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ELECTRICAL SPECIFICATIONS

NHA UHN DI CT 64 REPLACEMENT

UNIVERSITY HOSPITAL OF NORTHERN BRITISH COLUMBIA
1475 EDMONTON ST, PRINCE GEORGE, BC, V2M 1S2

ISSUED FOR TENDER
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Part 1 General

1.1 RELATED SECTIONS & SUMMARY

- .1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.
- .2 Refer to Division 01 - Closeout Procedures.
- .3 Reference to "Electrical Divisions" shall mean all sections of Divisions 26, 27, 28, 33, 34 & 48 in the Master Format or the Canadian Master Specifications.
- .4 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.
- .5 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, and establish orderly completion and delivery of a fully commissioned installation.
- .6 The most stringent requirements of this and other electrical sections shall govern.
- .7 All work shall be in accordance with the UHN DI CT 64 Replacement University Hospital of Northern BC Project Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.
- .8 Provide seismic restraints for all required equipment and wiring systems.
- .9 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/ separately packaged accessories.
- .10 "Consultant" shall be project based.

1.2 REFERENCES

- .1 Install in accordance with CSA C22.1 (current adopted edition) - except where specified otherwise.
- .2 Refer to CSA C22.1 Appendix A "Safety Standards for Electrical Equipment" for applicable codes and the related revisions
- .3 Refer to CSA C22.1 Pages xxix - xxxii for related 'Reference Publications'
- .4 Refer to NBCC Table 1.3.1.2 for applicable codes and the related revisions.
- .5 Comply with local Electrical Bulletins and by-laws relating to the Authority Having Jurisdiction.
- .6 Install overhead and underground systems in accordance with CSA C22.3 No.1 (current adopted edition) - except where specified otherwise.
- .7 Preferred Voltage Levels for AC Systems, 0-50,000V in accordance with CAN3-C235 (current adopted edition).

- .8 Refer to CSA Z8000-11 Canadian Health care Facilities-searchable section 12 for related "Building services and environmental design."

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications and on drawings are those defined by IEEE SP1122.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235:19 (current adopted edition).
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by the above standard. Equipment to operate in extreme operating conditions is established in the above standard without damage to the equipment.

1.5 SUBMITTALS

- .1 Submittals to be in accordance with Division 01.
- .2 Product Data: submit WHMIS MSDS in accordance with Division 01 - Sustainable Requirements and Division 02- Hazardous Materials
- .3 Shop Drawings
 - .1 Submit shop drawings, product data and samples in accordance with Division 01. The submission shall be reviewed, signed and processed as described in Division 01.
 - .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
 - .3 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.
 - .4 Content
 - .1 Shop drawings submitted title sheet.
 - .2 Data shall be specific and technical.
 - .3 Identify each piece of equipment.
 - .4 Information shall include all scheduled data.
 - .5 Advertising literature will be rejected.
 - .6 The project and equipment designations shall be identified on each document.
 - .7 The shop drawings/product data shall include:
 - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.
 - .2 Mounting arrangements.
 - .3 Detailed drawings of bases, supports and anchor bolts.

- .4 Control explanation and internal wiring diagrams for packaged equipment.
- .5 A written description of control sequences relating to the schematic diagrams.
- .5 Format
 - .1 PDF
 - .2 Bill of Materials quantities for related components, identified by model number, listed on the front cover with item identification numbers.
- .6 Coordination
 - .1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Consultants.
- .7 Retain one [1] copy of shop drawings and product data, on-site, available for reference.
- .8 Quality Control: in accordance with Division 01 - Quality Requirements
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, the electrical "load balance" report.
- .9 Permits and Fees:
 - .1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.
 - .2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Division 01 - Quality Requirements
- .2 Qualifications: All electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with Authorities Having Jurisdiction as per the conditions of Provincial and/ or Territorial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings: in accordance with Division 01 – Construction Progress Schedule.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Consultant with schedule within 4 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Division 01.

1.8 SYSTEM START-UP

.1 Refer to Division 01, and as follows.

.2 Instruct Consultant and operating personnel in the operation, care and maintenance of equipment.

.3 Arrange and pay for services of manufacturer's factory service Engineer to supervise start-up of installation, check, adjust, balance and calibrate components, where required in these specifications.

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

1.9 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 – Cleaning and

Waste Management.

- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.11 ASBESTOS REMOVAL

- .1 Refer to specification Division 01 for procedures, removal and disposal of asbestos.
- .2 If during renovations/demolition, asbestos is discovered (or material suspected to be asbestos), all work in that area shall immediately cease, and the General Contractor advised. The General Contractor shall take immediate appropriate action to verify the presence of friable asbestos and be responsible for the removal of all friable asbestos.
- .3 This division will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

1.12 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Architectural and Structural drawings.
- .2 Consult the architectural drawings and details for exact locations of fixtures and equipment. Obtain this information from the Consultant where definite locations are not indicated.
- .3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.
- .4 Where imperial units have been indicated in brackets [-] following the requirements in SI units, the conversion is approximate and provided for convenience. The SI units shall govern.

1.13 PROJECT COORDINATION

- .1 Electrical drawings are diagrammatic and approximately to scale. They establish the scope of the work and the general location and orientation of the electrical systems. The systems shall be installed generally in the locations and generally at the locations shown.
- .2 Run conduits close to the building structure and coordinated with other services. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.
- .3 Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass.
- .4 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate an installation satisfactory to FMO. Make no deviations to the design intent involving extra cost to the Owner, without the Owners, Architect and Consultant's written approval.

- .5 Prior to installation, to ensure a coordinated installation, the Contractor shall coordinate with all other trades for the layout and routing of services and locations of all equipment. The Contractor shall produce coordinated layout drawings indicating the resulting coordination with the other trades and indicating the coordinated layouts and routings for services and equipment. This effort shall result in a coordinated installation that is maintainable and accessible for maintenance, and safe, at no extra costs to the Owner for equipment, materials and or installation.
- .6 Work out jointly all interference problems on the site and coordinate all work before fabricating or installing any material or equipment. Where necessary, produce interference drawings showing locations of systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference drawings to the Owner, FMO, Architect and Consultant and all affected parties.
- .7 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Consultant of space problems before installing any material or equipment. Demonstrate to the Consultant on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.
- .8 Prior to installation, following demolition and clean-up, provide Ground Penetrating Radar (GPR) scanning of the renovation area of the ground floor. The purpose of this effort is to determine the location of existing underground (below slab) services, prior to cutting the floor slab to suit the renovation. Once scanning is complete, the Contractor shall produce a dimensioned sketch(s) locating and indicating the routing (and elevation) of all existing services. The produced sketch(s) shall be sufficient to inform where to cut the slab and to determine service routing required to complete the installation, per the intent depicted on the contract drawings, given possible differences between existing conditions and existing conditions depicted on the contract drawings. The Contractor shall update the contract drawings to indicate any pipe or conduit routing changes given the results of the scanning.

1.14 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

- .1 Leave clear spaces designated for future equipment or building expansion where indicated. Plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.
- .2 Where contract documents don't clearly indicate the future expansion requirements, but known services are required, provide written "Request For Information" to the consultant before making assumptions as to intent. When the Contractor submits a written RFI, the Contractor shall also provide a suggested solution with the submittal.

1.15 SPRINKLER-PROOF REQUIREMENTS

- .1 All equipment and wiring systems shall be sprinkler-proof standard where sprinkler fire protection systems are installed.
- .2 In rooms where electrical equipment is installed surface mounted, electrical equipment contained in these rooms to be protected by non-combustible drip hoods, shields, and gasketed doors as applicable to inhibit water ingress into electrical equipment. Exposed conduits connected to equipment to utilize watertight connectors. Top entry to be avoided where possible
- .3 Electrical equipment installed beneath sprinkler-protected areas shall be suitable for the environment and protected from water ingress.

1.16 EQUIPMENT RESTRAINT

- .1 Related Section: 26 05 05 Seismic Restraint.
- .2 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

1.17 REUSED EQUIPMENT

- .1 Where existing equipment is being relocated and re-used, check and report on the condition to the Consultant before reinstallation. Protect and carefully store equipment designated for reuse.

