1.1 **GENERAL**

1.2 **Grounding and Bonding for Communications Systems**

1. Grounding shall adhere to requirements specified in Canadian Electrical Code, ANSI/TIA 607-C and other applicable standards.

2. Telecommunications Main Grounding Busbar (TMGB) shall be typically provided in Communications room that is the closest to grade and to Electrical Main Grounding Busbar. TMGB will have minimum dimensions of 6.35mm (0.25") thick and 100mm (4") wide. Length shall be as needed to accommodate all connections plus 25% space and not less than 305mm.

3. The TMGB shall be bonded to the Electrical Main Grounding Busbar with grounding wire equal to that of the Telecommunications Bonding Backbone (TBB).

4. Telecommunications Ground Busbar (TGB) shall be provided in remaining Communications rooms. TGM shall have minimum dimensions of 6.35mm (0.25") thick and 50mm (2") wide. Length shall be as needed to accommodate all connections plus 25% space and not less than 305mm.

5. Telecommunications Bonding Backbone (TBB) shall bond the TMGB with TGBs in each Telecommunications Room. Each TGB shall be also bonded to the ground of electrical panel board serving the Telecommunications Room and to building steel structure.

6. The TBB shall be an insulated stranded copper conductor. TBB conductor size shall be as indicated on the drawings. Jacket shall be GREEN color and shall be FT4/FT6 rated as required.

7. Grounding Equalizer (GE) shall bond two or more TBBs in multistory building. The GE conductor shall be equal to that of TBB.

8. Grounding Connectors shall be in standard EIA bolt sizing corresponding to the Grounding Busbar bolt hole pattern. Surface of all bonding and grounding connectors used on TMGB and TGB shall be of a material that provided low electro-chemical potential of <0.3V between connector and grounding busbar.

9. TMGB and TGB shall be UL listed copper electro-tin-plated busbars provided with predrilled holes in standard BICSI pattern. The holes shall correctly match with listed lugs and hardware.

10. Provide bonding of telecommunication racks, cabinets, cable trays, conduit to TGB/TMGB using minimum 6 awg stranded copper bonding conductor and compression connector.

11. All wires used for telecommunications grounding purposes shall be identified with green insulation or green tape. Non-insulated wires shall be identified at each termination point using green tape. All cables and busbars shall be identified and labeled in accordance with applicable standards.

12. Use joint compound when making bonding connections between metal surfaces on racks, cabinets, cable runway, cable tray and busbars.
1.3 Pathways for Communications Infrastructure - Overview

.1 Generally rough-ins are provided by division 26. However, there may be some areas where some additional sleeves or short pieces of conduits are required. Contractor shall allow for some miscellaneous rough-ins in the scope of work.

.2 Supply and install rough-ins (conduits, raceways, boxes etc.) as required to provide a complete pathway for cabling.

.3 All specified items shall be installed as per manufacturer’s requirements, CEC, ANSI/TIA 569-D and any other applicable standards.

.4 All items installed shall not compromise the performance of the Cable Plant.

.5 All items installed shall be supported only by architectural structures (i.e. walls, slabs, etc.)

1.4 Hangers and Supports for Communications Systems

.1 Communications cabling shall be supported by cable tray or placed in conduit.

.2 Horizontal cables shall not be supported by structures that are not intended for cable support (i.e. luminaire, mechanical/ sprinkler pipes etc.).

.3 Only in rare circumstances (and only after Owner’s approval) J-Hooks may be used in locations where conduit or cable tray cannot be installed. Spacing between J-hooks must be not more than 1000mm. J-Hooks must have complete horizontal and vertical 1” bend radius control. Cable supported by J-hook shall be bundled with Velcro tape at maximum 300mm. Maximum cable bundle size per J-hook is 2”.

.4 Bracket mounting to suspended ceiling drop wires is not allowed.

