

**Part 1            General**

**1.1                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1            CSA C22.2 No.46-M1988, Electric Air-Heaters.

**1.2                PRODUCT DATA**

- .1        Submit product data sheets for baseboard convectors. Include:
  - .1            Mounting methods.
  - .2            Physical size.
  - .3            kW rating, voltage, phase.
  - .4            Cabinet material thicknesses.
  - .5            Limitations.
  - .6            Colour and finish.
- .2        Manufacturer's Instructions: Provide to indicate special handling, installation and maintenance procedures.

**1.3                CLOSEOUT SUBMITTALS**

- .1        Submit operation and maintenance data for baseboard convectors in accordance with Section 01 78 00 - Closeout Submittals.

**Part 2            BASEBOARD CONVECTORS**

- .1        Heaters: to CSA C22.2 No.46 latest edition standard wattage density as indicated with connection box.
  - .1            Element through-type fitted with aluminum convector vanes and resistor wire enclosed in mineral insulation in copper sheath.
- .2        Element: locked to cabinet and supported at additional points throughout length to allow for linear expansion with non metallic supports.
- .3        Cabinet: to CSA C22.2 No.46 latest edition pre-drilled back for securing to wall. Integral air diffusion reflector with wireway at bottom and built-in clamps.
  - .1            Bottom inlet/front outlet.
  - .2            Sloping front outlet.
  - .3            Panel: steel, metal thickness, bottom 0.8 mm, front 1.6 mm thick.
  - .4            Finish: phosphatized and finished with 2 coats air-dry, baked enamel, white colour.

- .4 Blank cabinet sections and inside corners complete with wireway in sections including splice plates, to match heater cabinets in respects for continuous baseboard effect as indicated.

## **2.2 CONTROLS**

- .1 Wall mounted thermostats: type low voltage.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install baseboard convector heaters, blank sections and controls.
- .2 When wireway is used, remove knock-outs and insert insulating bushing between units.
- .3 Install grounding wire to maintain ground integrity between heating, blank, and auxiliary sections.
- .4 Install thermostats in locations indicated.
- .5 Make power and control connections.

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Ensure heaters and controls operate correctly.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            This Section describes the Common Work Results applicable to electrical disciplines.

**1.2                GENERAL**

- .1            The general conditions and general requirements together with all amendments and supplements contained in the General Specifications shall form an integral part of the electrical specification and will be made part of this contract.
- .2            Reference to “Electrical Divisions” shall mean all Divisions 26, 27, 28, 33, 34 and 48 in the Master Format or the Canadian Master Specifications.
- .3            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.
- .4            Confirm with the architectural plans and specifications the extent and nature of the work and how it will affect the electrical work. Include in the tender sum for any complications or additional work described therein.
- .5            Review mechanical plans and specifications for the extent of electrical work required to make mechanical systems complete and include this work in the tender sum.
- .6            Review structural plans for limitations of penetrations or inclusions of electrical equipment. In the tender sum, allow for avoiding critical areas with electrical equipment.
- .7            Review existing site conditions for limitations of penetrations or inclusions of electrical equipment. In the tender sum, allow for avoiding critical areas with electrical equipment.
- .8            Comply with the requirements of the General Contract, and coordinate the installation with all other trades on site.
- .9            Confirm on-site the exact location of equipment, outlets, and fixtures and the location of outlets for equipment supplied by other trades.

**1.3                WORK INCLUDED**

- .1            This work shall include the supply and installation of all the necessary materials and apparatus for complete operating systems as indicated on the plans or mentioned in this specification, with the exception of materials or apparatus specifically mentioned to be omitted or to be supplied by owner.
- .2            Items obviously necessary or reasonably implied to complete the work, shall be included as if shown on drawings and noted in the specifications.

- .3 All materials, tools, appliances, scaffolding, apparatus and labour necessary for the execution, erection and completion of the systems described herein shall be furnished. This includes providing lighting and power for own work.
- .4 This contract shall include, but is not confined to, the following scope of work:
  - .1 Incoming services
  - .2 All electrically related civil works, trenching, backfilling, resurfacing
  - .3 Power distribution equipment
  - .4 Power connections and outlets
  - .5 Surface wireways
  - .6 Mechanical equipment connections
  - .7 Lighting system
  - .8 Exit signs
  - .9 Emergency lighting
  - .10 Data/Communications system
- .5 Complete all electrical connections to equipment and accessories pertaining to this contract and leave all in operating condition to the electrical Consultant's satisfaction.

#### **1.4 WORK EXCLUDED**

- .1 The contract scope of work shall not include the following:
  - .1 Low voltage mechanical systems control wiring where indicated in electrical and mechanical specifications to be done by controls contractor shall be excluded from the electrical contractor work as noted.

#### **1.5 DRAWINGS AND SPECIFICATIONS**

- .1 The drawings and specifications compliment each other and what is called for by one is binding as if called for by both. If there is any doubt as to meaning or true intent due to a discrepancy between the electrical drawings and specifications, and all other contract documents, obtain written ruling from Consultant prior to tender closing. **Failing this, the most expensive alternative is to be allowed for.**
- .2 The plans show the approximate location of outlets and apparatus but the right is reserved to make such changes in location as may be necessary to meet the emergencies of construction in any way. No extra will be allowed for such changes to any piece of electrical equipment unless the distance exceeds 3 metres, or if the relocation is required after initial installation is complete.
- .3 It is imperative that the contractor visit the site and completely familiarize himself as to the work to be undertaken.

## **1.6 CODES AND STANDARDS**

- .1 All electrical work shall be carried out in accordance with the latest edition of the CEC C22.1 (Canadian Electrical Code) as amended and adopted by the Province of British Columbia and to the satisfaction of the Electrical Inspection Authority having jurisdiction, except where specified or specifically stated otherwise.
- .2 Do underground systems in accordance with CSA C22.3 No.1 latest edition, except where specified or specifically stated otherwise.
- .3 All work shall be carried out in accordance with the National Building Code current edition (including all local amendments) to the satisfaction of local building inspector authority having jurisdiction.
- .4 Any electrical material and/or equipment supplied by any contractor or sub-contractor for installation on this project must bear evidence of CSA approval or special CSA certification acceptable to the Authorities having Jurisdiction.

## **1.7 CARE, OPERATION AND START-UP**

- .1 Instruct Operating Personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

## **1.8 VOLTAGE RATINGS**

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

## **1.9 PERMITS, FEES AND INSPECTION**

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay all associated fees.
- .3 Fees will cover all routine inspections by the District Electrical Inspector. Any fees for follow-up inspections found to be necessary by the District Electrical Inspectors as a result of incorrect work shall be borne by this contractor without any cost to the owner.
- .4 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

- .5 Furnish Certificates of Acceptance from Electrical Inspection Department Authorities having Jurisdiction on completion of work to Consultant.
- .6 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain electrical permit and pay associated fees.
- .7 Consultant will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost to the Contractor.
- .8 Furnish to Consultant on completion of work Certificates of Acceptance from Electrical Inspection Department.

#### **1.10 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with the Construction Waste Management Plan as established by the Construction Manager.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal: paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

#### **1.11 LOCATION OF OUTLETS**

- .1 Locate outlets in accordance with these specifications and as indicated on the Architectural and Electrical drawings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.
- .4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

#### **1.12 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 specified or indicated, verify before proceeding with installation.

- .3 Install electrical equipment at following heights unless indicated otherwise on the Architectural and Electrical drawings.
  - .1 Local switches: 1400 mm.
  - .2 Wall receptacles:
    - .1 General: 300 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1400 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Telephone and data outlets: 300 mm.

### **1.13 LOAD BALANCE**

- .1 Measure phase current to panelboards with normal loads (lighting and mechanical) 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 voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State voltage, time and date at which each load was measured.

### **1.14 EXTRA WORK**

- .1 Any extra work ordered to be done shall be governed by this specification unless specific instructions or clauses are contained in the Change Order. In such cases, these instructions or clauses shall supersede those of the specification for this particular application only.

### **1.15 FIELD QUALITY CONTROL**

- .1 All electrical work to be carried out by qualified, licensed electricians or supervised apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentice's program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks. The activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical Contractor License as issued by the Province that the work is being conducted.
- .3 Conduct and pay for following tests:
  - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.

- .3 Lighting and lighting control.
- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Systems: fire alarm system, communications.
- .4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .5 Insulation resistance testing:
  - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
  - .2 Check resistance to ground before energizing.
- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for Consultant's review.

#### **1.16 CO-ORDINATION OF TRADES**

- .1 Consult with Construction Manager and all subtrades involved to confirm the location of the various outlets and equipment, and cooperate fully to ensure that no conflict arises during the installation.
- .2 Special care shall be taken that equipment, outlets, junction boxes or pullboxes will not be obstructed by other structure, equipment, pipes or ducts installed under this general contract by other trades.
- .3 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 a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Consultant's written approval.
- .4 The drawings indicate the general location and route to be followed by the electrical services. 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. 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.
- .5 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/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Architect and the Consultant and all affected parties.



- .6 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.