1.18 PHASED CONSTRUCTION

- .1 See Architectural specifications and drawings for construction phasing. Make all allowances to phase the work in accordance with the project phasing.
- .2 All existing services and the existing building must be maintained in operation. Provide and install temporary services as required.
- .3 All trades in this Division shall make allowance for the implications of having to totally complete all work in the new addition before proceeding with work in the existing building.

1.19 SEQUENCE OF WORK

- .1 Before interrupting major services notify the Owner in writing, in advance, and arrange an acceptable schedule for the interruptions.
- .2 Before interrupting any services complete all preparatory work as far as reasonably possible and have all necessary materials on site and prefabricated (where practical) and work continuously to keep the length of interruption to a minimum.
- .3 Include for the cost of all work that may be required out of regular hours to minimize the period of service interruption when modifying the existing systems.
- .4 All trades in this Division shall make allowance for the implications of having to totally complete all work in the new addition before proceeding with work in the existing building.

1.20 BUILDING OPERATION DURING CONSTRUCTION

- .1 In order to minimize operational difficulties for the existing building staff, the various trades must cooperate with the owner throughout the entire construction period and particularly ensure that noise is minimized.

1.21 EXISTING SERVICES

- .1 Protect all existing services encountered. Every effort has been made to show the known existing services. However, the removal of concealing surfaces may reveal other existing services. Work with the Owner's staff to trace the originating source and points served. Obtain instructions from the Consultant when existing services require relocation or modifications, other than those already indicated in the Contract Documents.
- .2 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Owner's approval of the timing, and work to minimize any interruptions.
- .3 Shutdowns, to permit connections, to be coordinated with the maintenance staff.

- .4 In order to maintain existing services in operation, temporary relocations and wiring may be required.
- .5 Be responsible for any damages to existing systems by this work.
- .6 The interruption of utility services to permit tie-ins shall be arranged through the owner's representative. Application must be received in writing at least seven (7) calendar days prior to the date required for the shutdown. Service shutdowns shall only be carried out by Physical Plant and will normally be scheduled to occur during evenings or weekends. The Owner reserves the right to withhold permission for a reasonable period with respect to any shutdown, if the shutting-off of a service interferes with essential building operations.

1.22 SALVAGE

- .1 All conduit, wiring and equipment which becomes redundant and is no longer required due to the work in this Contract shall be completely removed and disposed of per terms of the contract.
- .2 All existing items which need to be removed, and which have a reasonable salvage value, shall be carefully removed and turned over to the Owner. Handing over to the Owner includes moving to Owner's designated storage place on site. These items shall not become the property of the Contractor. Obtain a written receipt from the Owner detailing each of the items handed over.
- .3 Remove all redundant material not required by the Owner from the site.

1.23 WARRANTY

- .1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the Division 01.
- .2 Take note of any extended warranties specified.
- .3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of two (2) years from the date of substantial performance.
- .4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

1.24 TENDER INQUIRIES

- .1 All Contractor queries during the tender period shall be made in writing to the consultant. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be considered valid or issued by the Consultant's office during tender. Telephone queries will not be responded to.

1.25 EXAMINATION

- .1 Visit the site before preparing the tender and examine all existing conditions. No extra cost will be considered for any misunderstanding of work to be done resulting from failure to visit the site.
- .2 Examine the documents for details of work included. Obtain a written clarification in the event of conflict within the specification, between the specification and the drawing, or in the drawing. Obtain written clarification from the Consultant if work affecting the installation is not clear. Where this is not done in advance, allow in the tender sum for providing the more costly alternative.

1.26 RESPONSIBILITIES

- .1 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.
- .2 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Consultant during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.
- .3 Protect equipment and material from the weather, moisture, dust and physical damage.
- .4 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at **no** extra cost to the Owner.
- .5 Protect all existing services encountered. Obtain instructions from the Consultant when existing services require relocation or modification.
- .6 Refinish damaged or marred factory finish to factory finish.
- .7 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Consultant.

1.27 STANDARD OF ACCEPTANCE

- .1 Standard of Acceptance means that the item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.
- .2 Where two or more manufacturers are listed, the manufacturer's name shown first or underlined or shown with a model name and/or number was used in preparing the base design. Tenders may be based on any one of those named, provided that they meet every aspect of the base design and every aspect of the drawings and specifications.
- .3 Where other than the first named or the underlined manufacturer or scheduled/specified manufacturer is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Equipment/materials shall not exceed the available space limitations. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.
- .4 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

1.28 ADDITION OF ACCEPTABLE MANUFACTURERS

- .1 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Consultant for consideration not later

than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

- .2 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.
- .3 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product
- .4 Where alternate equipment/ materials are selected, allow for effects on other parts of the work of this Trade and other Trades. Where substantial changes in arrangement are required, submit shop drawings of the proposed changes with Plan and Section views and show effects on work of other Trades. Alternate equipment/materials shall not exceed the available space limitations. Maintain installation, access and servicing clearances. No extra will be allowed due to the use of alternate equipment/materials.
- .5 Where two or more items of equipment and/ or material, of the same type, are required, provide products of a single manufacturer.
- .6 Install and test all equipment and material, in accordance with the detailed recommendations of the manufacturer.

1.29 CASH ALLOWANCES

- .1 Coordinate cash allowances with bid documents. Allowances directly affecting this Division include the modification of existing panels, removal of all existing unused wiring and devices throughout the space that are not shown on the drawings, and room reference ground bus grounding.

1.30 EQUIPMENT LIST

- .1 Submit a completed Equipment List, showing the make of equipment and material included in the Tender, including the names of the substrates, ten (10) days after the award of the Contract.
- .2 The equipment list shall be a full list of materials or systems intended for installation.

1.31 PROGRESS CLAIM AND CHANGE ORDER BREAKDOWNS

- .1 Ten (10) days after the award of contract.
- .2 In particular cases more detail may be necessary to properly assess a change order or progress claims. This additional information could include all suppliers and all sub-contractors when requested by the Consultant. Provide details for each section of the electrical work listed for each separate electrical change order item exceeding \$10,000.00.
- .3 Mark-up information is required for change orders but is optional on the original tender price.
- .4 Progress claims will not be certified nor payment made beyond **90%** of the overall Electrical contract until commissioning and verification of the systems are complete. This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems are commissioned.

1.32 PROJECT CLOSE-OUT REQUIREMENTS

- .1 Refer to detailed specifications in each section for detailed requirements. Record drawings to be submitted to Consultant and all life safety systems must be operational, verified and tested and demonstrated to Consultant prior to issuance of Schedule C.

1.33 SUBSTANTIAL PERFORMANCE REQUIREMENTS

- .1 Before the Consultant is requested to make an inspection for substantial performance of the work:
 - .1 Commission all systems and prove out all components, interlocks and safety devices.
 - .2 Submit a letter certifying that all work is complete for the intended use, operational, clean and all required submissions have been completed.
 - .3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Consultant, this list indicates the project is excessively incomplete, a Substantial Completion inspection will not be performed.
- .2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:
 - .1 All reported deficiencies have been corrected.
 - .2 Operating and Maintenance Manuals completed.
 - .3 Draft (red-line) "As Built" Record Drawings are ready for review.
 - .4 Systems Commissioning has been completed and the documentation has been reviewed by Consultant.
 - .5 All demonstrations to the Owner have been completed.
 - .6 All documentation required for LEED TM certification has been submitted.
- .3 Consultants Letters of Assurance will not be issued until the following requirements have been met (where applicable):
 - .1 All items listed in 1.33.3.1 above have been completed or addressed.
 - .2 Certificate of Penetrations through separations.
 - .3 Provincial or City Electrical Inspection - Certificate of final inspection.
 - .4 Seismic Engineers Letter of Assurance and final inspection report.
 - .5 Certificate of Substantial Performance.
 - .6 Signed-off copies of all the consultant's inspection reports.