.5 Reference product: Panduit J-Mod cable support system

1.5 Conduits and Backboxes for Communications Systems

.1 All indoor conduits shall be EMT. Outdoor conduits shall meet code requirements.

.2 Fittings in dry locations shall be steel or malleable iron set screw type fastener with insulated throats or non-metallic bushings on all open ends.

.3 Fittings in wet locations shall be steel or malleable iron in rain tight, compression-type, with insulated throat or non-metallic bushings on all open ends.
1.6 Sleeves for Communications Systems

.1 Sleeves or short sections of conduit shall be provided for all holes that permit communications cabling to pass through physical barriers. This includes cored holes, drilled holes, cut holes etc.

.2 The diameter of the Sleeve shall correspond to that of the hole and satisfy conduit fill requirements as outlined in ANSI/TIA and other standards plus 20% for future growth.

.3 Where suitable, sleeves 2” and larger in diameter shall be re-enterable type. Reference product: Hilti SpeedSleeve or approved equivalent.

.4 Sleeves and conduits shall be fire stopped according to the requirements of the AHJ.

1.7 Cable Trays for Communications Systems

.1 Cable Trays will act as the pathways for backbone and horizontal cabling. Unless otherwise noted all cable trays shall be 450 x 100mm (18” x 4”) wire-mesh type. Where cable tray changes direction, provide sweeping bends. Bends will have curved corners (both for the inside and outside corner). Utilize pre-manufactured radius corners for tees, intersections and locations where sweeping bend would not fit. Reference product: Cablofil Radius 90 degree kit RADT90KIT with RADT90RS radius shield. All bends are to be performed in accordance with manufacturer’s instruction sheets and shall conform to BICSI standards. Sharp corners will not be acceptable.

   Reference product: Cablofil CF 105 or approved equivalent.

1.8 Surface Raceways for Communications Systems

.1 Metallic Surface Raceways shall have the following requirements:

   ● Capable of containing low voltage cabling as well as power cabling.
   ● Have an electrical barrier between communications and power cabling.
   ● CSA approved

   Reference manufacturer: Wiremold 5400

1.9 Vibration Control

.1 Use vibration isolators for ceiling-mounted, floor-mounted, or wall-mounted equipment as required. Especially when it is evident that mounting surface transmits vibrations from mechanical equipment or moving loads.

.2 Select vibration isolators that have a high shear rating and sufficient weight capacity to support the physical load. The approved vibration isolator shall be manufactured by Mason Industries.

.3 Select appropriate vibration isolators that are intended to support equipment from the ceiling, wall, or floor. Use of the wrong type of vibration isolator may cause the supporting structure to fail during operation.

.4 Consult a specialist for the proper vibration isolators required to effectively address various vibration problems.
1.10 Seismic Control

.1 All racks, cabinets and cable trays are to be secured to prevailing local seismic codes.

.2 Select fasteners having a high shear rating and high tensile strength for anchoring the racks to the floor. Select fasteners appropriate for the floor construction.

.3 Ensure that floor anchors are placed deep enough into the slab in accordance with local requirements (e.g.: a typical seismic requirement is 8-inches). Where the slab is not thick enough, penetrate the slab, and secure the anchors from the floor below. In this event, ensure that the rack may be unbolted and removed without the anchor bolts falling through to the floor below.

.4 Ensure that racks are plumb when anchored.

Anchor top of racks that are greater than 36-inches in overall height to a wall to reduce tension load on the floor anchors.

.5 In addition to any other requirements stated herein, provide rear support for any piece of equipment that meets all of the following criteria:

- The unit exceeds 10-pounds per unit of its total vertical racking height (e.g. if a piece of equipment occupies 3-RU of rack space and weighs more than 30-pounds;
- Its centre of gravity is towards the rear;
- And, its overall depth is greater than 2.5 times its total vertical racking height (e.g. if a piece of equipment occupies 3-RU of rack space and has a depth of greater than 13 inches).

1.11 Cable and Wire Management - General

.1 Components of the premise distribution system shall be installed in a professional manner consistent with BICSI best practices.