#### **1.17 PROTECTION OF EQUIPMENT**

- .1 This contractor shall provide and ensure maximum protection of electrical equipment on the site. Electrical equipment, including existing electrical equipment, shall be kept clean and dry at all times and caution shall be taken to ensure no mechanical damage is done to the equipment. Equipment shall not be delivered to the site until it can be stored safely or placed in final position and the space is clean.

#### **1.18 DAMAGES**

- .1 If the finish of electrical equipment is damaged either when received or during installation, have such equipment completely refinished and restored to its original condition at no cost to the owner.
- .2 Irreparably damaged equipment shall be replaced at no cost to the owner.

#### **1.19 SHOP DRAWINGS**

- .1 Submit electronic shop drawings, product data and samples in accordance with the contract specifications.
- .2 Shop drawings to have been reviewed and stamped by contractor prior to submittal.
- .3 Shop drawings and product data shall indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .4 Where applicable, include wiring, single line and schematic diagrams.
- .5 Include wiring drawings or diagrams showing interconnection with work of other sections.
- .6 Prior to manufacture of any item made specifically for this job, submit detailed drawings of the item through the Construction Manager.
- .7 Shop drawings must be received by the Consultant at a date early enough to permit reasonable study prior to approval and manufacture, or to permit alterations where necessary. Late submissions of shop drawings will be sufficient reason for a stoppage of construction pending approval, or removal and replacement of any unsatisfactory item at the contractor's expense.
- .8 Shop drawings/product data 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 schedule 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 Control explanation and internal wiring diagrams for packaged equipment.
  - .4 A written description of control sequences relating to the schematic diagrams.

**1.20 CUTTING AND PATCHING**

- .1 This contractor is responsible for all cutting or blocking out required to install electrical equipment.
- .2 If this contractor makes excessive cuts or does not coordinate work so that finished work requires cutting or patching, then this contractor shall pay for all patching to original condition.
- .3 Any dispute resulting from this shall be referred to the Consultant for decision.
- .4 Prior to any major cutting of walls or floor, review the proposed location, size and method with the Consultant. This includes notification when cutting or coring into any fire rated construction.

**1.21 PROTECTION OF EXPOSED LIVE EQUIPMENT**

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

**1.22 INSPECTIONS AND TESTS**

- .1 Notify the Consultant and authorities having jurisdiction at least five (5) working days in advance when the installations will be ready for inspection or testing.
- .2 Test reports, signed by all attending authorities, shall be submitted to the Consultant through the General Contractor after successful completion of an inspection or test.
- .3 Conduct all tests in a thorough and complete manner to the satisfaction of the Consultant and pay for any fees incurred to complete tests.

- .4 Furnish the Consultant with a copy of Certificate of Inspection from Authorities having Jurisdiction indicating that all work has been satisfactorily completed and issued prior to final connection.

### **1.23 CLEAN UP**

- .1 Vacuum clean all new raceways and any electrical equipment. Ensure that no debris or spare parts are left in any electrical equipment.
- .2 Any scrap material shall be removed from the site and disposed of by the Contractor.
- .3 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

### **1.24 SURPLUS MATERIALS**

- .1 All material removed from existing site and not being reused in this contract shall be the property of the owner and delivered as directed by the owner's representative. Material as it becomes surplus shall be reviewed by the owner or owner's representative and that part considered of value to the owner shall be classed as surplus material, all other becomes scrap material, and shall be disposed of by the contractor.

### **1.25 SPARE PARTS**

- .1 This contract calls for spare parts or material. These are to be provided new in unopened cartons to the owner at the time of substantial completion of the contract.
- .2 Obtain a signed receipt from the owner's representative for all these parts or materials and include a copy in the front of the maintenance manual. Without this receipt these items will be treated as a deficiency and the cost withheld at twice the estimated value by the Consultant, or Owner Representative.

### **1.26 AS BUILT DRAWINGS**

- .1 Obtain two (2) sets of white prints for the sole purpose of recording changes in installation as they occur. One (1) set is to be used in the field for day-to-day recording, and one (1) set for submittal after completion.
- .2 These plans shall be kept up-to-date as changes occur and shall be available to be inspected by the Consultant.
- .3 Arrange and pay for the incorporation of any "as-built" changes to digital PDF plans and AutoCAD (Revit) plans on disks. These changes shall be of similar quality of presentation as the original plans. NOTE: All plans whether requiring as-built changes or not, shall be included in this disk.
- .4 **Should the contractor require the Electrical Consultant to prepare the as-built CAD disk, the cost would be \$275 per plan**, unless excessive changes have been required. Costs associated with such excessive changes should be included with the change orders.
- .5 These amended drawings shall be given to the Consultant at time of final inspections.

- .6 "As-built" drawings shall include the location and circuit numbers of junction boxes in ceiling spaces, and all conduit placed in or under poured concrete. Note normal depth of conduits below top of concrete slab.

### **1.27 OPERATING AND MAINTENANCE MANUALS**

- .1 Submit **four sets** of operating and maintenance manuals for equipment or as requested by the general section of the contract. Include descriptive and technical data, all shop drawings, operating procedures, routine and preventative maintenance, wiring diagrams, spare parts lists, warranties, service companies, suppliers for replacement parts, test results, fire alarm certificate of verification, electrical inspection authority certificate and contract guarantee.
- .2 Submit documentation in **green colored** heavy duty three ring binders, with lettering on spine identifying: "OPERATING AND MAINTENANCE MANUAL", project title and system names.
- .3 Submit one copy for approval by Consultant prior to assembly of final sets.

### **1.28 DEMONSTRATION OF SYSTEMS**

- .1 Instruct operating personnel in the operation, care and maintenance of equipment.
- .2 Arrange and pay for services of manufacturer's factory service Consultant to supervise start-up of installation, check, adjust, balance and calibrate components of generator system.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

### **1.29 WARRANTY**

- .1 Within a period of one year from the date of final acceptance of work, replace or repair at own expense any defect in workmanship or material. Reused material shall be operating satisfactorily at the time of final acceptance but subsequent failures are not the responsibility of this contractor.
- .2 Warranties for equipment having more than one year guarantee shall be made out to owner, and copies shall be provided in the maintenance manuals.
- .3 Maintenance from manufacturer and contractor of all equipment shall be included for first year, including all lamps except incandescent.

### **1.30 PAINTING**

- .1 Arrange and pay for the painting of the devices noted in these specifications, in particular:
  - .1 exposed conduits and conduit fittings.
- .2 Painting shall be to match colour and finish of adjacent walls, with at least two coats of sprayed enamel paint to the satisfaction of the Architect.

### **1.31 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Provide a coordination/protective study and short circuit study of all equipment specified herein and submit for review.
- .2 Include the following:
  - .1 120/208V panelboards, transformer, and connecting feeder cables.
  - .2 Any additional data necessary for successful completion of the coordination and short circuit study.

### **1.32 ARC FLASH HAZARD ASSESSMENT**

- .1 The Electrical Contractor is to include in tender sum a cash allowance to retain the services of an Electrical Engineer to perform an arc flash hazard assessment of electrical power distribution equipment installed under this contract in accordance with NFPA-70E requirements and IEEE-1584 Guidelines. Refer to “Cash Allowances and Separate Prices” in this Section.
- .2 Arc flash hazard assessment is to take place at time of completion of power distribution equipment installation and is to include power system wide short circuit and protective device coordination study of the electrical equipment installed to determine arc flash hazard threshold incident energy level boundaries and PPE requirements at each distribution panel installed.
- .3 Printed warning labels to be provided for installation by the Electrical Contractor at each panel indicating the following:
  - .1 Flash hazard boundary (inches)
  - .2 Cal/cm<sup>2</sup> Flash hazard at 18 inches
  - .3 PPE level and required protective equipment
  - .4 Shock hazard in KV when cover is removed
  - .5 Available fault current level in KA
- .4 Include copy of arc flash assessment in with maintenance manuals.

## **Part 2 Products**

### **2.1 MANUFACTURERS AND CSA LABELS**

- .1 Visible and legible, after equipment is installed.

### **2.2 MATERIALS AND EQUIPMENT**

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .2 Factory assemble control panels and component assemblies.

### 2.3 WARNING SIGNS

- .1 As specified and to meet the requirements of the BC Electrical Inspection Authority and the Consultant.
- .2 Decal signs, minimum size 175mm x 250mm.

### 2.4 FINISHES

- .1 Shop finish metal enclosure surfaces by 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 paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

### 2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
- .2 Nameplates:
  - .1 Lamicoïd 3mm thick plastic engraving sheet, mechanically attached with self tapping screws.
  - .2 Nameplate colors shall be as follows:
    - .1 Normal power: Black face with white letters;
    - .2 Life safety emergency power: Red face with white letters;
    - .3 Standby power: Blue face with white letters.
  - .3 Nameplate sizes shall be as follows

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
- .3 Labels:
  - .1 Embossed plastic labels with 6mm high letters unless specified otherwise.
- .4 Wording on nameplates and labels to be approved by Consultant prior to manufacture.
- .5 Allow for average of twenty-five (25) letters per nameplate and label.
- .6 Identification to be English
- .7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

- .8 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. [\_\_\_\_]".  
Number as and if directed by Consultant.
- .9 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .10 Terminal cabinets and pull boxes: indicate system and voltage.
- .11 Transformers: indicate capacity, primary and secondary voltages.