1.34 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS

- .1 Work under this Division which is still outstanding when substantial performance is certified will be considered deficient and a sum equal to at least twice the estimated cost of completing that work will be held back.
- .2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 26, 27, 28, 33 (electrical) work have been met and verified.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 – Common Product Requirements
- .2 Do verification requirements in accordance with Division 01 - Examination and Preparation.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Division 01 and as follows.
- .2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.
- .3 Where equipment or materials are specified by technical description only, they are to be of the best commercial quality available for the intended purpose.
- .4 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Provide all power and control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.
- .2 Ground all motors to conduit system with separate grounding conductor in flexible conduit or bonding conductor in the flexible conduit.
- .3 Connections shall be made with watertight flexible conduit with watertight connectors.
- .4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Mechanical Divisions for scope of work and particular details.

2.4 WARNING SIGNS

- .1 Provide warning signs, as specified or to meet the requirements of Inspection Department, Authority Having Jurisdiction & Consultant.
- .2 Use decal signs on metal surfaces, minimum 175mm x 250mm [7" x 10"] size.

2.5 WIRING TERMINATIONS

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

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify all electrical equipment including but not limited to starters, disconnects, remote ballasts and controls with nameplates and labels as follows:
 - .2 Nameplates:
 - .1 Lamacoids to be 3mm [0.125"] thick plastic engraving stock, white face, black core, self adhesive unless specified otherwise. Provide white face, red core for all essential distribution equipment.
 - .2 Nameplate Sizes:

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

.3 Typical Labelling:

.1 Panelboard & CDP – 5 lines

- .1 Line 1 – eg Conditional/Vital – Size 4 lettering
- .2 Line 2 – Panel/CDP designation – Size 4 lettering
- .3 Line 3 – eg 225A, 120/208V, 3 phase 4W – Size 2 lettering
- .4 Line 4 – Feeder: eg 4#3 – 35mm C – Size 2 lettering
- .5 Line 5 – Origin eg: Main Elect. Room – Size 2 lettering

.2 Distribution Circuit Breakers – 4 lines

- .1 Line 1 – Conditional/Vital – Size 4 lettering
- .2 Line 2 – Main Circuit Breaker – Size 4 lettering
- .3 Line 3 – Feeder: eg 4#3 – Size 2 lettering
- .4 Line 4 – Origin: eg K1 Sub-station – Size 2 lettering

.3 Label colours unless otherwise indicated:

- .1 120/208V labels: white letters on black base.
- .2 347/600V labels: Black letters on white base.
- .3 Standby/Emergency Power: white letters on red base.

.4 Wording on nameplates to be approved prior to manufacture.

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

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

.3 Labels:

- .1 Identify each outlet, starter, disconnect and all items of fixed equipment with the appropriate panel and circuit number origin by means of a Lamacoid lable. Confirm location of labels with Consultant before installing. Circuit number to

agree with Record Drawings. Labels to be mounted directly above faceplate of outlets and switches on wall.

- .2 Provide plastic covered, type-written panel directory with circuits and areas served to be mounted on inside of door. Directory to conform to Record Drawings.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT, CABLE AND PULLBOX IDENTIFICATION

- .1 Colour code conduits, metallic sheathed cables, pullboxes and junction boxes.
- .2 Code with 25 mm plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor and at 15 m intervals.

2.9 FINISHES

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.
- .3 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.

2.10 ACCESS PANELS (DOORS)

- .1 Unless otherwise noted, access doors shall be minimum: 450mm x 450mm [18"x18"] for body entry; 300mm x 300mm [12"x 12"] for hand entry.
- .2 Access doors in fire separations of 3/4 hour (45min) rating, and higher, and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self closing.

2.11 FASTENING TO BUILDING STRUCTURE

- .1 General:
 - .1 Do **not** use inserts in base material with a compressive strength less than 13.79 MPa [2000 psi] [refer to structural drawings].
- .2 Notation:
 - .1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.

- .2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.

2.12 EQUIPMENT SUPPORTS

- .1 Provide stands and supports for equipment and materials supplied.
- .2 Lay-out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions (where applicable).
- .3 Support ceiling hung equipment with rod hangers and/or structural steel.

2.13 MISCELLANEOUS METAL

- .1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:
 - .1 Support of equipment.
 - .2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.
 - .3 Earthquake restraint devices - refer also to "Seismic Restraint" sections
 - .4 Bridle rings - secure to structure or steel supports.
- .2 All steel work shall be primed and undercoat painted ready for finish under the related Division.

2.14 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Division 01 and specified in appropriate Sections.

2.15 OPERATION AND MAINTENANCE MANUAL

- .1 Provide operation and maintenance data for incorporation into maintenance manual specified in Division 01.

2.16 PROJECT RECORD DRAWINGS

- .1 Provide project record documents as specified in Division 01 as further called for in this Division.
- .2 During the construction period, keep on site a readable set of drawings marked up to reflect the "As-Built" state, for examination by the Consultant on a regular basis. Include elevations and detailed locations of buried services, empty conduit systems and junction and pull boxes.
- .3 At the time of "Substantial Performance" provide the Consultant with a draft of the red-lined "As-Built" drawings for review prior to producing the final record drawings.

Part 3 Execution

3.1 INSTALLATION

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

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm [2"].
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation.
- .4 All cables and conduits to be installed concealed in finished areas.

3.4 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm [16"] horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm [10'- 0"] and information is given before installation.
- .3 Locate light switches on strike side of doors unless otherwise indicated.
- .4 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated verify before proceeding with installation. Confirm the height of devices in handicapped facilities before installation.
- .3 Refer to detail on drawings.
- .4 In the absence of a drawing detail or drawing note, use the following:

<u>Device</u>	<u>Height</u>		<u>Comment</u>
Local switches	1200	[48"]	General
Wall receptacles/data	450	[18"]	General
Wall receptacles/data	200	[8"]	Above top of continuous baseboard heater
Wall receptacles/data	175	[7"]	Above top of counters or counter splash backs – coordinate with Architectural detail
Wall receptacles/data	900	[36"]	In mechanical rooms
Wall receptacles/data (Healthcare)	450 to 900	[18"] to [36"]	Confirm before installation

<u>Device</u>	<u>Height</u>		<u>Comment</u>
Panelboards	2000	[80"]	Panelboards: as required by Code or as indicated.
Wall mtd telephone	1500	[60"]	General
Card Readers	1200	[48"]	Confirm before installation
End of Line resistors (Fire alarm)	1800	[72"]	Coordinate with location of pullstation
Emergency Lighting (wall mounted)			150mm below ceiling or 4800mm max.

3.6 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to the required values and settings to provide a fully coordinated system.

3.7 FIELD QUALITY CONTROL

- .1 Load and Balance:
 - .1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase and neutral currents to dry-core transformers and motor control centres, operating under normal load,
 - .3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .2 The Contractor shall conduct the following tests:
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .4 Test new power distribution equipment, feeders, grounding and branch circuits installed under this contract.
 - .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350VAC with a 500VAC instrument.
 - .2 Megger 350-600VAC circuits, feeders and equipment with a 1000VAC instrument.
 - .3 Check resistance to ground before energizing.
- .3 Provide Consultant with five (5) days written notice prior to testing.

- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 All costs associated with the tests are to be included in the base contract amount.
- .6 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .2 Furnish manufacturer's certificate or letter conforming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
 - .3 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .4 Schedule site visits to review Work.
- .7 Reports:
 - .1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

3.8 CLEANING

- .1 Do final cleaning in accordance with Division 01.
- .2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

3.9 WORKMANSHIP

- .1 Workmanship shall be in accordance with well established practice and standards accepted and recognized by the Consultant and the Trade.

3.10 PROTECTION OF WORK

- .1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.
- .2 Mask machined surfaces. Secure covers over equipment openings and open ends of equipment and conduit, as the installation work progresses.
- .3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.
- .4 Refinish damaged or marred factory finish.

3.11 PROTECTION OF ELECTRICAL EQUIPMENT

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts, e.g. "LIVE 120 VOLTS".

3.12 CONCEALMENT

- .1 Conceal wiring and conduit in partitions, walls, crawlspace and ceiling spaces, unless otherwise noted.