.2 Ensure that all wiring, cabling and connector applications are in strict adherence to Standard Industry Practice and to local codes. Where these may vary, one from the other, follow the most stringent requirements.

.3 Generally, wire and cables shall be, if installed, in the ceiling space parallel to walls and as close to the walls as possible. Easy access to cables shall be maintained through the length of installation. Use Velcro-wraps to bundle the same systems cables together.

.4 Exposed cabling must be combed and/or routed in such a manner as to ensure all bundled cabling is neat and parallel to all other cables in the bundle. Exposed cable bundles to be wrapped at a maximum distance of 300 mm.

.5 Wraps shall be loose so they can be easily rotated without damage to the cabling. The number of cables managed by wraps shall not exceed 25.

.6 Horizontal fill ratios for conduit, cable trays, raceways and ducts shall conform to standards and manufacturer recommendations.

.7 All cabling shall be continuous without joins, or splices. No splices, junctions, or connections are permitted between ends of the cable.
.8 Provide adequate distribution rings and wire management accessories to permit a neat installation.

.9 All miscellaneous corresponding hardware components shall be of the same manufacturer.

.10 Communications cabling system wiring and equipment installation shall be in accordance with best industry practices as established by BICSI TDM and the approved manufacturer.

.11 Wiring shall meet all provincial and local electrical codes. All wiring shall test free from all ground loops and shorts.

.12 Cables on plywood back boards shall be wrapped at maximum 300mm on centers or closer as necessary to install cables neatly and tidily. Install equipment and wiring in closets to provide a logical progression for cabling and to minimize cables crossing.

.13 Maintain manufacturer’s minimum bend radius for all cables. At initial cable installation on tray, run cables parallel to each other with a minimum of crossovers.

.14 Standards for separation distances from electromagnetic sources are currently under study. Minimum clearance between cables and power sources until the new guidelines are available are found in CAN/CSA T530.

**Separation Distances from EMI Sources:**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Minimum Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2kVA</td>
</tr>
<tr>
<td>Unshielded power lines or electrical equipment in proximity to open/nonmetal pathway</td>
<td>127mm 5&quot;</td>
</tr>
<tr>
<td>Unshielded power lines or equipment in proximity to a grounded metal conduit pathway</td>
<td>64mm 2.5&quot;</td>
</tr>
<tr>
<td>Power lines enclosed in shielded or grounded metallic conduit pathway</td>
<td>-</td>
</tr>
</tbody>
</table>

.15 All optical fibre and copper cables shall be handled, installed and supported as per the manufacturer’s guidelines as a minimum standard. During the laying of the cable, installer shall take care not to over stress the cable. After the cable is installed, installer shall make sure that all parts of the cable are fully supported and shall be stress free at both ends and throughout their length.
.16 Appropriate attention shall be given to the handling of Category 6A copper and optical fiber cables to ensure that bending radius conforms to the manufacturer’s requirements. At no time shall the cable’s static or dynamic bending radius be exceeded.

.17 Fiber optic cables shall be installed in separate conduits from other cables. Where fiber optic cables are in cable trays or share conduits with other cables, split flexible tubing of orange color shall be used and shall be FT4 or FT6 rated as required.

.18 All cables shall be free from defects caused by but not limited to: shorts, damaged conductors and wiring crossovers.

.19 All cabling installed in conduit shall come with a pull-string by Division 27 contractor (pull-string is for future additions).

.20 If multiple conduits or sleeves are available for structured cabling, cables of different types (e.g. fiber x Cat 6A) shall be placed in separate conduits.

.21 In locations with multiple parallel conduits or sleeves the conduits/sleeves shall be filled to capacity with the same cable type (e.g. Category 6A) as per industry standards and manufactures recommendation, before using another conduit for the same cable type. The intent is to keep spare conduit capacity for future addition.