## **2.6 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 latest edition.
- .4 Use colour coded wires in communication cables, matched throughout system.

## **Part 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**





**Part 1        General**

**1.1        SECTION INCLUDES**

- .1        This section specifies materials and installation for seismic restraint systems for electrical installations.

**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 Engineer shall be able to provide a proof of professional insurance and the related practice credentials, upon request. The Seismic Engineer shall be familiar with SMACNA, ECABC & NFPA guidelines as well as the BC Building Code requirements.
- .3        The Contractor's Seismic Engineer shall submit original signed BC Building Code "Letters of Assurance" "Model Schedules S-B and S-C" to the Prime Consultant or Electrical Consultant.
- .4        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 Engineer, 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 Engineer 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 Engineer 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 Engineer.
- .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 Engineer.

### **Part 2 Execution**

#### **2.1 GENERAL**

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

#### **2.2 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.
- .3 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.
- .4 Provide transverse bracing at 12.2 m [40 ft] intervals maximum unless otherwise noted. Provide bracing at all 90° bend assemblies, and pull box locations.

- .5 Provide longitudinal bracing at 24.4 m [80 ft] intervals maximum unless otherwise noted.
- .6 Do not brace conduit runs against each other. Use separate support and restraint system.
- .7 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.
- .8 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.
- .9 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.
- .10 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.
- .11 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 Engineer and submit shop drawings to consultants for their reference.

### **2.3 FLOOR MOUNTED EQUIPMENT**

- .1 Bolt down all equipment, including kiosk, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.
- .2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.
- .3 All floor mounted equipment to be on a 100mm concrete pad.

### **2.4 LIGHT FIXTURES**

- .1 LED fixtures 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 seismic 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 concrete or structural deck above by seismic cables.
- .3 Fixtures which are hung independently of ceiling systems shall have 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 the 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                SECTION INCLUDES**

- .1        This section specifies the materials and installation for wire and box connectors, rated to 1000V.

**1.2                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CAN/CSA-C22.2No.18 latest edition, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .2        CSA C22.2No.65 latest edition, Wire Connectors.
- .2        National Electrical Manufacturers Association (NEMA)

**Part 2            Products**

**2.1                MATERIALS**

- .1        Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.
- .2        Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.
- .3        Bushing stud connectors: to EEMAC 1Y-2 to consist of:
  - .1        Connector body and stud clamp for stranded copper conductors.
  - .2        Clamp for stranded copper conductors.
  - .3        Stud clamp bolts.
  - .4        Bolts for copper conductors.
  - .5        Sized for conductors as indicated.

**Part 3            Execution**

**3.1                NOT USED**

- .1        Not Used

**END OF SECTION**



## **Part 1           General**

### **1.1           SECTION INCLUDES**

- .1       This section specifies copper rated 0-1000 Volts and the most common electrical insulation and covering materials.
- .2       This section does not include fire rated building wire to ULC S139 and CSA C83, marine, hazardous, mining, instrumentation, communication and fire alarm wiring.

### **1.2           REFERENCES**

- .1       CSA C22.2 No .0.3 latest edition, Test Methods for Electrical Wires and Cables.
- .2       CAN/CSA-C22.2 No. 131 latest edition, Type TECK 90 Cable.

### **1.3           GENERAL REQUIREMENTS**

- .1       Typically use insulated 98% conductivity copper conductor wiring enclosed in conduit for the general wiring systems unless otherwise indicated.
- .2       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-4 flame spread rating.
- .3       Flexible AC90 armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.
- .4       Provide all control wiring except HVAC controls as specified in Mechanical Divisions.
- .5       Refer to Equipment Schedule(s) for detailed responsibilities.
- .6       Non-metallic sheathed wiring is not to be used on this project.

## **Part 2           Products**

### **2.1           WIRE AND CABLE 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 latest edition.

- .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 (BX) cable may only be utilized for luminaire to luminaire recessed tee bar luminaire drops from ceiling mounted outlet boxes. Use anti-short connectors.

## **2.2 TECK CABLE**

- .1 Cable: to CAN/CSA-C22.2 No. 131 latest edition.
- .2 Conductors:
  - .1 Grounding conductor: copper.
  - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
  - .1 Type: ethylene propylene rubber.
  - .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel or aluminum.
- .6 Fastenings:
  - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  - .2 Channel type supports for two or more cables at 1000 mm centers.
  - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .7 Connectors:
  - .1 Watertight approved for TECK cable.

## **2.3 ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel or aluminum strip.

## **Part 3 Execution**

### **3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:



- .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Fittings.
- .2 In underground ducts in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Fittings.
- .3 All wires are to be pulled in together in a common raceway, using liberal amounts of Compound 77 lubricant.
- .4 All power circuits connected to isolated ground type receptacles are to have individual separate neutral c/w insulated bonding conductor.
- .5 No combining of circuits onto common neutral will be permitted. Use 2 pole or 3 pole breakers for combined circuits, no connector clips will be allowed.
- .6 Ensure that all single phase loadings are reasonably closely balanced over the main feeders.
- .7 All dimmer circuits are to have individual neutral conductors for each circuit.

**END OF SECTION**



**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            This section specifies U shape support channels either surface mounted. Suspended or set in poured concrete walls or ceilings.

**Part 2            Products**

**2.1                SUPPORT CHANNELS**

- .1            U shape, size 41 x 41mm, 2.5mm thick, surface mounted, suspended, or set in poured concrete walls and ceilings.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Secure equipment to surfaces with lead anchors or nylon shields as required.
- .2            Secure equipment to poured concrete with expandable inserts.
- .3            Secure equipment to suspended ceilings with toggle bolts.
- .4            Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5            Fasten exposed conduit or cables to building construction or support system using straps.
  - .1            One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2            Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3            Beam clamps to secure conduit to exposed steel work.
- .6            Suspended support systems.
  - .1            Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2            Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .7            For surface mounting of two or more conduits use channels at 1.5m on centre spacing.
- .8            Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9            Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            This section specifies materials and installation for splitters, junction boxes, pull boxes and cabinets.

**1.2                PRODUCT DATA**

- .1            Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2            Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.
- .3            Shop Drawings: submit shop drawings for custom manufactured items showing materials, finish, dimensions, accessories, layout, and installation details.

**Part 2            Products**

**2.1                SPLITTERS**

- .1            Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2            Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3            At least three spare terminals on each set of lugs in splitters less than 400 A.

**2.2                JUNCTION AND PULL BOXES**

- .1            Welded steel construction with screw-on flat covers for surface mounting.
- .2            Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

**Part 3            Execution**

**3.1                SPLITTER INSTALLATION**

- .1            Install splitters and mount plumb, true and square to the building lines.
- .2            Extend splitters full length of equipment arrangement except where indicated otherwise.

**3.2                JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1            Install pull boxes in inconspicuous but accessible locations.

- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal blocks as required.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

### **3.3 IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase, as appropriate to clearly indicate the enclosure use.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            This section specifies rigid and flexible wiring fasteners, fittings and installation.

**Part 2            Products**

**2.1                OUTLET AND CONDUIT BOXES - GENERAL**

- .1            Size boxes in accordance with CSA C22.1.
- .2            102 mm square or larger outlet boxes as required for special devices.
- .3            Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4            Blank cover plates for boxes without wiring devices.
- .5            Combination boxes with barriers where outlets for more than one system are grouped.

**2.2                SHEET STEEL OUTLET BOXES**

- .1            Electro-galvanized steel single and multi-gang device boxes for flush installation, minimum size 76 x 51 x 38 mm or as indicated. For 347 V switches, use 347 V type device boxes.
- .2            Larger 102 mm square x 54mm deep outlet boxes to be used for single gang when more than one conduit enters one side, for telecommunication outlets (for slack storage), or for flush mounting devices in finished plaster and/or tile walls. Provide raised device covers as required.
- .3            For larger boxes (those requiring more wiring space, MUTOAs, etc.) use pre-ganged 102 mm high x 51 mm deep solid type as required. Allow extra gang for telecommunication outlets.
- .4            For larger boxes for special receptacles (multi-phase, high ampacity) use 102 mm square or 119 mm square boxes 54 mm deep with appropriate cover(s).
- .5            Boxes for surface mounted switches, receptacles, or telecommunications outlets to be 102 mm square, or 102 mm high utility, boxes, with rounded corners and raised surface covers. Minimum 38 mm (54 for telecom.) deep
- .6            Lighting fixture outlets: 102 mm square outlet boxes or octagonal outlet boxes.
- .7            Provide extension and plaster rings as required.

### **2.3 SURFACE CONDUIT BOXES**

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

### **2.4 FITTINGS – GENERAL**

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections and to architectural layouts for particular mounting heights of outlet boxes where indicated.
- .2 Support boxes independently of connecting conduits.
- .3 Fill open boxes with paper, sponges, 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 of opening.
- .5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are 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 No sectional or handy boxes to be installed.
- .8 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.
- .9 Outlets installed back to back in party stud walls to be off-set by one stud space.
- .10 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.