- .2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

3.13 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

- .1 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-M85 that meets the requirements of the Building code in effect.
- .2 The scope includes new services which pass through existing rated separations and also all existing services which pass through a new rated separation or existing separations whose rating has been upgraded.
- .3 Fire resistance rating of installed fire-stopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings. Where this is not indicated assume a minimum of one hour for walls and two hours for floors.
- .4 Install fire-stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of fire-stopping and are to follow the requirements of a rated system as detailed above.
- .5 Contractors are expected to submit system information detailing firestopping product, backing, penetrant, penetrated assembly, Fire (F) and Temperature (T) rating, and ULC or cUL system number.
- .6 Provide fire-stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be repenetrated.
- .7 Coordinate rating of penetrations with a general contractor when acting as a sub-contractor. Final fire rating installation by general contractor.
- .8 Provide fire-stopping approval certificate including a Building Code / By-Law Schedule B, C-A & C-B, signed by a BC registered Professional Engineer. Submit a letter certifying that all work is complete and in accordance with this specification.

3.14 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

- .1 All cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

3.15 CONDUIT SLEEVES

- .1 Provide conduit sleeves for all conduit and wiring passing through rated walls and floors. Sleeves to be concentric with conduit or wiring.
- .2 Except as otherwise noted conduit sleeves are not required for holes formed or cored in interior concrete walls or floors.
- .3 Conduit sleeves shall extend 50 mm [2"] above floors in unfinished areas and wet areas and 6 mm [1/4"] above floors in finished areas.
- .4 Conduit sleeves shall extend 25 mm [1"] on each side of walls in unfinished areas and 6 mm [1/4"] in finished areas.

- .5 Conduit sleeves shall extend 25mm [1"] beyond exterior face of building. Caulk with flexible caulking compound.
- .6 Sleeve Size: 12 mm [1/2"] clearance all around, between sleeve and conduit or wiring.

3.16 ACCESSIBILITY AND ACCESS PANELS

- .1 Install all equipment, controls and junction boxes so as to be readily accessible for future modification, adjustment, operation and maintenance as appropriate.
- .2 Locate equipment and junction boxes in service areas wherever possible.

3.17 EQUIPMENT INSTALLATION

- .1 Provide means of access for servicing equipment.
- .2 CSA identification and equipment labels to be clearly visible after installation.
- .3 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.
- .4 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the electrical services.
- .5 Be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.
- .6 Verify the location of existing and planned service runs and structural components within concrete floor and walls prior to core drilling and/or cutting. Repairs to existing services and structural components damaged as a result of core drilling and cutting is included in this section of the work.
- .7 Openings through structural members of the building shall not be made without the approval of the Structural Consultant.
- .8 Openings in Concrete:
 - .1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.
 - .2 All openings shall be core drilled or diamond saw cut.
 - .3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.
 - .4 Refer to structural drawings for locations of steel reinforcing.
 - .5 Be responsible for repairing any damage to steel reinforcing.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other sections of the Contract Documents.

1.2 REGULATORY REQUIREMENTS

- .1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.
- .2 The Seismic Consulting Engineer should be able to provide a proof of professional insurance and the related practice credentials if requested by the Electrical Consultant. The Seismic Consulting Engineer should be familiar with SMACNA, ECABC & NFPA guidelines as well as BCBC requirements.
- .3 The Contractors Seismic Consultant shall submit original signed BC Building Code "Letters of Assurance", "Schedules B1, B2, and C-B" to the Prime Consultant or Electrical Consultant.
- .4 Project to comply with the provincial amendments and local bylaws as applicable.
- .5 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.3 SCOPE

- .1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.
- .2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.
- .3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.
- .4 The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.
- .5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.
- .6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.
- .7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure

or support slabs.

- .8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.
- .9 Include all costs associated with the Seismic installation and certification in the base tender.

1.4 SHOP DRAWINGS & SUBMITTALS

- .1 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the Seismic Consultant.
- .2 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Consultant.

Part 2 Products

2.1 SLACK CABLE SYSTEMS

- .1 Slack cable restraint systems shall be as designed and supplied by Vibra-Sonic Control® or equal.
- .2 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the engineer and inspection authority having jurisdiction.
- .3 Coordinate requirements of slack cables with suppliers prior to installation.

Part 3 Execution

3.1 GENERAL

- .1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

3.2 CONDUITS

- .1 Provide restraint installation information and details on conduit and equipment as indicated below:
- .2 Vertical Conduit:
 - .1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.
 - .2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m [30 ft] o.c.
- .3 Riser joints shall be braced or stabilized between floors.

- .4 Horizontal Conduits:
 - .1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.
 - .2 EMT tubing - tubing shall be supported at approximately 1.2 m [4 ft] intervals for tubing.
- .5 Provide transverse bracing at 12.2 m [40 ft] O.C. maximum unless otherwise noted. Provide bracing at all 90o bend assemblies, and pull box locations.
- .6 Provide longitudinal bracing at 24.4 m [80 ft] O.C. maximum unless otherwise noted.
- .7 Do not brace conduit runs against each other. Use separate support and restraint system.
- .8 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.
- .9 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.
- .10 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.
- .11 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.
- .12 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic consultant and submit shop drawings to consultants for their reference.

3.3 FLOOR MOUNTED EQUIPMENT

- .1 Provide seismic restraint for CT equipment, MDP, PDU, UPS, equipment cabinets, and associated electrical equipment as applicable.
- .2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.
- .3 Seismic restraint requirements shall apply only to new equipment installed as part of the CT replacement project.

3.4 LIGHT FIXTURES

- .1 Luminaires in suspended ceilings shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by at least two taught cables which are connected to the fixture at diagonal points.
- .2 Surface and recessed style fixtures shall be hung independently of the ceiling system. Fixtures shall be secured to the concrete or structural deck above by taut cables.
- .3 Fixtures which are hung independently of ceiling systems shall have a minimum of one seismic cable in addition to the chain or cable used to support the fixture. Seismic restraint cables shall be secured into the concrete or structural deck above.

- .4 Cables shall be corrosion-resistant and approved for application.
- .5 Fixtures which are rod hung shall have seismic ball alignment fittings at the ceiling and fixture.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated, and implemented in conjunction with all other sections of the Contract Documents.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Cleaning and Waste Management.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 ASBESTOS

- .1 Refer to specification Division 01 for procedures, removal and disposal of asbestos.
- .2 If during renovations/demolition, asbestos is discovered (or material suspected to be asbestos), all work in that area shall immediately cease and the General Contractor advised. The General Contractor shall take appropriate action without delay to verify presence of friable asbestos and be responsible for the removal of all friable asbestos.
- .3 This division will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

1.4 PCB (POLYCHLORINATED BIPHENYLS)

- .1 Carefully remove any electrical equipment containing hazardous materials identified during demolition and dispose of in accordance with applicable regulations and Owner requirements.

1.5 SCOPE

- .1 The Electrical Division to take note that demolition and renovation will be done on a staged basis in a building that is operational 24 hours a day, seven days a week, fifty-two weeks a year.
- .2 The Electrical Division to also take note of the Owner's dust containment requirements as outlined in the architectural and front end specification sections.
- .3 Electrical tender documents may not show all existing luminaires, wiring devices, conduit, boxes or wire. Conduit routing and wire grouping is not known. During demolition, the Electrical trade(s) are to deactivate all existing electrical and communication systems affected in such a manner that complete systems are not deactivated and affected circuits shall be restored immediately on a temporary or permanent basis as site conditions dictate.
- .4 This construction is typically sequenced or phased where demolition is required in a 24 hour operation building. Work in one area or phase to not affect work in subsequent or previous areas or phases. Areas outside the particular area of renovation are to be kept operational at all times unless permission has been received from the Owners representative to shut down a particular service.
- .5 Services needed for the first and subsequent areas or phases of construction must be provided in the earlier activity. Existing services to be removed that must remain operational in previous or subsequent areas or phases are not to be removed until new or temporary services have been provided. Any discrepancies appearing on the drawings

or in this specification are to be brought to the attention of the Consultant who will provide instruction.

- .6 Where devices are not shown on the new plans in walls that are not being removed, such devices are to be reinstated and remain unless they affect the proposed "Patient Care" area grounding in which case they must be removed.

1.6 SCHEDULING

- .1 Refer to Division 01.

1.7 EXAMINATION

- .1 Refer to Division 01.

1.8 PHASING

- .1 Refer to Division 01.

