus, nameplates, and warning labels.
 - .8 Operation counter.
 - .9 Ground bus and ground stirrup to Utility specification.
- .5 Bay #3,
- .1 S&C "Alduty" load break switch with snap action mechanism, rated 600A, 15KV, 40.0KA momentary and fault make 95KV BIL complete with provision for padlocking in 'on' and 'off' position, and key interlocks to prevent access to fuse compartment unless switch is open.
 - .2 Vacuum Circuit Breaker to meet all the requirements of Toronto Hydro's Customer Owned substations standards, as well as CSA, ANSI, ESA and code. The Circuit Breaker shall come complete with appropriately rated CT's and over current relay with 4 element 50/51, and 50/51N functions. The Circuit Breaker shall be used in place of a fuse for all installations 3 MVA and over in accordance with Toronto Hydro standards.
 - .3 Breakers shall be manually operated from the front of the switchgear only c/w visual indication of open, closed and charged. They shall also have provision for remote indication of status.
- .7 Bays #4, 5 6 and 7 shall contain:
- .1 S&C "Alduty" fused load break switch with snap action mechanism, rated 600A, 15KV, 40.0KA momentary and fault make 95KV BIL complete with provision for padlocking in 'on' and 'off' position, and key interlocks to prevent access to fuse compartment unless switch is open.
 - .2 Set of fixed mounted fuse clamps with power fuses, including six spares with holder in the room.
 - .3 Hinged access door on front complete with provision for padlocking.
 - .4 Safety glass viewing window.
 - .5 Red mimic bus, nameplates, and warning labels.
 - .6 Set of lugs as required with provision for stress cones, top exit.
 - .7 All necessary 600A copper bus bars, ground bus, barriers, supports, and insulators.
 - .8 Provide AIRCO voltage indicator c/w viewing window on the load side of fuses.
- .8 Fuses:
- .1 The fuses shall be power fuse assemblies. A fuse assembly shall consist of a renewable fuse unit complete with exhaust filter and blown fuse indicator.
 - .2 The fuse units shall be full range, non-aging and non-damageable. The time current characteristics shall be NEMA "E" type. A standard and slow speed shall be available for each rating up to 400E amperes. Each fuse shall contain a silver arcing rod

surrounded by epoxy cemented boric acid. The fuse units shall be able to withstand voltage upon interrupting, thereby not requiring trip-pin operation of the switch.

- .3 The fuses shall not have an MBC (minimum breaking current) nor shall they limit current such that over-voltages occur upon interruption. The fuses shall be constructed with a hinge on one end and a disconnecting latch on the other. It must be possible to remove the holder from the bay with only a grappler equipped hook stick. All fuses shall be immediately preceded by a dedicated load break switch, key interlocks to the main switches will not be acceptable. Fuses shall be S&C type SM-40. Six fuses shall be provided per feeder.

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 The main incoming primary service will be underground.
- .2 Contact the supply authority and coordinate all work under the responsibility of this section with that of the supply authority.
- .3 The incoming 15KV feeders will be provided by the supply authority. Provide all required ductbanks, hangers, supports, termination accessories and hardwood maple block spacers to suit the supply authority's requirements.
- .4 Working Drawings - immediately upon award of the contract, submit a complete set of electrical working drawings to Ontario Hydro Inspection and local authorities for approval as required under the applicable electrical code. In addition, and if required by the Commission, prepare and submit any other drawings required for approval.
- .5 Receive, install, wire and test on site the HV Switchboard.
- .6 Dismantle and re-assemble any items if access from point of receipt to final setting place is limited.
- .7 Join all shipping sections of HV Switchboard and connect all busses, enclosures, control wiring and miscellaneous items.
- .8 Install, co-ordinate and interface the equipment with its primary and secondary connection, do grounding, checking, testing and energizing of the entire system.
- .9 Delivery of HV Switchboard will be coordinated with availability of electrical room.
- .10 Procure the services of the supplier's factory trained technicians for the supervision of installation, field adjustments, calibration, testing and instructing of the Owner's staff.
- .11 Provide all required line and load side cable terminator for HV Switchboard equipment unless otherwise provided as part of the equipment.

3.02 TESTS

- .1 The switchgear shall be completely assembled, wired and adjusted at the factory to ensure the accuracy of wiring and correct functioning of the equipment.

- .2 The following routine factory tests shall be performed on the assembled switchgear structures:
- .1 Commercial frequency di-electric withstand tests on secondary, controls, and main power circuits and devices.
 - .2 Continuity of secondary and control circuit wiring.
 - .3 Mechanical tests to assure proper functioning of all parts of the assembly and interchangeability of the removable units.
 - .4 Operational tests under simulated service conditions to assure operability of all equipment and devices and correct mutual functioning of interrelated compartments.
 - .5 Other tests, as required, to be performed upon or with respect to component materials, parts or items in accordance with standards, trade practices or specified qualities pertaining to these components.
 - .6 The Owner reserves the right to witness all tests and/or inspect the completed switchgear assemblies at the equipment supplier's plant. It is the responsibility of the equipment supplier to notify the Owner in sufficient time so that a representative can be present during these tests and/or inspection, if so desired.
 - .7 Typed tests reports on Corona levels shall be submitted. The switchgear corona-free level shall be 14KV on components prior to assembly and on complete switchgear after assembly. Potential transformers shall have corona-free levels as guaranteed by the manufacture.
 - .8 Corona test to EEMAC G11-1 Standards.
 - .9 All test reports shall be submitted.

END OF SECTION 16302

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PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 APPLICABLE STANDARDS
- 1.05 ACCEPTABLE MANUFACTURERS

PART 2 – PRODUCTS

- 2.01 DRY TYPE TRANSFORMERS

PART 3 – EXECUTION

- 3.01 INSTALLATION

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010 Electrical General Requirements and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide Dry Type Power transformer(s) as specified herein and as shown on the contract documents.

1.03 SUBMITTALS

- .1 Submit Shop drawings indicating outline dimensions, connection and support points, weight, specified ratings and materials.
- .2 Submit product data indicating standard model design tests and options.
- .3 Submit manufacturer's installation instructions.
- .4 Submit operation and maintenance data

1.04 APPLICABLE STANDARDS

- .1 All components shall be CSA and/or ULC approved listed, labelled and built to the following standards:
 - .1 UL 1561: Dry Type General Purpose and Power Transformers.
 - .2 UL 1562: Transformers, Distribution, Dry Type over 600 Volts.
 - .3 IEEE C57.12.01: General Requirements for Dry Type Distribution and Power Transformers.
 - .4 NEMA ST-20: Dry Type Transformers for General Applications.
 - .5 NEMA 250: Enclosures for Electrical Equipment.
 - .6 ANSI C57.12.51: Requirements for Ventilated Dry Type Transformers.
 - .7 ANSI C57.12.70: Terminal Markings & Connections for Distribution & Power Transformers.
 - .8 ANSI C57.12.90: Guide for Short Circuit Testing of Distribution & Power Transformers.
 - .9 ANSI C57.12.91: Test Code for Dry Type Distribution & Power Transformers.
 - .10 CSA C22.2. No 47: Air Cooled (Dry Type) Transformers.
 - .11 CSA C9-M: Dry Type Transformers.
 - .12 CAN/CSA standard C802.2-00, Minimum Efficiencies Values for Dry Type Transformers.

1.05 ACCEPTABLE MANUFACTURERS

- .1 Acceptable manufacturers are Delta, Marcus, HPS Hammond, Cutler Hammer Square D and Siemens.

PART 2 - PRODUCTS

2.01 DRY TYPE TRANSFORMERS

- .1 The transformers shall be dry type.

- .2 The Transformer(s) shall be rated as noted on the contract drawings. Primary voltage 13,800 volts delta. Secondary voltage 347/600 volts 3-phase wye, 4-wire, 60 Hz as shown on the documents, with two 2½% full capacity above normal and two 2½% full capacity below normal primary taps. Impedance shall be manufacturer's standard impedance or as shown on the documents.
- .3 All transformers shall have a maximum temperature rise of 150°C above a 40°C maximum, 30°C average ambient.
- .4 The basic impulse levels (BIL) shall be a minimum of 95 kV BIL. Primary and secondary BIL shall be 95 kV and 10 kV respectively.
- .5 All coils shall be constructed of high grade, grain oriented, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. Core laminations shall be miter cut at the core corners to reduce hot spots, core loss, excitation current, and sound level. The laminations shall be clamped together utilizing insulated bolts through the core laminations to provide proper pressure throughout the length of the core.
- .6 Transformer coils shall be of the continuous wound construction and shall be impregnated in either polyester resin or thixotropic epoxy resin, and oven cured. Windings shall be vacuum impregnated a second time to ensure complete encapsulation.
- .7 The coils shall be wound with aluminum conductors.
- .8 The transformer enclosures shall be ventilated indoor with drip shields and fabricated of heavy gauge, sheet steel construction. Enclosures are to be provided with lifting devices bolted or welded to the base structure and shall have jacking pads designed to be flush with the enclosure. The base is to be constructed of structural steel members to permit skidding or rolling in any direction. Provisions shall be made to completely isolate the core and coil from the enclosure. There shall be no metal-to-metal contact. Rubber vibration isolation pads shall be visibly grounded to the ground bus or ground pad by means of a flexible-grounding conductor sized in accordance with applicable standards.

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Install transformer as unitized units or free standing, as shown on the contract drawings.
- .2 Floor-mount the transformer on a concrete base with vibration isolators as indicated on the drawings and on the acoustic report for the project.
- .3 Equip the transformer with lugs or connections suitable for the wiring connections specified. Isolate connections from transformer enclosure.

END OF SECTION 16303

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PART 1 - GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
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PART 2 - PRODUCTS

- 2.01 LOW VOLTAGE SWITCHBOARD
- 2.02 METERING CABINET

PART 3 - EXECUTION

- 3.01 INSTALLATION OF LOW VOLTAGE SWITCHBOARD
- 3.02 INSTALLATION OF METERING CABINET

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide service entrance switchboards and all necessary equipment.

1.03 SUBMITTALS

- .1 Submit Shop drawings of the entire assembly and all components.
- .2 Provide to the Owner a framed single line as-built diagram of the electrical distribution system and install in each electrical room.

1.04 ACCEPTANCE MANUFACTURERS

- .1 Acceptable manufacturers are Schneider Electric, Eaton Cutler Hammer and Siemens.

PART 2 - PRODUCTS

2.01 LOW VOLTAGE SWITCHBOARDS

- .1 General:
 - .1 Service entrance switchboard(s) shall be provided and installed as shown on the plans.
 - .2 The switchboard(s) shall consist of a main incoming section and one or more distribution sections as required for the feeder circuits, and shall be suitable for use on a 347/600V, 3-phase, 4-wire and solidly grounded system.
- .2 Construction:
 - .1 The vertical sections shall be of bolted steel channel frame with removable side and rear panels of code gauge steel. Provision for padlocking shall be provided for the main switch and the utility metering compartments. Provision for sealing shall be made on all panels covering unmetered bus. Full barriers shall be provided between the main section and the adjacent distribution sections.
 - .2 The distribution section shall be constructed so that operating handles of feeder devices are recessed from the face of the switchboard. The trim shall be split for ease of installation and safety.
 - .3 The switchboard shall be designed to be installed with the rear panels against a wall, so that ventilation and connection of all cables will be from the front.
- .3 Enclosure:
 - .1 The enclosure shall be sprinklered-proof with an extended top cover located on the front of the unit.
 - .2 The switchboard frame and panels shall be thoroughly de-greased and painted with light grey ASA 61 enamel (other colours may be substituted as an option).
 - .3 Engraved lamacoid nameplates, fastened with screws, shall identify main and distribution breakers and fusible switches as shown on the drawings.

- .4 Main Bus:
 - .1 The main bus shall be electrolytically tin-plated copper rated as shown on plans.
 - .2 Supported on a 2 inch stand-off insulator and braced to withstand stresses imposed by a short circuit of 42,000A RMS symmetrical, unless noted otherwise on the plans.
 - .3 Single bolt joints utilizing high strength steel bolts, large Belleville washers and locking strap shall be provided for ease of installation.
 - .4 Provision shall be made for future extension.
 - .5 A ground bus, bonded to each steel frame, shall be provided with a lug at each end suitable for 4/0 copper grounding cable.
- .5 Entry Options: Top entry and exit.
- .6 Main Device - Breaker:
 - .1 Electronic trip moulded case full function 100% rated circuit breaker, size as shown on plans and rated at 42 kA symmetrical, unless noted otherwise on the plans.
 - .2 The entire trip system shall be a microprocessor-based, true RMS sensing design.
 - .3 Provide the following time/current curve shaping adjustments to maximize system selective co-ordination. Each adjustment shall have discrete settings and each function is independent from all other adjustments:
 - .1 Adjustable Long Time Ampere Rating and Delay
 - .2 Adjustable Short Time Pick-up and Delay (delay includes 1²t in and 1²t OUT)
 - .3 Adjustable Instantaneous Pick-up
 - .4 Adjustable Ground Fault Pick-up and Delay (delay includes 1²t in and 1²t out)
 - .5 High Level Selective Override
 - .4 Circuit breakers(s) shall be provided with integral equipment protection for grounded systems.
 - .5 All lugs shall be UL Listed to accept solid and/or stranded copper conductors. Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating.
- .7 Utility Metering: Space and provision shall be made under the main switches to mount utility current and potential transformers in accordance with the local utility requirements. The contractor shall obtain the transformers and mount them in the switchboard. Secondary wiring shall be done by utility personnel.
- .8 Distribution Devices
 - .1 Circuit breakers 225 ampere frame and below shall be Square D with thermal-magnetic trip units and inverse time-current characteristics.
 - .2 Circuit breakers 400 ampere through 1200 ampere frame shall be Square D with microprocessor-based RMS sensing electronic trip units and the following features:
 - .1 Each moulded 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.

SERVICE ENTRANCE LOW VOLTAGE SWITCHBOARD

- .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 co-ordination 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 Owner's Instrumentation:
 - .1 Digital Meter Panel (type PM850): A digital meter panel for customers use shall be installed and factory wired in the first distribution section of the switchboard. The system shall be microprocessor based, displaying volts and current for each phase as well as power factor, frequency, THD voltage, THD current, K factor, KVA, KVAR, KW, and the accumulated MWH. The meter shall monitor and store the minimum values of volts and power factor and the maximum values of amperes, KW, KVA, KVAR, and KWD.
 - .2 The meter shall be designed to operate on systems to 600V without the need for control or metering transformers.
 - .3 All programmable parameters and accumulated values shall be stored in a non volatile memory in the event of a power failure.
 - .4 The power meter shall have a KYZ / KY pulse output.
 - .5 The power meter shall have a MODBUS RS 485 communications port

2.02 METERING CABINET

- .1 Provide metering equipment for the incoming electric services as shown.
- .2 Provide empty conduit between the incoming switchboard to the metering cabinet as shown.
- .3 Provide a 1/2" empty conduit complete with bushings at both ends between the revenue metering cabinet and the incoming telephone room for telephone service access.

PART 3 - EXECUTION

3.01 INSTALLATION A LOW VOLTAGE SWITCHBOARD

- .1 Install secondary switchboard as noted on the drawings and secure to a concrete housekeeping pad.

3.02 INSTALLATION OF METERING CABINET

- .1 Install metering equipment as shown.
- .2 Connect the equipment with conduit and provide fish wire for use by Toronto Hydro.
- .3 The conduit for telephone services shall be terminated at the top right hand corner of the cabinet.
- .4 Provide a 120 volt duplex receptacle in the bottom right hand corner of the cabinet and connect to emergency circuit.

END OF SECTION 16400

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PART 1 - GENERAL

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- 1.03 SUBMITTALS
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PART 2 – PRODUCTS

- 2.01 ENCLOSED SWITCHES (DISCONNECTS)

PART 3 - EXECUTION

- 3.01 INSTALLATION OF ENCLOSED SWITCHES (DISCONNECTS)

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, 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 Acceptable manufacturers are Schneider Electric, Eaton Cutler Hammer 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.
- .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 16410

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PART 1 - GENERAL

- 1.01 REFERENCES
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- 1.03 SUBMITTALS
- 1.04 ACCEPTABLE MANUFACTURERS

PART 2 - PRODUCTS

- 2.01 A/C CONTACTORS

PART 3 - EXECUTION

- 3.01 INSTALLATION OF CONTACTORS

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Provisions, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide contactors, to suit application, complete with all accessories for a complete installation, as required by the contract documents.

1.03 SUBMITTALS

- .1 Submit shop drawings of contactors.

1.04 ACCEPTABLE MANUFACTURERS

- .1 Acceptable manufacturers are Schneider Electric, Eaton Cutler Hammer and Siemens.

PART 2 - PRODUCTS

2.01 AC CONTACTORS

- .1 Provide magnetic full voltage contactors, Series A201 non-reversing type for heating and motor loads and Series A202 for lighting loads. Each contactor shall be suitable in all respects for the application.
- .2 Mount each contactor in a NEMA enclosure, complete with the necessary accessories including pilot light in cover.
- .3 The amperes rating, number of poles, etc., for contactors shall be as noted on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Install contactors as shown on drawings.
- .2 Comply with manufacturer's installation requirements.

END OF SECTION 16420

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- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 ACCEPTABLE MANUFACTURERS

PART 2 – PRODUCTS

- 2.01 GENERAL PURPOSE TRANSFORMERS – DRY TYPE

PART 3 – EXECUTION

- 3.01 INSTALLATION OF TRANSFORMERS

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide transformers for a complete installation as required by the contract documents.

1.03 SUBMITTALS

- .1 Submit Shop drawings of each transformer type.

1.04 ACCEPTABLE MANUFACTURERS

- .1 The specifications are based on Delta / Polygon Transformers. Acceptable alternates are Square "D", HPS Hammond, Siemens, Cutler Hammer, General Electric and ACME.

PART 2 – PRODUCTS

2.01 GENERAL PURPOSE TRANSFORMER – DRY TYPE

- .1 Three-phase Transformer:
 - .1 Transformers, sizes as shown on the contract documents, shall be 3-phase, 3 coils with a common core construction, 60 Hz.
 - .2 Primary winding shall be 600 volts, 3-phase, delta connected, complete with two full capacity 4.5% adjustment taps, 1 below (FCBN) and 1 above (FCAN) the rated voltage for 10 kVA and less, and four full capacity 2.5% adjustment taps, 2 below (FCBN) and 2 above (FCAN) the rated voltage for more than 10 kVA.
 - .3 Secondary winding shall be 208Y/120 volts, 3-phase, wye connected, with a 30° angular displacement (lagging) with respect to the primary winding.
 - .4 All winding conductors shall be of aluminum.
 - .5 Temperature rise at full load shall not exceed 150°C, with a class 220 insulation system.
 - .6 Standard impedance at 60 Hz.
 - .7 Standard audible sound level.
 - .8 Windings shall be wound with the secondary winding nearest to the core and shall be round coils.
 - .9 The core shall be constructed of high grade, grain oriented silicon steel laminations.
 - .10 The impregnation process for the core-and-coil assembly shall include a period under vacuum, followed by pressure impregnation using epoxy resin (EVI process).
 - .11 The transformer shall be isolated from the enclosure to reduce noise and vibration by means of anti-vibration pads.
 - .12 The transformer enclosure shall be fabricated from sheet steel and shall be of Type 2 (drip-proof).
 - .13 The enclosure coating shall be gray, ASA 61, and suitable for indoor/outdoor use.
 - .14 Transformer and enclosure shall be built as per the latest CSA standard C22.2 No.47.

PART 3 – EXECUTION

3.01 INSTALLATION OF SECONDARY DISTRIBUTION TRANSFORMERS

- .1 Floor-mount the transformers on a concrete base with Vibro-Acoustic Ltd., type "RCR" vibration isolators.
- .2 Equip the transformers with lugs or connections suitable for the wiring connections specified. Isolate connections from transformer enclosure.

END OF SECTION 16460

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PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, 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 Acceptable manufacturers are Schneider Electric, Eaton Cutler Hammer 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.

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 be Square D Type I-line. 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 and shall be Square or approved equal. 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 Square D with thermal-magnetic trip units and inverse time-current characteristics.
- .8 Circuit breakers 600 ampere through 1200 ampere frame shall be Square D with 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 POWER DISTRIBUTION PANELBOARDS – FUSIBLE SWITCH TYPE

- .1 Power distribution panelboards shall have fusible switches as specified below and include fuses with ratings indicated on the drawings. Panelboard shall be Square D type QMQB or QMB.
- .2 Fusible switch units shall be quick-make, quick-break design. Units 30 through 600A shall be rated not less than 200 kAIC with rejection-type clips for Class J type fuses. Units 800A and 1200A shall be rated for 200 kAIC with Class L fuse provisions. Fuses for these switches shall be supplied and field installed by the electrical contractor.

2.06 BRANCH CIRCUIT PANELBOARDS

- .1 The Minimum Integrated Short Circuit Rating for branch circuit panelboards shall be indicated on the drawings. Panelboards shall be 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.
- .4 Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts and 14,000 amperes symmetrical at 600 volts.

2.07 SUITE PANELS

- .1 Suite panels shall be Square D type QO load cent.
- .2 Circuit breakers shall be Square D type QO (plug-on) thermal magnetic trip, with an integral crossbar to ensure simultaneous opening of all poles in multi-pole circuit breakers.
- .3 Circuit breakers shall have an overcentre, trip-free, toggle-type operating mechanism with quick-make, quick-break action and possible handle indication.
- .4 Handles shall have ON, OFF, and "Tripped" positions. In addition, trip indication shall include a VISI-TRIP indicator appearing in the window of the circuit breaker case (through 125 amperes).
- .5 Circuit breakers shall have current ratings as noted on the plans. Interrupting ratings shall be selected to provide the required load centre short circuit current rating.
- .6 Single-pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall have the SWD marking.
- .7 Provide Class A ground fault interrupter circuit breakers where scheduled on drawings.
- .8 Provide arc fault circuit breakers as indicated on drawings.

2.08 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 c/w drip shield for surface-mounted enclosure unless otherwise noted.

2.09 NAMEPLATES

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

2.10 FINISH

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

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

3.03 FIELD SETTINGS

- .1 The 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 16470

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- 3.01 INSTALLATION

PART 1 – GENERAL

1.01 WORK INCLUDED

- .1 This section describes the materials and installation requirements for Surge Protective Devices (SPDs), for the protection of AC electrical circuits.

1.02 STANDARDS

Most recent editions of:

- .1 Underwriters Laboratories UL 1449 and 1283
- .2 ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002
- .3 UL 1449 Third Edition, effective 9/2009

1.03 LISTING REQUIREMENTS

- .1 SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification.

1.04 SUBMITTAL REQUIREMENTS

- .1 Submittals shall include UL 1449 listing documentation verifying:
 - .1 Short Circuit Current Rating (SCCR)
 - .2 Voltage Protection Ratings (VPRs) for all modes
 - .3 Maximum Continuous Operating Voltage rating (MCOV)
 - .4 I-normal rating (I-n)
 - .5 Type 1 Device Listing (labeled as a Type 2)
 - .1 VPR, MCOV, I-n, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCR's are posted in manufacturer's UL docs.
 - .2 UL data and visual inspection takes precedence over manufacturer's published documentation.
- .2 Submittals shall include shop drawings including manufacturer installation instruction manual and line drawings detailing dimensions and weight of enclosure, internal wiring diagram illustrating all modes of protection in each type of SPD required, wiring diagram showing all field connections and manufacturer's recommended wire and breaker sizes.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- .1 Subject to compliance, the following manufacturers are acceptable:
 - .1 Advanced Protection Technologies
 - .2 Siemens Industry
 - .3 Approved equal.
- .2 SPD shall be a Type 2, intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnects do not meet the intent of this specification.

- .3 SPD shall be UL labeled with 20kA Inominal (I-n) (verifiable at UL.com).
- .4 Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.
- .5 Minimum surge current capability (single pulse rated) per phase shall be:
- .1 Service Entrance or Transfer switch: 200kA
 - .2 Distribution panelboards & MCC: 100kA
 - .3 Branch panelboards: 50kA
- .6 SPD shall provide surge current paths for all modes of protection: L-N, L-G, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.
- .7 UL 144G Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	700V	700V	1200V	700V
480Y/277	1200V	1200V	1800V	1200V
600Y/347	1500V	1500V	2599V	1500V

- .8 UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V
600Y/347	20%	420V

- .9 SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.
- .10 SPD shall include visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED. SPD shall include an audible alarm with on/off silence function and diagnostic test function (excluding Distribution & Branch).

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 At Service Entrance a UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60A breaker is not available.
- .2 SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
- .3 Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to SPDs.
- .4 SPD shall be installed on the load side of the main service disconnect.
- .5 Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers.

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PART 3 – EXECUTION

- 3.01 INSTALLATION OF FUSES

PART 1 – GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, 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 The specifications are based on Ferraz Shawmut. Acceptable alternate is Bussman fuses.

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.

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PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Electrical General Provisions, Section 16010 and all other documents referred to therein.

1.02 WORK INCLUDED

- .1 A Cash Allowance will be identified for all light fixtures on the project under Division 1. The owner will assign the fixture package to the selected contractor upon formal award of contract.
- .2 Supply all labour, tools, services and equipment required to complete this section of the work.

1.03 SUBMITTALS

- .1 Submittals:
 - .1 Submit information in accordance with Section 16011.
 - .2 Submit shop drawings for all products as follows:
 - .1 Provide complete, fully dimensioned detail drawings including all major components and details fabrication of each fixture type.
 - .2 Provide requisite schematics and plans indicating assembly and installation of components.
 - .3 Submit ballast shop drawings with each applicable fixture shop drawing. If required by the Consultant, submit certified heat run test data for each type of ballast mounting.
 - .4 Submit information for each lamp type.

1.04 QUALITY ASSURANCE

- .1 All components to be approved/listed and labelled by an approved agency.

1.05 SOURCE QUALITY CONTROL

- .1 The Manufacturer of all products specified herein must have been engaged in the fabrication of the equipment for at least the past 5 years.
- .2 The Manufacturer must demonstrate that they have performed similar work on similar projects with regard to size and type of project within the past 10 years. Performance must be demonstrated on the selected projects, i.e., on-time delivery, successful implementation of the design with regard to quality, appearance, and construction.
- .3 The light fixtures listed in the light fixture schedule are pre-approved and are the standard of acceptance to be met through quality, performance, and architectural design.

1.06 DELIVERY AND STORAGE

- .1 All lighting equipment shall be individually packaged with sufficient, protective padding for the selected method of transport. All handling and shipping shall be performed in accordance with the equipment manufacturer's recommendations. Unopened containers shall be stored in a protected location.

1.07 WARRANTY

- .1 Provide Contractor warranties as well as factory warranties. All equipment and labor in this Contract shall be free from defects in products or workmanship for 18 months after substantial completion.

1.08 ACCEPTABLE MANUFACTURERS

- .1 Acceptable fixture manufacturers are as listed in the fixture schedules.

PART 2 - PRODUCTS

2.01 GENERAL

- .1 Provide new lighting fixtures complete with mounting accessories, junction boxes, trims, and lamps.
- .2 All products of a specified type are to be from the same manufacturer.
- .3 Fixture type catalogue numbers do not necessarily denote required mounting equipment or accessories. Provide complete mounting accessories appropriate for each mounting condition.
- .4 All fixtures shall be installed with a frame or canopy that is compatible with the ceiling type specified by the Consultant.
- .5 Provide appropriate accessories for proper mounting of all fixtures. Include plaster frames for plaster ceiling and firestop protection for fixtures in rated ceiling. For fixtures suspended from ceiling, provide pendants or aircraft cables complete with accessories to complete the installation as indicated on the drawings.
- .6 Where light fixture or light fixture suspension apparatus penetrates metal pan or sheet metal ceiling or canopies, an approved copy of the shop drawings of those fixtures shall be provided to the ceiling manufacturer. Apertures in the ceiling or openings for suspension cables shall be pre-cut by the ceiling manufacturer to suit light fixtures. Instruct the manufacturer accordingly.
- .7 If the words "equivalent" or "approved equal" are not indicated after light fixture manufacturer and catalog number in the fixture schedule, no other manufacturer will be acceptable for that particular type.

2.02 LAMPS

- .1 All fixtures shall be provided with proper, new, and operable lamps. Provide lamps indicated on the Fixture Schedule, or, if not indicated, as recommended by the fixture manufacturer. Lamps shall be compatible with the respective fixture in all cases.
- .2 All alike lamps shall be by one manufacturer.
- .3 Provide fluorescent lamps with tri-phosphor, rapid-start lamps, 3500 Degrees Kelvin Correlated Colour Temperature (CCT), unless noted otherwise in the Fixture Schedule. Allowance for change of fluorescent lamp CCT shall be included in this contract. Final CCT will be determined during shop drawing review of light fixtures.

- .4 Provide 32W T8 fluorescent lamps with 3500 Degrees K CCT, 1220mm (48") lamp length, a minimum CRI of 80, quality unless otherwise specified by the Fixture Schedule. Allowance for change of fluorescent lamp CCT shall be included in this Contract. Final lamp CCT will be determined during shop drawing review of light fixtures.

2.03 LAMP HOLDERS

- .1 Lamp holders shall hold lamps securely to prevent damage caused by normal vibrations and maintenance handling.
- .2 Provide porcelain body, solid nickel or nickel-and-silver-plated contacts, and socket with prelubricated silicone compound.
- .3 Fluorescent lamp holders shall have a white urea plastic body and silver plated phosphor bronze or beryllium copper contacts.