.22 Some conduits are reserved for other systems and noted on the drawings (e.g. CATV, CELL, Security, ...). Do not use these conduits for structured cabling.

.23 Conduits noted on the drawings as “SPARE - reserved for future use” may be used only, if approved by SFU under special circumstances.

1.12 Cable and Wire Identification - General

.1 Labeling of cables shall adhere to SFU standards.

.2 Identification markings shall be uniform for each system.

1.13 Cable and Port Identification for Structured Cabling

.1 Each cable shall be identified at both ends by laser-imprinted cable labels such as Panduit.

.2 Each outlet shall be identified with Brother P-Touch type labels attached to the faceplate. Unless noted otherwise, all labels shall have BLACK lettering (approximately 3mm high) on WHITE background. Only at locations where black outlet faceplates are specified, the labels shall have white lettering on black background.

Faceplate labels shall have following format:

XXXX-861
1275 - 2

Where:

XXXX = Building Code for building where Face Plate resides (1056)
861 = Closet number where set run comes from (as per drawings)
1275 = Room number where Face Plate resides (as per drawings)
2 = Face Plate number within the room. Assign Face Plate numbers sequentially (1, 2, 3, …) and clockwise within a room.

In addition, all individual ports on outlet faceplates shall be labeled as "A", "B", "C", "D", ..., with small printed stick-on labels. For port numbering sequence refer to outlet detail drawings.

.3 Racks within a TC will be numbered sequentially on the upper left corner when viewed from the front. Rack #1 is always the rack closest to the wall.

.4 Patch Panels will be numbered sequentially and individually. Ports will be numbered within each Patch Panel. For example if we are using 24 port Patch Panels they will be numbered PP01, PP02, PP03 etc... Ports will be 1-24 for each Patch Panel.

.5 Patch panel label format:

    XXXX-1275
    2 - A

Where:

    XXXX = Building Code for building where Face Plate resides (1056)
    1275 = Room number where Face Plate resides.
    2 = Face Plate number within room
    A = Port location on Face Plate.

.6 Final SFU room numbers shall be used for all labeling. Do NOT use construction numbers!

### 1.14 Testing of Structured Cabling

.1 Provide for the following testing report as follows:

- All tests, for each outlet detailed in the scope of work and pass Category 6A with no conditional passes or fails accepted.
- Test shall adhere to ANSI/TIA 1152 (including all addenda and TSB) and other applicable standards.

The following parameters shall be shown on test results:

- Wiremap
- Insertion Loss
- Length
- Near-End Crosstalk (NEXT) Loss, local and far end
- Power-Sum Near-End Crosstalk (PSNEXT) Loss, local and far end
- Attenuation to Crosstalk Ration, Far End (ACRF)
- Power Sum Attenuation for Crosstalk Ration, Far End (PSACRF)
- Return Loss, local and far end
- Propagation Delay
- Delay Skew
.2 Test will be done as a permanent link test in accordance to Belden specs. The test analyzer shall be Level IIIe performance or better and calibrated as per Manufacturers recommendations.

.3 Provide detailed test results in graphical as well as numerical format for each cable. Test result shall be in electronic PDF format and native format (e.g. FLW) on a labeled CD submitted with O&M Manuals. Do NOT print detailed test results.

.4 In addition provide a summary test report (one line per tested Category 6A cable) in electronic PDF format on CD and also printed on paper. Include in O&M Manuals.

.5 Each strand in fiber optic cables shall be tested for correctness of termination and overall transmission loss using an approved fiber optic transmission loss test instrument. System loss measurements shall be conducted at all wavelengths for each cable type of the completed installation to manufacturers loss values.

.6 A certification report listing both the calculated and measured loss for each fiber optic link. The report shall be submitted with the test results as called for above in the Operating and Maintenance Manuals.

.7 Verify all Category 3 backbone cabling polarity, continuity and length.

.8 System manuals shall include all tests and Manufacture’s System warranty as per 1.17.