- .11 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.

**END OF SECTION**



## **Part 1        General**

### **1.1        SECTION INCLUDES**

- .1        This section specifies rigid and flexible conduits, fasteners, fittings and installation.

### **1.2        REFERENCES**

- .1        Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.
- .2        Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3        Electrical metallic tubing (EMT): to CSA C22.2 No. 83.
- .4        Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5        PVC (DB2) conduit: to CSA #C22.1 211-1.
- .6        Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

### **1.3        BASIC WIRING METHODS**

- .1        Underground or in concrete exterior to building:
  - .1        All wiring shall be in Schedule 40 RPVC conduit.
- .2        Partition walls and ceilings:
  - .1        All wiring to be run in EMT conduit for:
    - .1        Branch circuits.
    - .2        Low voltage systems.
    - .3        Distribution feeders and sub-feeders.
    - .4        Surface wiring in electrical and mechanical rooms.
- .3        Motors, transformers and all vibrating equipment:
  - .1        Short (600mm to 1200mm) PVC jacketed flexible conduit with liquid tight connectors shall be used. Allow sufficient slack to avoid strain on connectors at extreme extension of equipment movement.
- .4        Surface raceways - interior:
  - .1        All surface raceways shall be EMT, except if located without protection in areas susceptible to damage, which shall be rigid steel conduit.
- .5        Surface raceways - exterior:
  - .1        All surface raceways shall be UV compensated Schedule 40 RPVC conduit, protected from damage and excessive heating to the Consultant's satisfaction.

## **1.4 LOCATION**

- .1 Electrical drawings are diagrammatic and do not show all conduits, wire, cable, etc. Electrical contractor to provide conduit, wire cable, etc., for a complete operating job to meet in all respects the intent of the drawings and specifications.
- .2 Outlet positions shown on architectural drawings (plans and elevations) to take precedence over locations and mounting heights indicated on electrical plans or in specifications.
- .3 Locate electrical devices on walls with regard given for convenience of operation and conservation of wall space. Switches, receptacles, fire alarm pull stations, etc. generally to be vertically lined up where items are in the same general location. Adjacent common devices to be installed in common outlet box.
- .4 Review the exact location criteria of each electrical outlet and device with the Architect and Consultant prior to rough-in. Relocate any item installed without architectural confirmation as required by the architect or Consultant at no cost to the owner as long as the relocation is within 3m of the location originally shown on the electrical drawings.
- .5 Do not install outlets back-to-back in party walls; allow a minimum of one stud space horizontal clearance between boxes. Install behind all outlets in party walls a Lowry Acoustic backing pad.
- .6 Locate light switches on latch side of doors. Locate disconnect devices in mechanical rooms on latch side of door.
- .7 All outlets located on exterior walls to be complete with moulded plastic vapour barriers to maintain integrity of wall vapour barrier system.
- .8 All raceways and wiring shall be installed concealed in building fabric, except for mechanical and electrical rooms where they shall be installed on the surface.
- .9 All outlet boxes, junction boxes, and cabinets to hold electrical devices shall be mounted so the equipment can be flush mounted unless indicated otherwise.
- .10 All junction boxes and other raceway access devices shall be mounted to avoid being visible from public areas. Obtain approval from Architect or Consultant for any and all junction boxes that, due to the building design, cannot be concealed.
- .11 All junction boxes mounted, out of necessity, on surface of solid walls shall be painted to match adjacent surface, with junction boxes painted to match designated systems.

## **Part 2 Products**

### **2.1 RIGID PVC RACEWAY SYSTEM**

- .1 Rigid PVC fittings shall be of the same manufacturer as the conduit.
- .2 PVC boxes and covers shall be Sceptre "F" Series or equivalent complete with all components and adaptors.

- .3 PVC junction boxes exceeding the size of “F” Series shall be Sceptre: “JB” Series boxes and be complete with junction box adaptors.
- .4 All fittings with removable covers shall be complete with VC gaskets and brass securing screws and inserts. All metal components shall be brass or stainless steel.

## **2.2 PVC DUCT RACEWAY**

- .1 PVC duct fittings shall be of the same manufacturer as duct.
- .2 PVC duct shall be colour coded white for communications, grey for power.

## **2.3 EMT RACEWAY**

- .1 Electrical Metallic Tubing (EMT) shall be galvanized steel of sufficient quality and thickness to allow smooth field formed bends.
- .2 EMT couplings, connectors and fittings shall be steel. Cast type units shall not be used on this installation.

## **2.4 PVC JACKETED FLEXIBLE CONDUIT**

- .1 PVC jacketed flexible conduit (liquid tight) shall be interlocking spiral aluminum conduit with continuous extruded PVC jacket.
- .2 Conduit fittings shall be steel liquid tight type that fit over PVC jacket and seal uniformly all round.

## **2.5 OUTLET BOXES AND JUNCTION BOXES**

- .1 Except as noted for rigid PVC raceways, all outlet boxes and junction boxes shall be one piece formed or welded.
- .2 Outlet boxes to be galvanized steel.
- .3 Junction boxes to be galvanized steel or aluminum.

## **2.6 ACCESS HATCHES**

- .1 Provide and install access hatches in drywall ceilings to access junction boxes. Coordinate with other trades and check locations with architect before installing.
- .2 Access hatches shall have the following specifications:
  - .1 Door: aluminum frame with gypsum board inlay.
  - .2 Frame: Recessed aluminum
  - .3 Finish: to receive the same finish and paint as the surrounding surface.
  - .4 Hinge: concealed, non-corroding.
  - .5 Latch: flush screwdriver cam latch.
- .3 Access hatches to be of a size to suit but not less than 305mm square.

## **2.7 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500mm oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

## **2.8 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT in all exterior applications. Set-screws are not acceptable.
- .4 are not acceptable.

## **2.9 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

## **2.10 FISH CORD**

- .1 Polypropylene.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use rigid galvanized steel threaded conduit except where specified otherwise.
- .4 Use epoxy coated conduit underground corrosive areas.
- .5 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.

- .6 Use rigid PVC conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.
- .7 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .9 Use explosion proof flexible connection for connection to explosion proof motors.
- .10 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .11 Minimum conduit size for lighting and power circuits: 19mm.
- .12 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .14 Install fish cord in empty conduits.
- .15 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in junction boxes in ceiling.
- .16 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .17 Dry conduits out before installing wire.
- .18 Conduits shall be installed mechanically continuous from outlet to outlet and without pockets. All the necessary standard bushings, elbows and bends shall be provided. All conduit bends shall have a radius of not less than six (6) times the internal diameter of the conduit and in no case shall the equivalent of more than four quarter bends from outlet to outlet be made. For all conduit sizes to be used for low voltage raceway, the conduits shall have a minimum bending radius of 230mm.
- .19 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.
- .20 On surface wall runs, all conduit shall be installed in true vertical or horizontal direction and on ceilings in true 90 degree angles or parallel to the walls. Crossings of conduits shall also be made at 90 degree angles. Parallel running conduit shall be kept on equal spacing on the entire length of run including bends.
- .21 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).
- .22 Where more than three conduits are run parallel in ceiling cavity, they shall be installed on cantruss type channel, complete with all manufacturer's fittings to secure channel to structure and to conduit.

- .23 Raceways extending out concrete slabs shall be securely protected using rebar stubs or similar material. All duct stubs are to be kept sealed during construction

### **3.2 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

### **3.3 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.

**END OF SECTION**



**Part 1           Generals**

**1.1           SECTION INCLUDES**

- .1       This section specifies the installation of direct buried cables and cables in ducts including protection, markers and testing.

**1.2           REFERENCES**

- .1       Canadian Standards Association, (CSA International)
- .2       Insulated Cable Engineers Association, Inc. (ICEA)

**Part 2           Products**

**2.1           MARKERS**

- .1       Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of duct runs.

**Part 3           Execution**

**3.1           CABLE INSTALLATION IN DUCTS**

- .1       Install cables as indicated in ducts.
  - .1       Do not pull spliced cables inside ducts.
- .2       Install multiple cables in duct simultaneously.
- .3       Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4       To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .5       Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6       After installation of cables, seal duct ends with duct sealing compound.

**3.2           FIELD QUALITY CONTROL**

- .1       Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .2       Acceptance Tests
  - .1       Ensure that terminations and accessory equipment are disconnected.

- .2 Ground shields, ground wires, metallic armour and conductors not under test.
- .3 Leakage Current Testing.
  - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
  - .2 Hold maximum voltage for specified time period by manufacturer.
  - .3 Record leakage current at each step.
- .3 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .4 Remove and replace entire length of cable if cable fails to meet any of test criteria.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            This Section specifies standard and custom panelboards and their installation.