2.04 BALLASTS AND TRANSFORMERS

- 1 High Intensity Discharge Ballasts:
 - .1 High intensity discharge ballasts shall be capable of operating lamps indicated on fixture schedule and shall comply with the relevant ANSI codes.
 - .2 All ballasts shall be by one manufacturer unless otherwise noted.
 - .3 Ballasts for operation in cold conditions shall be rated for -20 degree C.
- 2 Fluorescent Ballasts:
 - .1 Ballasts shall be instant start, operating lamps in parallel, such that failure of one lamp will not affect the other lamp.
 - .2
 - .3 Ballast shall be capable of operating lamps indicated on fixture schedule at full light output, unless specified otherwise.
 - .4 All ballasts shall be by one manufacturer unless otherwise noted.
 - .5 Ballasts for T5, T4 and T2 lamps shall contain dynamic end of life sensing circuitry.
 - .6 Ballasts shall operate at a frequency of 20 KHz and lamps shall have no detectable flicker.
 - .7 Ballasts shall be instant start, unless otherwise noted, voltage as noted on the fixture schedule with an operating frequency of 60 Hz.
 - .8 Ballast shall have a 0.95 minimum power factor.
 - .9 Ballast sound levels shall not exceed Class A ambient noise levels.
 - .10 Ballasts shall be cUL listed, Class P, Type 1 and CSA certified.
 - .11 Ballast shall contain integrated electronic circuits, incorporating silicon chip to monitor incoming voltage and produce light output with less than 10% fluctuation of input voltages from 90 to 145 volts or 330 to 370 volts.
 - .12 Total input current harmonic content shall not exceed 20%.
 - .13 Ballast shall meet FCC Standard for EMI/RFI (FCC 47 CFR Part 18, non consumer), ensuring suitable application for commercial and industrial application.
 - .14 Ballasts shall be capable of starting lamps at low temperature, (-17 Degrees C) for exterior fixtures or as listed on the fixture schedules.
 - .15 Ballast case temperature shall not exceed 70 Degrees Celsius.
 - .16 Ballast shall be designed in accordance with applicable ANSI Ballast/Lamp Specifications including maximum crest factor of 1.7.
 - .17 No polychlorinated biphenyls (PCBs) will be permitted.
 - .18 For frequently switched fixtures, provide "Programmed Start Ballasts".

2.05 FIXTURE CONSTRUCTION

- .1 General:
 - .1 All fixtures shall be free of inappropriate light leaks.
 - .2 Fixtures in non-accessible ceilings and in the columns shall have accessible junction boxes, ballasts, and transformers through fixture apertures.
 - .3 No metal clips, screws, angles, etc. shall be visible when the fixture is viewed from below.
 - .4 All mounting frames installed in damp locations or in plaster ceiling shall be galvanized.
 - .5 Extruded fixture housings shall have a minimum thickness of 2.3 (3/32") mm and be smooth and free of tooling lines. Die-cast end plates and joiner sections shall have a minimum thickness of 2 (3/32") mm thickness and concealed fasteners.
 - .6 Die-casts shall be smooth, free of pits, grooves, and imperfections.
 - .7 Spinning shall be smooth and clean with finished edges, and free of spinning lines.
 - .8 Sheet metal fixture housings shall be of welded construction with seams filled and ground smooth. Any exceptions shall be noted under individual fixture types.
 - .9 All adjustable fixtures shall have locking rotation and tilt devices.
 - .10 Pendant-mounted fixtures shall have stems with ball swivels or be cable-mounted to allow 45 degrees swing in any direction from vertical.
 - .11 Ball swivels and cables end hardware shall be concealed with sleeve.
- .2 Fixture utilizing both 120 volt services and 347 volt services or utilizing more than one 120 volt service or more than one 347 volt service shall have wiring sections and separate wiring connections and labelling as necessary to satisfy all Code and local inspection requirements.
- .3 Reflector Cones:
 - .1 Provide 45 Degrees lamp image cut-off when viewed from below unless indicated otherwise.
 - .2 Reflector cones shall have a minimum thickness of 0.8 (0.03125") mm and be manufactured of uniform gauge Alcoa 3002 alloy, free of spin marks, or other manufacturing defects. The use of plastic for cones or trim rings is not acceptable.
 - .3 Reflector finish shall be semi specular by means of an Alzak process. Reflector inner surface shall be free of water spotting and shall maintain a reflectivity ratio of no less than 80% on clear specular finish unless otherwise noted.
 - .4 Cone flange shall be formed as an integral part of cone and shall have identical appearance as inner cone unless otherwise indicated. Flange overlap shall have a perpendicular orientation to cone and shall have adequate width to cover ceiling opening with no visible light leaks.
 - .5 Fixtures with Alzak reflector cones shall all be furnished by the same manufacturer, unless otherwise indicated. All reflector cones shall have iridescent suppressant finish for fluorescent and HID fixtures unless otherwise specified.
- .4 Parabolic Louvre Assemblies:
 - .1 Louvre assemblies shall be shipped and stored in plastic bags and shall not be installed until construction has progressed to a suitably clean stage. Single piece peel-off seal on bottom of louvre is not acceptable. No construction dust or paint shall be allowed to accumulate on the louvres at any time. Louvres shall be constructed with minimum 0.6 (0.0235") mm Alcoa licensed process Coilzak semi-specular iridescent suppressant anodized aluminium. All louvre blades shall have parabolic designed curvature. All cell sizes shall be equal unless otherwise specified.
- .5 Unless otherwise noted, lenses for use with fluorescent fixtures shall be of minimum 3.175mm (0.125") thickness.
 - .1 Material shall be light-stable 100% virgin acrylic with minimum 98% transmittance unless otherwise indicated. Acrylic shall conform to minimum standards of IES-

NEMA-SPI, and have a minimum thickness of 3mm. Material shall perform as applied for a period of 20 years with no greater than 5% transmission loss.

- .6 Parabolic Baffles: All parabolic baffles shall be straight and paralleled with equal cell sizes. Baffles placed end to end shall have no visible break in appearance. Baffles shall be constructed with minimum 0.6mm (0.0235") Alcoa licensed process Coilzak semi-specular iridescent suppressant anodized aluminium unless otherwise specified.

2.06 FLUORESCENT FIXTURES

- .1 The fixture housing pressure fit construction or utilizing rivets shall not be accepted and, when applicable, shall have lenses in hinged frame utilizing hidden release mechanisms of a heavy duty standard (i.e., visible frame releases will not be accepted). Lenses shall be securely retained in the frame assembly utilizing the equivalent of stainless steel spring clips.
- .2 Fixture reflectors, unless specifically designed using specular metal, shall have a complete coverage of white alkyd reflecting enamel. Enamel shall have a minimum 85% reflectivity, applied by either an electrostatically charged spray or dip process then baked in a temperature controlled oven until paint is thoroughly cured. Prior to applying enamel, each metallic surface shall be prepared using a five stage hot zinc phosphatizing process.
- .3 All fluorescent fixtures other than those with cool white rapid-start lamps shall have the following wording stencilled above each lamp and visible only when the lamp is removed: "RE-LAMP ONLY WITH (...TYPE) LAMPS". Type shall include colour, temperature and lamp series.
- .4 All painting to be done after cutting.

2.07 FIXTURE FINISHES

- .1 Painted fixtures shall have synthetic enamel, with acrylic, alkyd, epoxy, polyester or polyurethane base applied after the fixture is completely constructed. Paint shall be light stabilized, baked on at minimum 180 Degrees C, and catalytically or photochemically polymerized after application.
- .2 All metal parts shall be cleaned and treated with phosphate or chromate bonding process after fabrication for maximum paint adhesion.
- .3 All polished decorative metals, (brass, chrome, etc.), shall have a clear protective finish, baked-on lacquer or air-cured urethane.
- .4 All custom colour finishes are to be approved by the Consultant.
- .5 All fixtures, lenses, diffusers and fittings to have a flame spread rating of less than 250.

2.08 LIGHTING FIXTURE SCHEDULE

- .1 Catalogue numbers in the Lighting Fixture Schedule are shown to indicate approved manufacturer and fixture quality requirements. The numbers may or may not include variations or special light fixture features as specified in the associated fixtures carried in his bid include all features as specified in the Schedule.

2.09 EXTERIOR LIGHTING

- .1 Supply and install exterior lighting as indicated in the FIXTURE SCHEDULE and as shown on the Drawings complete with poles, arms, light fixtures, lamps, anchor bolts and setting template, nut covers and other accessories necessary for proper installation. Finish all metal surfaces with zinc chromate primer, and finish paint as directed by the Consultant.

2.10 WIRE GUARDS

- .1 Provide wire guards to all fixtures that are mounted so that any part of the fixture is less than 2400mm (8'-0") above adjacent floor, unless noted otherwise in the fixture schedules.
- .2 All fixtures in storage rooms and services rooms shall have wire guards.

PART 3 - EXECUTION

3.01 VERIFICATION OF CONDITIONS

- .1 Confirm all ceiling depths against final architectural ceiling plans and sections to ensure that recessed fixtures can be installed in all ceiling conditions and advise the Consultant immediately of any discrepancies prior to ordering of the fixtures or proceeding with the Work.

3.02 INSTALLATION - GENERAL

- .1 Lighting fixtures shall be installed as indicated on architectural reflected ceiling plans, Electrical Drawings and per approved shop drawings.
- .2 Lighting fixtures are indicated in the Lighting Fixture Schedule by means of type letters, which correspond to similar letters on the plans.
- .3 Lighting fixtures shall be installed in accordance with fixture manufacturers written instructions, applicable requirements of CED, applicable authorities, and with recognized industry practices.
- .4 Verify locations and spacings of lighting fixtures with reflected ceiling plans and notify Consultant of any variance or conflict between the plans and field conditions. Do not proceed until conflict has been resolved.
- .5 Work shall be co-ordinated with other trades. Lighting fixture locations shall have priority over location of ducts, diffusers, sprinklers, smoke detectors and other non-structural obstructions.
- .6 All fixtures shall be supported directly from the building structural members or from bridging attached to the structural members by rod hangers and inserts. Provide all necessary hardware and blocking to ensure that fixtures hang true, square, plumb, and in proper alignment.
- .7 Fixtures installed in suspended T-bar ceiling shall be equipped with suspension chains, securely fastened to fixture and slab above. The light fixture shall be centred in the ceiling grid opening. Provide a minimum of two chains, one each on diagonal opposite corners, and provide more chains if required by local authority having jurisdiction.
- .8 Provide every light outlet in the building with a lighting fixture as instructed complete with lamps and other accessories necessary for its proper installation and operation. If a fixture type is not designed for any particular outlet, obtain the necessary details from the Consultants prior to submission of tender. Alternatively, supply a suitable fixture for the outlet involved as directed by the Consultants.

- .9 Effectively ground all fluorescent fixtures. Fixtures with their sockets so far apart as to give less than perfect contact at the lamps, or with poor grounds, will be rejected and shall be replaced by the Contractor without charge.
- .10 For exact location of ceiling mounted lighting fixtures, refer to Architectural reflected ceiling plan.
- .11 Install lighting fixtures true to the surface in or to which they are mounted, and except where otherwise indicated on the Drawings, align correctly with building or room walls as the case directs. Mount wall fixtures at elevations specified or as shown on Architectural or Electrical Drawings. Where no elevation is shown, confirm mounting height with the Consultant prior to rough-in.
- .12 Where lighting fixtures are stem hung from 'ball and socket' swivels at the ceiling, use stranded wire, #16 AWG (19 x 29) minimum size from outlet box to the fixture.
- .13 Where lighting fixtures are chain-suspended, use solid conductor in armoured cable or flexible conduit and secure to chain with white or clear nylon cable ties.
- .14 Provide lamicoid plate (white letters on blue background) with inscription "UPS" or "EMERG" and fasten to T-bar or fixture frame for all lighting fixtures connected to the UPS or emergency system.
- .15 All parts of all fluorescent and high intensity discharge lighting fixtures shall be securely fastened and if necessary fitted with neoprene spacers to minimize ballast noise amplification.
- .16 All fixtures shall be installed with the bottom of the fixture housing aligned with the finished ceiling line unless otherwise noted in manufacturers installation instructions.
- .17 Ceiling insulation shall be a minimum of 75 (3") mm away from fixture.
- .18 Support recessed fluorescent fixtures by four hangers per fixture minimum independent of ceiling structure or tee bars unless ceiling system is designed to carry the fixtures. In this case, provide seismic restraints only.
- .19 Support recessed compact fluorescent by one hanger per fixture minimum independent of ceiling structure or tee bars.
- .20 Provide wiring channel for mounting of fluorescent fixtures and wiring in between fixtures, suspended below mechanical piping, ductwork, etc., as directed on 15mm (0.6") rigid conduit or 10mm (0.4") galvanized rod hangers, on 2440mm (8 ft.) centres.
- .21 Nominal size of channels 70 x 70, 10mm (0.4") steel minimum, baked white enamel finish, complete with channel connectors, and closure pieces, coverpieces, mounting hickies, fixture connectors, etc., with jointer pieces 300mm (12") in length minimum to form a rigid assembly.

3.03 INSTALLATION OF RECESSED FIXTURES

- .1 Holes shall be cut to exact fixture size so that no gaps will be present when trims or cones are installed.
- .2 Round holes in acoustical tile ceilings shall be cut using adjustable diameter cutter on slow speed drill press.

- .3 Holes in metal pan and/or sheet metal ceiling and/or ceiling canopy shall be pre-cut by ceiling manufacturer based on approved shop drawings of the light fixtures located in these areas. Electrical contractor shall be responsible for co-ordination between Division 16 and metal ceiling manufacturer(s) of light fixture installation in areas with metal ceilings.
- .4 Provide plaster frames or plaster trim as required and turn same over to the ceiling section for installation.
- .5 Installation of trims shall be tight with no gaps or light leaks. Reflector cones, baffles, aperture plates and decorative elements shall be installed after completion of plastering, ceiling tile work painting, and general clean-up in areas. Caulking or sealing fixture trim cones to ceiling to eliminate light leaks or gaps shall not be acceptable.
- .6 Where fixtures are recessed into non-accessible ceiling and the fixtures specified are not pre-wired, wire to an outlet box adjacent to each fixture and visible only when the fixture is removed, connect to the fixture with suitable high-temperature wire in at least 1200mm (48") of flexible conduit. Install fixtures so that they may be readily removed to gain access to these outlet boxes.
- .7 Provide insulated housings on all recessed lighting fixtures installed in ceilings where thermal insulation is installed.

3.04 INSTALLATION OF LINEAR FIXTURES

- .1 Linear fixtures, surface mounted or suspended, shall not have more than 6mm (1/4") variation in alignment for any 5 metre (17 feet) run.
- .2 In spaces with metal pan or sheet metal ceiling installation of linear fixtures shall be co-ordinated with ceiling supplier and installer. Refer to mounting details on Electrical, Architectural, Interior Design drawings and manufacturer recommendation.

3.05 INSTALLATION OF TRACK LIGHTING

- .1 In spaces with parallel rows of track, all track shall be installed such that neutral conductors and feeds have the same orientation.

3.06 INSTALLATION OF LAMPS AND BALLASTS

- .1 At the time of occupancy of any area, all lamps within that area shall be in proper place and working order. High intensity discharge lamps and long-life exit sign lamps, which fail after this time shall be replaced by the Contractor up until expiration of specified warranty.
- .2 Should the Contractor request and receive approval to use the new permanent lighting fixture system (fluorescent only) for construction purposes (i.e. temporary lighting) and the use of the permanent fixtures is in excess of sixty (60) days prior to occupancy or substantial completion (whichever is first), the Contractor shall supply replacement lamps as follows:
 - .1 60-150 days - 10% of total lamps involved
 - .2 151-250 days - 20% of total lamps involved
 - .3 251-350 days - 50% of total lamps involved
 - .4 351-450 days - 100% of total lamps involved
- .3 Provide 2% of the total quantity of spare lamps of all types and turn over to the client. Obtain receipt and submit the same to the Consultant.

- .4 Noisy ballasts shall be replaced at the Contractors expenses. The decision as to what constitutes a noisy ballast rests solely with the Consultant.

3.07 FIELD QUALITY CONTROL

- .1 Operate each fixture after installation and connection. Each fixture shall be inspected for proper connection and operation.
- .2 Perform testing of operation of temporary or emergency power systems.
- .3 Verify that all lenses, louvres, baffles, fixture trim cones, diffusers and other parts are thoroughly cleaned in a manner recommended by the manufacturer.
- .4 Replace all lamps used during construction with new lamps prior to final acceptance of the Project.

3.08 LUMINAIRE WIRING

- .1 Connect recessed luminaries to outlet boxes with 10mm (0.4") flexible conduit and 90 Degrees C wire.

3.09 CONTROL AND CIRCUITING

- .1 Where no switching is shown, lighting shall be panel switched. Panel circuit breakers shall be suitable for switching duty marked "SWD".
- .2 Where circuiting is not specified, provide sufficient 15A - 1P breakers and wiring to limit loading to 1200 watts per circuit or to code which ever is the most restrictive.

3.10 FIXTURES IN SERVICE ROOMS

- .1 Before mounting any fixture in mechanical, electrical or other service room obtain written approval of layout to be used. Layout must suit equipment limitations in the room.

3.11 ADJUSTMENTS

- .1 All adjustable fixtures shall be aimed as instructed by the Consultant. Personnel, lifts, and ladders shall be provided as required.
- .2 Adjust exit sign directional arrows, if required.

3.12 CLEANING

- .1 Remove all plastic bags from parabolic fixtures after construction is finished and prior to final acceptance.
- .2 All unnecessary equipment, materials, wiring, and fixtures shall be removed from those areas affected by the construction. Materials that are not part of the lighting or electrical distribution system shall be removed from the Site.
- .3 All lighting fixtures shall be cleaned in a manner approved by the manufacturer and shall be free of dirt and debris upon completion of installation.

3.13 DEMONSTRATION

- .1 Building personnel shall be trained to operate lighting control system. Building personnel shall be advised on relamping procedures and be given a list of lamps required for the fixtures on the Project.

3.14 PROTECTION

- .1 Lighting fixtures, once installed, shall be protected from damage during the remainder of construction period.

END OF SECTION 16505

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PART 1 – GENERAL CONDITIONS

1.01 REFERENCE

- .1 Comply with Section 16010, Electrical General Provision, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide all conduit, wire, connectors, hardware, and other incidental items necessary for the complete and properly functioning relay lighting control system as described herein and shown on the plans.
- .2 This section includes general specification for the relay lighting control system.

1.03 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 16011.
- .2 Submittal package shall contain:
 - .1 A complete bill of materials
 - .2 Sets of catalog cuts for standard equipment
 - .3 Sets of shop drawings detailing all mechanical and electrical equipment including one line diagrams, wire counts, internal wiring and physical dimensions of each item. Marked up catalog cuts are unacceptable.
- .3 Upon completion of all contractor's wiring, and after all fixtures are installed and lamped, the contractor shall request the services of a factory representative to completely check out the system prior to energizing the system. At the time of check out and testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.
- .4 Two complete sets of as-built drawings shall ship with the equipment when it leaves the factory, along with operations and maintenance manuals for the relay system.
- .5 Be responsible to ensure that any fluorescent ballasts supplied are compatible with the equipment being furnished on this project.
- .6 Follow manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- .1 Obtain lighting controls from a single source with total responsibility for compatibility of lighting control system components specified in this Section.
- .2 All equipment shall be 100% tested. Sample testing is not acceptable.
- .3 All standard system line voltage components shall be UL listed and so labelled when delivered to the job site.
- .4 Manufacturer Requirements
 - .1 Experience – the manufacturer shall have been continuously engaged in the manufacture of architectural lighting controls and relays for no less than ten (10) years.
 - .2 Testing – manufacturer shall perform functional testing of all components to confirm proper operation prior to shipment.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Materials must be delivered in a timely manner to other trades.
- .2 Store materials away from exposure to harmful construction and weather conditions and at temperature and humidity conditions recommended by the manufacturer.

1.06 WARRANTY

- .1 All equipment shall be warranted free of defects in materials and workmanship.
- .2 24 months from date of turn-over to the Owner. Relay modules shall be warranted for a period of ten (10) years.

1.07 ACCEPTABLE MANUFACTURER

- .1 The specification is based on Leviton Lighting Management Systems Division, Z-MAX relay panels and shall serve to indicate the quality of equipment required.
- .2 Alternate manufacturers must comply with the specifications herein in every detail.

PART 2 – PRODUCTS

2.01 RELAY PANELS

- .1 Physical
 - .1 Relay panels shall be supplied in any of the following configurations:
 - .1 Small panel shall be populated with up to (8) relays and provided with Basic or network control module.
 - .2 Medium panel shall be populated with up to (24) relays and provided with network or Remote control module.
 - .3 Large panel shall be populated with up to (48) relays and provided with, Network or Remote control Module.
 - .2 Panel shall support installation of (1) Z-MAX Control Module with associated accessories, control protocols and inputs and outputs as defined in the Z-MAX Control Module specification.
 - .3 Panel shall support installation of multiple Z-MAX relay modules up to the maximum number of relays supported by the cabinet.
 - .4 Panels shall be constructed of Steel, a NEMA 1, IP-20 protection, enclosure with removable door.
 - .5 Relay panels shall be able to be mounted surface or flush in a typical 4" deep wall. Flush-mounted cabinets require field installation of a flush-mount trim which can be applied to any relay panel.
 - .6 Relay panel dimensions shall be less than or equal to 30-1/2" in width, allowing the panels to be installed in two standard 16" stud spaces.
 - .7 Panels shall be provided with a locking hinged door which can be removed for ease of installation.
 - .8 Panels shall be finished Leviton Standard Blue. Custom colors shall be available for an additional charge; contact factory for additional information.
- .2 Electrical
 - .1 Relay panels shall include an integral power supply to power control modules, backplane, keypad and other accessories which shall be powered directly or indirectly from the relay panel. An optional external power supply may be used to power external accessories and control devices.

- .2 Control backplane shall provide data bus and data intercommunication between all relay modules, control module and low voltage inputs.
- .3 Standard relay panel shall accept to a tolerance of +/- 10% the following incoming voltages:
 - .1 120 VAC
 - .2 347 VAC
- .4 Barriers for field installation in the medium and large size cabinets shall be available to separate differing voltages or for any other purpose as may be required by prevailing jurisdiction. If a configured cabinet is ordered, barriers can be provided pre-installed in the Relay Panels as required and shall be disclosed to the factory at time of quotation.
- .5 Circuit protection integral with the control module shall be provided to protect the relay panel electronics from overload or short circuit.
- .6 On panels with integral overcurrent protection:
 - .1 Medium panel support for up to (24) relay modules of any combination.
 - .2 Large panel support for up to (48) relay modules of any combination.
- .3 Certifications - Relay panels shall be certified to the following authorities:
 - .1 UL508 - If ballasted loads are or will be controlled by any relay panel on this project, all panels must carry a UL listing which directly addresses ballasted loads. If ballasted loads are controlled, panels which bear only a UL916 listing shall not be acceptable.
 - .2 cUL
- .4 Installation
 - .1 Relay panels shall be installed per codes and other instructions by any and all authorities having jurisdiction.
 - .2 Relay panels shall be installed per the detailed installation instructions provided with the panel by the manufacturer.
 - .3 Relay panels shall be installed by the Division 16 contractor inclusive of all line and low voltage termination.
 - .4 If factory system commissioning was requested, relay panel shall not be energized without factory approval.

2.02 Z-MAX CONTROL MODULE

- .1 Physical
 - .1 The control module for medium and large relay panels shall be a single self-contained unit, secured into the panel with readily accessible mounting screws and must be field installable and/or replaceable.
 - .2 Version shall be available – Network control module for small, medium and large relay panels.
- .2 Electrical
 - .1 The control module shall receive all power from the power supply integral to the relay panel.
 - .2 The control module shall distribute power to all connected devices and accessories as required.
 - .3 The total available power for all connected devices shall be at least 500mA at 24 VDC.
 - .4 Voltage supplied to connected devices shall be +24 VDC. Other supply voltages can be achieved with an external supply.
- .3 Installation – the control module shall be pre-installed into the cabinet by the factory.

- .4 Operation and features
 - .1 The basic and master control module keypad interface shall offer the following user interface components:
 - .1 LCD display to indicate:
 - Current status
 - Error conditions
 - Current time
 - Programming confirmation and feedback
 - .2 Alphanumeric data entry keys
 - .3 Arrow keys
 - .4 Lock/Unlock relay
 - .5 Relay/Group On/Off
 - .6 Programming keys
 - .2 The control module keypad interface shall offer the following features:
 - .1 Programming of Z-MAX relay cabinet features and operation
 - .2 Relay On/Off
 - .3 Timed Relay/Group OFF
 - .4 Network Relay groups On/Off
 - .5 Lock/Unlock relay state
- .5 The panels shall offer the following visual feedback mechanisms:
 - .1 Individual relay status
 - .1 On
 - .2 Off
 - .3 Locked on
 - .4 Locked off
 - .5 Override On
 - .6 Override Off
 - .2 Control module microprocessor online
 - .3 Ethernet Link
 - .4 Modem connection
 - .5 Relay communication microprocessor
 - .6 +5 VDC power supply normal operation
- .6 The following control protocols shall be supported:
 - .1 Low Voltage Inputs
 - .1 Medium relay cabinet – (12) 0-10 VDC inputs
 - .2 Large relay cabinet – (12) 0-10 VDC inputs
 - .2 Optionally one of the following:
 - .1 Ethernet
 - .2 Modem with touch-tone interface support
 - .3 The following features shall be supported:
 - .1 Software/firmware version display
 - .2 Relay group on/off delay/sequencing
 - .3 Adjustable on/off channel trigger points
 - .4 Bypass on, or bypass off switch
 - .5 Emergency input
 - .6 Time, Time clock, scheduler and astronomical features
 - 12 or 24 hour clock
 - automatic daylight savings time adjustment
 - latitude and longitude data entry
 - sunrise/sunset offsets
 - holiday and holiday schedule event engine – holiday schedules can be assigned to any of the pre-defined holidays.
 - 999 event dates (recurring by day of week, day of month, to occur only on a specified date or a specified date range)

- .7 Blink warn
 - Adjustable time between blink warn and lights off
 - Adjustable time of blink flash
 - Individual relays can be selected for the blink warn feature
- .8 After hours sweep with adjustable time
- .9 Relay groups
 - Each relay can be assigned to a maximum of 32 groups.
 - The network shall support up to 65,000 groups
- .10 Priorities
 - The system shall support 16 priorities
 - Each control input or many internal events can be assigned a priority level.
 - The highest priority is 1, the lowest priority is 16.
 - Higher priorities shall take and maintain control until a “relinquish” command has been issued for that relay.
 - Priority control is applied on a relay-by-relay basis.
- .11 Low voltage switch support
 - Low voltage switch inputs shall be supported through any of the low voltage inputs
 - Switch inputs can be triggered by either an “active low” (pull to common) or an “active high” (pull to + voltage) signal
 - Feedback shall be returned by the panel to the switch as either +V or common. Feedback can be used to illuminate LED's in the Z-MAX low voltage switch.
 - Inputs can be assigned the following functions:
 - i. Momentary (assigned relays operate in toggle behaviour, press for on, press for off)
 - ii. Maintained (assigned relays are on while pressed, off when released)
 - iii. Preset on (assigned relays turn on, all other relays in the reset group turn off when depressed and released)
 - iv. Preset off (all relays in the preset group turn off when depressed and released).
- .12 Photocell support
 - Photocells shall be connected to any of the low voltage inputs
 - (16) “Rising” and (16) “Falling” trigger points can be set for each photocell.
 - Any relay can be assigned to any photocell trigger point
 - Any group can be assigned to any photocell trigger point
 - Multiple photocell operational behaviours shall be support to allow for varying applications.
- .13 Occupancy sensor support
 - Occupancy sensors shall be connected to any of the low voltage inputs.
 - Occupancy sensors shall support multiple behaviours allowing for varying applications.
 - Occupancy sensors shall support the blink warn feature.
 - A delay off time shall be set establishing the time which must elapse between occupancy sensor signal and the assigned action.
 - Any relay can be assigned to any occupancy sensor
 - Any group can be assigned to any occupancy sensor
- .14 Contact closure
 - Contact closures shall be connected to any of the low voltage inputs
 - Any contact closure can be assigned any action
 - Any contact closure can be assigned any scheduled event/action

- .4 Network (Master) Control Module
 - .1 The network control module shall support all features of the basic control module.
 - .2 The following additional control protocols shall be available:
 - Z-MAX digital switch
 - Luma Net 3 (for Leviton Dimensions D8000 and D4200 controls)
 - Master/Remote Z-MAX Network communication
 - .3 The following additional features shall be available in the network control module:
 - Assignment of Luma-Net or Sapphire-Net address to relay
 - Configuration of all digital switch inputs (maximum of 206 total buttons per network)
 - .4 Master/Remote operation – The network control module shall support Z-MAX master/remote networking over the master/slave network. The master/remote network shall have the following features and requirements:
 - Maximum (96) total relays per network, including all local and remote
 - Maximum (96) total discreet inputs per network including all local and remote
 - Interconnection between master/remote control cabinets shall be via category 5 or better cable with RJ-45 connectors on each end. The network topology shall be daisy chained, however, star configurations may be allowed with additional network hardware.
 - Each master/remote network may have only 1 master control panel and as many remote panels as necessary so long as the total number of relays per network is not exceeded 96.
- .7 Warranty: The warranty on the relay panel shall be 2 years as described in section 1, service performed at Leviton Lighting Management Systems Division, Tualatin, Oregon. Exception; if system commissioning was elected, warranty service may be performed on site.