.9 All tests shall be sorted by type of cable then by telecom room number and then alphanumerically by port ID label.

.10 All test data shall be provided in SI units.

.11 Submitted test shall show final SFU room numbers. Do NOT use construction numbers!

1.15 Operating and Maintenance Manuals

.1 Operating and Maintenance Manuals shall containing the following:

a) Detail contact information on installation and service companies. Warranty certificate.

b) As-installed riser diagrams and drawings of installed cabling and equipment. For communication devices indicate signal type and settings.

c) Product list in tabular format with following columns:
   • Manufacturer – product brand
   • Part Number – clearly identifying the product (including any accessories, and equipment options).
   • Description – brief description of the item.

d) Catalogue cut-sheets shall clearly indicate (using electronic yellow highlighter pen or red arrow) product part number, accessories, and options of installed products. Provide only information pertinent to the project.

e) Operating manuals.
f) Installation and service manuals with information on maintenance, care, service and adjustment.

g) Cleaning instructions for all devices installed in the field.

.2 Manuals shall be generated in searchable electronic PDF format. Any markups and/or highlighting must be done electronically.

.3 All pages of O&M Manuals (including a cover page) shall be saved as a single PDF file. The file shall contain electronic bookmarks for all products grouped by installed systems to facilitate easy and fast lookup of the information. Cable tests shall be a separate PDF file.

.4 The content of printed and DPF Manuals shall be generated in searchable electronic PDF format. Any markups and/or highlighting must be done electronically.

.5 Manuals shall show final SFU room numbers. Do NOT use construction numbers!

.6 The Contractor shall submit to SFU for approval:

- One (1) CD disk with Operating and Maintenance Manuals in PDF format.
- One (1) CD disk with a complete set of Technology As-built Drawings in AutoCAD and PDF formats.
- One (1) printed copy of Operating and Maintenance Manuals.

.7 After implementing review comments, the Contractor shall provide following Operating and Maintenance Manuals:

- Two (2) CD disks with Operating and Maintenance Manuals in PDF format.
- One (1) CD disk with a complete set of Technology As-built Drawings in AutoCAD and PDF formats.
- Two (2) printed copies of Operating and Maintenance Manuals.

.8 With Operating and Maintenance Manuals include the following, if applicable:

- Installation disks (including licensing and passwords) for all required software.
- Back-up CD-disk containing final and accepted configuration of the system.
- Keys for all installed devices and equipment.
- Driver bits for tamper-resistant fasteners.
1.16 Cutover & Training

.1 Provide all necessary work and coordinate cutover sequence of operation with SFU.

.2 Contractor to coordinate with Service Provider and/or SFU to ensure that there is no disruption to communication services.

.3 Contractor shall be available upon request for a period of 30 days after substantial completion to assist Owner during commissioning of the Communications Systems.

.4 Provide, as a condition of Issuance of the Final Certificate for Payment, on-site operations and maintenance training to representatives named by the Owner. The exact scope and duration of this training is to be mutually agreed upon by the Contractor and the Owner, but will be no less than 2 days.

.5 Operations Training:
   - To be a minimum duration of two hours. The purpose of this training is to familiarize the Owner’s operations staff with operating procedures.
   - Provide 4 complete Operations & Maintenance Manuals for training.

.6 Maintenance Training
   - To be a minimum duration of two hours. The purpose of this training is to familiarize the Owner’s technical staff with maintenance and troubleshooting procedures.
   - Provide the Owner’s technical staff with a procedure to facilitate service requests in a prompt and timely manner.
   - Provide 4 completed Maintenance Manuals for this training.

1.17 General Warranty

.1 Warrant all supplied products, regardless or manufacturer, for a minimum of one (1) year on parts and one (1) year on labour without limitation other than those stated herein. This warranty is to apply to all equipment malfunctions not caused by abuse or misuse by the Owners or their agents. This warranty is to include all equipment modified by the Contractor, as well as the modifications themselves.