**1.2                SCOPE OF WORK**

- .1            Provide and install panelboards as indicated on the drawings, single line diagram, panel schedules and these specifications.
- .2            Types of panelboards in this section include the following:
  - .1            CDP type Power distribution panelboards.
  - .2            Lighting and power panelboards

**1.3                PRODUCT INFORMATION**

- .1            Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2            Shop drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
- .3            Shop drawings to include matching tub and trim details for factory installed low voltage relay cabinets where specified.

**1.4                PLANT ASSEMBLY**

- .1            Install circuit breakers in panelboards before shipment from plant.
- .2            In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .3            All panelboards to be of a common manufacturer.

**1.5                FINISH**

- .1            Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2            Panel finish in electrical and equipment rooms and closets to be standard ASA Grey baked enamel. Confirm with Consultant prior to shop finishing panels.

**Part 2            Products**

**2.1                PANELBOARDS, DOORS AND TRIMS**

- .1            Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.
- .2            Bus and breakers unless otherwise indicated on the drawings and in the specifications, shall be rated for:
  - .1            Minimum 10 kA at 208Y/120V.
  - .2            Minimum 22 kA at 600Y/347V.
- .3            Copper bus with full size neutral.
- .4            Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.
- .5            Mains capacity, number of circuits and number and size of branch circuit breakers as indicated.

- .6 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.
- .7 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.
- .8 Panelboards to have flush doors. (Gasketed where required for damp locations).
- .9 Provide two keys for each panelboard and key similar voltage and system panelboards alike.
- .10 Panel tubs to be typically 600mm wide.
- .11 Provide door within door trims where indicated to facilitate ease of service maintenance Each tub trim cover to be hinged and self supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.
- .12 Panels to have integral Surge Protection Device (SPD) where indicated. See drawings for quantities and locations.

## **2.2 BREAKERS**

- .1 All breakers to be:
  - .1 For Panelboards: Bolt on type molded case, non-adjustable and non-interchangeable trip, single, two and three pole, 120/208V 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.
- .3 Main breaker (where required) to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules or the Single Line Diagram.
- .5 Provide spare circuit breakers as indicated on panel schedules or single line diagram as applicable. Provide minimum 10% spare breakers.
- .6 Provide breaker type Ground Fault Interrupter(s) (GFI) as indicated.
- .7 Provide Lock-on devices for Exit sign circuits and Emergency Battery Equipment circuits.

## **2.3 PANELBOARD IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.
- .3 Complete updated circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a “letter sized” paper copy of each directory in the project maintenance manual.
- .4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a “letter sized” paper copy of each information card in the project maintenance manual.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1    Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.
- .2    Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.
- .3    Mount panelboards to height given in Section 26 05 00 or as indicated.
- .4    Connect loads to circuits as indicated.
- .5    Connect neutral conductors to common neutral bus with respective neutral identified.

**END OF SECTION**



## **Part 1           General**

### **1.1               SECTION INCLUDES**

- .1       This section specifies materials and installation for fused and non-fused disconnect switches.

### **1.2               REFERENCES**

- .1       Canadian Standards Association (CSA International).
  - .1       CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
  - .2       CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

### **1.3               ACTION AND INFORMATIONAL SUBMITTALS**

- .1       Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

### **1.4               HEALTH AND SAFETY**

- .1       Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

### **1.5               WASTE MANAGEMENT AND DISPOSAL**

- .1       Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
- .2       Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3       Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4       Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.
- .5       Fold up metal banding, flatten and place in designated area for recycling.

## **Part 2           Products**

### **2.1               DISCONNECT SWITCHES**

- .1       Fusible, horsepower rated, disconnect switch in CSA Enclosure to CAN/CSA C22.2 No.4 size as indicated.
- .2       Provision for padlocking in on-off switch position by three locks.
- .3       Mechanically interlocked door to prevent opening when handle in ON position.

- .4 Fuses: size as indicated.
- .5 Quick-make, quick-break action.
- .6 ON-OFF switch position indication on switch enclosure cover.

## **2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install disconnect switches complete with fuses if applicable.

**END OF SECTION**



**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            This section specifies materials and installation for self contained emergency lighting.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.2 No.141-M1985 (R1999), latest addition Unit Equipment for Emergency Lighting.

**1.3                PRODUCT DATA**

- .1            Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Data to indicate system components, mounting method, source of power and special attachments.

**Part 2            Products**

**2.1                EQUIPMENT**

- .1            Emergency lighting equipment: to CSA C22.2 No.141.
- .2            Supply voltage: 120 ac.
- .3            Output voltage: 24 V dc.
- .4            Operating time: **60** min.
- .5            Battery: sealed, maintenance free.
- .6            Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
- .7            Solid state transfer circuit.
- .8            Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9            Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10          Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 4W.
- .11          Suitable for wall or ceiling mounted.
- .12          Finish: white.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install unit equipment.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            This section specifies materials and installation for emergency lighting systems.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.2 No.141-M1985 (R1999), latest addition Unit Equipment for Emergency Lighting.

**1.3                PRODUCT DATA**

- .1            Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Data to indicate system components, mounting method, source of power and special attachments.

**Part 2            Products**

**2.1                EQUIPMENT**

- .1            Emergency lighting equipment: to CSA C22.2 No.141.
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- .3            Output voltage: 24 V dc.
- .4            Operating time: **60** min.
- .5            Battery: sealed, maintenance free.
- .6            Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
- .7            Solid state transfer circuit.
- .8            Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9            Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10          Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 4W.
- .11          Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

- .12 Finish: white.
- .13 Auxiliary equipment:
  - .1 Ammeter.
  - .2 Voltmeter.
  - .3 Test switch.
  - .4 Time delay relay.
  - .5 Battery disconnect device.
  - .6 AC input and DC output terminal blocks inside cabinet.
  - .7 Bracket.
  - .8 Hardwire connection for AC.
  - .9 RFI suppressors.

## **2.2 WIRING OF REMOTE HEADS**

- .1 Conduit: in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: in accordance with Section 26 05 21 – Wires and Cables 0-1000 V, sized as indicated [in accordance with manufacturer's recommendations].

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install unit equipment.
- .2 Direct heads.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        This section specifies materials and installation for exit signs complete with directional arrows.

**1.2                TYPE OF EXIT SIGN**

- .1        Install specification grade LED type exit signs in general public areas where indicated on drawings.

**1.3                PRODUCT DATA**

- .1        Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2        Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.

**Part 2            Products**

**2.1                EXIT SIGN – PICTORIAL GREEN RUNNING MAN**

- .1        Thin line, LED type with white finish thermoplastic housing 2 LED lights and battery back-up.
- .2        All exit signs shall comply with CAN/CSA C860.
- .3        Exit signs shall be complete with 10 year warranty.

**2.2                MOUNTING TYPE**

- .1        Exit signs to be suitable for universal mounting. Allow for exit signs to be mounted as to best suit ceiling/wall type and architectural features:
  - .1        Surface wall mounted
  - .2        End wall mounted double face
  - .3        Ceiling mounted single face
  - .4        Ceiling mounted double face
- .2        Exit signs to have direction arrows where indicated.
- .3        Provide steel rod pendant supports for exit signs to mount to +3.5m A.F.F. in high ceiling areas as required.

**Part 3            Execution**

### **3.1           INSTALLATION**

- .1       Install exit signs as shown on plans complete with double face units where indicated.
- .2       Connect to life safety emergency power circuit as indicated on the plans.
- .3       Exit signs must be clear of all visual obstruction.
- .4       Contractor to confirm locations before final installation.

### **3.2           LOCATION**

- .1       Review locations of exit signs with engineer and architect to ensure effectiveness and compatibility with decor before rough in. Failure to do so may result in relocation at no extra charge to the project.

### **3.3           MOUNTING HEIGHT**

- .1       Wall mounted signs shall be clear above doors and, if space allows, 2.4 metres to centre, but with 25mm clearance of ceiling.
- .2       Ceiling mounted signs shall be mounted directly on ceiling, unless it is obstructed from view. Stem mount using two fixture rods (9.5mm white smooth type).

**END OF SECTION**

**Part 1            General**

**1.1                SCOPE OF WORK**

- .1        Supply and installation of new horizontal connectors and cover plates, racks and patch panels, BIX block, etc.

**1.2                STANDARDS AND CODES**

- .1        ANSI-J-STD-607-A
- .2        TIA/EIA -606-A
- .3        TIA/EIA-569-A
- .4        TIA/EIA -568-B.1 & all addenda
- .5        TIA/EIA -568-B.2 & all addenda
- .6        TIA/EIA -568-B.3
- .7        NBCC - 1995

**1.3                CONTRACTOR QUALIFICATIONS**

- .1        The cabling contractor must be a certified system vendor of the manufacturer's components and/or cable being bid. The technicians working on the projects must be fully trained and qualified, by the manufacturer, for the installation and testing of all cabling and components being used.
- .2        Upon request from the Departmental Representative, the Contractor shall provide certified documentation of the qualifications described above. Failure to meet or provide such documentation will be the basis for disqualification of the cabling Contractor.
- .3        All staff performing any type of work contained in this specification must be certified in the installation, termination and testing of all aspects of UTP cable systems by the manufacturer.