2.03 Z-MAX RELAY CARDS

- .1 Physical
 - .1 On cabinets with modular relays:
 - .1 Each relay card shall occupy a maximum of (1) relay card space
 - .2 No relay card shall require reduction of total relay panel capacity
 - .3 Relay cards can be secured to the relay panel backplane with a single screw
 - .4 Relay cards shall contain a low voltage data connector for connection to the backplane which shall employ no wires.
 - .2 All power terminations to the relay card shall be via screw-terminals.
- .2 Electrical
 - .1 The following relay cards shall be available:
 - .1 Standard relay card
 - .2 2-pole relay card
 - .3 Canadian relay card
 - .4 Latching relay card
 - .2 All relay cards shall support the following load types at the full rated load of the relay card:
 - .1 Incandescent
 - .2 Tungsten
 - .3 Halogen
 - .4 Magnetic low voltage
 - .5 Electronic low voltage
 - .6 Neon
 - .7 Cold cathode

- .8 Magnetic fluorescent
- .9 Electronic fluorescent
- .10 HID
- .11 Motors
- .3 The standard relay card shall have the following electrical characteristics:
 - .1 Single pole contacts
 - .2 20A continuous load rated
 - .3 Voltage up to 277 VAC
 - .4 Motor rating of 1 HP @ 120V or 2 HP at 277V
 - .5 "No-load" switching of relay
 - .6 Zero-cross switching circuitry
 - .7 Relay rated for 10,000,000 cycles under full electrical load
 - .8 Relay will withstand 50 times the load as in-rush current for resistive, inductive and capacitive loads.
 - .9 Supported wire size of 8-20 AWG.
- .4 The two-pole relay card shall have the following electrical characteristics:
 - .1 Two pole contacts
 - .2 20A continuous load rated
 - .3 Voltage up to 277 VAC
 - .4 Motor rating of 2 HP @ 240V or 3 HP at 480V
 - .5 Relay rated for 30,000 cycles
 - .6 Relay will withstand 50 times the load as in-rush current for resistive, inductive and capacitive loads.
 - .7 Supported wire size of 6 – 20 AWG.
- .5 The Canadian relay card shall have the following electrical characteristics:
 - .1 Single pole contacts
 - .2 20A continuous load rated
 - .3 Voltage up to 347 VAC
 - .4 Motor rating of 1 HP @ 120V or 2 HP at 277V
 - .5 Relay rated for 30,000 cycles
 - .6 Relay will withstand 50 times the load as in-rush current for resistive, inductive and capacitive loads
 - .7 Supported wire size of 6 – 20 AWG
- .6 The latching relay card shall have the following electrical characteristics:
 - .1 Single pole contacts
 - .2 20A continuous load rated at up to 277V
 - .3 15A continuous load rated at up to 347V
 - .4 Motor rating of 1 HP @ 120V or 2 HP at 277V
 - .5 Relay rated for 30,000 cycles
 - .6 Relay will withstand 50 times the load as in-rush current for resistive, inductive and capacitive loads.
 - .7 Supported wire size of 8 – 20 AWG
- .7 Each group of (8) relay cards can be isolated from every other group of (8) relay cards in the medium and large cabinets with the use of optional voltage barriers.
- .3 Installation
 - .1 Relay cards shall be furnished pre-installed in the cabinets by the factory or may be user-installed in the field.
 - .2 Custom configuration of multiple types of relay cards in the same cabinet can be performed by the factory or in the field.

2.04 LOW VOLTAGE SWITCHES

- .1 Physical
 - .1 All switches shall fit into a standard 1 gang "deep" electrical back box.
 - .2 Switches shall employ standard "Decora" style screwless wall plates.
 - .3 Switches shall be available in any of the following button configurations:
 - .1 1 button
 - .2 2 buttons
 - .3 3 buttons
 - .4 4 buttons
 - .5 5 buttons
 - .6 6 buttons
 - .7 8 buttons
 - .8 10 buttons
 - .4 Labels for each button shall be as standard: Zone 1, Zone 2, Zone 3, etc.
 - .5 Factory custom labelling per specification shall be available.
 - .6 End-user labelling kits shall be available – consult factory.
 - .7 Standard color for all stations, wall plates, and trim rings shall be white.
- .2 Electrical
 - .1 Connection to controlled equipment shall be via standard low voltage wiring.
 - .2 Switches when depressed may either supply voltage or connect to common as decided by the particular application (Z-MAX relay cabinets prefer +V).
 - .3 Each switch shall employ a back-lit LED which can optionally provide visual feedback to the user. The LED terminal for each switch can either be connected to +V or common depending on the particular requirements of your installation (+V or common depending on the particular requirements of your installation (+V is recommended for Z-MAX installations).
 - .4 Each switch station shall have a "locator" LED which can provide visual feedback to the user of station location, system activity, etc. The locator LED terminal may be connected either to +V or common depending on the particular requirements of the installation. If no visual feedback is required the LED can be left unconnected.
- .3 Installation
 - .1 Installation of the low voltage switch shall be per manufacturer's instructions and performed by the contractor.
 - .2 Programming of switch functionality shall be performed by the contractor at the control panel and at their discretion unless factory commissioning is required.

2.05 Z-MAX™ DIGITAL SWITCH

- .1 Physical
 - .1 All switches shall fit into a standard 1 gang "deep" electrical back box.
 - .2 Switches shall employ standard "Decora" style screwless wall plates.
 - .3 Switches shall be available in any of the following button configurations:
 - .1 1 button
 - .2 2 buttons
 - .3 3 buttons
 - .4 4 buttons
 - .5 5 buttons
 - .6 6 buttons
 - .7 8 buttons
 - .8 10 buttons
 - .4 Labels for each button shall be as standard: Zone 1, Zone 2, Zone 3, etc.
 - .5 Factory custom labelling per specification shall be available.
 - .6 End-user labelling kits shall be available – consult factory.

- .7 Standard color for all stations, wall plates and trim rings shall be white.
- .8 A maximum of (206) buttons are supported per Z-MAX cabinet.
- .2 Electrical
 - .1 Connection to controlled equipment shall be via standard digital low voltage network wiring.
 - .2 Digital low voltage wiring or "network wiring" shall be of acceptable cable types specified by the manufacturer on data sheets, installation guides and submittals (if provided). Follow the traditional Luma-Net wiring specification as a guide.
 - .3 Each switch shall employ a back-lit LED which provides visual feedback to the user.
 - .4 Each switch requires (4) wires, (1) pair of data wiring, and (1) pair of wires for power.
 - .5 An optional infrared remote control can activate each button on the station.
 - .6 Programming of switch functionality is performed at the Z-MAX relay panel. In addition to simply relay or group on/off, switches can be programmed for advanced actions. See Z-MAX relay cabinet specification for complete functionality.
- .3 Installation
 - .1 Installation of the low voltage switch shall be per manufacturer's instructions and performed by the contractor.
 - .2 Programming of switch functionality shall be performed by the contractor at the control panel and at their discretion unless factory commissioning is required.

PART 3 – EXECUTION

3.01 EXECUTION

- .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 Field measurements and coordinating the physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.
- .3 Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

3.02 INSTALLATION

- .1 Receive, mount, connect and place into operation all equipment. Provide all conduit, wire, connectors, hardware and other incidental items necessary for a properly functioning lighting control and relay system as described herein and shown on the plans.
- .2 Comply with manufacturer's product data, including shop drawings, technical bulletins, product catalog installation instructions and product carton instructions for installation.
- .3 Test that all branch load circuits are operational before connecting loads to system load terminals and then de-energize all circuits before installation.
 - .1 Power shall not be applied to the relay system during construction and prior to turn-on unless specifically authorized by written instructions from the manufacturer.

3.03 TESTING

- .1 Upon completion of the installation, notify the manufacturer that the system is ready for formal check out. Notification shall be given in writing a minimum of 21 days prior to the time factory-trained personnel are required on site.

- .2 Upon completion of all line, load and interconnection wiring and after all fixtures are installed and lamped, manufacturer's rep shall completely check the installation prior to energizing the system. Each installed relay system shall be tested for proper ON/OFF operations, and proper LED illumination. Each installed control panel shall be tested verifying that each controlled load adjusts to the selected setting and that all switch LED's illuminate properly.
- .3 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 SITE PROTECTION

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

END OF SECTION 16570

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PART 1 - GENERAL

1.01 REFERENCE

- .1 Comply with Section 16010, Electrical General Provision, 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 16011.
- .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 1/4HP @ 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 1/4HP @ 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 1/4HP @ 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

PART 3 – EXECUTIONS

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 16575

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- 3.01 INSTALLATION OF CONDUIT SYSTEM

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Electrical General Requirements, Section 16010 and all other documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide a system of empty conduits, backboxes and pull wire to allow the installation of a security system.

PART 2 - PRODUCTS

2.01 CONDUITS, PULL BOXES AND OUTLET BOXES

- .1 Refer to appropriate sections.

2.02 CABLING REQUIREMENTS

- .1 The cables will be provided by the Security Contractor.

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUIT SYSTEMS

- .1 Provide a system of conduit, cables and outlet boxes for the Security system.
- .2 The security system will be supplied and installed under Division 17.
- .3 Conduits shall be minimum 20mm complete with pull strings. There shall not be more than two (2) 90° bends in any run of conduit and pullboxes shall be provided in runs in excess of 100' or where more than two (2) 90° bends are required.
- .4 Conduit shall be left clear and free of all obstructions and shall be terminated as shown. Equip terminations with bushings and clearly identify each run.
- .5 Co-ordinate the work with the Consultant and Division 17 and obtain the exact location of equipment, conduit sizes, outlet box requirements prior to roughing-in.
- .6 Provide power outlets as shown on the drawings.
- .7 Provide interface with the fire alarm system to release the mag locks as specified.
- .8 Where security equipment requires special back-boxes to be mounted, they will be provided by the Security Contractor for installation by this Contractor.
- .9 Provide one 110 volt GFI service at the common reader equipment location for power supply to the card access system, with separate permit to be provided to Division 17.
- .10 Provide all fire alarm pull stations on mag lock doors with secondary contacts for mag lock release.

END OF SECTION 16610

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PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Electrical General Requirements Section 16010 and all other documents referred to therein.

1.02 RELATED WORK

- .1 Sprinkler system.
- .2 Standpipe and hose systems.
- .3 Security System

1.03 STANDARDS

- .1 Design, manufacture, install and test the fire alarm system in accordance with good industry practice and the latest version of the following standards and codes:
 - .1 The Ontario Building Code.
 - .2 The Ontario Electrical Code -and the Ontario Hydro supplements.
 - .3 Standard CAN/ULC S524-M: Standard for the installation of fire alarm systems.
 - .4 Standard ULC S525 Standard for audible signal appliances for fire alarm systems.
 - .5 Standard ULC S527 Standard for control units for fire alarm systems.
 - .6 Standard ULC S528 Standard for manually actuated signalling boxes for fire alarm systems.
 - .7 Standard ULC S529 Standard for smoke detectors for fire alarm systems.
 - .8 Standard ULC S530 Standard for heat actuated fire detectors for fire alarm systems.
 - .9 Standard CAN/ULC S537-M: Standard for verification of fire alarm system installations.

1.04 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 16011 and as follows:
 - .1 A complete description of the system operation.
 - .2 A complete description of each component.
 - .3 Zone description to review by the consultant.
 - .4 Riser diagram
 - .5 Component layouts in the CACF.
 - .6 Detailed annunciator and control panel layout.

1.05 OPERATION AND MAINTENANCE DATA

- .1 Provide data to be incorporated into the maintenance manual including the following:
 - .1 Operation and maintenance instructions for the complete fire alarm system to permit its effective operation and maintenance.
 - .2 Technical data and illustrated parts lists with part numbers.
 - .3 A copy of the final reviewed shop drawings.
 - .4 Copy of all drawings, rack-ups, and location sheets to be provided.

1.06 VERIFICATION

- .1 At the completion of the installation provide two (2) letters of certification, one (1) from the electrical sub-contractor and one from the system manufacturer, each on company letterhead and signed by an authorized officer of the company. Each letter shall indicate the following:
 - .1 The name of the system.
 - .2 The name of the facility.

- .3 The correct address of the facility.
- .4 A statement that the system has been installed and that it operates in accordance with the drawings and specifications and that the system was found to be in proper operating condition.
- .2 The building will be turned over in stages; verification shall be performed as required to suit individual turn over dates, with a final "Total System" verification carried out at the completion of the project.
- .3 Co-ordinate turn over dates with the Owner's construction schedule.

1.07 SYSTEM DESCRIPTION

- .1 The Fire Alarm System shall be a peer to peer addressable modified two-stage, zoned, integrated, non-coded, supervised, fire alarm system in accordance with all applicable local, municipal, and provincial regulations.
- .2 All initiating devices shall be on an addressable Class A wired loop.
- .3 Provide separate loops for signalling devices on the floors, provide a Class A loop per floor for the suites, and a separate Class A or B (with end of line devices in electrical closets) for the corridor devices. The system shall have provision for the automatic signal silence within dwelling units as per OBC Sentence 3.2.4.19(13).
- .4 The drawings indicate the final locations of the fire alarm system components. It is the sub-contractor's responsibility to provide all components necessary to ensure a complete and operative system in accordance with the intent of these documents. Contractor to provide as built drawings upon project completion.
- .5 The Fire Alarm system shall include but not be limited to the following main components:
 - .1 Central control facility.
 - .2 Remote data gathering panels.
 - .3 Trouble signal devices.
 - .4 Power supply equipment.
 - .5 Manual alarm stations.
 - .6 Automatic alarm initiating devices.
 - .7 Audible and visual signal devices.
 - .8 End of line devices.
- .6 Use only those components that are CSA and ULC listed.
- .7 The specifications identify the general scope of each fire alarm system only; refer to the drawings for additional system information and interconnections with other buildings and multiple CACF's.

1.08 ACCEPTABLE MANUFACTURERS

- .1 The system specification is based on Edwards EST 3 system. Acceptable alternate, Mircom.

PART 2 - PRODUCTS

2.01 CONTROL SYSTEM OPERATION

- .1 Operation of any addressable detecting device shall cause an alarm and the following shall happen:
 - .1 Visually indicate the device in alarm on the LCD at the central control facility and the remote units located at each of the concierge desks.
 - .2 Indicate the initiating zone via an LED at the central control facility and remote annunciator.
 - .3 A signal shall be given to all ancillary devices (fans, door holders, maglocks, elevators, etc.).
 - .4 Strobes will operate.
 - .5 Transmit an alarm signal to the local monitoring agency.
 - .6 Sound an alert signal of a 1000 HZ tone at 20 strokes per minute in the building.
 - .7 Evacuate the floor in alarm.
- .2 It shall be possible to manually silence the alarm signals at the central control facility only after a delay as determined by the authorities having jurisdiction. Manual silencing of alarm signals shall cause a visible and audible trouble signal and a "Signal Silenced" indicator to illuminate.
- .3 Operation of any supervisory device shall cause a visible and audible trouble alarm at the central control facility and will:
 - .1 Display at the central control facility and the remote units at the concierge desks LCD the device.
 - .2 Indicate the zone via an LED at the central control facility and remote annunciator.
 - .3 Send a trouble signal to the local monitoring agency.
- .4 Any open, short circuit or ground in any field wiring shall cause a common visible and audible trouble alarm at the central control facility. A trouble condition shall also occur upon:
 - .1 Loss of main power.
 - .2 Standby power trouble.
 - .3 Removal of any system component.The trouble shall be indicated on the LCD display at the central control facility and the remote units.
- .5 When all initiating and supervisory devices have been restored to their normal condition the fire alarm system shall be reset by pressing a "Reset" button on the control panel.
- .6 A subsequent alarm or trouble from another initiating or supervisory circuit shall re-activate the appropriate sequence.
- .7 The system shall provide integrated signal page outputs circuits for:
 - .1 70 VRMS integrated signal appliances such as cone and horn speakers.
 - .2 Manual selection for emergency paging and selective evacuation shall be provided on a circuit by circuit basis at the CACF.
 - .3 The field wiring of the signal page circuit shall be supervised for open and short circuit conditions through the use of an end of line resistor.
 - .4 An open or short fault condition in the field wiring shall activate the common trouble sequence and illuminate the respective zone trouble indicator at the CACF.
 - .5 A ground fault in the field wiring shall activate the common trouble sequence.
 - .6 The system shall provide eight (8) audio sources for distribution to one of the eight audio channels. Presently, one (1) channel should be dedicated to the alert signal, one channel to the evacuation signal and one channel for voice, to provide full simultaneous

distribution of the paging message, alert and evacuation tones to selected circuits.

2.02 CENTRAL ALARM CONTROL FACILITY (CACF's)

- .1 The Life Safety System shall include all required hardware and system programming to provide a complete and operational system, capable of providing the protected premises with the following functions and operations:
 - .1 Modular systems design, with a layered application design concept, including an "Operational Layer" and a "Human Interface Layer", to allow maximum flexibility of the system with a minimum physical size requirement.
 - .2 Audio Paging and Emergency Evacuation subsystem with fully digitized and multiplexed audio. Up to 32 minutes of pre-recorded audio is transmitted over one of eight (8) audio channels over a single pair of wires. The system shall not require mechanical potentiometers to make adjustment of audio levels within the system, as these devices are prone to require re-adjustment over time, and may fail under uncontrolled field conditions.
 - .3 All system operational software is to be stored in FLASH memory. Control Panel disassembly, and replacement of electronic components of any kind shall not be required in order to upgrade the operations of the installed system to conform to future application code and operating system changes.
 - .4 Up to 250 Service Groups must be definable within the system program to allow the testing of the installed system based on the physical layout of the system, not on the wiring of the field circuits connected to the Fire Alarm Control Panel.
 - .5 Advanced Windows TM-based System Definition Utility with Program Version Reporting to document any and all changes made during system start-up or system commissioning. Time and Date Stamps of all modifications made to the program must be included to allow full retention of all previous program version data.
 - .6 System response to any alarm condition must occur within 3 seconds, regardless of the size and the complexity of the installed system.
 - .7 One amplifier shall be supplied per speaker circuit to enhance system survivability.
 - .8 Fire Fighters' Telephone System shall include a dedicated back-lit Liquid Crystal Display (LCD) to indicate in full language the Call-In Status of remote telephones. Selection of any remote telephone for two-way communications shall be accomplished with the pressing of a single switch.
 - .9 System Common Control Functions shall be automatically routed to any node of the system as a function of the time of day and date.
- .2 The Fire Alarm/Life Safety System shall include an Emergency Operators' Interface Panel, which shall include the following system annunciation and control functions:
 - .1 Hands-free Emergency Operation. The first and last highest priority event on the system shall be displayed automatically and simultaneously.
 - .2 Control Panel Internal Audible Signal shall have four programmable signal patterns, to allow for the easy differentiation between Alarm, Supervisory, Trouble, and Monitor conditions within the installed system.
 - .3 Power Status LED - Green LED shall illuminate when AC power is present.
 - .4 Test Status LED - Yellow LED shall illuminate when any portion of the system is in the test mode. A programmable timer shall cause the system to automatically exit the test mode after a period of system inactivity. This Test LED shall function in a local or in a group mode.
 - .5 CPU Fail Status LED - Yellow LED shall illuminate when the panel controller has an internal failure.
 - .6 Ground Fault Status LED - Yellow LED shall illuminate when ungrounded wiring connected to the cabinets' power supply has continuity to ground. This feature shall

- function in either a local or group mode.
- .7 Disable Status LED - Yellow LED shall illuminate whenever any point or zone in the installed system is manually disabled.
- .8 Reset: Depression of the Reset Switch starts the system reset operation. The associated Yellow LED shall have three flash rates during this operation to inform the user of the progress status of the reset cycle. The LED shall flash fast during the smoke detector power down sequence, then it shall flash slowly during the restart phase and shall illuminate steadily for the restoral phase. The LED shall go out completely when the system is back to normal mode. Each phase, as well the overall reset cycle shall be programmable to perform other functions.
- .9 Alarm Silence: Depression of the Alarm Silence Switch shall turn off all (audible and/or visible) Notification Appliance Circuits. The Associated yellow LED illuminates when the Alarm Silence function is active, whether by the Alarm Silence Switch, or by an integral software timer. Subsequent activation of the Alarm Silence Switch shall re-sound the signals. Activation of the Alarm Silence switch shall be programmable to perform other functions.
- .10 Panel Silence: Depression of the Panel Silence Switch shall turn off the systems' internal audible signal when configured as a 'local' system. The associated yellow LED illuminates when the panel silence feature is activated.
- .11 Drill Switch / LED: Depressing the DRILL switch activates the fire drill function. Yellow LED indicates that the fire drill function is active. The Drill Switch shall also be programmable to perform system functions other than the Drill Function.
- .12 Previous Message Switch: Pressing the Previous Message Switch shall scroll the display to show the preceding message in the selected queue. Holding the Previous Message Switch and pressing any queue select switch moves to the top of the respective queue event list. Scrolling through event messages may be done by the operator at any time.
- .13 Next Message Switch: Pressing the Next Message Switch shall scroll the display to show the following message in the selected queue. Holding the Previous Message Switch and pressing any queue select switch moves to the bottom of the respective queue event list. Scrolling through event messages may be done by the operator at any time.
- .14 More Details Switch: Pressing the More Details Switch shall show the address and 42 character location message of the active device on display. If a zone is active, pressing the switch displays the address and message of active devices within the zone. When multiple devices are active, the "Previous/Next" message switch may be used to scroll through the messages.
- .15 The Liquid Crystal Display shall provide the means to inform the System Operator with detailed information about the off-normal status of the installed Fire Alarm/Life Safety System. The Main Display shall automatically respond to the status of the system and shall display that status on a 8 line by 21 character backlit alpha numeric Graphical Liquid Crystal Display. The following status functions shall be annunciated by the Main Liquid Crystal Display. When the Fire Alarm/Life Safety System is in the "Normal" Mode, the LCD displays:
- .1 The current Date and Time.
- .1 A custom System Title (2 lines X 21 characters).
- .2 A summary total of the Alarm History of the system.
- With the Fire Alarm Life Safety System in the alarm Mode, the LCD shall automatically reconfigure into four logical windows.
- .16 The LCD shall show the system time and the number of active points and disabled points in the system in this section of the LCD Display. The LCD shall show the first active event of the highest priority in reverse text to highlight the condition to the Emergency Operator. The top line of the reversed text shall show the sequence number in which the displayed event was received, as well as its event type. The

second and third lines of reversed text shall display an identification message related to the displayed event. The LCD shall show the most recent, highest priority event received by the system. The LCD shall show the total number of active events in the system, by event type. There shall be four different System Event types which shall be displayed, "Alarm Events", "Supervisory Events", "Active Trouble Events", and "Active Monitor Events".

- .17 In order to simplify, and to clarify the System Status information, which is given to the Emergency Operator, the Main LCD shall include queues for each of the System Event Types. The Main LCD shall allow the Emergency operator access to the System Status information contained within those queues by pressing an associated queue select switch. Whenever there is an unacknowledged event in any of the system Event queues, the associated Status LED shall flash. Viewing each event listed in a queue shall acknowledge all events in that queue and shall cause the associated LED to illuminate steady. All messages contained in any of the System Event queues shall be accessible for review by the Emergency Operator using the "Previous/Next" message switch. It shall be possible to route additional event information to a printer.
- .18 The Main LCD shall also allow the System Operator to access system maintenance functions through a four level password system. The authorized System Operator shall be able to access the following functions:
 - .1 System Status - The system shall allow the operator to determine the status of individual system components, including active points, disabled points, and active points by panel.
 - .2 Enable - The system shall allow the operator to restore a disabled point (device) in the system, allowing that point (device) to operate as originally intended by the application program of the system. Additionally, the system shall allow the operator to restore any group function, guard patrol function, Panel, system module, "software - defined zone", operator control, or time control function.
 - .3 Disable
 - .1 The system shall allow to disable any point (device) in the system, inhibiting that point (device) from operating as originally intended by the application program of the system.
 - .2 Additionally, the system shall allow the operator to disable any group function, guard patrol function, Panel system module, "software - defined zone", operator control, or time control function within the system.
 - .4 Activate - The system shall allow the operator to manually turn on any system output point, or system function. Alternate Smoke Detector sensitivity, message routing within the system, guard patrol timing, and check-in group timings shall be modifiable with this simple command from the control panel.
 - .5 Restore - The system shall allow the operator to restore the primary (application program defined) operation to the Smoke Detector sensitivity and the message routing functions with this simple command form the control panel.
 - .6 Control Output - The system shall allow the operator to manually command and control relays and LEDs. Relays shall be able to be commanded to "Latch", to energize as a "High Priority", or as a "Low Priority", to "Energize", or to "De-Energize". LEDs shall be commanded to "Latch", to energize as a "high Priority", or as a "Low Priority", to turn "On", to turn "Off", to "Slow Blink", or to "Fast Blink".
 - .7 Reports
 - .1 The system shall provide the operator with system reports, which

- give detailed description of the status of certain system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the Main LCD, and shall be capable of being printed on any of the connected system printers.
- .2 The system shall provide a report which give a sensitivity listing of all detectors which have less than 75% environmental compensation remaining.
 - .3 The system shall provide a report, which provides a sensitivity listing of any particular detector.
 - .4 The system shall provide a report which gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any give SDC loop within any given panel.
 - .5 The system shall provide a report, which gives a chronological listing of up to the last 1740 system events.
 - .6 The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.
- .19 Program
- 1. The system shall allow the authorized operator to perform all of the following system functions:
 - .1 Set the System Time
 - .2 Set the System Date
 - .3 Set (Change) the System Passwords.
 - .4 Restart the System.
 - .5 Set the Dates for the system Holiday Schedule.
 - .6 Clear the Chronological System History File.
 - .2 The system shall allow the authorized operator to perform test functions within the installed system. Test functions shall be defined by the authorized operator to be performed on a per cabinet, circuit, or service group basis.
 - .3 Incorporate a computer drawn passive graphic diagram on Lexan plate to display all zones.
 - .1 Finish to match panel
 - .4 The CACF. shall also have the following system indicators and controls:
 - .1 AC Power "ON" indicator.
 - .2 CPU failure indicator.
 - .3 Ground fault indicator.
 - .4 Test and indicator.
 - .5 One bypass switch c/w indicator for each fan as shown in the CACF schedule.
 - .6 One bypass switch c/w indicator for all auxiliary functions.
 - .7 System trouble signal silence switch. The system shall have a feature to resound the trouble signal upon subsequent trouble alarms if silenced. Activation of a bypass switch will initiate a common trouble condition.
 - .8 Alarm signal silence switch and indicator. Indicator illuminates when the alarm signals are silenced and visual strobe extinguished. System shall have a feature to resound the alarm signal upon subsequent fire alarms if silenced.
 - .9 Lamp test switch.
 - .10 Total evacuation switch complete with indicator.
 - .11 The CACF shall have a red LED per alarm zone.
 - .12 The CACF shall have an amber LED per supervisory zone.
 - .13 The CACF shall have an amber LED per paging zone, telephone zone, and strobe circuit.
 - .14 The CACF shall provide a paging switch and telephone switch with

- telephone LCD control complete with indicator per zone. Provide evacuation switches complete with indicator and signal rate status indicators for each paging zone to indicate whether the paging circuit is receiving alert, evacuation or paging messages.
- .15 A master paging microphone and master telephone handset.
 - .16 Page to all zones switch and total evacuation switch.
 - .17 The CACF shall have a device bypass/disconnect feature so that it is possible on an individual basis to bypass each device individually.
 - .18 Common telephone call in indicator and buzzer.
- .5 Power Supply
- 1. The control panel shall operate on 120V AC 60 Hz as the primary source of power.
 - 2. The system shall have an integral standby power source consisting of gelled electrolyte batteries, automatic charger and automatic transfer switch. Battery capacity shall be sized in accordance with the latest NBC standards. The standby power system shall be supervised and shall provide 24-hour supervision and 120 minutes of alarm.
 - 3. The control panel shall be semi-flush, wall-mounted. The cabinet shall have locking interior doors to provide access to electrical connections and locking outer doors to provide access to manual controls.

2.03 REMOTE DATA GATHERING PANELS (DGP)

- .1 Each shall contain a 3-CPU 16 Bit central processing with non-volatile EEPROM memory and field programmable software. Each 3-CPU shall have an RS-232 Printer/Programming port. Each shall contain an LCD display c/w reset and signal silence switch.
- .2 The Analog Loop Controller 3SSDC shall plug onto a rail in the controller and shall serve as an interface to the Signature Series analog devices. All addressable loops shall be class A wired. The system shall have the following features:
 - .1 The Analog Loop Controller shall provide full digital communication with all Signature Series analog devices. The system shall use both broadcast polling and direct address search communication formats for increased integrity and improved response time. Response time on the loop will be 750MS. Response time on the entire network will be within 3 seconds.
 - .2 The Analog Loop Controller shall be capable of detecting the electrical location of each intelligent device. It shall be possible to display on a Laptop Personal Computer, the intelligent device "map" in the manner, which the circuit is wired.
 - .3 All system programming shall be permanently stored in EEPROM memory to ensure no programming is lost during momentary power loss.
 - .4 The Analog Loop Controller shall provide a minimum of 5 levels of supervision:
 - .1 Device location
 - .2 Unexpected device add/delete
 - .3 Missing device address
 - .4 Changes in the physical wiring circuit
 - .5 Changes in device type/personalities
 - .5 The Analog Loop Controller shall be capable of automatic Day/Night sensitivity of individual detectors or groups of detectors.
 - .6 It shall be possible to retrieve from each analog device microprocessor the following device specific information:
 - .1 Device serial number
 - .2 Device address
 - .3 Device type and personality code

- .4 Date of manufacture
- .5 Hours in use
- .6 Number of alarms and troubles
- .7 Time and date of last alarm
- .8 Amount of environmental compensation left/used
- .9 Last maintenance date
- .10 Job/project number
- .11 Analog signal patterns for each sensing element just before last alarm
- .12 Current detector sensitivity values
- .13 Diagnostic information (trouble codes)

This information shall be available to authorized service personnel at the control panel using Signature Program/Service Tool or P.C.