1.9 PROTECTION

- .1 Refer to Division 01.

Part 2 Products

2.1 STANDARDS

- .1 Refer to applicable material standards in other specification sections and/or as detailed on drawings.

Part 3 Execution

3.1 DEMOLITION

- .1 Demolition to be carried out in strict conformance to provincial, local and municipal authorities and Part 8 of the B.C. Building Code current edition.
- .2 All redundant electrical components in the areas of demolition excluding those specifically identified in the following clauses shall become the property of the Electrical Division and shall be removed from the site.
- .3 Remove existing CT electrical infrastructure including the existing CT disconnect, associated feeder conductors, wiring, and electrical equipment identified for demolition on the drawings. Dispose of removed materials in accordance with Owner requirements.
- .4 The following existing electrical components to be disconnected by the Electrical Trade(s), cleaned and suitably packaged where applicable, and turned over to the Owner at designated location established on site. If the Owner rejects these items they become property of the Electrical Division and are to be removed from site
 - .1 Existing luminaires identified for removal.
 - .2 Fire alarm components.
 - .3 Existing electrical devices and equipment identified for removal on the drawings.

3.2 DISRUPTION TO OPERATIONS

- .1 Contractor to issue a scheduled shutdown time and coordinate installation of the new equipment as appropriate. All equipment installed and modified requires testing before startup.
- .2 Contractor to provide temporary connections to all required equipment for temporary power during the installation of any new equipment.

3.3 REUSE OF EXISTING COMPONENTS

- .1 Existing components may be reused only where so specifically indicated on the drawings or in the specifications, or otherwise permitted by facility maintenance operations. However in all cases all wiring shall be new, and consider revising for feeder replacement work where approved splice kits may be required during shutdown sequencing.

3.4 DISTRIBUTION OF CIRCUITS

- .1 Circuit: power, voice/data, fire alarm, control etc. which are disrupted during demolition and are essential, to be made good immediately. The Electrical Trade(s) to identify these circuits to the Consultant. Specific tasks involving the demolition of essential circuits will require that the contractor to obtain permission from the Owner before proceeding.

3.5 ABANDONED CONDUIT, WIRE AND EXISTING CIRCUITS

- .1 All abandoned conduit and wire to be removed and disposed of by the Electrical Divisions.
- .2 Remove all accessible (i.e. surface) wiring and cables back to source.
- .3 Remove abandoned outlets and raceway, even if in or behind drywall, where they are located behind millwork or in locations unsuitable for reuse i.e. not at standard heights for switches or outlets.
- .4 All remaining circuits to be rerouted as required and suitably secured to the building structure.
- .5 Any cabling, including voice/data wiring, presently resting on any suspended ceiling system to be removed as part of the renovation process and shall be neatly bundled, protected and permanently secured to building structure. No cabling is permitted to rest on the ceiling system.

3.6 EXCAVATION AND CUTTING DAMAGE

- .1 Circuits disrupted by floor cutting or drilling (ie. buried cables) to be brought to the attention of the consultant. Obvious systems disturbed because due care and attention was not followed, shall be repaired immediately at no additional cost to owner.

3.7 FIRE ALARM SYSTEM

- .1 Construction/ demolition activities in existing building may require that certain fire alarm devices are protected from construction dust, damage etc. Coordinate with the Owners representative as required to protect components of the fire alarm system to prevent nuisance operation and alarms.
- .2 Provide, install and test temporary heat detectors in the area of construction where the construction area is not protected by an active supervised fire protection sprinkler system. The "construction" detectors are to be removed and discarded at the end of the project.

- .3 Verify with project scope. No fire alarm modifications currently shown on electrical drawings.
- .4 Maintain existing fire alarm system in areas under construction where practical. Protect existing fire alarm devices from damage and contamination during construction activities.
- .5 Contractor to check in with the Physical Plant at the start and end of each working day to confirm the fire alarm status in the area of work. Arrange for the related fire alarm zone card or area to be deactivated either to suit the progress of the work and/or where dust will be present on a day to day basis. Bag and protect fire detectors in dusty areas during construction. Remove any bagging at the end of the workday. Any fire alarm devices subject to moisture to be replaced immediately.
- .6 The fire alarm system is to be fully functional in the area of construction when the contractor is neither on site, or after the Contractor's normal work hours. (ie overnight, holidays, weekends), otherwise a fire watch will be required.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other sections of the Contract Documents.
- .2 Refer to Division 27 & 28 for particular Communications, Electronic Safety & Security wiring systems and cable types.

1.2 TERMS OF REFERENCE

- .1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated. Refer to "Site Services" Section for allowable site conduits as an alternative to steel.
- .2 Aluminium conductors only permitted where indicated on drawings and then typically only for feeder conductors larger than 3/0 AWG. All conductor sizes indicated on drawings are based on copper conductors unless otherwise noted.
- .3 TECK cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, TECK wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type TECK90 1000 Volt having a PVC jacket with FT-6 flame spread rating.
- .4 Flexible armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.
- .5 Cabling indicated to be 2-Hour Fire-Rated shall be Texcan "VITALink®" 2-hour rated cable compliant to CAN/ULC-S139 and CSA 38-95. Cabling shall be low smoke halogen free.
- .6 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.
- .7 Refer to Mechanical Equipment Schedule(s) for detailed responsibilities.
- .8 Non-metallic sheathed wiring is not to be used on this project.

1.3 PRODUCT DATA

- .1 Provide product data in accordance with Division 01

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Cleaning and Waste Management.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

Part 2 Products

2.1 WIRING & CABLES – GENERAL

- .1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.
- .2 Insulation to be 600 volt RW90XLPE (X link) for the general building wiring in conduit.
- .3 Use RWU90XLPE for underground installations.

- .4 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1.
- .5 Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.
- .6 Armoured (AC90) cable may only be utilized for recessed tee bar luminaire drops from ceiling mounted outlet boxes. "Tite Bite" connectors and their counterparts of other manufacturers shall not be used. Install anti-short connectors. Cable from luminaire to luminaire is discouraged. Allow nominally 900mm [3'] extra cable looped and supported in the ceiling space to permit fixture relocations of one tile space.
- .7 Conductors to be colour-coded. Conductors 10 AWG and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

2.2 TWO HOUR FIRE RATED CABLE ASSEMBLIES.

- .1 Cabling indicated to be 2-Hour Fire-Rated shall be Vitalink 2-hour rated cable compliant to CAN/ULC-S139 and CSA 38-95. Cabling shall be low smoke halogen free.

2.3 ARMoured CABLE (AC-90, 'BX')

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC-90 600 V AC rated.
- .3 Armour: interlocking type fabricated from galvanized steel.
- .4 Anti-short connectors.

2.4 NON-METALLIC SHEATHED CABLE

- .1 Non-metallic sheathed copper cable type: NMD-90 size as indicated.

2.5 LOW VOLTAGE CONTROL CABLES

- .1 Type LVT: soft annealed copper conductors, with thermoplastic insulation, outer covering of thermoplastic jacket. Minimum size #18 AWG.
- .2 Unless otherwise specified wiring to be multicore individually identified and colour coded with grey sheath enclosed in conduit or (EMT). Free-air cabling to have FT-6 rated sheathing for return air plenum spaces. Free-air installations require acceptance from the Consultant or the facility maintenance operator prior to installation.

2.6 WIRE & BOX CONNECTORS

- .1 Pressure type wire connector current carrying parts to be copper and sized to fit conductors used.
- .2 Fixture type splicing connector current carrying parts to be copper sized to fit conductors 10 AWG or less.
- .3 Bushing stud connectors to EEMAC 1Y-2 and suitable for stranded copper conductors

- .4 Clamps or connectors for armoured cable, flexible conduit, as required.