**Part 2            PRODUCTS**

**2.1                HORIZONTAL CABLING**

- .1        Four pair, Cat 6, unshielded, twisted, 22 AWG to 24 AWG, 100 ohm, solid copper, FT4 rated.
- .2        Transmission requirements shall meet or exceed all requirements of TIA/EIA-568-B.2 for Category 6 cabling and components.

- .3 Pinned in compliance with T568A standard.

## **2.2 CONNECTORS/COUPLERS/ ADAPTERS**

- .1 Category 6 UTP cable connectors:
  - .1 8P/8W modular female connectors at both ends of horizontal cabling.
  - .2 8P/8W modular male connectors at both ends of patch cords.
  - .3 IDC connectors for installation in consolidation points.
  - .4 All connectors shall meet or exceed all requirements of TIA/EIA-568-B.1 & B.2
  - .5 Non-keyed, 4-pair, 8P/8W modular jacks, T568A wiring.
  - .6 Use snap-in type connectors at both ends of cables.
  - .7 Blue for data, pink for voice, white for auxiliary.
  - .8 Keystone format.

## **2.3 PATCH CORDS**

- .1 Modular patch cords:
  - .1 Stranded conductors Cat 6 patch cords, 4 pair, 24 AWG, 8P/8W, T568A wired.
  - .2 Determine Required lengths and quantities:
- .2 Label each patch cord with sequential number and the cable length. e.g. 30-3 is patch cable 30 which is 2m long.
- .3 Provide patch cords for all horizontal cables.

## **2.4 Patch Panel**

- .1 Modular patch panel.
- .2 24-port, high density, individual cut-outs for snap in type female 8P/8W.
- .3 Must not take up more than 1 unit of rack.
- .4 Keystone format.

## **2.5 FACEPLATES**

- .1 Flush faceplates for wall mounted outlets
  - .1 For use on all flush mounted Voice/2 x Data/Aux
  - .2 Supply 4-port face plate. Install blanks on all unused
  - .3 Single gang, flush mounted - white.

## **2.6 HORIZONTAL CABLING**

- .1 Supply and install 4 drops to each outlet (1V, 2D, 1A).
- .2 Cables to be used are unshielded, twisted, 4-pair, solid copper core, Category 6, 100 ohm, 22 AWG to 24 AWG, FT4 rated.



- .3 Each cable is to be hardwired directly to the IDC connector, T568A wired modular jack at both ends.
- .4 Leave 1m of cable slack in the communications cabinet end and 300mm at the outlet end.
- .5 To maintain the cable geometry, the cable sheath shall be removed only as much as necessary to terminate the cable pairs on the connecting hardware, regardless of the termination hardware type, i.e. 8P/8W jack or IDC. IDC mounting hardware has to be suitable to allow for proper bend radius of fully jacketed cables every 600mm.
- .6 Horizontal fields should be color coded as per TIA/EIA-606-A.

## **2.7 GROUNDING**

- .1 Install a ground lug in communications panel.
- .2 Install #6 insulated copper ground wire.
- .3 Provide labeling as per TIA/EIA-606-A.
- .4 Bond communications panel with #6 insulated ground wire.
- .5 Provide labeling as per TIA/EIA-606-A.

## **2.8 WALL MOUNTABLE EQUIPMENT RACKS**

- .1 The wall mountable equipment racks shall meet the following specifications:
  - .1 Be of fully welded steel construction;
  - .2 Unless otherwise specified, be made of 12 gauge steel;
  - .3 Be equipped with wall mounting plate;
  - .4 Provide 77 inch (44U) of usable rack mounting space;
  - .5 Provide aluminum of 19 inch of usable rack width;
  - .6 Be tapped with mounting holes (10-32) and in accordance with EIA-310C mounting hole spacing standard.
  - .7 Be equipped with ground lugs.

## **Part 3 EXECUTION**

### **3.1 TESTING CAT 6 CABLE**

- .1 The cabling Contractor must perform a permanent link to verify and ensure full functional capabilities.
- .2 Testing of each cable must be performed on a pair-to-pair basis.
- .3 Testing must be performed on all cables terminated at work-stations and in the consolidation points.

- .4 All testing must be implemented in both directions.
- .5 Tests are to be done using a Level II-E tester in accordance with TIA/EIA-568-B.1 and contain the following data:
  - .1 Wire map
  - .2 Insertion loss.
  - .3 Length.
  - .4 Near-end crosstalk (NEXT) loss.
  - .5 Power sum near-end crosstalk (PSNEXT) loss.
  - .6 Equal-level far-end crosstalk (ELFEXT).
  - .7 Powersum equal-level far-end crosstalk (PSELFEXT).
  - .8 Return loss.
  - .9 Propagation delay.
  - .10 Delay skew.
- .6 Marginal or conditional pass will not be acceptable.

### **3.2 LABELS**

- .1 Labels:
  - .1 Boldface laser quality printed labels on patch panels and faceplates (black print on white background). Font shall be as large as possible.
  - .2 There shall be no handwritten labels of any kind.
- .2 Horizontal UTP cable labeling:
  - .1 Label format for the components is to follow the format below:
  - .2 Example
  - .3 VI indicates Port 1 on the voice patch panel
- .3 Both ends of each cable shall be labelled with the same designation and patch panel port ID to which it is connected. Labels should be placed 150 to 300 mm from each jack or connector.
- .4 Label each installed 8P/8W, T568A jack with ID and the patch panel port ID to which it is connected.
- .5 All IDC field labeling and patch panel labeling shall have background colours as per TIA/EIA-606-A.
  - .1 Inter-building cable labeling:
  - .2 Label as per TIA/EIA-606-A standards.

### 3.3 DOCUMENTATION

- .1 One copy of the floor plan, typically referred to as "as-built drawings" and detailing the items below, is to be provided upon completion.
  - .1 Produce the drawing using AutoCAD 2000. Provide 2 hard copies and an AutoCAD disk of as-built drawings.
  - .2 Required details: location and label of each installed 8P/8W, T568A jack.
- .2 Provide hard and soft copies of all test results.
- .3 Provide a Category 6 certificate document issued by the cable/component manufacturer, guaranteeing transmission capabilities of the cabling system to support 1000 Mbps devices for a period of 15 years.
- .4 Installation technicians must be certified through the manufacturer's certification program. Technicians must provide evidence of their training certification. Contractor must supply documentation verifying their current participation in the manufacturer's certification program.
- .5 Manufacturer's certification:
  - .1 The manufacturer's certification must guarantee that design or installation on the part of the certified Contractor will not negate or void any portion of the certified system.
  - .2 Manufacturer must guarantee that:
    - .1 All material and labour is covered in this circumstance for the full certification period, and
    - .2 In the event that the Contractor is no longer in business, the full certification remains valid.
- .6 The installed structured cabling system must be covered by a warranty which includes, as a minimum:
  - .1 15 year coverage.
  - .2 Warranty against defects in material and workmanship from the date of installation.
  - .3 Repair or replacement of a failed component, covering parts and labour, at no charge.
  - .4 Single point of contact for all warranty service.
- .7 Upon request and at no additional cost to PWGSC, provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.

**END OF SECTION**



Approved: 2006-09-30

## **Part 1            General**

### **1.1                REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117-[04], Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-[05], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-63[2002], Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698-[00ae1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ; ) (600 kN-m/m ; ).
  - .5 ASTM D1557-[02e1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ; ) (2,700 kN-m/m ; ).
  - .6 ASTM D4318-[05], Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-[December 2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System For New Construction and Major Renovations.
- .4 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-[03], Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-[03], Cementitious Materials for Use in Concrete.
  - .2 CSA-A23.1/A23.2-[04], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

### **1.2                DEFINITIONS**

- .1 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .3 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

- .4 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .5 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to [ASTM D422] [and] [ASTM C136] : Sieve sizes to [CAN/CGSB-8.1] [CAN/CGSB-8.2].
    - .2 Table:

Sieve Designation	% Passing
2.00 mm	[100]
0.10 mm	[45 - 100]
0.02 mm	[10 - 80]
0.005 mm	[0 - 45]
    - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

### 1.3 EXISTING CONDITIONS

- .1 Examine geotechnical report.
- .2 Buried services:
  - .1 Before commencing work verify location of buried services on and adjacent to site.
  - .2 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .3 Confirm locations of buried utilities by careful test excavations.
  - .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered .
  - .5 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such Work to be paid by Departmental Representative.
  - .6 Record location of maintained, re-routed and abandoned underground lines.
- .3 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, pavement which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative

**Part 2 Products**

**2.1 MATERIALS**

.1 Type 1 and Type 2 fill: properties to the following requirements:

- .1 Crushed, pit run or screened stone, gravel or sand.
- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

.3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	5-100]	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

**Part 3 Execution**

**3.1 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly

**3.2 PREPARATION/PROTECTION**

- .1 Keep excavations clean, free of standing water, and loose soil.
- .2 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .3 Protect buried services that are required to remain undisturbed.

**3.3 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Departmental Representative.
  - .1 Stockpile granular materials in manner to prevent segregation.

- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

### **3.4 EXCAVATION**

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Excavation must not interfere with bearing capacity of adjacent foundations.
- .3 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .4 Keep excavated and stockpiled materials safe distance away from edge of trench
- .5 Restrict vehicle operations directly adjacent to open trenches.
- .6 Provide steel cover plates capable of supporting all traffic to maintain emergency access to site. Equipment required to place plates to be on site at all times trenches are open. Applicable to trenches in road only.
- .7 Dispose of surplus and unsuitable excavated material off site.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

### **3.5 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from relevant ASTM specifications.
  - .1 Under pavement: As indicated on contract drawings. Compact base course to 98% SPD.
  - .2 Under foundations: As indicated on contract drawings and geotechnical report. Compact base course to 100% SPD.

### **3.6 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

### **3.7 BACKFILLING**

- .1 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.



- .2 Place backfill material in uniform layers not exceeding 150mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

### **3.8 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris Replace topsoil as directed by Departmental Representative.
- .2 Reinstate lawns to elevation which existed before excavation.
- .3 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .4 Clean and reinstate areas affected by Work as directed by Departmental Representative
- .5 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**



Modular Labs  
Centre for Aquaculture and Environmental Research  
4160 Marine Drive, West Vancouver, B.C.

Appendix A

## APPENDIX A

Geotechnical Report,  
Thurber Engineering Ltd.  
DFO - West Vancouver Laboratory, Modular Buildings,  
Geotechnical Report  
December 11, 2017





**THURBER** ENGINEERING LTD.



December 11, 2017

File: 21575

Fisheries and Oceans Canada  
4160 Marine Drive  
West Vancouver, BC  
V7V 1N6

Attention: Cher LaCoste, M.Sc., R.P.Bio

**DFO – WEST VANCOUVER LABORATORY, MODULAR BUILDINGS  
GEOTECHNICAL REPORT**

Dear Cher:

Thurber Engineering Ltd. has conducted a geotechnical investigation for the above-mentioned project. This letter describes the results of the investigation and provides geotechnical engineering recommendations for design and construction of the proposed buildings.

It is a condition of this letter that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

**1. BACKGROUND**

We understand that DFO is proposing to install two modular buildings to facilitate immediate needs at the West Vancouver Laboratory located at 4160 Marine Drive. The proposed buildings are 24' by 24', constructed of foam board and proposed to be founded on lock blocks.

Assessment of soil and groundwater contamination was not in our scope of work.

**2. SITE INVESTIGATION**

Prior to conducting the field investigation, BC One Call was notified to identify utilities in the vicinity of the proposed investigation area. In addition, Western Utilities Services Ltd. was retained to scan for underground utilities at the proposed test pit locations.

The field investigation was scheduled for November 27, 2017, with a total of four test pits to be completed by an excavator. Due to the inability to locate a gas line during the utility scan, the investigation was delayed. A decision was made on site that three test holes would be completed using a hydrovac contractor due to the presence of utility lines in the area.

The field investigation comprised three test pits (TP17-1 to TP17-3) located within the proposed footprints of the modular buildings. TP17-1 and TP17-2 were completed in the footprint of the northern building, and TP17-3 in the footprint of southern building. The test pits were completed on December 1, 2017 using a hydrovac truck operated by First Call Energy. The test pits terminated at depths ranging from 1.4 m to 3.0 m.

The soils were logged in the field by a Thurber representative and disturbed samples were obtained at selected depths from the test pit walls for visual identification and moisture content determination. The test pits were backfilled with sand and gravel fill.

Test pit locations are shown on the attached Dwg. 21575-1.

### **3. SOIL AND GROUNDWATER CONDITIONS**

The results of the field and laboratory testing are provided on the attached test pit logs. The logs provide a complete, detailed description of the conditions encountered and should be used in preference to the generalized summary provided below.

The ground conditions generally comprise compact sand and gravel to 0.6 m in depth over a matrix of boulders and cobbles with some compact gravel and sand. Construction debris and wood were encountered near the bottom of TPs 17-02 and 17-03.

Ground water was encountered at 2.1 m below existing grade in TP17-2.

### **4. GEOTECHNICAL ASSESSMENT & RECOMMENDATIONS**

#### **4.1 Limitations**

The depth of our investigation was limited due to the ground conditions encountered. Our test pits did not encounter native material. However, based on the information collected and exposed bedrock nearby we provide following recommendations.

#### **4.2 Base Preparation**

In preparation for lock block placement, all organics, loose or wet, or any delirious material should be removed near surface. A 150 mm thick layer of well-graded 19 mm crushed sand and gravel should be placed on the subgrade. The sand and gravel pad should extend 200 mm beyond the edge of the lock block footing. The sand and gravel should be compacted to 100% Standard Proctor maximum dry density (SPMDD).

#### **4.3 Bearing Resistances**

We understand that the proposed structure will be bearing on lock blocks. Foundations can be designed using a bearing pressure of 50 kPa under SLS loading conditions and 70 kPa under ULS loading conditions.

Long-term settlement of footings should be expected due to the presence of decomposable material such as wood. The footings may require height adjustments in the future.

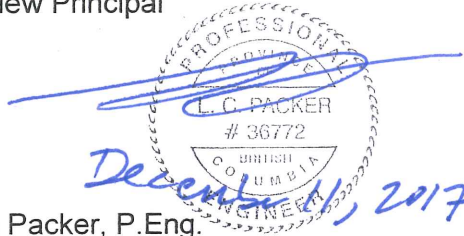
#### 4.4 Seismic Design

Based on the results of our investigation, seismically induced soil liquefaction is not a concern for the two proposed modular buildings. In our opinion, Site Class D is appropriate for seismic design.

#### 5. CLOSURE

We trust the above provides the information you require at this time. If you have any questions regarding this letter, please contact either of the undersigned.

Yours truly,  
Thurber Engineering Ltd.  
David Regehr, P.Eng.  
Review Principal



*December 11, 2017*

Liza Packer, P.Eng.  
Project Engineer

Attachment(s)	Statement of Limitations and Conditions (1 Page)
	Test Pit Location Plan (1 Page)
	Symbols and Terms (1 Page)
	Test Pit Logs (3 Pages)
	Photos (2 Pages)



## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

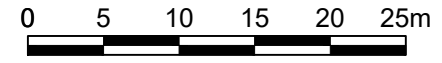
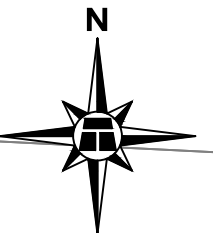
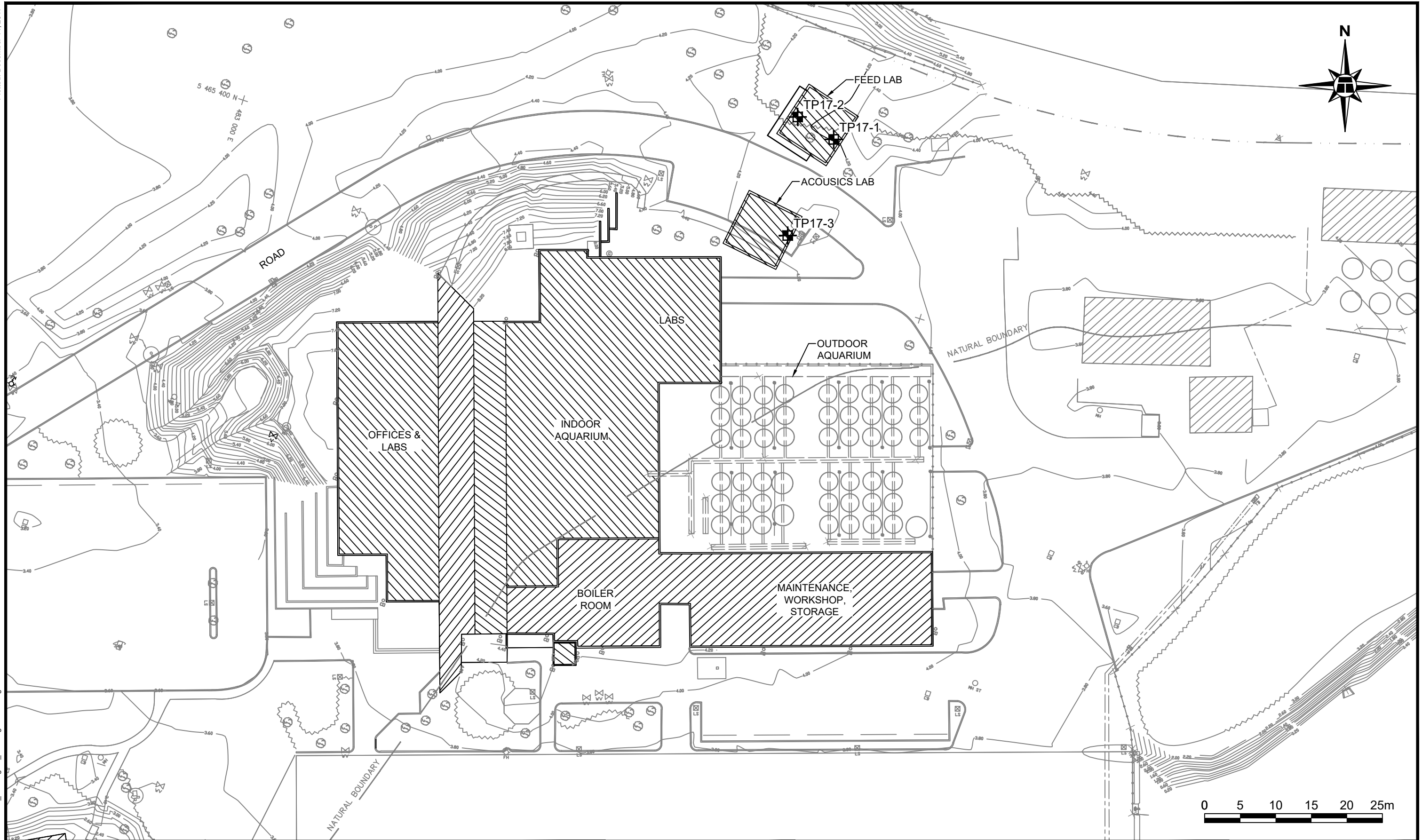
### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES


Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.