- .7 It shall be possible to change the personality/function of a Signature Series Device.
 - .8 The Analog Loop Controller shall be capable of alerting the system operator when any intelligent analog detector reports a "routine maintenance required" message.
 - .9 The Analog Loop Controller shall support up to 125 intelligent signature detectors, and up to 125 intelligent signature modules.
- .3 The DGP shall provide 3-ZA zoned amplifiers. Each amplifier is to contain a de-multiplexing circuit to allow any one of the 8 digital audio channels to be broadcast. Provide one (1) back-up amplifier per DGP.
- .4 The DGP shall enter regenerative mode upon loss of communication with the network master. The DGP shall establish sub-network communications with any other DGP controllers that remain connected and operational on the RS-485 data line. When in the regenerative mode, the DGP's shall be capable of performing all their pre-programmed Actions, Sequences, Time Controls, Annunciation and Control Switch functions and shall fully support their optional cards.
- .5 The DGP shall enter stand alone mode upon loss of communication with the network master and all other DGP's. When in the stand alone mode, the DGP shall be capable of performing all its pre-programmed Actions, Sequences, Time Controls, Annunciation and Control Switch functions and shall fully support its cards.
- .6 The data Line Format shall be RS-485 @ 38,000 BPS up to a maximum of 10,000 ft. over a minimum #18 AWG pair. The data line and audio line shall be wired Class A.
- .7 The Power Supply/Chargers, EST Models 3-PPS/MA or 3-BPS/M shall provide 24 Vdc operating and emergency power to the system. The 3-PPS power supply shall be of switch mode design. The power supply shall provide two 3.5 Amp outputs of fully regulated, power-regulated, power limited 24 Vdc. The power supply shall be monitored by the 3-CPU. The power supply shall have Brown Out and Low Battery feature. It shall be capable of charging from 10 AH to 65 AH batteries. Power supply to accept 120 VAC 60 Hz as the primary source. The batteries shall provide 24-hour supervision and 120 minutes of alarm.
- .8 The panel shall be provided with a backup alert and evacuation tone generator. A standby amplifier shall also be provided so that upon failure of any amplifier, the failed amplifier shall be disconnected automatically and replaced with the standby amplifier.

2.04 ADDRESSABLE DETECTORS - GENERAL

- .1 Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted

deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.

- .2 Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller.
- .3 Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total analog loop response time for detectors shall be 750 RMS.
- .4 Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the analog loop controller. A red LED shall flash to display alarm status. Both LEDs on steady shall indicate alarm stand alone mode status. Both LEDs shall be visible through a full 360 degree viewing angle.
- .5 The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.
- .6 Each detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level.
- .7 Each detector microprocessor shall contain an Environmental Compensation algorithm, which identifies and sets ambient "Environmental Thresholds" approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity and other contaminants as well as detector aging. The process shall employ digital compensation to adapt the detector to long term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 50% and 100% of the allowable environmental compensation value.
- .8 Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "learned base line sensitivity". The base line sensitivity information shall be permanently stored at the detector approximately once every hour.
- .9 Each detector may be individually programmed to operate at any one of five (5) sensitivity settings.
- .10 The intelligent analog device and the analog loop controller shall provide increased reliability and inherent survivability through intelligent analog conventional operation. The device shall automatically change to standalone, conventional device operation in the event of a loop controller polling communications failure. In the analog conventional detector mode, the analog detector shall continue to operate using sensitivity and environmental compensation information, stored in its microprocessor at the time of communication failure. The analog loop controller shall monitor the loop and activate a loop alarm if a detector reaches its alarm sensitivity threshold.
- .11 Each Signature Series device shall be capable of automatic electronic addressing and/or custom addressing without the use of DIP or rotary switches. Devices using DIP or rotary switches for addressing, either in the base or on the detector shall not be acceptable.
- .12 It shall be possible to program the Signature Series analog devices into a minimum of 16 groups with a minimum of 32 devices per group. It shall also be possible to link groups to program activities.

- .13 The intelligent analog detectors shall be suitable for mounting on any Signature Series detector mounting base.
- .14 Detectors shall be blown out type
- .15 Fixed Temperature Heat Detectors - SIGA-HFS
 - .1 The intelligent heat detector (SIGA-HFS) shall have a thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.
 - .2 The integral micro-processor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable.
 - .3 The heat detector shall have a nominal rating of 135 degree F (57 degree C).
 - .4 The heat detector shall have a minimum linear spacing rating of 70 foot (21.3m) centres and be suitable for wall mount applications.
- .16 Fixed Temperature/Rate-of-Rise Heat Detector - SIGA-HRS
 - .1 The intelligent combination fixed temperature/rate-of-rise heat detector (SIGA-HRS) shall have a thermistor heat sensor and operate at a fixed temperature and at a pre-determined temperature rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.
 - .2 The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable.
 - .3 The intelligent heat detector shall have a nominal fixed temperature rating of 135 degree F (57 degree C) and a rate of rise rating of 15 degree F (9 degree C)/minute. The heat detector shall have a minimum linear spacing rating of 70 foot (21.3m) centres and be suitable for wall mount applications.
- .17 Single Sensor Devices - Single Sensor Device shall be SIGA-PS Intelligent Photo Detector shall use a light scattering type photo sensor. The detector shall be suitable for area protection and direct insertion into air ducts up to 0.91m high and 0.91m wide with air velocities up to 25.39 m/sec. without requiring specific duct detector housings or supply tubes. The detector shall have a ULC Smoke Sensitivity Range 0.67 - 3.70% Obscuration/ft (305mm). Restrict the operating environment to a temperature of 0 degree C to 49 degree C, humidity: 0-93% RH, non-condensing. The photo detector shall be rated for ceiling installation at a minimum of 9.1m centres.
- .18 Detector Bases - Signature Series Detector Bases shall be suitable for mounting on any of the North American: 1 gang, 3 1/2" or 4" octagon box, 4" square box European: BESA or 1 gang.
- .19 Standard Base (SIGA-SB) - The base (SIGA-SB) shall, contain no electronics, support all signature Series Detector types and have the following minimum requirements:
 - .1 Removal of the respective detector shall not affect communications with other detectors.
 - .2 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.
 - .3 The standard detector base shall be capable of supporting one (1) Signature Series SIGA-LED (Red) Remote Alarm Indicator.
- .20 Relay Base (SIGA-RB) - The relay base (SIGA-RB) shall support all Signature Series Detector types and have the following minimum requirements:
 - .1 The relay shall be a bi-stable type and selectable for normally open or normally closed operation.

- .2 The position of the contact shall be supervised.
 - .3 The relay operation shall be exercised by the detector processor on power up.
 - .4 The relay shall automatically de-energize when a detector is removed.
 - .5 The operation of the relay base shall be controlled by its respective detector processor.
 - .6 Form "C" Relay contacts shall have a minimum rating of 1 amp. @ 24 Vdc and be listed for "pilot duty".
 - .7 Each detector shall be capable of Intelligent Analog Conventional operation providing inherent survivability in the event of a communication failure with the Analog Loop Controller. This operation shall ensure the operation of the relay. Relay bases not controlled by the detector micro-processor shall not be acceptable. Removal of the respective detector shall not affect communications with other detectors.
 - .8 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.
- .21 Isolator Base (SIGA-IB) or SIGA-IM - The isolator base (SIGA-IB) or isolator module (SIGA-IM) shall have the following minimum requirements:
- .1 The isolator shall operate within a minimum of 23 msec. of a short circuit condition on the communication line.
 - .2 Following a short circuit condition, each isolator shall be capable of performing an internal self-test procedure to re-establish normal operation. Isolator not capable of performing independent self tests shall not be acceptable.
 - .3 In a Class A configuration, the Signature Loop controller shall identify an isolated circuit condition and provide communications to all non isolated analog devices. Provide isolators whenever passing through 2-hour rated areas.
 - .4 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.
 - .5 The Signature Series Analog Loop or SIGA-IM Controller shall support up to 125, SIGA-IB isolator bases.
- .22 Single Input Module SIGA-CT1
- .1 The intelligent Single Input Module (SIGA-CT1) shall be capable of a minimum of 4 personalities, each with a distinct operation.
 - .2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code down loaded from the 3-SSDC, Analog Loop Controller. Single function modules or modules requiring EPROM, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.
 - .3 The single input module shall support the following circuit types:
 - .1 Alarm Latching, Manual Station, Conventional Heat, Waterflow
 - .2 Delayed Waterflow
 - .3 Non-Latching Monitor
 - .4 Supervisory
 - .4 Input circuit wiring shall be supervised for open and ground faults. The input module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
 - .5 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
 - .6 The single input module shall be suitable for mounting on North American; 2½" (64mm) deep 1 gang, 1½" (38mm) deep 4" square box with 1 gang cover.
 - .7 The input module shall be suitable for operation in the following environment: Temperature: 32 degree F to 120 degree F (0 degree C to 49 degree C) Humidity: 0-93% RH, non-condensing.
 - .8 It shall be possible to address each Signature Series module without the use of DIP or

rotary switches. Devices using DIP switches for addressing shall not be acceptable.

- .23 Dual Input Module SIGA-CT2
- .1 The intelligent Dual Input Module (SIGA-CT2) shall provide two (2) supervised input circuits capable of a minimum of 4 personalities, each with a distinct operation.
 - .2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code down loaded from the ZAS-2, Analog Loop Controller, Single function modules or modules requiring EPROM, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.
 - .3 The dual input module shall support the following circuit types:
 - .1 Alarm Latching, Manual Station, Conventional Heat, Waterflow
 - .2 Delayed Waterflow
 - .3 Non-Latching Monitor
 - .4 Supervisory
 - .4 Input circuit wiring shall be supervised for open and ground faults.
 - .5 The dual input module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
 - .6 The dual input module shall be suitable for mounting on North American, 2½" (64mm) deep 1 gang, 1½" (38mm) deep 4" square box with 1 gang cover.
 - .7 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
 - .8 The input module shall be suitable for operation in the following environment: Temperature: 32 degree F to 120 degree F (0 degree C to 49 degree C) Humidity: 0-93% RH, non-condensing
 - .9 It shall be possible to address each Signature Series module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.
- .24 Monitor Module SIGA-MM1
- .1 The intelligent Monitor Module (SIGA-MM1) shall be factory set to support a supervised, non-latching monitor circuit.
 - .2 Input circuit wiring shall be supervised for open and ground faults.
 - .3 The monitor module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
 - .4 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
 - .5 The monitor module shall be suitable for mounting on North American; 2½" (64mm) deep 1 gang, 1½" (38mm) deep 4" square box with 1 gang cover.
 - .6 The monitor module shall be suitable for operation in the following environment: Temperature: 32 degree F to 120 degree F (0 degree C to 49 degree C) Humidity: 0-93% RH, non-condensing
 - .7 It shall be possible to address each Signature Series module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.
- .25 Control relay Module SIGA-CR
- .1 The intelligent micro-processor based Control relay Module (SIGA-CR) shall provide one form "C" dry relay contact rated at 2 amps. @ 24 Vdc. to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems.
 - .2 The position of the relay contact shall be confirmed by the system firmware.

- .3 The control relay module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
 - .4 The control relay module shall be suitable for mounting on North American; 2½" (64mm) deep, 1 gang, 1½" (38mm) deep, 4" square box with 1 gang cover.
 - .5 The module shall be suitable for operation in the following environment: Temperature: 32 degree F to 120 degree F (9 degree C to 49 degree C) Humidity: 0-93% RH, non-condensing.
 - .6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
 - .7 It shall be possible to address each Signature Series Module without the use of DIP switches. Devices using DIP switches for addressing shall not be acceptable.
- .26 Duct mounted ionization smoke detectors, Cat #SIGA-DH series, photoelectric type visual indication alarm lamp, duct mounting hardware and air sampling tubes and suitable for air speeds of 1.5 m/s to 18 m/s.
- .27 Manual pull stations shall be cat. #SIGA-270P, pull lever, break glass type. Pull stations shall be semi-flush or surface mounted with cat. # 27193-11 back box where indicated. The detector shall be connected to the addressable loop. Pull stations located at maglocks are to be provided with an auxiliary contact to release the maglock directly.

2.05 VISIBLE SIGNALLING DEVICES

- .1 Strobe: Use synchronized strobes labelled "Fire" in English markings. Polarize the strobes for supervised operation. Mount the units flush or surface as indicated on the plans. Strobes shall provide a high intensity flashing light (15 candela) for visual signalling. Cover plate shall be red Edwards Cat. #202-7A-001.
- .2 Provide combination units as shown on the plans.

2.06 AUDIBLE SIGNALLING DEVICES

- .1 Provide EST 965-1C-4RW 4" round flush or 965-1C-4SW surface speakers as indicated on the drawings. The speaker shall be designed for broadcasting high quality fire alarm signals and voice messages. The speakers shall operate on 70.7 VRMS supervised alarm lines and shall be tapped at 1/4, 1/2, 1 or 2 watts, initially set at 1 watt in corridors and ½ watt in suites.
- .2 Provide EST CSV7-77UCR horn speakers with 1, 2, 4 and 7.5 watt taps, initially set at 2 watts.
- .3 Suite isolators and suite switches shall be provided. Install isolators in the corridor so that if devices within one suite are damaged or tampered with the remaining audible signal devices shall be able to sound. Locate the isolator switch within each suite in the master bedroom as shown.

2.07 TELEPHONE HEANSETS

- .1 Provide EST 6702 series telephone stations to consist of red telephone handset, hook switch and coil cord in a flush or surface enclosure. The enclosure shall have a break glass insert and red locking door.

2.08 END OF LINE DEVICES

- .1 Provide end of line supervision devices for each circuit as required. End-of-line resistors to be mounted in single gang box complete with stainless steel covers.

2.09 ANNUNCIATORS

- .1 The annunciators shall have LEDs with programmable (software-controlled) flash rates and slide-in labels for annunciation of system events. The enclosure to be complete with an LCD display panel, in addition to the LED display.
- .2 Annunciators shall provide the system with individual alarm and trouble annunciation per zone.

2.10 PRINTER

- .1 Provide an Edwards desk mounted PT-1 printer. The event and status printer shall be a 9 pin, impact, dot matrix printer with a minimum print speed of 232 characters per second. Printer parameters shall be set up with a menu driven program in the printer. The communication speed for RS 232 communications shall be adjustable from 300 to 900 baud. The cable shall be supervised. The serial printer shall support haul modems. The printer shall list the time, date, type and user defined message for each event printed.

2.11 REMOTE ANNUNCIATOR PANELS

- .1 Provide a remote LCD panel at each concierge desk, to display all system functions. Mount the panels in co-ordination with all other equipment mounted on the desks.
- .2 Provide a remote annunciator panel in the retail entrance vestibule to display all commercial retail zones, refer to drawings for additional information.

2.12 SUPERVISED MODEM

- .1 Provide a modem to transmit signals to a central monitoring agency.
- .2 The modem shall be a listed device on the system.

2.13 RESIDENTIAL CO/SMOKE DETECTORS

- .1 Provide combination carbon monoxide ionization smoke detector, 120 VAC, compete with built in battery and visual device where shown in residential suites.
- .2 Provide combination carbon monoxide ionization smoke detector, 120 VAC American Sensors Cat. No. COS 2010 with built n battery and compete with optional CB100 relay and connect via addressable loop through a monitor module, into a fire alarm zone. Program the zone as a non-monitor type zone (trouble) for indication to staff only.

PART 3 - EXECUTION

3.01 INSTALLATION PER CAN/ULC S524

- .1 Install manual pull stations as indicated and connect to alarm circuit wiring. Co-ordinate mounting height with other devices, equipment and finishes.
- .2 Install product of combustion and automatic alarm initiating devices as indicated and connect to

alarm circuit wiring. Co-ordinate mounting and locations with other devices, equipment and finishes.

- .3 Install all control equipment as indicated.
- .4 Install duct-mounted products of combustion detectors as indicated and as follows:
 - .1 Mount at a suitable location in the return air stream prior to exhausting from the building or being diluted by outside air.
 - .2 Mounted at a suitable locations in the supply air stream downstream of the filters and also downstream of the fan motor if the motor is enclosed in the air stream.
 - .3 Readily accessible for maintenance.
 - .4 Each duct detector mounted near bends in the duct shall be located at least twice the duct width away from the bend.
 - .5 Co-ordinate with Division 15.
- .5 Install audible signal devices as indicated and connect to signal circuit wiring. D.C. signal circuit wiring shall be suitable for Class II. AC circuits must be Class I.
- .6 Connect from the fire alarm system to the designated doors so that the operation of the fire alarm system shall release all doors equipped with electric hold-open door closures and maglock power supplies. Size the wiring for a maximum 5% voltage drop.
- .7 Locate and install the audible and visual signal devices as indicated and connect them to the signalling circuits. Each adjacent speaker to be on a separate circuit.
- .8 Connect from the fire alarm system to the emergency generator control panel to monitor operation.
- .9 Provide all wiring between the fire alarm control panel and fan starters for fire alarm shut down.
- .10 All wiring to be in conduit. The contractor shall be responsible for the supply and installation of the conduit, wire, wire pulling, junction boxes, electrical boxes, and terminal cabinets in accordance with the manufacturer's recommendations.
- .11 The manufacturer shall allow for the necessary amount of on site assistance for the contractor during the construction period.
- .12 Provide wiring for the fire alarm system with the following characteristics:
 - .1 Copper conductors only.
 - .2 For alarm receiving circuits a maximum circuit resistance of 50 ohms and a minimum wire size of:
 - 1. Pair of #18 AWG wires for the addressable loop.
 - 2. Provide 1 pair of #18 AWG twisted/shielded per phone circuit.
 - 3. Provide #18 AWG twisted and 18 AWG twisted/shielded MICC (2-hour fire-rated) cables for main communication riser.
 - 4. Provide 1 pair of #18 AWG twisted/pair per speaker circuit.
 - 5. Provide 1 pair of #18 AWG from SIGA modules to supervisory valves and flow switches.
 - 6. Each manufacturer to indicate whether the floor wiring (loop, page, telephone circuits, etc.) can be in the same conduits or separate conduits.
 - 7. Obtain quantity and size of all conductors for all circuits, main riser, between equipment, etc., from manufacturer as required to complete the installation. (MICC cables, etc.)

3.02 INSTALLATION OF SINGLE STATION SMOKE AND ALARM AND C.O. DETECTORS

- .1 Install single station smoke alarms where noted on the drawings.
- .2 Smoke alarms shall be installed by permanent connections to an electrical circuit on a standard outlet box and shall have no disconnect switch between the overcurrent device and the smoke alarm.
- .3 Smoke alarms shall be installed on the ceiling or on the walls between 150mm and 350mm below the ceiling in conformance with the manufacturers' installation instructions.
- .4 Where multiple detectors are provided, interconnect the detector such that all detectors shall sound if any one of the detectors are activated.
- .5 Connect auxiliary contacts to the security system as indicated on the drawings.

3.03 TEST AND VERIFICATION

- .1 Perform system verification in accordance with the latest CAN/ULC Standard S537.
- .2 Test each device and alarm circuit to ensure that the manual stations, thermal and smoke detectors, sprinkler system, etc. transmit an alarm to the fire alarm control panel and actuates a first stage alarm, second stage alarm and ancillary devices.
- .3 Check annunciator panel to ensure that the zones are shown correctly.
- .4 Simulate open, ground and short circuit faults on the alarm and signalling circuits to ensure the proper operation of the trouble signals.
- .5 Check all signalling devices for correct operation.
- .6 Check all supervised circuits for correct operation.

3.04 OWNER TRAINING

- .1 Allow 16 hours for training in the operation of the system.

End of Section 16615

CONTENTS

PART 1 – GENERAL

1.01 WORK INCLUDED

PART 2 – PRODUCTS

- 2.01 CONDUITS, PULLBOXES, OUTLET BOXES, PLYWOOD, ETC.**
- 2.02 COMMUNICATIONS ENCLOSURES FOR RESIDENTIAL SUITES**

PART 3 – EXECUTION

- 3.01 UNDERGROUND SERVICE ENTRANCE**
- 3.02 PULLBOXES**
- 3.03 SEPARATION FROM POWER**
- 3.04 SERVICE / ELECTRICAL ROOMS**
- 3.05 GROUNDING**
- 3.06 RESIDENTIAL SUITE & FLOOR WIRING DISTRIBUTION**
- 3.07 CONDUIT AND FITTINGS**

PART 1 - GENERAL

1.01 WORK INCLUDED

- .1 Comply with Electrical General Requirements, Section 16010 and all other documents referred to therein.
- .2 Provide a complete system of conduits, pull boxes enclosures and outlet boxes to accommodate the installation of Communications System wiring by others.
- .3 Conduit shall be of size as shown on the drawing and shall interconnect outlets and/or rooms as detailed and/or shown.
- .4 Pull box sizes shall not be less than sixteen (16) times the entering conduit diameter.

PART 2 - PRODUCTS

2.01 CONDUITS, PULLBOXES, OUTLET BOXES, PLYWOOD, ETC.

- .1 Refer to appropriate sections for details.

2.02 COMMUNICATION ENCLOSURES FOR RESIDENTIAL SUITES

- .1 Service provider will supply residential network enclosures (1 per suite) for installation by the electrical contractor.
- .2 The enclosure is approximately 14 inches wide by 3.5 inches depth, with a height of 30 inches.
- .3 Provide and install in the enclosure, a 120v AC duplex power receptacle on a dedicated circuit from the suite.

PART 3 - EXECUTION

3.01 UNDERGROUND SERVICE ENTRANCE

- .1 Provide 100mm (4") E.M.T. conduits from the telecommunication terminal room to the property line locations as shown on plan.
- .2 The conduits shall be thoroughly cleaned, swabbed out and provided complete with 3mm (1/8") braided nylon waterproof pull cord.
- .3 Service entrance conduits must be terminated in an unobstructed space adjacent to the telephone plywood backboard.
- .4 No conduit installation can have more than two (2) 90 degree bends. A pullbox should be inserted in the conduit line to avoid exceeding two bends.
- .5 The maximum pulling lengths should not exceed 61m (200') through two (2) 90 degree bends or 91.5m (300') in a straight pull.
- .6 LB fittings on entrance conduits are NOT acceptable.

- .7 All conduits entering a building must be suitably drained. Slope conduits away from the building.
- .8 Conduits shall be connected with approved couplings and secured mechanically to prevent disturbance to alignment during construction or cable placing.
- .9 Provide pulling eyes opposite the entrance ducts for facilitate the placing of the entrance cables.

3.02 PULL BOXES

- .1 Pull box size and locations must be approved by the consultant prior to installation. Pull boxes must be located in an area, which will remain accessible over the life of the building.
- .2 Pull boxes are to be free of electrical distribution cables and designated for communications use only.
- .3 Conduits should enter ends of pull boxes.

3.03 SEPARATION FROM POWER

- .1 Maintain a minimum separation of 300mm (12") between telephone and electrical services.

3.04 SERVICE/ELECTRICAL ROOMS

- .1 When a conduit enters a building up through the floor, they must terminate 50mm (2") out from the finished wall where equipment is to be mounted.

3.05 GROUNDING

- .1 The maximum ground resistance for the telephone equipment is 25 OHMS. Provide a 38mm (1.5") PVC conduit with a minimum 2/0 cable must be provided to the telephone equipment room directly from the main building ground bar.
- .2 Refer to the riser diagram for grounding riser requirements.

3.06 RESIDENTIAL SUITE AND FLOOR WIRING DISTRIBUTION

- .1 Provide a Residence Unit Box, sized as detailed on drawings for each residential suite. Install boxes as detailed on plans.
- .2 Provide an AC duplex power outlet from the suite main power panel to the residential suite enclosure.
- .3 Two conduits shall be placed from the riser closet to the Residence Unit Box in each suite servicing that floor. Refer to the riser for conduit side.
- .4 Provide a 25mm (1") conduit for the in-suite LAN distribution box which is located below the Residence Unit Box.
- .5 Within the suite, each communication outlet box shall be provided with a home run conduit from the outlet to the Residential Unit Box.
- .6 Outlets shall be 100mm X 100mm square boxes, 50mm deep, with single gang plaster ring in poured or insulated walls. In interior suite shallow walls, provide plaster ring properly supported to metal studs on both sides. Run the conduit to within 12mm of the ring, and

properly support at 150mm above the ring and at intervals of 1000mm on centre, up to the slab above.

- .7 Location of Residential Unit Box shall be co-ordinate with architect prior to rough-in.
- .8 For stud mounting, use a #8 wood lag screw in each of the four mounting holes in the sides of the enclosure.
- .9 Bond the enclosure to an approved ground according to applicable codes and as per ANSI-J-Std 607-A.

3.07 CONDUIT AND FITTINGS

- .1 All conduits shall be connected using approved couplings and fittings and installed to conform to existing building codes.
- .2 All conduits shall be installed complete with a 3mm (1/8") braided nylon waterproof pull cord.
- .3 Bends in conduit that connect sections of a building or distribution locations shall be long sweep radius bends whenever it is possible and practical. However, in no instance shall the inside radius of bend be less than:
 - .1 Six (6) times the internal diameter for conduits 50mm (2") and smaller.
 - .2 Ten (10) times the internal diameter for conduits 64mm (2 1/2") and larger.
- .4 LB fittings are NOT acceptable.
- .5 Conduits shall not exceed two (2) 90° sweep bends or the equivalent without the use of a pull box. Two offsets equal one (1) 90° bend.
- .6 No conduit run shall be longer than 30.5m (100') between pullboxes or telephone terminating points.
- .7 Leave conduits free and clear of all obstructions and terminate as shown. Equip terminations with bushings and clearly identify each run.

END OF SECTION 16743

CONTENTS

PART 1 – GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 EXTENDED WARRANTY
- 1.05 ACCEPTABLE MANUFACTURERS

PART 2 – PRODUCTS

- 2.01 ELECTRIC SNOW MELTING SYSTEM

PART 3 – EXECUTION

- 3.01 INSTALLATION OF SNOW MELTING CABLES
- 3.02 TESTS

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide a complete system of specified heating cables, junction boxes, contactors, GFCI's and controls for electric snow melting system.

1.03 SUBMITTALS

- .1 Submit shop drawings for all components and equipment, including complete zone layout.

1.04 EXTENDED WARRANTY

- .1 Provide a manufactures 20 year limited warranty on the cables.

1.05 ACCEPTABLE MANUFACTURERS

- .1 The specifications are based on Pyrotenax of Canada Ltd., mineral insulated (MI) series cables. Britech TXLP series cables are an acceptable alternate.

PART 2 - PRODUCTS

2.01 ELECTRIC SNOW MELTING SYSTEM

- .1 The heating cable and termination components shall be approved as De-Icing and Snow Melting Equipment, CSA Certified for designation G-W. The heating cable shall be series resistance type.
- .2 The heating cable shall be magnesium oxide or TXLP insulated, with a copper or resistance alloy conductor and a continuous metal sheath. All heater core materials shall be inorganic and will not deteriorate with age.
- .3 The heating cable shall be jacketed with high density polyethylene (HDPE) to resist corrosion.
- .4 Each heating cable shall be factory-fabricated to the length required and shall not be altered on site. The heated section shall be joined to a factory made cold lead section. Cold lead shall be six (6) or fifteen (15) feet long unless otherwise specified.
- .5 Heating cables will be designed for operation on supply voltages up to 600V.

2.02 CONTROLS

- .1 Automatic Snow Controller
 - .1 Sensors shall be suitable for installation in exposed, elevated locations, or for flush installation in pavement and ramps.
 - .2 Sensors shall incorporate a microprocessor that, in conjunction with integral ambient air temperature and moisture detectors, will verify the presence of moisture at 38°F (3.3°C) and below.
 - .3 Pavement sensors controlling pavement snow/ice melting shall function to incrementally ramp pavement temperature to minimize thermal stresses that may

contribute to concrete cracking and shall maintain a maximum slab temperature of 44°F (6.7°C).

- .4 Control panel shall be microprocessor based to provide effective, economical automatic control.
- .5 Control panel shall have an adjustable hold-on timer to provide up to 1.5 hours of system operation after snowfall ceases for complete melting.
- .6 Control panel shall have a manual cycle switch permitting:
 - .1 Manual system operation for the hold-on time period to clear tracked slush and drifted snow.
 - .2 Manual termination of the hold-on period during time-down.
- .7 Control panel shall have individual LEDs to provide indication of power supply, sensor status and heater operation.
- .8 GFCI's to be provided by cable manufacturer. GFCI's will be maximum 30 mA for personnel protection. GFCI panel will be NEMA 4, complete with alarm lamp and relay, push to test feature, line voltage contactors and relays to interface with snow sensor and with BAS. Panel to signal BAS on GFCI fault indication.