Part 3 Execution

3.1 INSTALLATION

- .1 Install all cables and wiring.
- .2 Conductor length for parallel feeders to be identical. Provide permanent plastic nametag indicating load fed.
- .3 Group Teck, Armoured, MI & Sheathed cables on channels wherever possible.
- .4 Lace or clip groups of feeder conductors at all distribution centres, pullboxes, and termination points.
- .5 Wiring in walls should typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls should be avoided unless indicated.
- .6 All grounding conductors and straps to be copper. All bonding conductors to have green insulation jacket.
- .7 Colour coding to be strictly in accordance with Section 26 05 00.
- .8 Provide sleeves where cables enter or exit cast concrete or masonry.
- .9 Power wiring up to and including No.6 gauge shall be spliced with nylon-insulated expandable spring-type connectors. Large conductors shall be spliced using split-bolt or other compression type connectors wrapped with cambric tape then PVC tape.
- .10 Wires shall be sized for 2% maximum voltage drop to farthest outlet on a loaded circuit. Increase home run cable size to meet these requirements.
- .11 All branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .12 Install all control cables in conduit.
- .13 Provide numbered wire collars for all control wiring. Numbers to correspond to control drawing legend. Obtain wiring diagram for control wiring of other Divisions.

3.2 VOLTAGE REGULATION

- .1 The drawings are diagrammatic and indicate the general routing of conduit runs and not exact routing, either horizontally or vertically.
- .2 Branch circuit conductor sizes shall be #12 AWG or larger based on the Canadian Electrical Code CSA 22.1 Section 8, which allows a maximum 3% voltage drop for branch circuits.

3.3 WIRE & BOX CONNECTORS

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other sections of the Contract Documents.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 - Cleaning and Waste Management.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE).
- .2 Transformer grounding shall comply with CSA C22.2 No.41.
- .3 All grounding conductors to be stranded soft annealed copper unless otherwise noted.
- .4 Install complete grounding and bonding system in accordance with Canadian Electrical Code and local inspection authority requirements.

1.4 TESTING REQUIREMENTS

- .1 Any third party testing agency costs for the testing and reporting shall be included in the Electrical Division base tender and shall be carried out by a pre-approved testing agency.

1.5 ADDITIONAL SCOPE

- .1 Refer to drawings for extent of grounding in addition to code requirements.

Part 2 Products

2.1 MATERIALS

- .1 Grounding equipment to: CSA C22.2 No.41.

2.2 EQUIPMENT

- .1 Clamps for grounding of conductor, size as required.
- .2 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, sized as indicated. Insulation where specified or required to be green.
- .3 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, and connectors.
- .4 Non-corroding accessories necessary for grounding system, type, size material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted-type conductor connectors.
 - .4 Thermit welded type conductor connectors.

- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, and accessories.
- .2 Provide ground wire in EMT conduits installed in grade or below slabs.
- .3 Install connectors in accordance with manufacturer's instructions.
- .4 Protect exposed grounding conductors from mechanical injury.
- .5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process or permanent mechanical connectors approved for the use.
- .6 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .7 Soldered joints not permitted.
- .8 Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit. Provide a ground conductor in all flexible conduit and secure to system grounding lugs at both the equipment and source.
- .9 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .10 Install separate ground conductor to each outdoor lighting standard.
- .11 Connect building structural steel and metal siding to ground by welding copper to steel.
- .12 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .13 Bond single conductor, metallic armoured cables to cabinet at supply end and provide non-metallic entry plate at load end.
- .14 Ground secondary service pedestals.
- .15 Provide a bonding conductor appropriately sized within each raceway routed within the building.
- .16 All bonding and grounding connections to be compression type unless noted otherwise.
- .17 Supply and install complete grounding and bonding system as indicated and as required by Canadian Electrical Code and the local electrical inspection authorities.
- .18 Provide grounding/ bonding bus bars mounted on stand-off insulators or as shown on the drawings.
- .19 All components shall be securely and adequately bonded and where required to accomplish this, bonding jumpers, grounding studs and bushings shall be used.
- .20 Ensure that all raceways, terminal panels, etc. for fire alarm, etc. are securely and adequately bonded and provide grounding conductor to main ground bus where called for or when required.
- .21 All interior metallic gas piping which may become energized to be made electrically continuous and to be bonded in accordance with requirements of Canadian Electrical Code.

- .22 Bond all low tension equipment with #6 AWG bonding conductor.
- .23 All metallic conduits longer than 1m in length, containing a single grounding or bonding conductor, shall be bonded as per the Canadian Electrical Code.

3.2 EQUIPMENT GROUNDING OR BONDING

- .1 Install grounding or bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, UPS, control panels, building steel work, generators, elevators, distribution panels and outdoor lighting.
- .2 Coordinate grounding and bonding requirements with the latest GE CT installation requirements. Provide grounding and bonding conductors, grounding bus connections, and equipment bonding for the CT equipment, MDP, PDU, UPS, system cabinet, and associated equipment as required by the equipment manufacturer.
- .3 Provide a grounding conductor from the secondary of every distribution transformer to the grounding system. Ground conductor to be sized and installed in accordance with Canadian Electrical Code.
- .4 Provide grounding conductor(s) from all major switchgear to solidly ground the secondary system. This includes equipment located in the main electrical room as well as each sub-electrical room. Grounding conductors to be sized to Canadian Electrical Code and switchgear manufacturer's requirements.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions.
- .3 Carry out all tests required by the Electrical Inspection Authority and provide all required reports and copied to the Consultant. Include all associated costs.
- .4 Ensure test results are satisfactory before energizing the electrical system.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other sections of the Contract Documents.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Cleaning and Waste Management.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REFERENCES

- .1 All conduits and accessories to be manufactured and certified by the related CSA standard.

1.4 SCOPE

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form only.
- .2 Conceal all conduits where possible in finished areas. Conduits may be surface mounted either only where indicated or in service areas accessible only to authorized personnel.
- .3 If a finished area is concrete (existing) or concealment is not practical, obtain ruling from Consultant or Owner's representative, where exposed raceways such as Wiremold® may be substituted.
- .4 Note particular requirements for routing of conduits where detailed.
- .5 Provide polypropylene pull cord in all "empty" conduits and conduits with additional pulling capacity for future use.

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No.45 Galvanized Steel.
- .2 Electrical Metallic Tubing (EMT): to CSA C22.2 No.83.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 41mm [1.5"] and smaller. Use two hole steel straps to conduits larger than 41mm [1.5"].
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 10mm [3/8"] threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings manufactured for use with conduits specified. Coating same as conduit.
- .2 Provide factory "ells" where 90° bends are required for 27mm [1"] and larger conduits.

- .3 EMT couplings and connectors shall be formed steel only. Couplings used on conduit containing fire-rated cable shall be steel. Regular die-cast alloy fittings and couplings are not acceptable. Provide plastic bushings (insulated throat) for all connectors unless there is no chance of burrs. Provide water-tight connectors in damp or wet locations and for surface equipment (e.g. Panelboards, MCC's, etc) in rooms that are fire sprinkler protected.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable linear expansion.
- .2 Water-tight expansion fittings: with integral bonding jumper, suitable for linear expansion and 21mm [3/4"] deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel as required.

2.5 RIGID P.V.C. CONDUIT

- .1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured by C.G.E®, "Sceptre®", or equal.
- .2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.
- .3 Solvent: as recommended by conduit manufacturer.

2.6 SURFACE RACEWAYS

- .1 Removable cover finished painted steel surface raceways.
- .2 Internal barriered to provide physical separation between power and communication cabling.
- .3 Colour to be as indicated on the drawings or where not indicated confirm with Consultant before installation.
- .4 All raceway fittings to be accessories available from the manufacturer.
- .5 Standard of acceptance:
 - .1 "Wiremold 3000®" (39mm x 70mm), 4000 (44mm x 121mm), or 6000 (90mm x 121mm), as indicated on the drawings or as required for wiring capacity.
 - .2 Approved equal
- .6 All product to be from the same manufacturer.

2.7 OUTLET AND CONDUIT BOXES IN GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm [4"] square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4 Blank cover plates for boxes without wiring devices.
- .5 120V outlet boxes for 120V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.
- .7 Bushing and connectors with nylon insulated throats.
- .8 Knock-out fillers to prevent entry of foreign materials.

- .9 Conduit outlet bodies for conduit up to 35 mm[1.25"]. Use pull boxes for larger conduits.
- .10 Double locknuts and insulated bushings on sheet metal boxes.