.2 Warrant all supplied software and firmware, regardless of manufacture, for a minimum of one (1) year without limitations other than those stated herein. During this period, provide all major updates and upgrades at no cost, whether normally charged for by the manufacturer or not.

.3 Warrant the installation work for a minimum of one (1) year on labour without limitation other than those stated herein. This warranty is to apply to all malfunctions directly attributable to faulty workmanship or materials.

.4 Warrant software programming done on programmable systems for a minimum of one year on labour without limitation other than those stated herein. This warranty is to apply to all bugs, glitches, or other program malfunctions directly attributable to programming errors. This does not include adding features after the final programming changes have been made (i.e. changes made after the first month or two of full operation). This also does not apply to any programming changes made by the Owner or its agents.
.5 Begin warranty period upon Substantial Performance of Work.

.6 Process all warranty requests from the Owner or its agents during the warranty period. If this results in a service call, charge the Owner for the service call at prevailing labour rates (i.e. this warranty is not an “on-site” warranty). In the event that a reported malfunction proves to be caused by abuse or misuse by the Owner or its agents, charge the Owner for the repairs, if authorized to make such repairs by the Owner, at prevailing labour rates.

.7 If any manufacturer’s existing warranty on any supplied product is less than the terms specified herein, is prorated, or has limitations, extend the manufacturer’s warranty to meet the requirements stated herein. Assume all costs associated with such warranty extensions.

.8 In the event that any manufacturer’s warranties are for a longer term than specified herein, ensure that all such warranties are fully transferred to the Owner. Transfer of any warranty to the Owner must not in any manner diminish the Contractor’s responsibilities as stated herein.

.9 Submit manufacturer’s warranty certificates and registration forms as required under the “SUBMITTALS” article.

.10 Nothing in any of these warranties is to limit any rights or remedies the Owner may otherwise have under the Contract with respect to defects in material and workmanship.

.11 Restrict warranty and problem evaluation to normal working hours unless the Owner agrees to pay the difference in labour rates for overtime or off-hours work.

.12 Warrant that replacement parts will be available from the Contractor for a minimum of five (5) years following Substantial Performance of Work.

1.18 Manufacturers Structured Cabling System Warranty

.1 Provide following warranty/guarantee coverage from a Manufacturer approved by SFU.

.2 Product Warranty: All components installed in the system will be warranted for a period of minimum 25 years from the date of substantial completion against defects in materials and workmanship. For the same period, these components will be warranted to meet or exceed the specifications of ANSI/TIA standards for the category of installed system. If a component fails during the warranty period, the Manufacturer and the Contractor will repair or replace the failed component, including labour, at no cost to the original registered owner of the Certified Structured Cabling System.

.3 System Application and Performance Guarantee: to assure that the structured cabling system shall support 1Gigabit Ethernet applications for Category 6A media and 10Gigabit Ethernet and Fibre Channel over fiber. If the system fails to operate at standard performance parameters, Manufacturer and the Contractor will repair or replace the system as required, including labour at no cost to the original registered owner.
.4 The guarantee must be from the warranty underwriting Manufacturer for a minimum of 25 years from the date of substantial completion.

.5 The name and address of the building/facility and location of site must appear on the warranty document.

.6 The contractor must be fully approved and certified by the warranty underwriting manufacturer prior to responding to the bid as a prequalification.

1.19 Final Acceptance

.1 Final Acceptance shall be granted upon resolution of deficiencies (if any) resulting from the Substantial Performance Review. In addition, the following stipulations must be met.

.2 The Contractor shall supply to SFU NS positive test results for approval and system acceptance.

.3 Submit to SFU, a certificate stating that system is fully operational; and that meets all standard requirements as instructed in the contract documents and as required.

.4 Provide warranties as specified under the article “WARRANTY” 1.17 and 1.18.

.5 Provide all requirements as specified under the article “CLOSE OUT SUBMITTALS”.

***END OF SECTION***