PART 3 - EXECUTION

3.01 INSTALLATION OF SNOW MELTING CABLES

- .1 Series Resistance Heating Cable
 - .1 The heating cable shall be installed according to local electrical codes, manufacturer's recommendations, and the instructions supplied with the heating cable and components.
 - .2 Cables and cable sheaths shall not touch or cross one another nor shall cables cross expansion joints. Concrete crack control joints must be crossed in accordance with manufacturer's recommendations.
 - .3 Heating cables are laid out at the specified spacing. Spacing should not be greater than 6 inches to ensure reasonably uniform distribution of heat and maximum energy efficiency.
 - .4 All junction boxes shall be located in accessible areas. Junction boxes shall not be located in the heated slab, but shall be located above grade level. Covers shall be kept on boxes at all times when not working therein.
 - .5 All terminations shall be protected from the weather and from physical damage. The MI cable gland assembly shall be bonded to the system ground.
 - .6 Any field alterations or deviations shall proceed only after authorization has been issued by the engineer. All changes shall be accurately recorded by the contractor and shall be turned over to the engineer upon completion of that phase of the work.

3.02 TESTS

- .1 Series Resistance Heating Cable
 - .1 The heating cable shall be tested for continuity with a multi-meter (or ohmmeter), and for insulation resistance with a 500-Vdc Megger™, when received on the job site, after installation, during and after the concrete pour, and annually thereafter according to the manufacturer's recommendations.
 - .2 Insulation resistance shall be consistently not less than 20 megohms.
 - .3 A complete system test of controls shall be conducted to verify cable operation.
 - .4 Copies of all such testing shall be delivered to the Consultant.

END OF SECTION 16920

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PART 1 - GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 ACCEPTABLE MANUFACTURERS

PART 2 - PRODUCTS

- 2.01 ELECTRIC PIPE HEATING CABLES AND CONTROLS
- 2.02 CONTROLS
- 2.03 HEAT TRACE PANEL

PART 3 - EXECUTION

- 3.01 INSTALLATION OF ELECTRIC PIPE HEATING CABLES

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Section 16010, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide a complete system of heating cables, components and controls to provide freeze protection as indicated on plans.

1.03 SUBMITTALS

- .1 Submit shop drawings for all components and equipment, in accordance with Section 16011.

1.04 ACCEPTABLE MANUFACTURERS

- .1 The heating cable shall be XL-Trace cable as manufactured by Raychem Corporation.

PART 2 - PRODUCTS

2.01 ELECTRIC PIPE HEATING CABLES AND CONTROLS

- .1 The self-regulating heating cable shall consist of two (2) 16 AWG nickel-copper bus wires embedded in parallel in a self-regulating polymer that varies its power output to respond to temperature all along its length, allowing the heating cable to be cut to length in the field. The heating cables shall be covered by a radiation-cross linked, modified polyolefin dielectric jacket. To provide a ground path and to enhance the heating cable's ruggedness, the heating cable shall have a braid of tinned copper and an outer jacket of (select modified polyolefin (-CR) or fluoropolymner (-CT)) as required.
- .2 All heating cable components shall be cUL listed, CSA Certified, for use as part of the system to provide freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that uses crimps or terminal blocks, shall not be acceptable. All components that make an electrical connection shall be re-enterable for servicing. No component shall use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.
- .3 In order to conserve energy and to prevent overheating, the heating cable shall have a self regulating factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heating cable output going from 40°F pipe temperature operation to 150°F pipe temperature operation.
- .4 The heating cable shall operate on line voltages of 120 or 208 volts as indicated on plans.
- .5 The heating cable for metal-pipe freeze protection shall be sized according to the table below. The required heating cable output rating is in watts per foot at 50°F. Heating cable selection based on 1 inch fibreglass insulation on metal piping.

Pipe size (inches)	Minimum Ambient Temperature	
	0°F	-20°F
3 or less	5 watts	5 watts
4	5 watts	8 watts
6	8 watts	8 watts
8	8 watts	2 strips-5 watts
10	2 strips-5 watts	2 strips-8 watts

- .6 Each circuit shall be protected by a 30-mA ground-fault protection device.
- .7 Heating cable circuit shall be protected by a ground-fault circuit breaker for equipment protection.

2.02 CONTROLS

- .1 Thermostatic Control-Line Sensing: The system shall be controlled by a line sensing thermostat, AMC-F5 fixed at 40°F either directly or through an appropriate contactor.

2.03 HEAT TRACE PANEL

- .1 For freeze protection or group control process-temperature maintenance systems, distribution panels shall consist of an enclosure, including a panel board with ground-fault circuit breakers (30 mA trip level). The panels shall provide ground-fault alarm capabilities. If more than one circuit is required, a main contactor shall be used. The panels shall operate with ambient-sensing or proportional ambient-sensing controllers. The panel shall be the Tracer HTPG heat tracing panel as manufactured by Tyco Thermal Controls.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRIC PIPE HEATING CABLES

- .1 Install heating cables as indicated and to manufacturer's recommendations.
- .2 Prior to ordering any pipe heating cables site measure piping installed by others and be responsible for correctly ordering all pipe tracing.
- .3 Field testing of insulation resistance and continuity of the units shall be carried out with a 500 volt megger and recorded by Division 16. Testing shall be done when received on the job site resistance shall be consistently not less than 5 megohms with no decline in reading.
- .4 Cable shall first be roughed in using tape or rubber bands which shall be removed after permanent banding.
- .5 Cable sheaths shall not cross or touch another shall cables be installed directly on top of pipe.
- .6 Heating cable shall be strapped to 150 mm and larger pipe using 13 mm wide stainless steel strapping at intervals not exceeding 750 mm. Copper or stainless steel tie wire #6 AWG or larger shall be used to hold the cable to irregular surfaces such as valves.
- .7 Tie wire and strapping shall be snug, but not so tight as to indent cable sheath. On small diameter, low temperature pipe nylon ties or glass tape may be used.

- .8 Extra cable shall be provided at areas of increased heat loss such as valves and flanges to allow dismounting and removal of equipment.
- .9 Thermostat bulb shall be located as far away from the heating cable as possible. Thermostat capillary and control wire shall have mechanical protection between the equipment rack and the pipe line.
- .10 Where the source of supply does not coincide with the location of the thermostat MI cable shall be run along the pipe, under the insulation, to the thermostat.
- .11 All lines shall be insulated within 24 hours of tracer installation.
- .12 Junction boxes, thermostats, transformers and the like shall not be attached to the insulation, but shall be mounted on brackets fabricated of galvanized angle, channel or other material of sufficient strength to support equipment mounted on them. Brackets shall not be mounted on pipes, but rather on separate supports.
- .13 Electrically heated pipe lines shall have adhesive backed labels on the outside of the insulation cover at intervals not exceeding 7 metres reading "Electrically Traced".

END OF SECTION 16921

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PART 1 - GENERAL

- 1.01 REFERENCES
- 1.02 WORK INCLUDED
- 1.03 SUBMITTALS
- 1.04 ACCEPTABLE MANUFACTURERS

PART 2 - PRODUCTS

- 2.01 HEATING CABLE
- 2.02 PERFORMANCE

PART 3 - EXECUTION

- 3.01 INSTALLATION
- 3.02 TESTING

PART 1 - GENERAL**1.01 REFERENCES**

- .1 Comply with Section 16010, Electrical General Requirements, and all documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide a concrete floor warming or heat loss replacement system composed of heating cable, components, and controls.

1.03 SUBMITTALS

- .1 Submit shop drawings for all components and equipment, in accordance with Section 16011.

1.04 ACCEPTABLE MANUFACTURERS

- .1 The heating cable shall be Britech TXLP as manufactured by Britech Corp. or Pyrotenax as manufactured by Raychem Corporation.

PART 2 - PRODUCTS**2.01 HEATING CABLE**

- .1 The heating cable and termination components shall be cUL Listed for Radiant Heating and CSA Certified for Designation G.
- .2 The heating cable shall be series resistance type as manufactured by Britech or Tyco Thermal Controls.
- .3 The heating cable shall be magnesium oxide or TXLP insulated with a copper or resistance alloy conductor and a continuous metal sheath. All heater core materials shall be inorganic and will not deteriorate with age.
- .4 The heating cable shall be jacketed with high density polyethylene (HDPE) to resist corrosion.
- .5 Each heating cable shall be factory-fabricated to the length required and shall not be altered on site. The heated section shall be joined to a factory made cold lead section. Cold lead shall be six (6) or fifteen (15) feet long unless otherwise specified.
- .6 Heating cables will be designed for operation on supply voltages up to 600V.
- .7 The power connection, end seal, and splice kits shall be factory applied.
- .8 Each circuit shall be protected by a 30-mA ground-fault circuit breaker.

2.02 PERFORMANCE

- .1 The heating cable shall meet the following performance criteria:

- .1 For floor heat loss replacement: A minimum temperature of 70°F ($\pm 5^\circ\text{F}$) or 2 watts/ft².
 - .2 For floor warming: A minimum temperature of 80°F ($\pm 5^\circ\text{F}$) or 6 watts/ft².
 - .3 A maximum thermal output at 40°F or 16.5 watts/ft².
- .2 The heating cable spacing shall be determined by an application-specific, steady-state, finite-difference, thermal analysis of the floor to be warmed.
- .3 The program output shall show slab temperature based on the depth and thermal conductivities of the floor layers, ambient temperatures, voltage, and heating cable output. A copy of the program output shall be submitted to the engineer for approval.

PART 3 – EXECUTION

3.01 INSTALLATION

- .1 The heating cable shall be installed according to the manufacturer's recommendations, the instructions supplied with the heating cable and components, and the instructions in the manufacturer's manual.
- .2 Heating cables shall be installed on the underside of the slab and attached by manufacturer supplied stainless steel strips that are fastened securely to the slab. Strips shall be spaced no more than 24" apart. Foil back insulation to be installed after cables are inspected and meggered. Megger again after completion of insulation installation.
- .3 The heating cable shall be protected from damage during installation. Heating cable repairs and splices shall be made using a manufacturer supplied splice kit.

3.02 TESTING

- .1 After installation, prior to concrete pour, the cable shall be meggered at 2500 Vdc, from conductor to braid. Resistance readings shall be 1000 megohms to infinity. After concrete pour, the cables shall be re-tested. Submit test record to the engineer.

END OF SECTION 16923

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- 1.01 REFERENCES
- 1.02 WORK INCLUDED

PART 2 – PRODUCTS

- 2.01 CARBON MONOXIDE MONITORING AND CONTROL SYSTEM
- 2.02 SEQUENCE OF OPERATION

PART 3 – EXECUTION

- 3.01 INSTALLATION OF CARBON MONOXIDE MONITORING AND CONTROL SYSTEM

PART 1 - GENERAL

1.01 REFERENCES

- .1 Comply with Electrical General Requirements, Section 16010 and all other documents referred to therein.

1.02 WORK INCLUDED

- .1 Provide a Carbon Monoxide Monitoring and Control System including conduits, backboxes wires, devices and control panels as required for the installation of a complete system.

PART 2 - PRODUCTS

2.01 CARBON MONOXIDE MONITORING SYSTEM

- .1 Supply a complete CO monitoring system as shown on the drawings and specified herein.
- .2 The central gas monitoring panel shall be an Arjay/Enmet PG-2000 series Scanner supplied by Kilmer Environmental Inc., (905) 890-8908.
- .3 The main control panel accepts a 120 vac power input and has a built in 24 Vdc power supply to power the remote sensors. A four-line backlit LCD display will indicate each sensors ppm concentration and provide sensor diagnostics. Alarm status of each sensor will be available at this display. A keypad pass code entry will access the set-up, calibration, and diagnostics menus.
- .4 The panel will be capable of monitoring up to 80 field sensors via RS-485 communication on one continuous cable run. The system shall be designed to designate up to 8 zones and provide discrete control functions for each zone.
- .5 The panel will monitor the EC-Gold field sensor inputs via RS-485 communication using a two conductor shielded wire (Beldon 3105A or equal) run in true daisy chain fashion. A second two conductor shielded 24 Vdc sensor power wire may run adjacent to the communication wire in the same conduit but should be run in a T-tapped fashion to minimize the distance the power wiring needs to run between the main panel and the furthest sensor(s).
- .6 Eight (8) SPDT 5amp dry contact relays for user control and one SPST Fault relay will be provided in the main panel. The main control panel shall be mounted in the motor control centre room for exhaust fans associated with Tower A. Interlock the motor starters located in Tower B directly from the associated relays in the Main control panel.
- .7 Each user control relay will have a field selectable differential for ppm ON vs. ppm OFF. A user selectable time delay of 0-99 minutes will be included. A panel mounted buzzer with silence will be provided independent of the relays and with its own ppm setpoint. A 4-20 mA output will be available and will be indicative of the highest ppm concentration within the field of sensors. These can be used for fan speed control or customer interface and logging.
- .8 The relay control sequence can be user defined in the field by reprogramming of the main control panel, if required.
- .9 The sensors will be electrochemical type to minimize nuisance alarms from background vapors. For carbon monoxide, the calibrated sensor range will be 0 to 200 ppm CO with alarm LED status indication at 25 ppm and 50 ppm CO. The circuit will perform a weekly self test on the sensor to verify sensor response by activating an internal reactive correlation gas

onto the sensor. Remote alarms and fans will be by-passed during this function test. Any failure will be indicated by a flashing LED at the sensor and will alarm the fault relay and initiate the low level fan relay for that sensor's zone.

- .10 Sensors are assigned to one or more zones at the control panel in the set-up, calibration, and diagnostics menus. Relays are set to activate based on alarm levels and by zone. Relays can activate from different alarm levels from different zones.
- .11 The sensors will be mounted between 2'11" and 3'11" above grade or as per local building code.
- .12 The electrochemical sensors and sensor circuits will have a 2 year parts warranty. Regular calibrations will be required as per the manual. The system shall be manufactured in an audited ISO 9001-2000 facility.
- .1 Supplier shall provide factory-trained technician to perform initial calibration check. Equipment manufacturer shall be capable of providing optional maintenance contract for periodic re-calibration of sensors for optimum operational efficiency

2.02 SEQUENCE OF OPERATION

- .1 For example, EF-1 may activate at 25 ppm in Zone 1. EF-2 & EF-3 may activate at 25 ppm in Zone 2. All three of EF-1, EF-2 and EF-3 can activate when either Zone 1 or Zone 2 reads 50 ppm. If the ppm level in any individual zone continues to climb to 75 ppm Relay 8 can active to sound a remote alarm at the fire alarm panel or concierge desk. At 100 ppm the main panel mounted buzzer can sound.
- .2 The relays will automatically clear if the levels fall below the prescribed setpoint levels.
- .3 Relays for all parking garage exhaust fans shall be located in the main control panel in the Tower A motor control centre. Exhaust fan motor starters located in the Tower B motor control centre shall be interlocked with the associated relay in the main control panel in Tower A.
- .4 Example: Single fan per zone with other zones on the same parking level backing each other up. Sequence of operation shown in detail in the following table.

Parking Level	CO (ppm)	Zone	Relay	Activates to Control
P4	25	1	1	EF-1
P4	25	2	2	EF-2 and 3
P4	50	1 or 2	1 and 2	EF-1, 2 and 3
P3	25	3	3	EF-4
P3	25	4	4	EF-5 and 6
P3	50	3 or 4	3 and 4	EF-4, 5 and 6
P2	25	5	5	EF-7 and 9
P2	25	6	6	EF-8
P2	50	5 or 6	5 and 6	EF-7, 8 and 9
P1	25	7	7	EF-10
Any Level	75	Any Zone	8	Remote Alarm
Any Level	100	Any Zone	buzzer	Main Control Buzzer

PART 3 - EXECUTION

3.01 INSTALLATION OF CARBON MONOXIDE MONITORING AND CONTROL SYSTEM

- .1 Provide a system of conduit, cables and outlet boxes as required.
- .2 Conduits shall be minimum 20mm. There shall not be more than two (2) 90° bends in any run of conduit and pullboxes shall be provided in runs in excess of 100' or where more than two (2) 90° bends are required.
- .3 Provide power outlets as shown on the drawings.
- .4 Provide interface with other building systems as shown and or required for a functional system.

END OF SECTION 16925

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

100NA MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				2P4RAM			JOB NAME: Aquavista					
100NA		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
HEATING BOILER HBA-01				20	1a	1560			2a	15				For Metering
HEATING BOILER HBA-02				20	3b		1560		4b					
HEATING BOILER HBA-03				15	5c			0	6c					
HEATING BOILER HBA-04				15	7a			600	8a	20				Spare
Exhaust Fan EFA-01,02				15	9b			600	10b	20				Spare
Exhaust Fan EFA-03				15	11c		500		12c	15				Spare
Unit Heater UHA-01,02				15	13a			400	14a	15				Spare
Unit Heater UHA-03,04				15	15b	460			16b					
Unit Heater UHA-05				15	17c		460		18c					
					19a			230	20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					
Appendix-A					40c									



TOTAL AMP

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				2P1MRAM			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
Exhaust Fan EFA-04,05				15	1a	0			2a	15				For Metering
						500			4b					
Exhaust Fan EFA-06,07				15	3b		0		6c					
							500							
Entance Heater EHA-01,02				15	5c			0						
								690	8a	15				VFCA-01 OFFICE L1M
Entance Heater EHA-03,04				15	7a	1160								VFCA-02 OFFICE L1M
						690			10b	15				VFCA-02 OFFICE L1M
Unit Heater UHA-06				15	9b		1160							VFCA-03 OFFICE L1M
							230		12c	15				VFCA-03 OFFICE L1M
Unit Heater UHA-07				15	11c			1160						
								230	14a	15				Spare
SPARE				20	13a									
									16b	15				Spare
SPARE				20	15b									
					17c									
									20a					
					19a									
									22b					
					21b									
									24c					
					23c									
									26a					
					25a									
									28b					
					27b									
									30c					
					29c									
									32a					
					31a									
									34b					
					33b									
									36c					
					35c									
									38a					
					37a									
									40b					
Appendix-A					20b									



TOTAL AMP

MOUNTING: _____ SURFACE _____

PANEL SCHEDULE

120/208		VOLTS				JOB NUMBER: 8489D										
3	PHASE	4	WIRE				JOB NAME: Aquavista									
200		AMP MAINS				Feed Through Panel										
MLO		MAIN BREAKER														
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION		
						a	b	c								
REC RA1 CORRIDOR L2 ~ L7	6		180	20	1a	720			2a	15	180		4	REC MECH RM P4/P3		
REC RA2 CORRIDOR L2 ~ L7	6		180	20	3b	1080	720		4b	15	180		4	REC MECH RM P4		
REC RA3 CORRIDOR L2 ~ L7	6		180	20	5c		1080	720	6c	15	180		4	REC ELEV #5/6 PIT P3		
REC RA4 CORRIDOR L2 ~ L7	6		180	20	7a	1500		1080	8a	20	1500		1	E CAR CHARGING P2		
REC RA5 CORRIDOR L2 ~ L7	6		180	20	9b	1080	540		10b	15	180		3	REC LOCKER/MECH RM P2		
REC RA6 CORRIDOR L2 ~ L7	6		180	20	11c		1080	720	12c	15	180		4	REC LOCKER RM/ELEV LOBBY P2		
REC RA7 CORRIDOR L2 ~ L7	6		180	20	13a	1000		1080	14a	15	500		2	DOOR OPNER ELEV LOBBY P2		
REC RA1/RA2/RA3 CORRIDOR L8 ~ L10	6		180	20	15b	1080	1500		16b	20	1500		1	E CAR CHARGING P2		
REC RA4/RA5/RA6 CORRIDOR L8 ~ L10	6		180	20	17c		1080	540	18c	15	180		3	REC CACF RM/ MAIL RM L1		
REC RA7 CORRIDOR L8 ~ L10	2		180	20	19a	540		1080	20a	20	180		3	REC ELEV LOBBY L1		
SPARE				20	21b	360	0		22b	20				SPARE		
REC ELEV LOBBY L1M	4		180	20	23c		0	0	24c	15				SPARE		
REC ARTSCAPE BOARDROOM L1M	6		180	15	25a	1080		720	26a	15				SPARE		
REC ARTSCAPE ADMIN L1M	6		180	15	27b		200		28b	15	200		1	PWR GARBAGE CONTROL L1M		
REC ARTSCAPE OFFICE L1M	5		180	15	29c		1080	1080	30c	15	180		6	REC GARBAGE RM L1M		
DOOR OPNER ELEV LOBBY L1M	2		500	15	31a		900		32a	15				SPARE		
					33b	1000	720		34b	15	180		4	REC ARTSCAPE ELEC RM P1M		
					35c		0	0	36c	15				For Metering		
					37a			0	38a							
					40b											
Appendix-A					39b											

					42c	15				Spare
				41c						
 TOTAL WATT TOTAL AMP					9440	8000	7920	PANEL TYPE: TYPE1-SPRINKLER PROOF LOCATION: LEVEL P1MEZZNINE MOUNTING: SURFACE		
					25360					
					70					

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200		AMP MAINS				2P1MRAL			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG CORRIDOR L2 L3		16	26	20	1a	104			2a	20	26	4		LTG ELEV LOBBY P2
LTG CORRIDOR L4 L5		16	26	20	3b	832	0		4b	20				SPARE
LTG CORRIDOR L6 L7		16	26	20	5c		832	1040	6c	20	26	40		LTG ELEV LOBBY L1
LTG CORRIDOR L8 L9		16	26	20	7a			832	8a	20				SPARE
LTG GARABGE CHUTE L8 L9		9	26	20	9b	832			10b	20	26	40		LTG ELEV LOBBY L1M
					11c		234		12c	20	26	40		LTG OFFICE L1M
					13a				14a	15				For Metering
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					
Appendix-A					40c									

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2RRAAM			JOB NAME: _____					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
ENERGY RECOVERY UNIT ERVA-E				15	1a	0			2a	15				For Metering
						660			4b					
ENERGY RECOVERY UNIT ERVA-F				15	3b		0		6c					
							660							
Chimney Vent Exhaust Fan VENTA-01				15	5c			0						
								350	8a	20				Spare
Chimney Vent Exhaust Fan VENTA-02				15	7a									
						350			10b	20				Spare
Exhaust Fan EFA-09				15	9b									
							300		12c	15				Spare
Unit Heater UHA-08,09				15	11c									
								460	14a	15				Spare
Unit Heater UHA-10				15	13a									
						230			16b					
					15b									
									18c					
					17c									
									20a					
					19a									
									22b					
					21b									
									24c					
					23c									
									26a					
					25a									
									28b					
					27b									
									30c					
					29c									
									32a					
					31a									
									34b					
					33b									
									36c					
					35c									
									38a					
					37a									
									40b					
Appendix-A					39c									

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

2RRAP

Feed Through Panel

LOAD PER PHASE

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
SPARE				15	1a	720			2a	20	180		4	REC AMENITY L13
SPARE				15	3b	500	720		4b	20	180		4	REC AMENITY L13
REC MECH RM L13	6		180	15	5c			720	6c	20	180		4	REC AMENITY L13
REC ELEV MACH RM L13	3		180	15	7a	180		1080	8a	15	180		1	REC TV AMENITY L13
REC ELEV SHAFT L13	2		180	15	9b	540	720		10b	20	180		4	REC AMENITY KITCHEN L13
REC COOLING TOWER L13	1		180	20	11c		360	1000	12c	15	1000		1	FRIDGE AMENITY KITCHEN L13
REC ELEC RM L13	4		180	15	13a	1000		180	14a	15	1000		1	DISHWASHER AMENITY KITCHEN L13
REC GENERATOR RM L13	5		180	15	15b	720	1000		16b	20	1000		1	MW AMENITY KITCHEN L13
SPARE				15	17c		900		18c	15	500		2	DOOR OPNER AMENITY L13
SPARE				15	19a			1000	20a					For Metering
SPARE				15	21b			0	22b	15				
SPARE				15	23c				24c					
SPARE				15	25a				26a	15				
					27b				28b	15				SPARE
					29c				30c	15				SPARE
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					

Appendix-A

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS						2RRAL			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG MECH RM L13		64	6	20	1a	0			2a	20				LTG AMENITY L13
LTG COOLING TOWER L13		100	5	20	3b	384	0		4b	20				LTG AMENITY L13
SPARE				20	5c		500		6c	20				LTG AMENITY L13
SPARE				20	7a				8a	15				For Metering
SPARE				20	9b				10b					
					11c				12c					
					13a				14a					
					15b				16b	15				Spare
					17c				18c	15				Spare
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					
Appendix-A					40c									

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

						RP-GEN RA									
						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	a	b	c							
GENERATOR BATTERY CHARGER				15	1a	500			2a	20				BLOCK HEATER	
						200			4b						
					3b		500		6c						
					5c			500	8a						
					7a	0			10b						
					9b		0		12c						
					11c			0							
						700	500	500	PANEL TYPE: TYPE1-SPRINKLER PROOF						
						TOTAL WATT			LOCATION: LEVEL 13 GENERATOR RM ARTSCAPE						
						TOTAL AMP			MOUNTING: SURFACE						
						1700									
						5									



TOTAL WATT
TOTAL AMP

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 3 WIRE

200 AMP MAINS

200NA MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS						6P4RAM			JOB NAME: Aquavista							
200NA MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION		
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c								
Cond.Water Pump(11.2kW Each) PA-01/PA-02 Standby Duty				40	1a	733			2a	15				DHW Heating Sec Pump (2.2kW Each) PA-13/PA-14 Standby Duty		
						3733					4b					
					3b		733					6c				
					5c				733							
Cooling Heating Water Pump(7.5kW Each) PA-03/PA-04 Standby Duty				25	7a	187			8a	15				DHW Recirculating Pump (.56kW Each) PA-19		
						2500					10b					
					9b		187					12c				
					11c				187							
Boiler Pump#1(1.5kW) PA-05				15	13a	187			14a	15				DHW Recirculating Pump (.56kW Each) PA-20		
						500					16b					
					15b		187					18c				
					17c				187							
Boiler Pump#2(1.5kW) PA-06				15	19a				20a	15				For Metering		
						500					22b					
					21b		500					24c				
					23c											
High Temp Secondary Pump(3.7kW Each) PA-07/PA-08 Standby Duty				15	25a				26a	15				Spare		
						1233					28b					
					27b		1233					30c				
					29c											
Boiler Pump#3(0.75kW) PA-11					31a				32a	15				Spare		
						250					34b					
					33b		250					36c				
					35c											
Appendix A					37a				38a	15				Spare		
						250					40b					

Appendix A PA-12

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 3 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS						6P1MRAM			JOB NAME: Aquavista						
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c							
Fan Coil Unit HFCA-01				15	1a				2a	15				For Metering	
						1195					4b				
					3b		1195				6c				
					5c				1195		8a				
Unitary DX Unit ACA-01				15	7a	2324				20				Air Cooled Condenser Unit ACUA-01	
						996					10b				
					9b		2324								
						996					12c				
Unitary DX Unit ACA-02				15	11c			2324		20				Air Cooled Condenser Unit ACUA-02	
								996			14a				
					13a	2324									
						996					16b				
Unitary DX Unit ACA-03				15	15b		2324			20				Air Cooled Condenser Unit ACUA-03	
						996					18c				
					17c			2324							
						996					20a				
Unitary DX Unit ACA-04				15	19a	2324				20				Air Cooled Condenser Unit ACUA-04	
						996					22b				
					21b		2324								
						996					24c				
Unitary DX Unit ACA-05				15	23c			2324		20				Spare	
								996			26a				
					25a	2324									
						996					28b				
Unitary DX Unit ACA-06				15	27b		2324			15				Spare	
						996					30c				
					29c			2324							
						996					32a				
Unitary DX Unit ACA-07				15	31a					15				Spare	
											34b				
					33b										
											36c				
Unitary DX Unit ACA-08				15	35c					15				Spare	
											38a				
					37a										
											40b				

Appendix-A

[illegible]

TOTAL WATT

TOTAL AMP

14475	14475	14475
43425		
42		

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1MEZZNINE

MOUNTING: _____ SURFACE _____

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				6P1MRAP			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG MECH/LOCKER RM P4/P3/P2/L1M		64	18	20	1a	1600			2a	15				For Metering
LTG PARKING P2		64	24	20	3b		1568		4b					
				20	5c			384	6c					
				20	7a	32			8a					
					9b				10b					
					11c				12c					
					13a				14a					
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					
Appendix-A					40c									



TOTAL AMP

MOUNTING: _____ SURFACE _____

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2EP1MRAL			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG CORRIDOR L2 L3		16	26	20	1a	52			2a	20	26	2		LTG ELEV #5/6 LOBBY P2
LTG CORRIDOR L4 L5		16	26	20	3b	832	0		4b	15	100	2		LTG ELEV #5/6 PIT P3
LTG CORRIDOR L6 L7		16	26	20	5c		832	0	6c	20				SPARE
LTG CORRIDOR L8 L9		16	26	20	7a	520		832	8a	20	26	20		LTG ELEV LOBBY L1
					9b	832			10b	20				SPARE
					11c		0	1040	12c	20	26	40		LTG ELEV LOBBY/OFFICE L1M
					13a				14a	15				For Metering
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					
Appendix-A					40c									

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2EP1MRAP1			JOB NAME: Aquavista					
MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
PWR CACF RM L1	1		200	15*	1a	0			2a	20*				AIR COMPRESSOR ARTSCAPE ELEC RM P1M LEVEL
PWR CACF RM L1	1		200	15*	3b	200	0		4b					
REC CACF RM L1	1		180	15*	5c		200	0	6c					
				15*	7a		180	0	8a	15*				AIR COMPRESSOR CONTROL ARTSCAPE ELEC RM P1M LEVEL
SPARE				15	7a	0				15				For Metering
PWR LVP-4 P1M				15	9b	0	0		10b					
PWR GREENMAX P2				15	11c	200		0	12c					
PWR POWER PACK P2				15	13a		200	0	14a					
				15	13a	0				15				SPARE
				15	15b	200	0		16b					
				15	15b					15				SPARE
				15	17c		0		18c					
Exhaust Fan EFA-02				15	17c		300	0	20a	15				SPARE
					19a					15				SPARE
					21b				22b					
					21b									
					23c				24c					
					23c									
					25a				26a					
					25a									
					27b				28b					
					27b									
					29c				30c					
					29c									
					31a				32a					
					31a									
					33b				34b					
					33b									
					35c				36c					
					35c									
					37a				38a					
					37a									
					40b				40b					
Appendix-A					40b									