LEGEND:  
 TEST PIT

NOTES:  
 1. BASE PLAN TAKEN FROM THE PUBLIC WORKS AND GOVERNMENT SERVICES OF CANADA SSO# 00314 DRAWINGS 1 TO 3.  
 2. TEST PIT LOCATIONS ARE APPROXIMATE.



CLIENT  
 FISHERIES AND OCEANS CANADA  
**TEST PIT LOCATION PLAN**  
 WEST VANCOUVER LABORATORY  
 MODULAR BUILDINGS - 4160 MARINE DRIVE  
 WEST VANCOUVER, BC

DESIGNED LP	DRAWN NAK	APPROVED DNR
DATE 11/12/17		SCALE 1:500
PROJECT No. 21575	DWG. No. 1	REV. 0

# SYMBOLS AND TERMS

## FOR SOIL DESCRIPTION AND TEST HOLE LOGS

### BASIC SOIL SYMBOLS

	Predominant Material	Secondary Material
GRAVEL		gravelly to some gravel
SAND		sandy to some sand
SILT		silty to some silt
CLAY		clayey to some clay
PEAT / ORGANICS		some organics
Undifferentiated BEDROCK		
ORGANIC SILT		
FILL / DEBRIS		

PROPORTION OF MINOR COMPONENTS BY WEIGHT <sup>(2)</sup>	
and	35 - 50%
y / ey	20 - 35%
some	10 - 20%
trace	0 - 10%

### SYMBOL VARIATIONS - EXAMPLES <sup>(1)</sup>

SAND and GRAVEL	
SAND, silty	
SILT with some clay	

### DENSITY OF GRANULAR SOILS

Description	SPT N <sup>(5) (6)</sup>
Very Loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	> 50

### CONSISTENCY OF COHESIVE SOILS

Description	Undrained Shear Strength (kPa) <sup>(6)</sup>
Very Soft	< 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	> 200

### PENETRATION TESTS

Dynamic Cone Penetration	
Standard Penetration	
Becker Closed Casing	
Becker Open Casing	
Bounce Chamber Pressure	

### CLASSIFICATION BY PARTICLE SIZE

Name	Size Range <sup>(6)</sup> (mm) <sup>(3)</sup>	U.S. Standard Sieve Size	
		Retained	Passing
		Boulders	> 200
Cobbles	75 - 200	3 inch	8 inch
Gravel:	coarse 19 - 75	0.75 inch	3 inch
	fine 5 - 19	No. 4	0.75 inch
Sand:	coarse 2 - 5	No. 10	No. 4
	medium 0.4 - 2	No. 40	No. 10
	fine 0.075 - 0.4	No. 200	No. 40
Fines (Silt or Clay) <sup>(4)</sup>	< 0.075	-	No. 200

- (1) Only selected examples of the possible variations or combinations of the basic symbols are illustrated.
- (2) Example: SAND, silty, trace of gravel = sand with 20 to 35% silt and up to 10% gravel, by dry weight. Percentages of secondary materials are estimates based on visual and tactile assessment of samples.
- (3) Approximate metric conversion.
- (4) Fines are classified as silt or clay on the basis of Atterberg limits.
- (5) SPT N values on test hole logs are uncorrected field values.
- (6) Reference Canadian Foundation Engineering Manual 4th Edition, 2006.

# LOG OF TEST PIT

TEST PIT NO.  
**TP17-1**

**LOCATION:** See Dwg. 21575-1

**CLIENT:** Fisheries and Oceans Canada  
**PROJECT:** DFO West Vancouver Lab - Modular Buildings

**TOP OF HOLE ELEV:**



**METHOD:** Hydrovac  
**DRILLING CO.:** First Call Energy  
**INSPECTOR:** ANR

**DATE:** December 1, 2017  
**FILE NO.:** 21575  
**REVIEWED BY:** DNR

DEPTH (m)	PENETRATION (blows/300 mm)	WATER CONTENT (%) ○ Disturbed ● Undisturbed	WATER LEVEL ▼ Plastic Limit Liquid Limit	SAMPLES ■ Disturbed ■ Undisturbed ☒ No Recovery	UNDRAINED SHEAR STRENGTH (kPa) ◆ Peak ◇ Residual ◇ Remolded	GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve	SOIL HEADSPACE READING (ppm) ■ GASTECH reading ⊗ PID reading	DEPTH (m)
0								0
0.5								0.5
1.0								1.0
1.5								1.5
2.0								2.0
2.5								2.5
3.0								3.0
3.5								3.5
4.0								4.0

LOG OF TEST PIT (NO EST.) 21575.GPJ PRACTICE MARLON.GDT 17-12-11- THURBER BC 2017.GLB

# LOG OF TEST PIT

TEST PIT NO.  
**TP17-2**

**LOCATION:** See Dwg. 21575-1



**CLIENT:** Fisheries and Oceans Canada  
**PROJECT:** DFO West Vancouver Lab - Modular Buildings

**TOP OF HOLE ELEV:**

**METHOD:** Hydrovac

**DATE:** December 1, 2017

**DRILLING CO.:** First Call Energy

**FILE NO.:** 21575

**INSPECTOR:** ANR

**REVIEWED BY:** DNR

DEPTH (m)	PENETRATION (blows/300 mm)	WATER CONTENT (%) ○ Disturbed ● Undisturbed	WATER LEVEL ▼ Plastic Limit Liquid Limit	SAMPLES ■ Disturbed ■ Undisturbed ☒ No Recovery	UNDRAINED SHEAR STRENGTH (kPa) ◆ Peak ◇ Residual ◇ Remolded	GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve	SOIL HEADSPACE READING (ppm) ■ GASTECH reading ⊗ PID reading	DEPTH (m)	COMMENTS	SOILS DESCRIPTION
0								0		TOPSOIL
										Grey, moist SAND and GRAVEL with some silt (Fill).
										Grey, moist COBBLES and BOULDERS with some gravel and traces of sand and silt (Fill).
1								1		
2								2		- bricks from 2.1 to 2.4 m depth
										- possible wood at bottom of test hole - cloth at 2.4 m depth
										End of test pit due to refusal. Water observed at 2.1 m depth upon completion of test pit.
3								3		
4								4		

LOG OF TEST PIT (NO EST.) 21575.GPJ PRACTICE MARLON.GDT 17-12-11- THURBER BC 2017.GLB

# LOG OF TEST PIT

TEST PIT NO.  
**TP17-3**

**LOCATION:** See Dwg. 21575-1



**CLIENT:** Fisheries and Oceans Canada  
**PROJECT:** DFO West Vancouver Lab - Modular Buildings

**TOP OF HOLE ELEV:**

**DATE:** December 1, 2017

**METHOD:** Hydrovac

**FILE NO.:** 21575

**DRILLING CO.:** First Call Energy

**REVIEWED BY:** DNR

**INSPECTOR:** ANR

DEPTH (m)	PENETRATION (blows/300 mm)	WATER CONTENT (%) ○ Disturbed ● Undisturbed	WATER LEVEL ▼ Plastic Limit Liquid Limit	SAMPLES ■ Disturbed ■ Undisturbed ☒ No Recovery	UNDRAINED SHEAR STRENGTH (kPa) ◆ Peak ◇ Residual ◇ Remolded	GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve	SOIL HEADSPACE READING (ppm) ■ GASTECH reading ☒ PID reading	DEPTH (m)	COMMENTS	SOILS DESCRIPTION
0								0		ASPHALT (75 mm thick).
										Grey, moist GRAVEL with some sand (Road Base).
										Grey, moist COBBLES with some boulders, gravel and sand and a trace of silt (Fill).
										WOOD (Possible log).
										End of test pit at required depth. Water level undetermined due to hydrovac method.
4								4		

LOG OF TEST PIT (NO EST.) 21575.GPJ PRACTICE MARLON.GDT 17-12-11- THURBER BC 2017.GLB



TP17-1



TP17-2



TP17-2, Brick from test pit



TP17-3