2.8 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm [3" x 2" x 1.5"] or as indicated. Larger 102 mm square x 54mm deep [4"x 2"] outlet boxes (No. 52151 or 52171) to be used when more than one conduit enters one side. Provide extension and plaster rings as required.
- .2 For larger boxes use GSB solid type as required.
- .3 Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square No. 52151 or 52171 with Taylor 8300 series covers.
- .4 Lighting fixture outlets: 102 mm [4"] square outlet boxes (No 52151, 52171 or 72171) or octagonal outlet boxes (No 54151 or 54171).
- .5 102 mm [4"] square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

2.9 MASONRY BOXES

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

2.10 CONCRETE BOXES

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

2.11 FLOOR BOXES

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with faceplate. Device mounting plate to accommodate short or long ear receptacles. Minimum depth: 28 mm [1.1"] for receptacles; 73 mm [2.9"] for communication equipment.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16 mm [0.5"] and 21 mm [0.75"] conduit. Minimum size: 73 mm [2.9"] deep

2.12 SURFACE CONDUIT BOXES

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

Part 3 Execution

3.1 CONDUIT - GENERAL

- .1 Generally, use electrical metallic tubing (EMT) in the building interior and in above grade slabs except where subject to mechanical injury or where otherwise indicated.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Set out the work and coordinate with other services prior to installation. Maintain access to junction and pull boxes.
- .3 Where practical conceal conduits.

- .4 Any conduit exposed in finished areas to be free of unnecessary labels and trade marking.
- .5 All conduit ends to be reamed to ensure a smooth interior finish that will not damage the insulation of the wiring.
- .6 Ensure grounding continuity in all conduit systems.
- .7 Surface conduits are acceptable in mechanical and electrical service rooms and in unfinished areas or where indicated.
- .8 Use rigid galvanized steel (RGS) threaded conduit where the installation is subject to mechanical injury. In any event, use RGS conduit for surface installations up to 1.5m [5'] above the finished floor.
- .9 Field threads on rigid conduit shall be sufficient length to draw conduits ends together.
- .10 Unless otherwise noted and where practical, all conduits to be routed through the ceiling space rather than in, or below, slabs or floor structures to facilitate future changes.
- .11 Conduits in walls should typically drop (or loop) vertically from above to better facilitate future renovations. Generally conduits from below and horizontal conduits in walls and concrete structures should be avoided unless indicated.
- .12 All branch circuit conduit, home-runs and communication/data conduits to be minimum 21 mm [3/4"] diameter unless otherwise indicated.
- .13 Generally, use Rigid PVC conduits in or below ground level slab unless otherwise noted. Transition to RGS conduit in exposed locations: eg where conduits emerge from ground level slab.
- .14 Conduits are not permitted in terrazzo, carpet or concrete toppings.
- .15 Cap turned up conduits to prevent the entrance of dirt or moisture during construction.
- .16 Locate conduits more than 75mm [3"] parallel to steam or hot water lines with a minimum of 25mm [1"] at crossovers.
- .17 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Conduits bent more than this or kinked to be replaced.
- .18 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.
- .19 Where conduits become blocked, the use of corrosive agents is prohibited. Remove and replace blocked section.
- .20 Damaged conduits to be repaired or replaced.
- .21 Dry conduits out thoroughly before installing wiring. Swab out conduit and thoroughly clean internally before wires and cables are pulled.
- .22 Conduits shall not pass through structural members except as indicated.
- .23 Conduit sizes indicated on drawings are minimum only. Increase sizes as required to suit alternative wiring types or to comply with Code.
- .24 Conduits and ducts crossing building expansion joints shall have approved conduit expansion fittings to suit the type of conduit used.
- .25 Seal conduits with approved sealant where conduits are run between heated and unheated areas.
- .26 Seal openings with approved sealant where conduits or cables.

- .27 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits are installed, wall openings shall be closed with material compatible with the wall construction and/or to meet any fire separation integrity.
- .28 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.
- .29 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of standard boxes where box support is not provided.
- .30 Provide necessary roof jacks or flashing where conduits pass through roof or watertight membranes. Apply approved sealant to maintain membrane integrity.
- .31 Use flexible metal conduit for connection to recessed luminaires without a prewired outlet box and connection to recessed luminaires.
- .32 Use liquid tight flexible metal conduit for connection to motors, and other vibrating equipment and transformers.
- .33 Use explosion proof flexible connection for connection to explosion proof motors.
- .34 Install conduit-sealing fittings in hazardous areas, isolation rooms and clean rooms. Fill with compound.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with minimum 1.5m [5'] clearance.
- .3 Conduits to be run in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended and/or surface channels.
- .5 Surface conduits will not be accepted in finished areas unless detailed.

3.3 SPARE CONDUITS

- .1 Provide spare conduits as indicated.

3.4 SURFACE RACEWAYS

- .1 Where practical provide regularly spaced device outlets and factory pre-cut raceway covers and cover plates. Field install outlets where factory installation is not possible due to delivery issues or irregularly spaced outlet requirement. In this event covers may be field cut with proprietary factory cover shear equipment with sharp blades.
- .2 Raceways shall be free of burrs inside and out.
- .3 Covers to be matching colour, smooth, free of burrs and parallel with no gaps.
- .4 Preserve and organize the space within the wireway to facilitate multiple wiring runs and future additions. In finished areas and where practical, conduit to feed the surface raceway from a box recessed behind and via grommets openings to the back of the surface raceway. Maintain pullbox access as required by the Canadian Electrical Code.

3.5 BOXES INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Ceiling outlet boxes to be provided for each surface mounted fixture or row of fixtures installed in other than T bar ceilings with removable tiles.

- .3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material. Remove upon completion of work.
- .4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm [0.25"] of opening.
- .5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not to be used.
- .6 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.
- .7 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.
- .8 NO sectional or "Handy" boxes shall be installed.
- .9 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.
- .10 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with architectural details.
- .11 Outlets installed back to back in party stud walls to be off-set by one stud space.
- .12 Refer to wiring device and communication specification sections and to architectural layouts for mounting heights of outlet boxes.
- .13 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.
- .14 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.
- .15 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other sections of the Contract Documents.
- .2 Section 26 05 00 Common Work Results.
- .3 Section 26 24 16 Panelboards – Breaker Type.
- .4 Section 26 27 26 Wiring Devices.

1.2 SYSTEM DESCRIPTION

- .1 Lighting control system shall the following components:
 - .1 Low-voltage room controller
 - .2 Occupancy Sensors.
 - .3 Low-voltage wall switches
 - .4 0-10V dimming control
 - .5 Emergency lighting control interface

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings & product data in accordance with Section 26 05 .00.
- .2 Retain the equipment supplier's representative to assist with the review of the equipment application at the shop drawing stage.
- .3 Provide custom schematic shop drawings of the complete systems and devices specified in this section.

1.4 SYSTEM DESCRIPTION

- .1 Provide lighting control as shown on the plans and specified herein.
- .2 Provide all relays, power supplies, interfaces and accessories required for a complete lighting control system as shown on the drawings.

Part 2 Products

2.1 OCCUPANCY SENSORS WALL SWITCHES (LOW VOLTAGE)

- .1 Low-voltage wall switch sensors shall be capable of detecting presence in the floor area to be controlled by detecting shifts in infrared light and/ or ultrasonic sound.
- .2 Sensors shall be complete with the following:
 - .1 Override push switch.
 - .2 LED detection status indicator.
 - .3 Low profile recessed design to suit "Decorator Plate
 - .4 Dual-level lens to enhance detection at the desktop level.
 - .5 Ability to maintain luminaires in operation when occupancy is only one person sitting at a desk in accordance with NEMA WD7 guidelines.
 - .6 Temperature and humidity resistance.
 - .7 Time delay ranges from 30 seconds to 30 minutes.

- .8 Sensitivity adjustment from 20% to 100%.
- .9 Compatible with LED drivers and 0-10V dimming systems.
- .10 Immunity to RFI and EMI interference.
- .11 Integrated light level sensor option holds light off when the natural light are above the preset levels.
- .12 CSA approved.
- .13 Five-year warranty.
- .3 Standard of Acceptance:
 - .1 Occupancy sensors shall be compatible with the specified room controller system.
 - .2 Pre-approved product.