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200		AMP MAINS				6EP1MRAP1			JOB NAME:					Aquavista
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
EXIT SIGNS P4/P3/P2/P1/P1M		100	5	20	1a	9000			2a	90				TX-ERA1 75KVA
						500			4b					
EXIT SIGNS L1 ~ L9		200	5	20	3b		9000		6c					
LTG MECH/LOCKER RM P4/P3/P2		64	15	20	5c		1000	9000		15				For Metering
								1344	8a					
LTG ELEC/MECH RM P1M/L1/L1M		64	12	20	7a									
LTG PARKING P2		64	7	20	9b	800			10b					
							864		12c					
					11c									
									14a	20				Spare
					13a									
									16b	20				Spare
					15b									
									18c	15				Spare
					17c									
									20a	15				Spare
					19a									
									22b					
					21b									
									24c					
					23c									
									26a					
					25a									
									28b					
					27b									
									30c					
					29c									
									32a					
					31a									
									34b					
					33b									
									36c					
					35c									
									38a					
					37a									
									40b					
Appendix-A					39c									

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2EP1RAP			JOB NAME: Aquavista						
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c							
ELEV #8 CAB LTG P1 LEVEL				15*	1a	200			2a	15*				REC CONTROL PANEL P1	
ELEV #8 CAB PWR P1 LEVEL				15*	3b	200	328		4b	15	32	4		LTG ELEV SHAFT/PIT P1M / L1 MEZZ	
ELEV #8 COTROLLER P1 LEVEL				15*	5c		200	360	6c	15	180		2	REC ELEV SHAFT/PIT P1M / L1 MEZZ	
SPARE				15	7a	540		200	8a	15	180		3	REC ELEV MACH RM P1	
SPARE				15	9b	200	0		10b	15				SPARE	
					11c		200	0	12c	15				SPARE	
					13a	0			14a	15				For Metering	
					15b				16b						
					17c				18c						
					19a				20a						
					21b				22b						
					23c				24c						
						1140	728	760	PANEL TYPE: TYPE1-SPRINKLER PROOF						
TOTAL WATT						2628			LOCATION: L1 MEZZ ELEV MACH RM (131)						
TOTAL AMP						7									



PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note -* Lockable Breaker

100		AMP MAINS				2ERRAL			JOB NAME: Aquavista						
MLO		MAIN BREAKER							Note -* Lockable Breaker						
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
						a	b	c							
LTG ELEV MACH RM/MECH RM L13		64	6	20	1a	0			2a	20				LTG AMENITY L13	
						448									
LTG ELEV SHAFT L13		32	4	20*	3b		0		4b	20				LTG AMENITY L13	
							128								
LTG ELEC/GENERATOR RM L13		64	10	20	5c			0	6c	20				SPARE	
								640							
PWR GENERATOR RM L13		2	144	15	7a				8a	20				SPARE	
						352									
SPARE				20	9b				10b	20				SPARE	
SPARE				20	11c				12c	20				SPARE	
					13a				14a	15				For Metering	
					15b				16b						
					17c				18c						
					19a				20a						
					21b				22b						
					23c				24c						
						800	128	640	PANEL TYPE: TYPE1-SPRINKLER PROOF						
						TOTAL WATT 1568									
						TOTAL AMP 4									
						LOCATION: LEVEL 13 MECH PENTHOUSE									



PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note -* Lockable Breaker

200 AMP MAINS						2ERRAP			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			Note -* Lockable Breaker					
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
Exhaust Fan EFA 10,11				15	1a	200			2a	15*	200		1	ELEV #5 CAB LTG L13 ELEV MACH RM
						500								
SPARE				15	3b		200		4b	15*	200		1	ELEV #5 CAB PWR L13 ELEV MACH RM
REC SECURITY L13				20	5c			200	6c	15*	200		1	ELEV #6 CAB LTG L13 ELEV MACH RM
REC SECURITY L13				20	7a	200			8a	15*	200		1	ELEV #6 CAB PWR L13 ELEV MACH RM
						200								
SPARE				15	9b		200		10b	15*	200		1	ELEV #5 #6 CONTROLLER L13 ELEV MACH RM
SPARE				15	11c			180	12c	15*	180		1	REC CONTROLLER L13 ELEV MACH RM
								0						
					13a				14a	15				For Metering
						0								
					15b									
							0		18c					
					17c									
								0						
					19a				20a	15				Spare
					21b				22b	15				Spare
									24c					
					23c									



TOTAL WATT

TOTAL AMP

1100	400	580
2080		
6		

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL 13 MECH PENTHOUSE

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

						2EP1MRAP2									
						LOAD PER PHASE									
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
O/H DOOR GARAGE P2				20	1a	180			2a	15	180		1	REC SECURITY DESK L1M	
						500			4b	15	180		1	REC SECURITY DESK L1M	
					3b		180		6c	15	180		1	REC SECURITY DESK L1M	
					5c		500	180	8a	15	180		1	REC SECURITY DESK L1M	
DOOR OPENER L1	2		500	15	7a	180			10b	15	180		1	REC SECURITY DESK L1M	
REC COMM PANEL	2		180	15	9b	1000	180		12c	15	180		1	REC SECURITY DESK L1M	
REC COMM PANEL	1		180	15	11c		360		14a	15	180		1	REC SECURITY DESK L1M	
REC COMM PANEL P1M ELEC RM				20	13a		180		16b	15	180		1	REC SECURITY DESK L1M	
REC COMM PANEL P1M ELEC RM				20	15b	0	180		18c	15	200		1	PWR ENTER PHONE	
SPARE				20	17c		0	200	20a	20	180		1	REC SECURITY PANEL P1M ELEC RM	
SPARE				20	19a	180			22b	20	180		1	REC SECURITY PANEL P1M ELEC RM	
SPARE				15	21b	0	180		24c	20				SPARE	
SPARE				15	23c		0		26a	20				SPARE	
					25a				28b	15				SPARE	
					27b				30c	15				SPARE	
					29c				32a	15				For Metering	
					31a				34b						
					33b				36c						
					35c				38a						
					37a				40b						
					39a										

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS						2P1MRAPT			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
SPARE				20 GFCI	1a	0			2a	15				For Metering
SPARE				20 GFCI	3b		0		4b					
SPARE				20 GFCI	5c			0	6c					
SPARE				20 GFCI	7a				8a	20 GFCI				SPARE
SPARE				20 GFCI	9b				10b	20 GFCI				SPARE
SPARE				20 GFCI	11c				12c	20 GFCI				SPARE
SPARE				20 GFCI	13a				14a	20 GFCI				SPARE
SPARE				20 GFCI	15b				16b	20 GFCI				SPARE
					17c				18c	20 GFCI				SPARE
					19a				20a	20 GFCI				SPARE
					21b				22b	20 GFCI				SPARE
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					
Appendix-A					40c									

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

						6RRAM									
						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	a	b	c							
MUA 1 Heating Pump(1.1kW Each) PA-09/PA-10 Standby Duty				15	1a	367			2a	15				For Metering	
					3b		367		4b						
					5c				6c						
								367	8a						
Fan Coil Unit HFCA-02				15	7a	1195			10b	15				Spare	
					9b		1195		12c						
					11c				14a						
								1195	16b	15					
Fan Coil Unit HFCA-03				15	13a	1195			18c					Spare	
					15b		1195		20a						
					17c				22b	15					
								1195	24c						
					19a				26a					Spare	
					21b				28b						
					23c				30c						
									32a						
					25a				34b						
					27b				36c						
					29c				38a						
									40b						
					31a										
					33b										
					35c										
					37a										

					41c										
					42c										



TOTAL WATT
TOTAL AMP

2757	2757	2757
8271		
8		

PANEL TYPE: TYPE1-SPRINKLER PROOF
LOCATION: PENTHOUSE
MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				2EP2CP			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
ELEV #10 CAB LTG P2				15*	1a	200			2a	15*				REC CONTROL PANEL P2
ELEV #10 CAB PWR P2				15*	3b	200	540		4b	15	180		3	REC ELEV MACH RM P2
ELEV #10 /# 11 COTROLLER P2				15*	5c		200	720	6c	15	180		4	REC ELEV SHAFT/PIT P2 MEZZ
ELEV #11 CAB LTG P2				15*	7a	0		200	8a	15	32	4		LTG ELEV SHAFT/PIT P2 MEZZ
ELEV #11 CAB PWR P2				15*	9b		0		10b	15				SPARE
SPARE				15	11c			0	12c	15				SPARE
					13a	0			14a	15				For Metering
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
									38a					

	TOTAL WATT	600	940	1120	PANEL TYPE:	TYPE1-SPRINKLER PROOF
	TOTAL AMP	2660			LOCATION:	L1 MEZZ ELEV MACH RM (131)
		7				

LOCATION: L1 MEZZ ELEV MACH RM (131)



TOTAL AMP

7

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2EP1CPP1			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
REC (METER) ELEC RM P1M	1		180	15	1a	0			2a	20*				AIR COMPRESSOR ARTSCAPE ELEC RM P1M LEVEL
PWR LVP-5 P1				15	3b	180	0		4b					
PWR GREENMAX P1				15	5c		200	0	6c					
PWR POWER PACK P1				15	7a		200	0	8a	15*				AIR COMPRESSOR CONTROL ARTSCAPE ELEC RM P1M LEVEL
SPARE				15	9b		0		10b	15				SPARE
SPARE				15	11c			0	12c	15				For Metering
SPARE				15	13a		0		14a					
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
						380	200	200	PANEL TYPE: TYPE1-SPRINKLER PROOF					
TOTAL WATT						780			LOCATION: LEVEL P1 COMM PARKING					
TOTAL AMP						2			ELEC RM					





TOTAL WATT
TOTAL AMP

PANEL SCHEDULE

347/600 VOLTS

3 PHASE WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				6EP1CPP1			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG PARKING P1		18	64	20	1a	367			2a	15				Stair Pressurization Fan STAIR D SFCM-01
						1632			4b					
LTG ELEV LOBBY/STAIR D P1		6	32	20	3b		367							
							192		6c					
EXIT SIGNS PARKING P1/L1		50	5	20	5c			367						
								250	8a					
LTG ELEC RM/ ELEV MACH RM P1		8	64	20	7a	1000				15				TX-ECP1-15kVA
						512			10b					
SPARE				20	9b		1000							
									12c					
SPARE				20	11c			1000						
									14a					
					13a					15				For Metering
									16b					
					15b									
									18c					
					17c									
									20a					
					19a									
									22b					
					21b									
									24c					
					23c									
									26a					
					25a									
									28b					
					27b									
									30c					
					29c									
									32a					
					31a									
									34b					
					33b									
									36c					
					35c									

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

125 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

125 AMP MAINS						2P1CP-EV			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
COMMERCIAL UNIT P1 LEVEL				40	1a	0			2a	15				METERING
						3500			4b					
					3b		0							
COMMERCIAL UNIT P1 LEVEL				40	5c			0						
								3500	8a					
					7a		3500							
SPARE				40	9b									
									12c					
					11c									
					13a									
									16b					
					15b									
					17c									
									20a					
					19a									
					21b									
									24c					
					23c									
						7000	3500	3500	PANEL TYPE: TYPE1-SPRINKLER PROOF					
						14000								
						39								
						LOCATION: LEVEL P1 COMM PARKING ELEC RM								



TOTAL WATT
TOTAL AMP

PANEL SCHEDULE

347/600 VOLTS

3 PHASE WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				6P1CPP			JOB NAME:					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG PARKING P1		49	64	20	1a	3616			2a	20				SPARE
LTG ELEV LOBBY/STAIR D P1		6	32	20	3b		192		4b	20				SPARE
					5c			1500	6c	35				TX-CP2 30kVA
					7a	1500			8a					
					9b		1500		10b					
					11c				12c					
					13a				14a	15				METERING
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
						5116	1692	1500	26a	PANEL TYPE:				
MCW TOTAL WATT TOTAL AMP						8308			LOCATION:					
						8								
						LEVEL P1 COMM PARKING ELEC RM								



TOTAL WATT
TOTAL AMP

5116	1692	1500
8308		
8		

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 COMM PARKING ELEC RM

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

125 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

125		AMP MAINS				2P1CPP			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
REC STAIR D & Z	2		180	15	1a	200			2a	15	200		1	REC PAY STATION P1
						360			4b	15	200		1	REC PAY STATION P1
REC STAIR Z / MECH RM P1M	3		180	15	3b		200							REC PAY STATION P1
							540							REC PAY STATION P1
REC ELEC RM P1M	2		180	15	5c			200						REC PAY STATION P1
								360	8a	15	200		1	REC PAY STATION P1
SPARE				15	7a	200								REC PAY STATION P1
									10b	15	200		1	REC PAY STATION P1
DOOR OPNER SHOWER P1	2		500	15	9b		200							REC PAY STATION P1
							1000		12c	15				SPARE
SPARE				15	11c			0						
									14a	15				SPARE
SPARE				20	13a	0								
									16b	15				SPARE
SPARE				20	15b									
									18c	15				SPARE
					17c									
									20a					METERING
					19a									
									22b	15				
					21b									
									24c					
					23c									
									26a					
					25a									
									28b					
					27b									
									30c					
					29c									
									32a					
					31a									
									34b					
					33b									
									36c					
					35c									
									38c					

[illegible]

760	1940	560
3260		
9		

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

125 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

						2P1CPM									
						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	a	b	c							
Entrance and Unit Heater EHCM-01, 02				15	1a	690			2a	15				Metering	
Entrance and Unit Heater EHCM-03, 04				15	3b		690		4b						
					5c			432	6c						
Unitary DX Unit ACCM-01				20	7a	432			8a	15				Spare	
					9b		432		10b						
					11c			1501	12c						
Air Cooled Condenser ACUCM-01				40	13a	1501			14a	20				Spare	
					15b		1501		16b						
					17c			146	18c						
Unitary DX Unit ACCM-02				20	19a	146			20a						
Air Cooled Condenser ACUCM-02				20	21b		884		22b						
					23c			884	24c						
					25a				26a						
					27b				28b						
					29c				30c						
					31a				32a						
					33b				34b						
					35c				36c						
					37a				38a						

PANEL SCHEDULE

347/600 VOLTS

3 PHASE WIRE

100 AMP MAINS

100 MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS		6EP1CPP2			JOB NAME: Aquavista							
100		MAIN BREAKER												
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Elevator Sump Pumps PCM-01, PCM-02 each 5.6Kw				40	1a	1000			2a	15				TX-15kVA
						3733			4b					
					3b		1000		6c					
					5c			1000						
								3733	8a	15				SPARE
					7a	0			10b					
					9b				12c					
					11c									
									14a	15				METERING
					13a									
					15b				16b					
					17c				18c					
									20a					
					19a									
									22b					
					21b									
									24c					
					23c									
						4733	4733	4733	PANEL TYPE: TYPE1-SPRINKLER PROOF					
						14199								
						14								
						LOCATION: LEVEL P1 COMM PARKING ELEC RM								



TOTAL WATT
TOTAL AMP

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

125 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

125		AMP MAINS		2EP1CPP2			JOB NAME: Aquavista							
MLO		MAIN BREAKER												
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
SPARE				15	1a	500			2a	20	500		1	REC (SECURITY) ELEC RM P1M
SPARE				15	3b	0	500		4b	20	500		1	REC (SECURITY) ELEC RM P1M
DOOR OPNER ELEV LOBBY P1	2		500	15	5c			0	6c	20				SPARE
DOOR OPNER ELEV LOBBY L1	1		500	15	7a	0		1000	8a	20				SPARE
SPARE				15	9b		0		10b	15				METERING
					11c			0	12c					
					13a	0			14a					
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
						500	500	1000	PANEL TYPE: TYPE1-SPRINKLER PROOF					
						2000								
						6								
									LOCATION: LEVEL P1 COMM PARKING ELEC RM					



TOTAL WATT
TOTAL AMP

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 COMM PARKING ELEC RM

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

60A NA MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS		2POOL			JOB NAME: Aquavista							
60A NA		MAIN BREAKER												
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
REC	180		2	20	1a	120			2a	15				SPARE
						360			4b	15				SPARE
SPARE				20	3b		240		6c	15				SPARE
SPARE				20	5c			0	8a	15				SPARE
SPARE				20	7a	0			10b	15				SPARE
SPARE				20	9b		0		12c	15				SPARE
SPARE				20	11c			0	14a					
					13a	0			16b					
					15b				18c					
					17c				20a					
					19a				22b					
					21b				24c					
					23c									
						480	240	0	PANEL TYPE: NEMA TYPE3					
						720			LOCATION: LEVEL 1 MEZZ					
						2								



TOTAL WATT

TOTAL AMP

PANEL TYPE: NEMA TYPE3

LOCATION: LEVEL 1 MEZZ

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

400 AMP MAINS

MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

400						AMP MAINS			2P1RC-EV			JOB NAME: Aquavista								
						MAIN BREAKER			LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION			
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c												
RESENDITAL UNIT P3 LEVEL				20	1a	0			2a	15						METERING				
						1920			4b											
RESENDITAL UNIT P3 LEVEL				20	3b		0		6c											
						1920														
RESENDITAL UNIT P3 LEVEL				20	5c			0												
							1920		8a	20						RESENDITAL UNIT P2 LEVEL				
RESENDITAL UNIT P3 LEVEL				20	7a	1920														
									10b	20						SPARE				
RESENDITAL UNIT P2 LEVEL				20	9b		1920													
									12c	20						SPARE				
RESENDITAL UNIT P2 LEVEL				20	11c			1920												
									14a	20						SPARE				
					13a															
									16b											
					15b															
									18c											
					17c															
									20a											
					19a															
									22b											
					21b															
									24c											
					23c															
						3840	3840	3840	PANEL TYPE: TYPE1-SPRINKLER PROOF											
						TOTAL WATT			11520								LOCATION: LEVEL P1 EAST ELEC RM			
						TOTAL AMP			32											



TOTAL WATT

TOTAL AMP

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 EAST ELEC RM

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2P1RCMW			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
Exhaust Fan EFC-28, 29				20	1a	0			2a	15				For Metering
						600			4b					
Exhaust Fan EFC-32,33				20	3b		0		6c					
							600							
Fan Coil Unit HFCC-09				15	5c			0	8a	20				Air Cooled Condenser Unit ACUC-09
					7a	1716		252	10b					
						252								
Fan Coil Unit HFCC-10				15	9b		1716		12c	20				Air Cooled Condenser Unit ACUC-10
							372		11c					
								1716						
							372							
Fan Coil Unit HFCC-11				15	13a	1716			16b	15				Unitary DX Unit ACC-09
						408			15b					
							135.2							
							408							
Fan Coil Unit HFCC-16				15	17c			135.2	20a	15				Unitary DX Unit ACC-10
								288	19a					
						135.2								
						288								
Force Flow Cabinet Heater EHC-05,06				20	21b		135.2		24c	15				Spare
							690							
Force Flow Cabinet Heater EHC-07,08				20	23c				26a	15				Spare
								690						
Force Flow Cabinet Heater EHC-12				20	25a				28b	15				Spare
						345								
Force Flow Cabinet Heater EHC-14,15				20	27b				30c	15				Spare
							690							
Force Flow Cabinet Heater EHC-19				20	29c				32a					
								345						
Hot Water Unit Heater UHC-07, UHC-08				20	31a				34b					
						480								
Hot Water Unit Heater UHC-12 UHC-13				20	33b				36c					
							480							
Air Cooled Condenser Unit				15	35c			1080	38a					

ACUC-08				15	37a									
Unitary DX Unit ACC-08				15		1080			40b					
					39b		240		42c					
					41c									
								240						
					7020.2	5466.4	5118.2	PANEL TYPE: TYPE 1 SPRINKLER PROOF						
					TOTAL WATT			17605						
					TOTAL AMP			49						
								LOCATION: P1 ELECTRICAL ROOM WEST						
								MOUNTING: SURFACE						



TOTAL WATT

TOTAL AMP



TOTAL WATT

TOTAL AMP

17605

49

PANEL TYPE: TYPE 1 SPRINKLER PROOF

LOCATION: P1 ELECTRICAL ROOM WEST

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

125 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

125						AMP MAINS		2P1RCME			JOB NAME: Aquavista				
MLO						MAIN BREAKER									
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
						a	b	c							
Exhaust Fan 22,23,24				20	1a	540			2a	15				For Metering	
Exhaust Fan 25,26,27				20	3b		360		4b						
Exhaust Fan 30				20	5c			300	6c						
Exhaust Fan 34,35				20	7a	1716			8a	20				Air Cooled Condenser Unit ACUC-11	
Exhaust Fan 36				20	9b		1716		10b						
Force Flow Cabinet Heater EHC-09, EHC-10				20	11c			1716	12c	20				Air Cooled Condenser Unit ACUC-12	
Force Flow Cabinet Heater EHC-11				20	13a	1716		690	14a						
Force Flow Cabinet Heater EHC-13,16				20	15b		936		16b	15				Air Cooled Condenser Unit ACUC-13	
Force Flow Cabinet Heater EHC-17, EHC-18				20	17c			936	18c						
Force Flow Cabinet Heater EHC-20				20	19a	135.2			20a	15				Unitary DX Unit ACC-11	
Force Flow Cabinet Heater EHC-21				20	21b		135.2		22b						
Hot Water Unit Heater UHC-05, UHC-06				20	23c			135.2	24c	15				Unitary DX Unit ACC-12	
Hot Water Unit Heater UHC-09				20	25a	135.2		480	26a						
Hot Water Unit Heater UHC-10, UHC-11				20	27b		104		28b	15				Unitary DX Unit ACC-13	
					29c			104	30c						
					31a				32a	15				Spare	
					33b				34b	15				Spare	
									36c	15				Spare	

					35c				38a	15				Spare
					37a				40b					
					39b				42c					
					41c									
						5772.4	4721.2	4706.2	PANEL TYPE: TYPE1-SPRINKLER PROOF					
						TOTAL WATT 15200			LOCATION: P1					
						TOTAL AMP 42			MOUNTING: SURFACE					

PANEL SCHEDULE

120/208 VOLTS
 3 PHASE 4 WIRE
 100 AMP MAINS
 MLO MAIN BREAKER

JOB NUMBER: 8489D
 JOB NAME: Aquavista

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Make Up Air Unit -MAUC 01 ERV Motor				20	1a	372			2a	15				Fancoil Unit HFCC-13
						370			4b					
Energy Recovery Ventilator ERVC-E				30	3b		372		6c	15				Fancoil Unit HFCC-14
							1260							
Energy Recovery Ventilator ERVC-F				30	5c			288	8a					
								1260						Fancoil Unit HFCC-15
Vretical fan coil Unit VFCC-01,02,03				20	7a	288			10b	15				
						480								
Vretical fan coil Unit VFCC-04,05,06				20	9b		408		12c					
							480							For Metering
Vretical fan coil Unit VFCC-07,08,09				20	11c			408						
									14a					
Vretical fan coil Unit VFCC-10,11,12				20	13a	345			16b	15				
						480								
Vretical fan coil Unit VFCC-13				20	15b		480		18c					Pool panel '2POOL'
SPARE				15	17c			372	20a					
					19a	480								
						372			22b	60				
Fancoil Unit HFCC-02				15	21b		240		24c					Exhaust Fan EFC-38
							372							
					23c			0	26a	15				Spare
								372						
Fancoil Unit HFCC-03				15	25a	120			28b	15				Spare
						372								
					27b		372		30c	15				Spare
Fancoil Unit HFCC-04				15	29c			252	32a	15				
					31a									
						252			34b					
Fancoil Unit HFCC-05				15	33b		372		36c					
					35c									
								372	38a					



TOTAL AMP

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: P1 ELECTRICAL ROOM

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS
 3 PHASE 4 WIRE
 125 AMP MAINS
 MLO MAIN BREAKER

JOB NUMBER: 8489D
 JOB NAME: Aquavista

125						AMP MAINS		2P4RCM			JOB NAME: Aquavista					
MLO						MAIN BREAKER		LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c								
Low Heating Boiler HBC-02				20	1a	1560			2a	15					For Metering	
Low Heating Boiler HBC-03				20	3b		1560		4b							
Low Heating Boiler HBC-04				20	5c			1560	6c							
Low Heating Boiler HBC-05				20	7a	1560			8a	20					Low Heating Boiler HBC-08	
Low Heating Boiler HBC-06				20	9b		1560		10b	20					Spare	
Low Heating Boiler HBC-07				20	11c			1560	12c	15					Spare	
Exhaust Fan 09,11				20	13a	320			14a	15					Spare	
Exhaust Fan 12,13,14				20	15b		550		16b							
Exhaust Fan 15, 16				20	17c			220	18c							
Exhaust Fan 17,18				20	19a	220			20a							
Exhaust Fan 19,20,21				20	21b				22b							
Force Flow Cabinet Heater EHC-01,02				20	23c			690	24c							
Force Flow Cabinet Heater EHC-03,04				20	25a	690			26a							
Hot Water Unit Heater UHC-01, UHC-02				20	27b		480		28b							
Hot Water Unit Heater UHC-03, UHC-04				20	29c			480	30c							
Air Cooled Condenser Unit ACUC-07				15	31a	1080			32a							
					33b		1080			34b						
					35c			240			36c					
Unitary DX Unit				15												

ACC-07					37a	240			40b					
					39b				42c					
					41c									



TOTAL WATT

TOTAL AMP

5670	5230	4750
15650		
43		

PANEL TYPE: NEMA TYPE 3

LOCATION: LEVEL 1 MEZZ

MOUNTING: SURFACE

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 3 WIRE

200 AMP MAINS

200NA MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Exhaust Fan EFC-31				15	1a				2a					For Metering
						187			4b	15				
					3b		187		6c					
					5c			187						
Air Cooled Condenser Unit ACUC-04				20	7a	5772.4			8a					2P1RCME' Through 30kVA transformer
						10357			10b	15				
					9b		4721.2		12c					
					11c			4706.2						
Unitary DX Unit ACC-04				15				10357	14a					Spare
					13a	1673			16b	15				
					15b		1673		18c					
					17c			1673	20a					
Elevator #12				125	19a				22b	15				Spare
						12433.3			24c					
					21b		12433.3							
					23c			12433	26a					
					25a				28b					
					27b				30c					
					29c				32a					
					31a				34b					
					33b				36c					
					35c									

				37a									
				39b									
				40b									
				41c									
				30422.7	29371.5	29357							
				TOTAL WATT			89151						
				TOTAL AMP			86						



PANEL TYPE: TYPE1-SPRINKLER PROOF
 LOCATION: P1
 MOUNTING: Surface

PANEL SCHEDULE

347/600 VOLTS
 3 PHASE 3 WIRE
 200 AMP MAINS
 MLO MAIN BREAKER

JOB NUMBER: 8489D
 JOB NAME: Aquavista

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Make Up Air Unit MACU-01 exhaust Fan				15	1a	3452			2a	20				Air Cooled Condenser Unit ACUC-01
						1233			4b					
					3b		3452		6c					
					5c			3452						
Make Up Air Unit MACU-01 Supply Fan				20	7a	558			8a	15				Unitary DX Unit ACC-01
						1667			10b					
					9b		558		12c					
					11c			558						
Make Up Air Unit MACU-02				40	13a	3452			14a	20				Air Cooled Condenser Unit ACUC-02
						3733			16b					
					15b		3452		18c					
					17c			3452						
MUA-1 Heating Pump PC-14, PC-15 (Duty standby) Each 1.1KW				15	19a	558			20a	15				Unitary DX Unit ACC-02
						367			22b					
					21b		558		24c					
					23c			558						
MUA-1 Heating Pump PC-16, PC-17 (Duty standby) Each 2.2kW				15	25a	3452			26a	20				Air Cooled Condenser Unit ACUC-03
						733			28b					
					27b		3452		30c					
					29c			3452						
DHW Rwcirculation Pump PC-44				15	31a	558			32a	15				Unitary DX Unit ACC-03
						187			34b					
					33b		558		36c					
					35c			558						
								187	38a					



TOTAL AMP

MOUNTING: Surface

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 3 WIRE

200 AMP MAINS

200 NA MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Condenser Water Pump PC-01, PC-02 (Duty standby) Each 30kW					1a				2a					For Metering
						1000			4b	15				
				100	3b		10000		6c					
					5c			10000						
Chilled Water Pump PC-03, PC-04 (Duty standby) Each 30kW					7a	367			8a					Boiler#7 Pump PC-21
						10000			10b	15				
				100	9b		367							
							10000		12c					
Boiler #2 Pump PC-06					11c			367						Boiler#8 Pump PC-22
								10000	14a					
					13a	367								
						500			16b	15				
Boiler #3 Pump PC-07					15b		367							DHW Heating Secondary Pumps PC-23, PC-24 (Duty standby) Each 5.6kW
				15			500		18c					
					17c			367						
								500	20a					
Boiler #4 Pump PC-08					19a	1867								Boiler Room Supply SFC-04
						500			22b	20				
				15	21b		1867							
							500		24c					
Boiler #5 Pump PC-09					23c			1867						Boiler#6 Pump PC-20
								500	26a					
					25a	187								
						367			28b	15				
Boiler #6 Pump PC-20					27b		187							
				15			367		30c					
					29c			187						
								367	32a					
Boiler #5 Pump PC-09					31a	367								
						367			34b	15				
				15	33b		367							
							367		36c					
					35c			367						
								367	38a					



TOTAL AMP

MOUNTING: Surface

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 3 WIRE

400 AMP MAINS

300 MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Boiler #1 Pump PC-05					1a	5600			2a					Elevator Sump Pumps PC-40,PC-41 (Each 8.4kW)
						500			4b	45				
				15	3b		5600		6c					
						500								
					5c			5600						
Low Temp Secondary Pumps PC-12, PC-13 (Duty standby) Each 15kW								500	8a					Elevator Sump Pumps PC-42,PC-43 (Each 2.2kW)
					7a	1467								
						5000			10b	20				
				40	9b		1467		12c					
							5000							
Sanitary Sump Pumps PC-30,PC-31 (Each 5.6kW)								1467						Exhaust Fan EFC-01 (2.2kW)
					11c			5000	14a					
						733								
						3733			16b	15				
				35	15b		733							
Sanitary Sump Pumps PC-32,PC-33 (Each 8.4kW)								3733	18c					Exhaust Fan EFC-02 (2.2kW)
								733						
								3733	20a					
					19a	733								
						5600			22b	15				
Weeping Sump Pumps PC-34,PC-35 (Each 8.4kW)					21b		733							Exhaust Fan EFC-03 (2.2kW)
							5600		24c					
					23c			733						
								5600	26a					
					25a	733								
Elevator Sump Pumps PC-36,PC-37 (Each 5.4kW)						5600			28b	15				Exhaust Fan EFC-04 (2.2kW)
					27b		733		30c					
							5600							
					29c			733	32a					
								5600						
									34b	15				
					31a	733								
						3733								
					33b		733		36c					
							3733							
					35c			733						
								3733	38a					



TOTAL AMP

MOUNTING: Surface

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 3 WIRE

400 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Domestic Booster Pump PC-27				40	1a	3733			2a	15				For Metering
					3b		3733		4b					
					5c			3733	6c					
									8a					
DHW Heating Pumps PC-23, PC-24(Duty and Standby) Each 5.6kW				20	7a	733			10b	15				Spare
					9b		733		12c					
					11c			733	14a					
Fan Coil Unit HFCC-06 (2.2kW)				15	13a	733			16b	15				Spare
					15b		733		18c					
					17c			733	20a					
Fan Coil Unit HFCC-07 (2.2kW)				15	19a	12500			22b	90				SP-2EP1RCP Through 75kVA transformer
					21b	733	12500		24c					
					23c			12500	26a					
								733						
					25a				28b					
					27b				30c					
					29c				32a					
								500						
					31a				34b					
					33b				36c					
					35c				38a					



TOTAL AMP

MOUNTING: Surface

PANEL SCHEDULE

347/600 VOLTS
 3 PHASE 3 WIRE
 400 AMP MAINS
 MLO MAIN BREAKER

JOB NUMBER: 8489D
 JOB NAME: Aquavista

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Jockey Pump PC-29					1a	733			2a					Stair Pressurization Fan SFC-01 (2.2kW)
						500			4b	15				
				15	3b		733							
						500			6c					
					5c			733						
Exhaust Fan EFC-05 (2.2kW)								500	8a					Stair Pressurization Fan SFC-02 (2.2kW)
					7a	733								
						733			10b	15				
				15	9b		733							
						733			12c					
Exhaust Fan EFC-06 (2.2kW)								733	14a					Stair Pressurization Fan SFC-03(2.2kW)
					13a	733								
									16b	15				
				15	15b		733							
									18c					
Exhaust Fan EFC-07 (2.2kW)								733	20a					For Metering
					19a	1233								
									22b	15				
				20	21b		1233							
									24c					
Exhaust Fan EFC-08 (2.2kW)								1233	26a					Spare
					25a	1233								
									28b	15				
				20	27b		1233							
									30c					
Exhaust Fan EFC-10(2.2kW)								1233	32a					P-2EP1RCPT* Through 75kVA transformer
					31a	15000								
						250			34b	90				
				15	33b		15000							
						250			36c					
					35c			15000						
								250	38a					



TOTAL AMP

MOUNTING: Surface

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

100A MB MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note -* Lockable Breaker

Feed through Panel

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
DOOR OPENER STAIR A L1	500		1	15	1a	500			2a	15*	500		1	PWR W CACF RM L1
DOOR OPENER STAIR G L1	500		1	15	3b		500		4b	15*	500		1	PWR W CACF RM L1
DOOR OPENER VEST (126) L1	500		1	15	5c			500	6c	15*	500		1	PWR W CACF RM L1
DOOR OPENER EXIT CORRIDOR (112) L1	500		1	15	7a	500			8a	15*	500		1	REC W CACF RM L1
SAPRE				15	9b		0		10b	15				SPARE
LOW VOLTAGE CONTROL GREENMAX P4				15	11c			0	12c					AIR COMPRESSOR WEST MAIN ELEC RM P1 LEVEL
LOW VOLTAGE CONTROL GREENMAX P3				15	13a	0			14a	20				
LOW VOLTAGE CONTROL GREENMAX P2/P1				15	15b	200			16b					
LOW VOLTAGE CONTROL POWER RACK P1				15	17c		0		18c	15				
SPARE				15	19a	200			20a	15				AIR COMPRESSOR CONTROL WEST MAIN ELEC RM P1 LEVEL
SPARE				15	21b		200		22b	15				METER COBINET WEST MAIN ELEC RM P1 LEVEL
SPARE				15	23c			200	24c	15				METER CABINET WEST MAIN ELEC RM P1 LEVEL
SPARE				15	25a				26a	15				LVP-1 WEST MAIN ELEC RM P1 LEVEL
					27b				28b					LVP-3 WEST MAIN ELEC RM P1 LEVEL
					29c				30c	15				For Metering
					31a				32a					
					33b				34b					
					35c				36c					

	TOTAL WATT	2400	1400	1800	PANEL TYPE: TYPE1-SPRINKLER PROOF LOCATION: LEVEL P1 MAIN ELEC RM
		5600			
	TOTAL AMP	16			



TOTAL WATT
TOTAL AMP

2400	1400	1800
5600		
16		

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 MAIN ELEC RM

MOUNTING: _____ SURFACE _____

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2EP1RCLW			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG CORRIDOR L2 L3 L4 L5				20	1a	78			2a	20	13	6		LTG W ELEV LOBBY P3~P4
LTG CORRIDOR L6 L7 L8 L9				20	3b	800	200		4b	20	100	2		LTG ELEV #1/2 PIT P4
LTG CORRIDOR L10 L11 L12				20	5c		760		6c	20				SPARE
P1 Amenity Level Lighting				20	7a			660	8a	20	26	15		TYPE LS1 EXTERIOR L2
Level 1 Amenity Level Lighting				20	9b	390			10b	20	100	3		TYPE X4 POOL AREA L2
				20	11c	500			12c	20				SPARE
SPARE				20	13a				14a	20				SPARE
					15b				16b	15				For Metering
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS						2P1RCLW			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG CORRIDOR L2 L3				20	1a	278			2a	20	13	6		LTG W ELEV LOBBY P3~P4
LTG CORRIDOR L4 L5				20	3b	1417			4b	20				SPARE
LTG CORRIDOR L6 L7				20	5c		1436		6c	20				LTG ARTSCAPE GALLERY L1
LTG CORRIDOR L8 L9				20	7a			1419	8a	20				SPARE
LTG CORRIDOR L10				20	9b	1402			10b	20				SPARE
LTG CORRIDOR L11 L12				20	11c		954		12c	20				SPARE
LTG GARBAGE CHUT L2 ~ L12		12	26	20	13a			1654	14a	20				SPARE
					15b	312			16b	15				For Metering
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Feed Through Panel

						2P1RCPW								
						LOAD PER PHASE								
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
REC RCW1 CORRIDOR L2~L7	6		180	20	1a	540			2a	15	180		3	REC STAIR A
REC RCW2 CORRIDOR L2~L7	6		180	20	3b	1080	1260		4b	15	180		7	REC STAIR G/Gx
REC RCW3 CORRIDOR L2~L7	6		180	20	5c		1080	360	6c	15	180		2	REC STAIR E
REC RCW4 CORRIDOR L2~L7	6		180	20	7a	1260		1080	8a	15	180		7	REC STAIR H
REC RCW5 CORRIDOR L2~L7	6		180	20	9b		0		10b	15				SPARE
REC RCW1 CORRIDOR L8~L12	5		180	20	11c		1080	900	12c	20	180		5	REC CORRIDOR L1 MEZZ
REC RCW2 CORRIDOR L8~L12	5		180	20	13a	540		900	14a	15	180		3	REC MAKE UP UNIT RM L1 MEZZ
REC RCW3 CORRIDOR L8~L12	5		180	20	15b		500		16b	15	500		1	PWR MAKE UP UNIT RM L1 MEZZ
REC RCW4 CORRIDOR L8~L12	5		180	20	17c		900	1080	18c	15	180		6	REC WEST GARBAGE RM L1 MEZZ
REC RCW5 CORRIDOR L8~L12	6		180	20	19a	500		900	20a	15	500		1	COMPACTOR CTRL. WEST GARBAGE RM L1 MEZZ
REC RCW6/7/8 CORRIDOR L10~L12	6		180	20	21b		360		22b	15	180		2	REC. FRESH AIR PLENUM L1 MEZZ / L1
REC RCW9/10 CORRIDOR L2	2		180	20	23c			0	24c	15				SPARE
SPARE				20	25a	0		360	26a	15				SPARE
REC SPRINKLER / SANITARY RM P1 / P1M	6		180	15	27b	0	720		28b	15	180		4	REC W ELEV LOBBY P3/P4
REC ELEC RM P1	6		180	15	29c		1080	1000	30c	15	500		2	DOOR OPNER W ELEV LOBBY P3
SPARE				15	31a		1080		32a	15	180		4	REC LOCKER P3/P4
OPERABLE GLAZING ARTSCAPE GALLERY L1	2		500	20	33b	720			34b	15	500		2	DOOR OPNER W ELEV LOBBY P4
SPARE				20	35c	0	1000	540	36c	15	180		3	REC LOCKER P4
								0	38a	15	180		3	REC FLEV #1/2 PIT

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200		AMP MAINS				2P1RCAL			JOB NAME: Aquavista					
MLO		MAIN BREAKER												
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
Theatre Lighting DL2B, DL8		8, 40m	25, 25/m	20	1a	1000			2a	20	25	40		Mens Change Room , Womens Change Room
						1200			4b	20	25	42		Spinning Room+Westibule+West Elev. Lobby
Gym		46	25	20	3b		1050							
							1150		6c	20	48 , 26	3, 24		Parcel Room , Lobby
Janitor room , AV room, Yoga room		25	25	20	5c			768						
								625	8a	20	9.6, 42	22, 3		Lobby DL1A, DL4B Lights
Mail Room, Mail Pick Up,Meeting Rm,office, T bar,kitchen		8, 32	48, 25	20	7a	337.2								
						1184			10b	15				For Metering
Admin Office, West Elev. Lobby, Barrier Free Wash Rm		3, 30	48, 25	20	9b		924		12c					
					11c				14a					
					13a									
					15b				16b	20				Spare
					17c				18c	20				Spare
					19a				20a	20				Spare
					21b				22b	20				Spare
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
									38a					

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200		AMP MAINS				2P1RCAP			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			Feed through panel					
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
REC CORRIDOR P1	5		180	20	1a	800			2a	20				REC TREADMILL GYM P1
REC YOGA RM/ GYM P1	6		180	15	3b	900	800		4b	20				REC TREADMILL GYM P1
REC THEATER P1	4		180	15	5c		1080	800	6c	20				REC TREADMILL GYM P1
REC AV THEATER P1	1		180	20	7a	800			8a	20				REC TREADMILL GYM P1
REC MEN'S WOMEN'S RM P1	6		180	15	9b		800		10b	20				REC TREADMILL GYM P1
DOOR OPNER VEST P118 P1	2		500	15	11c			800	12c	20				REC TREADMILL GYM P1
DOOR OPNER ELEV LOBBY/SPINNING RM P1	2		500	15	13a	800		1000	14a	20				REC TREADMILL GYM P1
DOOR OPNER YOGARM/ THEATRE P1	2		500	15	15b	1000	800		16b	20				REC TREADMILL GYM P1
DOOR OPNER MEN'S CHANGE P1	2		500	15	17c		1000	500	18c	20				REC SPINNING SPINNING RM P1
DOOR OPNER WOMEN'S CHANGE P1	2		500	15	19a	500		1000	20a	20				REC SPINNING SPINNING RM P1
DOOR OPNER WOMEN'S CHANGE/GYM P1	2		500	15	21b	1000	500		22b	20				REC SPINNING SPINNING RM P1
					23c		1000	500	24c	20				REC SPINNING SPINNING RM P1
					25a	500			26a	20				REC SPINNING SPINNING RM P1
					27b				28b	15				For Metering
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c	20				spare
									38a	20				spare

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

100NA MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				2RRCPW			JOB NAME: Aquavista										
100NA		MAIN BREAKER																	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION					
						a	b	c											
Air Cooled Condenser Unit ACUC-04				50	1a	180			2a	15	180		1	REC (IRRIGATION) ROOF L11/L7					
						2882													
					3b		180		4b	15	180		1	REC (IRRIGATION) ROOF L14					
							2882												
				50	5c			180	6c	20	180		1	REC ROOF L14					
								2882											
					Unitary DX Unit ACC-04				15	7a	720			8a	15	180		4	REC ELEV MACH RM L13
											365			10b	15	180		4	REC ELEV SHAFT L13
				15	9b		720												
							365		12c	15						SPARE			
					11c			0											
								365	14a	15						SPARE			
Force Flow Cabinet Heater EHC-23				15	13a	0													
						360			16b	15					SPARE				
					15b		0												
							0		18c	15					SPARE				
					17c			0											
								0	20a	15				For Metering					
					19a	0													
						0													
					21b		0												
							0		24c										
					23c			0											
								0	26a										
					25a														
									28b										
					27b														
									30c										
					29c														
									32a										
					31a														
									34b										
					33b														
									36c										
					35c														

[illegible]

4507	4147	3427
12081		
34		

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note -* Lockable Breaker

						2ERRCPW									
						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	a	b	c							
ELEV #1 CAB LTG L13				15*	1a	200			2a	15*				REC CONTROL PANEL L13	
ELEV #1 CAB PWR L13				15*	3b	200	320		4b	15*	32	4		LTG ELEV SHAFT L13	
ELEV #2 CAB LTG L13				15*	5c		200	0	6c	15*				SPARE	
ELEV #2 CAB PWR L13				15*	7a	0		200	8a	15*				SPARE	
ELEV #1 & #2 CONTROLLER L13				15*	9b	200	0		10b	15				SPARE	
					11c		200	0	12c	15				SPARE	
					13a	0		200	14a					For Metering	
					15b				16b	15					
					17c				18c						
					19a				20a						
					21b				22b						
					23c				24c						
					25a				26a						
					27b				28b						
					29c				30c						
					31a				32a						
					33b				34b						
					35c				36c						
					37a				38a						

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2EP1RCP2			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
Excess Pressure Pump PC-46				15	1a	180			2a	15	180		1	REC CONCIERGE DESK L1
						200			4b	15	180		1	REC CONCIERGE DESK L1
SPARE				15	3b		180							
DOOR OPNER W ENTRANCE VEST L1	2		500	15	5c			180	6c	15	180		1	REC CONCIERGE DESK L1
								1000	8a	15	180		1	REC CONCIERGE DESK L1
SPARE				15	7a	180								
REC SECURITY RM P1	2		180	20	9b		180		10b	15	180		1	REC CONCIERGE DESK L1
							360		12c	15	180		1	REC CONCIERGE DESK L1
REC SECURITY RM P1	2		180	20	11c			180						
								360	14a	15	180		1	REC CONCIERGE DESK L1
PWR ENTER PHONE CONTROL DETAIL DWG				15	13a	180								
						500			16b	15	180		1	REC CONCIERGE DESK L1
Low Heating Boiler HBC-01				20	15b		1560		18c	15				For Metering
					17c									
					19a									
					21b									
					22b									
					24c									
					23c									
					26a									
					25a									
					28b									
					27b									
					30c									
					29c									
					32a									
					31a									
					34b									
					33b									
					36c									
					35c									

	TOTAL WATT	1240	2280	1720	PANEL TYPE:	TYPE1-SPRINKLER PROOF
	TOTAL AMP	5240			LOCATION:	LEVEL P1 MAIN ELEC RM
		15				

TOTAL WATT

TOTAL AMP

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 MAIN ELEC RM

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

JOB NUMBER: 8489D

JOB NAME: Aquavista

AMP MAINS

MAIN BREAKER

2P1RCOD

LOAD PER PHASE

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
TYPE X2 X6 WEST ENTRANCE CONDO L1				20	1a	500			2a	20				TYPE X10 WEST ENTRANCE RETAIL L1
SIGNAGE WEST ENTRANCE CONDO L1				15	3b	500	500		4b	15				SIGNAGE WEST ENTRANCE RETAIL L1
TYPE X2 ENTRANCE ARTSCAPE L1				20	5c			500	6c	15				SIGNAGE WEST CANOPY RETAIL L1
SIGNAGE ENTRANCE ARTSCAPE L1				15	7a	500			8a	20				TYPE X10 EAST CANOPY RETAIL L1
TYPE X9 / X9A CONDO L1				20	9b		500		10b	15				SIGNAGE EAST CANOPY RETAIL L1
TYPE X2 EAST ENTRANCE CONDO L1				20	11c			500	12c	15				SIGNAGE EAST CANOPY RETAIL L1
SIGNAGE EAST ENTRANCE CONDO L1				15	13a	0			14a	20				TYPE X2 EAST ENTRANCE RETAIL L1
SPARE				15	15b		500		16b	20				TYPE X9 / X9A RETAIL L1
SPARE				15	17c			1000	18c	20				TYPE X11 RETAIL LOADING L1M
TYPE LS1 EXTERIOR L2		27	26	20	19a	702			20a	20				SPARE
TYPE X4 EXTERIOR L2		3	26	20	21b				22b	20				SPARE
					23c				24c	20				SPARE
					25a				26a	20				SPARE
					27b				28b					For Metering
					29c				30c	15				
					31a				32a					
					33b				34b					
					35c				36c					
									38a					

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				2COMM			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
SPARE				20	1a	360			2a	15	180		2	COMM PANEL N/E CLOSET
SPARE				20	3b		360		4b	15	180		2	COMM PANEL N/E CLOSET
SPARE				20	5c			540	6c	15	180		3	COMM PANEL E CLOSET
SPARE				20	7a	360			8a	15	180		2	COMM PANEL W CLOSET
SPARE				20	9b		360		10b	15	180		2	COMM PANEL W CLOSET
SPARE				20	11c			0	12c	15				SPARE
					13a				14a	15				SPARE
					15b				16b	15				SPARE
					17c				18c	15				SPARE
					19a				20a	15				For Metering
					21b				22b					
					23c				24c					
						720	720	540	PANEL TYPE: TYPE1-SPRINKLER PROOF					
TOTAL WATT						1980			LOCATION: CCU RM					
TOTAL AMP						5								



TOTAL WATT
TOTAL AMP



TOTAL WATT
TOTAL AMP

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200		AMP MAINS				2EP1RCPT			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
SPARE				20 GFCI	1a	0			2a	15				For Metering
SPARE				20 GFCI	3b		0		4b					
SPARE				20 GFCI	5c			0	6c					
SPARE				20 GFCI	7a				8a	20 GFCI				SPARE
SPARE				20 GFCI	9b				10b	20 GFCI				SPARE
SPARE				20 GFCI	11c				12c	20 GFCI				SPARE
SPARE				20 GFCI	13a				14a	20 GFCI				SPARE
SPARE				20 GFCI	15b				16b	20 GFCI				SPARE
SPARE				20 GFCI	17c				18c	20 GFCI				SPARE
SPARE				20 GFCI	19a				20a	20 GFCI				SPARE
SPARE				20 GFCI	21b				22b	20 GFCI				SPARE
SPARE				20 GFCI	23c				24c	20 GFCI				SPARE
SPARE				20 GFCI	25a				26a	20 GFCI				SPARE
					27b				28b	20 GFCI				SPARE
					29c				30c	20 GFCI				SPARE
					31a				32a	20 GFCI				SPARE
					33b				34b	20 GFCI				SPARE
					35c				36c					
					38a				38a					

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

						2P1RCPT									
						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	a	b	c							
SPARE				20 GFCI	1a	0			2a	15				For Metering	
SPARE				20 GFCI	3b		0		4b						
SPARE				20 GFCI	5c			0	6c						
SPARE				20 GFCI	7a				8a	20 GFCI				SPARE	
SPARE				20 GFCI	9b				10b	20 GFCI				SPARE	
SPARE				20 GFCI	11c				12c	20 GFCI				SPARE	
SPARE				20 GFCI	13a				14a	20 GFCI				SPARE	
SPARE				20 GFCI	15b				16b	20 GFCI				SPARE	
SPARE				20 GFCI	17c				18c	20 GFCI				SPARE	
SPARE				20 GFCI	19a				20a	20 GFCI				SPARE	
SPARE				20 GFCI	21b				22b	20 GFCI				SPARE	
SPARE				20 GFCI	23c				24c	20 GFCI				SPARE	
SPARE				20 GFCI	25a				26a	20 GFCI				SPARE	
					27b				28b	20 GFCI				SPARE	
					29c				30c	20 GFCI				SPARE	
					31a				32a	20 GFCI				SPARE	
					33b				34b						
					35c				36c						
					37a				38a						

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note -* Lockable Breaker

100		AMP MAINS		2EP4RC			JOB NAME: Aquavista							
MLO		MAIN BREAKER					Note -* Lockable Breaker							
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
ELEV #12 CAB LTG P4 LEVEL				15*	1a	200			2a	15*				REC CONTROL PANEL L1
ELEV #12 CAB PWR P4 LEVEL				15*	3b	200	328		4b	15*	32	4		LTG ELEV SHAFT/PIT L1 MEZZ
ELEV #12 COTROLLER P4 LEVEL				15*	5c		200	0	6c	15				SPARE
SPARE				15	7a	0		200	8a	15				SPARE
SPARE				15	9b		0		15					For Metering
					11c			0						
					13a	0								
					15b									
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					

[illegible]

600	728	400
1728		
5		

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note -* Lockable Breaker

100		AMP MAINS				2E1RC			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			Note -* Lockable Breaker					
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
ELEV #7 CAB LTG L1				15*	1a	200			2a	15*				REC CONTROL PANEL L1
ELEV #7 CAB PWR L1				15*	3b	200	328		4b	15*	32	4		LTG ELEV SHAFT/PIT L1 MEZZ
ELEV #7 COTROLLER L1				15*	5c		200	0	6c	15				SPARE
ELEV #9 CAB LTG L1				15*	7a	0		200	8a	15				SPARE
ELEV #9 CAB PWR L1				15*	9b	200	0		10b	15				SPARE
ELEV #9 COTROLLER L1				15*	11c		200	0	12c	15				SPARE
					13a	0			14a	15				For Metering
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b					
					23c				24c					
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					

	TOTAL WATT	600	728	400	PANEL TYPE: TYPE1-SPRINKLER PROOF LOCATION: L1 MEZZ ELEV MACH RM (131)
	TOTAL AMP	1728			
	5				



TOTAL AMP

600	728	400
1728		
5		

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

						RP-GEN RA									
						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	a	b	c							
GENERATOR BATTERY CHARGER				15	1a	500			2a	20				BLOCK HEATER	
						200			4b						
					3b		500		6c						
					5c			500	8a						
					7a	0			10b						
					9b		0		12c						
					11c			0							
						700	500	500	PANEL TYPE: TYPE1-SPRINKLER PROOF						
						TOTAL WATT			LOCATION: LEVEL 13 GENERATOR RM CONDO						
						TOTAL AMP			MOUNTING: SURFACE						
						1700									
						5									



TOTAL WATT
TOTAL AMP

PANEL SCHEDULE

347/600 VOLTS

3 PHASE WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS					6P1RCOD			JOB NAME: Aquavista						
MLO MAIN BREAKER					LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b							c
SPARE				20	1a	10000			2a	35				TX-RCW4 30KVA
						0			4b					
SPARE				20	3b		10000		6c					
							0			20				SPARE
SPARE				20	5c			10000	8a					
								0						
SPARE				20	7a	0				20				SPARE
						0			10b					
SPARE				20	9b		0							
										20				SPARE
					11c				12c					
										15				For Metering
					13a				14a					
					15b				16b					
					17c				18c					
										20a				
					19a									
										22b				
					21b									
										24c				
					23c									
						10000	10000	10000	PANEL TYPE: TYPE1-SPRINKLER PROOF					
						TOTAL WATT 30000								
						TOTAL AMP 29								
						LOCATION: LEVEL P1 MAIN ELEC RM								



TOTAL WATT
TOTAL AMP

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 MAIN ELEC RM

MOUNTING: SURFACE

347/600	VOLTS
3 PHASE	WIRE
200	AMP MAINS
MLO	MAIN BREAKER

JOB NAME: Aquavista

30/10/2015

[illegible]

20560	15376	17040
52976		
51		

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

200NA MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS						6EP1RCP1			JOB NAME: Aquavista					
200NA MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
EXIT SIGNS P4/P3 LEVEL		200	5	20	1a	12500			2a					TX-ERCE1 75KVA
						1000			4b					
EXIT SIGNS P2/P1/L1 LEVEL		200	5	20	3b		12500							
							1000		6c					
EXIT SIGNS WEST L2 ~ L13		260	5	20	5c			12500						
								1300	8a	20	64	50		LTG PARKING P4/P3/P2/P1
EXIT SIGNS EAST L2 ~ L13		260	5	20	7a	4032								LTG LOCKER/BICYCLE/MECH RM P4/P3/P2/P1
						1300			10b	20	32	23		
SPARE				20	9b		1760							
							0		12c	20	64	31		LTG ELEC RM P2/P1
LTG STAIR A/G/Gx		40	32	20	11c			1984						
								1280	14a	20	64	6		LTG PARKING RAMP L1
LTG STAIR E/H		50	32	20	13a	1216								
						1600			16b	20				SPARE
LTG STAIR B/J/Jx		40	32	20	15b									
							1280		18c	20				SPARE
LTG STAIR C/K/Kx		40	32	20	17c									
								1280	20a	20				SPARE
SPARE				20	19a									
									22b					
LTG CORRIDOR/MECH RM L1 MEZZ		13	32	20	21b									
							544		24c	15				For Metering
LTG LOADING AREA (CONDO) L1/ L1 MEZZ		5	64	20	23c									
								576	26a					
					25a									
									28b					
					27b									
									30c					
					29c									
									32a					
					31a									
									34b					
					33b									
									36c					
					35c									
									38a					

[illegible]

TOTAL WATT

21648	17084	18920
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55

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 MAIN ELEC RM

MOUNTING: SURFACE

PANEL SCHEDULE

347/600 VOLTS

3 PHASE 4 WIRE

400 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note - * GFCI BREEAKER

						6P1RCSM									
						LOAD PER PHASE									
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
SNOW MELT GARAGE RAMP L1				20*	1a	3742			2a	20*				SNOW MELT WALKWAY NORTH L2 EXTERIOR	
						3096			4b						
					3b		3742								
SNOW MELT GARAGE RAMP L1				20*			3096		6c	20*				SNOW MELT WALKWAY NORTH L2 EXTERIOR	
					5c			3742							
					7a	3742		3096	8a						
SNOW MELT GARAGE RAMP L1				20*		3096			10b	20*				SNOW MELT WALKWAY SOUTH EAST L2 EXTERIOR	
					9b		3877								
					11c		3096	3877	12c						
SNOW MELT GARAGE RAMP L1				20*				3096	14a	20*				SNOW MELT WALKWAY SOUTH EAST L2 EXTERIOR	
					13a	3877									
					15b	3096		3877	16b						
SNOW MELT LOADING (CONDO) L1				20*			3096		18c	20*				SNOW MELT WALKWAY SOUTH EAST L2 EXTERIOR	
					17c			3877							
					19a	3877		2328	20a						
SNOW MELT LOADING (CONDO) L1				20*		2328			22b	20*				SNOW MELT WALKWAY SOUTH WEST L2 EXTERIOR	
					21b		2469								
					23c		2328	2469	24c						
SNOW MELT MAINTAIN PATH L13				20*				2328	26a	20*				SNOW MELT WALKWAY SOUTH WEST L2 EXTERIOR	
					25a	2469									
					27b	3406		2469	28b						
SNOW MELT MAINTAIN PATH L13				20*			3406		30c	20*				SNOW MELT STAIR WEST TOWER L14	
					29c			1225							
					31a	1225		3406	32a						
SNOW MELT MAINTAIN PATH L13				20*		3406			34b	20*				SNOW MELT STAIR EAST TOWER L14	
					33b		1225								
					35c		3406	1225	36c						
								3406	38a						

	TOTAL WATT	49859.1	48586.8	46575	PANEL TYPE:	TYPE1-SPRINKLER PROOF
	TOTAL AMP	145020			LOCATION:	LEVEL P1 MAIN ELEC RM
		140			MOUNTING:	SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