2.2 OCCUPANCY SENSORS – CEILING OR WALL MOUNTED (LOW VOLTAGE)

- .1 Sensors shall be capable of detecting presence in the floor area to be controlled by detecting relative shifts in Infrared Energy and/or doppler shift ultrasonic.
- .2 Provide a bypass switch (or pin) to defeat automatic function that shall be visible from the floor when installed. Function select - on/off switching or off-only switching.
- .3 LED detection status indicator.
- .4 Low profile recessed design not to protrude more than 25mm [1"] down from the ceiling.
- .5 Ability to maintain luminaires in operation when occupancy is only one person sitting at a desk in accordance with NEMA WD7 guidelines.
- .6 Multi-directional 360° detector with temperature and humidity resistance. Compatible with the specified room controller and capable of parallel connection where required.
- .7 Time delay range from 30 seconds to 30 minutes.
- .8 Sensitivity adjustment by dip switches – minimum 4 levels.
- .9 Tilt & swivel lens direction adjustment.
- .10 Immunity to RFI and EMI interference.
- .11 CSA approved
- .12 Five-year warranty.
- .13 Standard of Acceptance:
 - .1 Sensor shall be compatible with the specified room controller system.
 - .2 Pre-approved product

2.3 LOW VOLTAGE ROOM CONTROLLER

- .1 Provide room controller as indicated on drawings. Controller shall support occupancy sensor inputs, low-voltage wall switches, 0-10V dimming control, emergency lighting interface, and local lighting control functions. Controller shall be Copper RC3DE-PL series or approved equal.
- .2 Room controller shall provide relay control, occupancy-based control, local override control, emergency lighting interface, and 0-10V dimming functions.

2.4 WIRING

- .1 Provide all control wiring as required and recommended by the manufacturer.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide and install all equipment including all components needed to make the system work in the intended manner.
- .2 Confirm control wiring individual conductor sizes with equipment manufacturer prior to installation.
- .3 Equipment supplier shall be available to provide technical support during rough-in and installation as required.

3.2 INSPECTION

- .1 Coordinate controls and interfaces with other Divisions as required for a complete and operational installation.

3.3 COMMISSIONING

- .1 Check and confirm that all control devices and sensors work in the intended manner.
- .2 Retain the equipment supplier's representative to review sensor coverage and adjust device settings after installation and prior to substantial completion. Provide a supplier sign-off letter and a schedule indicating the final set points of all devices.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other sections of the Contract Documents.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Cleaning and Waste Management.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00.
- .2 Submit shop drawings for modified existing panelboards and replacement circuit breakers, including breaker type, ampacity, interrupting rating, and compatibility with existing panelboard.

1.4 PLANT ASSEMBLY

- .1 Install and prewire low voltage relays assemblies where indicated.
- .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .3 Replacement breakers shall be listed and approved for use in the existing panelboard.

1.5 FINISH

- .1 Apply finishes in accordance with Section 26 05 00.

Part 2 Products

2.1 BREAKERS

- .1 All breakers to be bolt on type, moulded case, non adjustable and non interchangeable trip, single, two and three pole, 120/208(240)V or 347/600V and with trip free position separate from "On" or "Off" positions.
- .2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard. Minimum interrupting rating of breakers to be as follows:
 - .1 277/480V panelboards - 14,000 Amps at 277 volts.
 - .2 120/208V panelboards - 10,000 Amps at 120 volts.
- .3 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Provide replacement circuit breakers as indicated on drawings and compatible with existing panelboard.
- .5 Provide GFI type breakers as indicated.

- .6 Provide Lock-on devices as indicated and in any event for Fire Alarm circuits, Security equipment circuits, EXIT sign circuits and Emergency Battery equipment circuits.

2.2 STANDARD OF ACCEPTANCE

- .1 Engineer approved equal

Part 3 Execution

3.1 INSTALLATION

- .1 Connect loads to circuits as indicated.
- .2 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other sections of the Contract Documents.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 HOSPITAL GRADE RECEPTACLES

- .1 Use "Hospital Grade" devices in all areas unless otherwise noted.

Part 2 Products

2.1 SWITCHES

- .1 Heavy duty specification grade.
- .2 20A, 120 V or 347 V, single pole, double pole, three-way, four-way switches as indicated.
- .3 Manually-operated general purpose ac switches as indicated and with following features:
 - .1 Terminal holes approved for No.10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine molding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle (red toggle for emergency power circuits).
- .4 Toggle operated fully rated for LED lighting loads and motor loads in accordance with manufacturer's ratings.
- .5 Switches of one manufacturer throughout project.
- .6 Standard of acceptance:
 - .1 Hubbell HBL.1221 20A series
 - .2 Leviton 1221-20A 120V series
 - .3 Pass & Seymour PS20AC1 120V series

2.2 RECEPTACLES – GENERAL

- .1 Hospital grade.

- .2 Duplex receptacles, CSA type 5-15R or 5-20R, 125 V, 15A or 20A as indicated on drawings, U ground, with the following features:
 - .1 White impact resistant nylon face and back body (red for emergency power circuits)
 - .2 Circuit label space on nylon face allows permanent circuit identification
 - .3 Nickel-plated brass, triple-wipe power contacts.
 - .4 One-piece brass mounting strap with integral ground (no rivets)
- .3 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

- .1 Provide stainless steel coverplates for receptacles and switches to match existing building standards.
- .2 Grouped receptacles and switches will have a single cover plate for the whole group.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.
- .2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.
- .3 All plates to be installed parallel or perpendicular to building lines.

3.2 INSTALLATION PARTICULAR

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .2 Receptacles:
 - .1 Install all receptacles in the vertical plane unless otherwise noted.
 - .2 Generally install the 5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle is mounted horizontal.
 - .3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.
 - .4 Where split receptacles has one portion switched, mount vertically and switch the upper portion.
 - .5 Provide surge suppression receptacles where indicated on drawings. Provide dedicated neutral conductors for each surge suppression receptacle.
 - .6 Ground fault interrupter duplex receptacles to be used, adjacent sinks or water sources.
- .3 Cover plates:
 - .1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.

- .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other sections of the Contract Documents.

1.2 REFERENCES

- .1 CAN/CSA C22.1:21, Canadian Electrical Code, Part I, current adopted edition.
- .2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – Cleaning and Waste Management.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.4 ADDITION OF ACCEPTABLE MANUFACTURERS

- .1 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.
- .2 Alternate approvals will be provided by written addendum only. No other substitution will be permitted after closing of tenders.
- .3 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product

1.5 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00.
- .2 Submit complete photometric and heat dissipation data prepared by independent testing laboratory for proposed luminaires.
- .3 Photometric data to include VCP Table and spacing criterion.

1.6 INTENT

- .1 Provide lighting fixtures and accessories for all outlets as listed in the Fixture Schedule and as shown on drawings.
- .2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.
- .3 Ground all lighting equipment to grounding system.
- .4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Consultant before ordering fixtures.
- .5 Fixtures of the same or similar type shall be supplied by the same manufacturer.

Part 2 Products

- .1 Refer to luminaire schedule for all lighting products.

Part 3 Execution

3.1 INSTALLATION AND SUPPORTS

- .1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.
- .2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.
- .3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.
- .4 Self-aligning seismically rated ball joint hangers shall be used for rod-suspended fixtures. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted or prevent the complete alignment of several fixtures in a row.
- .5 The suspension length of all ceiling-mounted suspended types of lighting fixtures as listed in the Luminaire Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.
- .6 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.
- .7 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile. Fixtures shall be supported from the quarter points.
- .8 Wiring from outlet boxes to LED luminaires and wiring through LED luminaires channels shall be rated for 90 degrees C.
- .9 Connection to LED luminaires shall be by means of approved fixture type wiring.
- .10 All recessed fixtures to be installed so that they are removable from below to gain access to outlet box or prewired fixture box. Connect all recessed fixtures to boxes with flexible conduit and approved fixture wire. Provide approved drywall enclosures in insulated ceilings. Volume of enclosure to comply with the electrical code.
- .11 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Consultant.
- .12 Where LED drivers are to be remotely located, they shall be enclosed together and labelled with size 3 lamacoid.

END OF SECTION