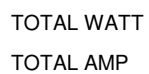
100N/A MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2EP1RCP3			JOB NAME: Aquavista					
100N/A MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
REC SECURITY TV E ENTRANCE VEST L1	500		1	15	1a	500			2a	20				O/H DOOR GARAGE P2 LEVEL
						500			4b					
DOOR OPERNER E ENTRANCE VEST L1	500		2	15	3b		500		6c					
							1000							
SPARE				15	5c			500						
								0	8a	20				O/H DOOR GARAGE L1
Low Heating Boiler HBC-01 P4 LEVEL				20	7a	500								
						1560			10b					
SPARE				20	9b		500							
							0		12c					
SPARE				20	11c			500						
								0	14a	15				For Metering
SPARE				20	13a	0								
						0			16b					
SPARE				20	15b		0							
							0		18c					
					17c			0						
								0	20a					
					19a	0								
						0			22b					
					21b		0							
							0		24c					
					23c			0						
								0	26a					
					25a	0								
						0			28b					
					27b		0							
							0		30c					
					29c			0						
								0	32a					
					31a									
									34b					
					33b									
									36c					
					35c									

	TOTAL WATT	3060	2000	1000	PANEL TYPE: TYPE1-SPRINKLER PROOF LOCATION: LEVEL P1 EAST ELEC RM
	TOTAL AMP	6060			
	17				



PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 EAST ELEC RM

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note-* Lockable Breaker

100		AMP MAINS		2EP1RCLE			JOB NAME: Aquavista							
MLO		MAIN BREAKER					Note-* Lockable Breaker							
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
LTG ELEV #3/4 PIT P4		2	100	20*	1a	608			2a	20				TYPE 'DL8' 'DL1A' 'DL12' E ELEV & MAIN LOBBY L1
						200			4b	20	100	2		LTG GAS REGULATORS L1
SPARE				20	3b		200			6c	20			SPARE
SPARE				20	5c					8a	20	100	4	LTG E ELEV LOBBY P1 ~ P4
SPARE				20	7a				10b	15				For Metering
SPARE				20	9b				12c					
					11c				14a					
					13a				16b					
					15b				18c					
					17c				20a					
					19a				22b					
					21b				24c					
					23c				26a					
					25a				28b					
					27b				30c					
					29c				32a					
					31a				34b					
					33b				36c					
					35c				38a					

	TOTAL WATT	808	200	0	PANEL TYPE:	TYPE1-SPRINKLER PROOF
	TOTAL AMP	1008			LOCATION:	LEVEL P1 EAST ELEC RM
		3				

LOCATION: _____ LEVEL P1 EAST ELEC RM



TOTAL AMP

1008

3

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

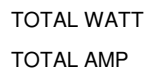
JOB NAME: Aquavista

Note :* - Lockable breaker

Feed Through Panel

DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIXT.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
DOOR OPENER STAIR B L1	500		1	15	1a	500			2a	15*	500		1	PWR E CACF RM L1
DOOR OPENER STAIR Jx L1	500		1	15	3b		500		4b	15*	500		1	PWR E CACF RM L1
DOOR OPENER STAIR C L1	500		1	15	5c			500	6c	15*	500		1	PWR E CACF RM L1
DOOR OPENER STAIR K L1	500		1	15	7a	500			8a	15*	500		1	REC E CACF RM L1
SPARE				15	9b		0		10b	15				SPARE
SPARE				15	11c			0	12c					AIR COMPRESSOR EAST ELEC RM P1 LEVEL
AIR COMPRESSOR PARK ELEC RM P1 LEVEL				20*	13a	0			14a	20*				
				20*	15b		0		16b					
				20*	17c			200	18c	15*				
AIR COMPRESSOR CONTROL PARK ELEC RM P1 LEVEL				15*	19a	200			20a	15				AIR COMPRESSOR CONTROL EAST ELEC RM P1 LEVEL
CO CONTROL PANEL P4				15*	21b		0		22b	15*				SPARE
CO CONTROL PANEL P3				15*	23c			0	24c	15				SPARE
CO CONTROL PANEL P2				15*	25a	0			26a	20*				SPARE
CO CONTROL PANEL P1				15*	27b		0		28b	20				SPARE
SPARE				15	29c			0	30c					For Metering
SPARE				15	31a			0	32a	15				
SPARE				15	33b				34b					
SPARE				15	35c				36c					

	TOTAL WATT	2200	1000	1200	PANEL TYPE:	TYPE1-SPRINKLER PROOF
	TOTAL AMP	4400			LOCATION:	LEVEL P1 EAST ELEC RM
		12				



PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 EAST ELEC RM

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS						2P1RCLE			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG CORRIDOR L2				20	1a	866			2a	20	8	58.7		TYPE 'DL8' 'DL1A' 'DL12' EAST ELEV LOBBY L1
LTG CORRIDOR L3				20	3b	999	732		4b	20	8	32.1		TYPE 'DL2B' 'DL4A' EAST ELEV LOBBY L1
LTG CORRIDOR L4				20	5c		992		6c	20				SPARE
LTG CORRIDOR L5				20	7a			1000	8a	20				SPARE
LTG CORRIDOR L6				20	9b	1000	772		10b	20	100	4		LTG E ELEV LOBBY P1 ~ P4
LTG CORRIDOR L7				20	11c		1000		12c	20				SPARE
LTG CORRIDOR L8				20	13a			951	14a	20				SPARE
LTG CORRIDOR L9				20	15b	959			16b	20				SPARE
LTG CORRIDOR L10				20	17c		959		18c	20				SPARE
LTG CORRIDOR L11				20	19a			1024	20a	15				For Metering
LTG CORRIDOR L12				20	21b	1024			22b					
GARBAGE CHUT L2 ~ L12		12	26	20	23c		885		24c					
SPARE				20	25a			312	26a					
LTG MECH RM L13		12	64	20	27b				28b					
					29c		1132		30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

200 MB MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Feed Through Panel

						2P1RCPE								
						LOAD PER PHASE								
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
REC RCE1 CORRIDOR L2~L7	6		180	20	1a	540			2a	15	180		3	REC STAIR B
						1080			4b	15	180		4	REC STAIR J
REC RCE2 CORRIDOR L2~L7	6		180	20	3b		720		6c	15	180		4	REC STAIR EJ/Jx
							1080		8a	15	180		3	REC STAIR C
REC RCE3 CORRIDOR L2~L7	6		180	20	5c			720						
								1080	10b	15	180		7	REC STAIR K/Kx/Ky
REC RCE4 CORRIDOR L2~L7	6		180	20	7a	540			12c	15				SPARE
						1080			14a	15	180		4	REC ELEV SHAFT / PIT L1 MEZZ
REC RCE5 CORRIDOR L2~L7	6		180	20	9b		1260		16b	15	180		2	REC ELEV MACH RM L1
							1080		18c	20	180		5	REC CORRIDOR L1 MEZZ
REC RCE6 CORRIDOR L2~L7	6		180	20	11c			0	20a	15				SPARE
								1080	22b	20	180		3	REC SERVICE CORRIDOR L1
REC RCE1 CORRIDOR L8~L12	5		180	20	13a	720			24c	15	180		6	REC E GARBAGE RM L1
						900			26a	15	180		6	COMPACTOR CONTROL E GARBAGE RM L1
REC RCE2 CORRIDOR L8~L12	5		180	20	15b		360		28b	15	180		3	REC EAST CACF RM L1
							900		30c	15	1000		1	FIRE PLACE EAST MAIN LOBBY L1
REC RCE3 CORRIDOR L8~L12	5		180	20	17c			900	32a	20	180		6	REC EAST MAIN LOBBY L1
								900	34b	20	180		2	REC BIKE/DOG WASH RM L1
REC RCE4 CORRIDOR L8~L12	5		180	20	19a	0			36c	15				SPARE
						900			38a	15	500		2	DOOR OPNER E ELEV LOBBY
REC RCE5 CORRIDOR L8~L12	5		180	20	21b		540							
							900							
REC RCE6 CORRIDOR L8~L12	5		180	20	23c			1080						
								900						
REC RCE7/8 CORRIDOR L10~L12	4		180	20	25a	1080								
						720								
REC RCE9/10 CORRIDOR L2	2		180	20	27b		540							
							360							
SPARE				20	29c			1000						
								0						
REC E ELEV LOBBY P1 ~ P4	4		180	15	31a	1080								
						720								
DOOR OPNER E ELEV LOBBY P1	2		500	15	33b		360							
							1000							
REC ELEC RM P1	2		180	15	35c			0						
								360						

DOOR OPNER E ELEV LOBBY P2	2		500	15	37a	1000			40a	15	180		2	ELEV LOBBY P3
REC IRRIGATION RM/MECH RM P2	2		180	15	39b	1000			40b	15	180		3	REC BICYCLE RM P3
REC BICYCLE RM P2	4		180	15	41c	540			42c	15				SPARE
SPARE				15	43a	360			44a	15				DOOR OPNER E ELEV LOBBY P4
REC IRRIGATION CONTROLLER SOUTH OUTSIDE	1		500	15	45b	0			46b	15	180		5	REC BICYCLE RM P4
REC IRRIGATION CONTROLLER NORTH OUTSIDE	1		500	15	47c	900			48c	15	180		4	REC BOILER RM P4
REC IRRIGATION CONTROLLER L2 ROOF SOUTH	1		180	15	49a	500			50a	15	180		3	REC CHILLER RM P4
O/H DOOR LOADING (CONDO) L1				20	51b	540			52b	15	180		2	REC ELEV #3/#4 PIT P4
					53c	180			54c	15	180		1	REC ELEV #12 PIT P4
					55a	360			56a	15	180		3	REC ELEV #12 MACH RM P4
					57b	500			58b	15				SPARE
					59c	500			60c	15				SPARE
					61a				62a	15				SPARE
					63b				64b	15				SPARE
					65c				66c	15				For Metering
					67a				68a					
					69b				70b					
					71c				72c					
					73a				74a					
					75b				76b					
					77c				78c					
					79a				80a					
					81b				82b					
					83c				84c					



TOTAL WATT

TOTAL AMP

14120	12260	10640
37020		
103		

PANEL TYPE: TYPE1-SPRINKLER PROOF

LOCATION: LEVEL P1 EAST ELEC RM

MOUNTING: SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

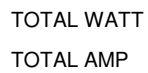
MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2ERRCLE			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG CORRIDOR L2 ~ L5				20	1a	896			2a	20	64	13		LTG MECH RM/ELEV MACH RM L13
LTG CORRIDOR L6 ~ L9				20	3b	968	128		4b	20	32	4		LTG ELEVA. SHAFT L13
LTG CORRIDOR L10 ~ L13				20	5c		872		6c	20				SPARE
				20	7a			700	8a	20				SPARE
				20	9b				10b	20				SPARE
				20	11c				12c	20				SPARE
				20	13a				14a	15				For Metering
				20	15b				16b					
				20	17c				18c					
				20	19a				20a					
				20	21b				22b					
				20	23c				24c					
				20	25a				26a					
				20	27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
									38a					

	TOTAL WATT	1864	1000	700	PANEL TYPE:	TYPE1 SPRINKLER PROOF
	TOTAL AMP	3564			LOCATION:	MECH PENTHOUSE-EAST
		10				



PANEL TYPE:	TYPE1 SPRINKLER PROOF
LOCATION:	MECH PENTHOUSE-EAST
MOUNTING:	SURFACE

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

Note - * Lockable Breaker

100 AMP MAINS						2ERRCPE			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			Note - * Lockable Breaker					
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c	CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
Chimney Exhaust Fan VENTC-01				15	1a	200			2a	15*				ELEV #3 LTG ELEV. MACH. RM L13
						250			4b	15*				ELEV #3 PWR ELEV. MACH. RM L13
					3b		200							ELEV #4 LTG ELEV. MACH. RM L13
							250							ELEV #4 PWR ELEV. MACH. RM L13
Air Cooled Condenser Unit ACUC-05				50	7a	200			8a	15*				ELEV #3 & #4 CONTROLLER ELEV. MACH. RM L13
						2882			10b	15*				ELEV #3 & #4 CONTR. PANEL ELEV. MACH. RM L13
					9b		200							ELEV #3 & #4 CONTR. PANEL ELEV. MACH. RM L13
							2882							SPARE
Unitary DX Unit ACC-05				15	13a	0			14a	15				PWR BATTERY CHARGE GEN RM L13
						365			16b	15				SPARE
					15b		288							PWR E CACF RM L1
							365							PWR E CACF RM L1
					17c			365	18c	15				PWR E CACF RM L1
					19a				20a	15				REC E CACF RM L1
					21b				22b	15				For Metering
					23c				24c	15				For Metering
					25a				26a	15				For Metering
					27b				28b					For Metering
					29c				30c	15				For Metering
					31a				32a					For Metering
					33b				34b	15				Spare
					35c				36c	16				Spare
									38a	17				Spare

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

125 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

125		AMP MAINS				2RRCPE			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
Chimney Exhaust Fan VENTC-02				15	1a	900 350			2a	15	180		5	REC MECH RM (1316) L13
Chimney Exhaust Fan VENTC-02				15	3b		1080 350		4b	15	180		6	REC GEN RM L13
Hot Water Unit Heater UHC-14, UHC-17				20	5c			720 480	6c	15	180		4	REC ELEV MACH RM L13
Hot Water Unit Heater UHC-15, UHC-16				20	7a	360 480			8a	15	180		2	REC ELEV SHAFT L13
SPARE				20	9b		180		10b	20	180		1	REC COOLING TOWER L13
SPARE				20	11c			540	12c	15	180		3	REC MAKE UP AIR UNIT L13
					13a	180 480			14a	20	180		1	REC ROOF L14
					15b		180		16b	15	180		1	REC (IRRIGATION) ROOF L13
					17c			360	18c	15	180		2	REC (IRRIGATION) ROOF L11/L7
					19a				20a	15				SPARE
					21b				22b	15				SPARE
					23c				24c	15				For Metering
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					38a				38a					

PANEL SCHEDULE

347/600 VOLTS

3 PHASE WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						6E1MCRP			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
LTG RETAIL (N) L1		19	64	20	1a	1024			2a	20	64	13		LTG MECH RM/LOADING AREA L1 / L1M
LTG RETAIL (S) L1		20	64	20	3b	1216			4b	20	64	13		LTG ELEC RM L1M
EXIT SIGNS RETAIL AREA L1 / L1M		200	5	20	5c		1280	1000	6c	35				TX-ECR1 -30kVA
					7a	1000		1000	8a					
					9b	0			10b					
					11c		1000		12c					
					13a				14a	15				For Metering
					15b				16b					
					17c				18c					
					19a				20a					
					21b				22b	15				Spare
					23c				24c	15				Spare
					25a				26a					
					27b				28b					
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					
Appendix-A					40c									

					40c									
					41c									
					43a									
					45b									
					47c									
					49a									
					51b									
					53c									
					55a									
					57b									
					59c									



TOTAL WATT

TOTAL AMP

3240	2280	2000
7520		
7		

PANEL TYPE: TYPE 1 SPRINKLER PROOF

LOCATION: L1M RETAIL ELEC RM

MOUNTING: _____ SURFACE _____

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				2E1MCRP1			JOB NAME: Aquavista					
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
PWR FIRE ALARM PANEL L1M				15*	1a	300			2a	20*				AIR COMPRESSOR RETAIL ELEC RM L1M LEVEL
REC METER L1M				15	3b				4b					
SPARE				15	5c			0	6c					
SPARE				15	7a				8a	15*				AIR COMPRESSOR CONTROL RETAIL ELEC RM L1M LEVEL
SPARE				15	9b	0	250		10b	15				VENTR-01 (0.75KW) RETAIL ROOF
SPARE				15	11c			250	12c					
SPARE					13a	250			14a					
					15b	0			16b	15				For Metering
					17c				18c					
					19a				20a					
					21b				22b	15				Spare
					23c				24c	15				Spare
					25a				26a	15				Spare
					27b				28b	15				Spare
					29c				30c					
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
					39b				40b					
Appendix A					CCT.									

Appendix-A

PANEL SCHEDULE

347/600 VOLTS

3 PHASE WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200		AMP MAINS				61MCRP			JOB NAME: Aquavista					
MLO		MAIN BREAKER							LOAD PER PHASE					
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c				CCT. NO.	BRKR SIZE	WATT / FIXT.
LTG RETAIL (NW) L1		33	64	20	1a	1152			2a	20	64	18		LTG MECH RM L1 / L1M
LTG RETAIL (NE) L1		43	64	20	3b	2112	1248		4b	20	64	17		LTG LOADING AREA L1 / L1M
LTG RETAIL (SW) L1		45	64	20	5c		2752		6c	20				SPARE
LTG RETAIL (SE) L1		38	64	20	7a			2880	8a	20				SPARE
SPARE				20	9b	2432	3242		10b	20 GFCI				SNOW MELT RETAIL LOADING L1
SPARE				20	11c			3242	12c					
SPARE				20	13a	3242			14a	20 GFCI				SNOW MELT RETAIL LOADING L1
SPARE				20	15b		3242		16b					
SPARE				20	17c			3242	18c	20 GFCI				SNOW MELT RETAIL LOADING L1
SPARE				20	19a	3242			20a					
					21b		11000		22b					TX-75kVA
					23c			11000	24c					
					25a	11000			26a					
					27b				28b					
					29c				30c	15				For Metering
					31a				32a					
					33b				34b					
					35c				36c					
					37a				38a					
									40b					
Appendix-A														

Appendix-A

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						21MCRP			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
REC RETAIL GABAGE RM L1	4		180	15	1a	500			2a	20				O/H DOOR RETAIL LOADING L1
						720			4b					
PWR RETAIL GABAGE CONTROL L1	1		200	15	3b		500							
							200		6c					
REC RETAIL SERVICE CORRIDOR L1	3		180	20	5c			500		20				O/H DOOR RETAIL LOADING L1
								540	8a					
REC RETAIL CHILLE RM L1	3		180	15	7a	500								
						540			10b					
SPARE				15	9b		500			15				For Metering
							0		12c					
REC RETAIL CONDENSER RM L1M	3		180	15	11c			500		15				For Metering
								540	14a					
REC RETAIL MAKEUP AIR RM L1M	5		180	15	13a	0								
						900			16b					
REC RETAIL MECH RM L1M	4		180	15	15b		720			15				Spare
									18c					
REC RETAIL ELEC RM L1M	4		180	15	17c									
									20a					
					19a					15				
									22b					
					21b					15				
									24c					
					23c					15				
									26a					
					25a					15				
									28b					
					27b									
									30c					
					29c									
									32a					
					31a									
									34b					
					33b									
									36c					
					35c									
									38a					
					37a									
									40b					
Appendix-A					39b									

Appendix-A

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200 AMP MAINS						21MCRM			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
Boiler HBR-01				15	1a	432			2a	15				Unitary DX Fan Coil Unit ACR-02
						1320			4b					
Boiler HBR-02				15	3b		432		6c					
							1320							
Fan EFR-01, 02				20	5c			432						
								500	8a	40				Air Cooled Condenser Unit ACUR-02
Fan EFR-04,06				20	7a	1992								
						500			10b					
Fan SFR-01				15	9b		1992							
							300		12c					
Force Floor Cabinet Heater EHR-01,02				20	11c			1992						
								720	14a	15				Metering
Hot Water Unit Heater UHR-01,02				15	13a		480							
									16b					
Hot Water Unit Heater UHR-03,04				15	15b		480		18c					
Hot Water Unit Heater UHR-05,06				15	17c			480	20a	15				Unitary DX Fan Coil Unit ACR-03
Hot Water Unit Heater UHR-07				15	19a	156								
						240			22b					
					21b		156							
							432		24c					
Unitary DX Fan Coil Unit ACR-01				15	23c			156						
								432	26a	20				Air Cooled Condenser Unit ACUR-03
					25a	1980								
						432			28b					
					27b		1980							
							1992		30c	15				Spare
Air Cooled Condenser Unit ACUR-01				40	29c			1992	32a	15				Spare
					31a									
						1992			34b	15				Spare
					33b		350		36c	15				Spare
				15	35c									
									38a					
					37a									
									40b					
Appendix A					39c									

Appendix-A

PANEL SCHEDULE

347/600 VOLTS

3 PHASE WIRE

200 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

200		AMP MAINS				61MCRM			JOB NAME: Aquavista						
MLO		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION	
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c							
Make Up Air Unit MAUR-1				40	1a	733			2a	15				MAUR 01Heating Pumps PR-11, PR-12 Duty/ Standby each 2.2kW	
						3733			4b						
					3b		733				6c				
						3733									
					5c				733						
Condenser Water Pumps PR-01, PR-02 Duty/ Standby each 11.2kW				40		3733			8a	15				DHW Circulation Pump PR-15 0 .56kW	
					7a	187									
						3733			10b						
					9b		187				12c				
						3733									
Chilled Water Pumps PR-03, PR-04 Duty/ Standby each 7.5kW				25		3733			14a					Loading Bay Exhaust EFR-05	
					13a	250									
						2500			16b						
					15b		250				18c				
						2500									
Boiler#1 Pump PR-05 2.2kW				15		250			20a	15				Metering	
						2500									
					19a						22b				
						733									
					21b				733		24c				
Boiler#2 Pump PR-06 2.2kW				15		733			26a	35				Cooling Tower CTR-01	
						4467									
						733			28b						
					27b		4467				30c				
						733									
High Temp Secondary Pumps PR-07, PR-08 Duty/ Standby each 5.6kW				20		4467			32a	15				Spare	
						733									
					31a						34b				
						1867									
					33b				1867		36c				
Low Temp Secondary Pumps PR-09 Duty/				15					38a	15				Spare	
						1867									
					37a				733		40b				

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

50 MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				2E1MCRP2			JOB NAME: Aquavista					
50		MAIN BREAKER				LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	a	b	c						
Chiller Refrigerent Exhaust Fan EFR-03				15	1a	300			2a	15				Metering
SPARE				15	3b				4b					
									6c					
REC SECURITY L1M	1		200	15	5c			200	8a	15				Spare
REC SECURITY L1M	1		200	15	7a	200			10b					
REC COMM. L1M	1		200	15	9b		200		12c					
REC COMM L1M	1		200	15	11c			200	14a	15				Spare
DOOR OPNER ENTRANCE L1	1		500	15	13a	500			16b	15				Spare
					15b				18c					
					17c				20a					
					19a				22b					
					21b				24c					
					23c				26a					
					25a				28b					
					27b				30c					
					29c				32a					
					31a				34b					
					33b				36c					
					35c				38a					
					37a				40b					
Appendix A					CCT.									

Appendix-A

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100 AMP MAINS						2P1ATP			JOB NAME: Aquavista					
MLO MAIN BREAKER						LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	OCT. NO.	a	b	c						
				20	1a				2a	20				
				20	3b				4b	20				
				20	5c				6c	20				
				20	7a				8a	20				
				20	9b				10b	20				
				20	11c				12c	20				
				20	13a				14a	20				
				20	15b				16b	20				
				20	17c				18c	20				
				20	19a				20a	20				
				20	21b				22b	20				
				20	23c				24c	20				
				20	25a				26a	20				
				20	27b				28b	20				
				20	29c				30c	20				
				20	31a				32a	20				
				20	33b				34b	20				
				20	35c				36c	20				
				20	37a				38a	20				

PANEL SCHEDULE

120/208 VOLTS

3 PHASE 4 WIRE

100 AMP MAINS

MLO MAIN BREAKER

JOB NUMBER: 8489D

JOB NAME: Aquavista

100		AMP MAINS				2P1PSL			JOB NAME: Aquavista					
MLO		MAIN BREAKER												
DESCRIPTION	# OF REC.	# OF FIXT.	WATT / FIX.	BRKR SIZE	CCT. NO.	LOAD PER PHASE			CCT. NO.	BRKR SIZE	WATT / FIXT.	# OF FIXT.	# OF REC.	DESCRIPTION
						a	b	c						
				20	1a				2a	20				
				20	3b				4b	20				
				20	5c				6c	20				
				20	7a				8a	20				
				20	9b				10b	20				
				20	11c				12c	20				
				20	13a				14a	20				
				20	15b				16b	20				
				20	17c				18c	20				
				20	19a				20a	20				
				20	21b				22b	20				
				20	23c				24c	20				
				20	25a				26a	20				
				20	27b				28b	20				
				20	29c				30c	20				
				20	31a				32a	20				
				20	33b				34b	20				
				20	35c				36c	20				
				20	37a				38a	20				

LOW VOLTAGE LIGHTING RELAY SCHEDULE

PANEL ID: LVP-1
LOCATION: MAIN ELEC RM (LEVEL P1)

CIRCUIT #	RELAY #		DESCRIPTION	LOCAL SWITCH	MASTER SWITCH	TIMER	CTRL DEVICE	COMMENTS
2P1RCAL-2.1	1		Mens Barrier Free Washroom			X	OS	120V
2P1RCAL-2.2	2		Mens Change Room			X	OS	120V
2P1RCAL-2.3	3		Mens Barrier Free Shower			X	OS	120V
2P1RCAL-2.4	4		Mens Shower			X	OS	120V
2P1RCAL-2.5	5		Mens Steam Room	LV switch		X		120V
2P1RCAL-2.6	6		Womens Steam Room	LV switch		X		120V
2P1RCAL-2.7	7		Womens Change Room			X	OS	120V
2P1RCAL-2.8	8		Womens Barrier Free Shower			X	OS	120V
2P1RCAL-3.1	9		GYM-DL2B Centre	LV switch		X		120V
2P1RCAL-3.2	10		GYM-DL8	LV switch		X		120V
2P1RCAL-3.3	11		GYM-Outer DL2B, 11A	LV switch		X		120V
2P1RCAL-4.1	12		Spinning Room DL2Bs	LV switch		X		120V
2P1RCAL-4.2	13		Spinning Room DL11A	LV switch		X		120V
2P1RCAL-4.3	14		Lobby DL5 Fixtures+West Elev Lobby DL12			X		120V
2P1RCAL-5.1	15		Janitor Room	LV switch		X		120V
2P1RCAL-5.2	16		AV Room	LV switch		X		120V
2P1RCAL-5.3	17		Yoga room	LV switch		X		120V
2P1RCAL-5.4	18		Stair-L			X		120V
2P1RCAL-6.1	19		Parcel Room	LV switch		X		120V
2P1RCAL-6.2	20		Lobby			X		120V
2P1RCAL-8	21		Lobby			X		120V
2P1RCAL-7.1	22		Mail Room	LV switch		X		120V
2P1RCAL-7.2	23		Mail Pickup			X		120V
2P1RCAL-7.4	24		T Bar	LV switch		X		120V
2P1RCAL-7.5	25		Meeting Room	LV switch		X		120V
2P1RCAL-7.6	26		Kitchen	LV switch		X		120V
2P1RCAL-9.1	27		Admin Office	LV switch		X		120V
2P1RCAL-9.2	28		West Elevator Lobby			X		120V
2P1RCAL-9.3	29		Barrier Free Wash Room			X	OS	120V
2P1RCAL-2.9	30		Womens shower			X	OS	120V
2P1RCAL-2.10	31		Womens barrier Free wash room			X	OS	120V
2P1RCAL-2.11	31		vestibules			X		120V
2EP1RCLW-8	33		Type 'LS1' - L2 Exterior			X	XX	120V
2EP1RCLW-10	34		Type 'X4' - L2 Exterior Pool			X	XX	120V
	35		Spare					
	36		Spare					
	37		Spare					
	38		Spare					
	39		Spare					
	40		Spare					
	41		Spare					
	42		Spare					

NOTES:

COMMISSIONING SHALL BE DONE BY FACTORY AUTHORIZED PERSONAL AND TIMER FUNCTION TO BE COORDINATED WITH THE OWNER. PROVIDE MASTER CONTROL SWITCH IN SECURITY ROOM TO OVERRIDE THE RELAY PANEL

XX-LIGHTING COMES TO 'FULL BRIGHTNESS'/'TURN ON' WHEN NORMAL POWER FAILS

D-DIMMER

OS- OCCUPANCY SENSOR

DL-DAYLIGHT SENSOR

LVS-LOW VOLTAGE SWITCH

LOW VOLTAGE LIGHTING RELAY SCHEDULE

PANEL ID: LVP-2
LOCATION: EAST ELEC RM (LEVEL P1)

CIRCUIT #	RELAY #		DESCRIPTION	LOCAL SWITCH	MASTER SWITCH	TIMER	CTRL DEVICE	COMMENTS
2P1RCLE-2	1		EAST ELEV LOBBY - TYPE 'DL1A'			X		120V
2P1RCLE-2	2		EAST ELEV LOBBY - TYPE 'DL8'			X		120V
2P1RCLE-2	3		EAST ELEV LOBBY - TYPE 'DL12'			X		120V
2P1RCLE-4	4		EAST ELEV LOBBY - TYPE 'DL2B'			X		120V
2P1RCLE-4	5		EAST ELEV LOBBY - TYPE 'DL4A'			X		120V
2P1RCLE-4	6		EAST ENTRANCE VEST - TYPE 'DL8'			X		120V
	7		SPARE					
	8		SPARE					
	9		SPARE					
	10		SPARE					
	11		SPARE					
	12		SPARE					

NOTES: COMMISSIONING SHALL BE DONE BY FACTORY AUTHORIZED PERSONAL AND TIMER FUNCTION TO BE COORDINATED WITH THE OWNER. PROVIDE MASTER CONTROL SWITCH IN SECURITY ROOM TO OVERRIDE THE RELAY PANEL
XX-LIGHTING COMES TO 'FULL BRIGHTNESS'/'TURN ON' WHEN NORMAL POWER FAILS
D-DIMMER
OS- OCCUPANCY SENSOR
DL-DAYLIGHT SENSOR
LVS-LOW VOLTAGE SWITCH