



# UTM Communication Cabling Standards

UTM Information and Instructional Technology Services (I&ITS)

**Revision 3.1**  
November 2020

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## **UTM Standards:** Renovations & New Construction

**Facilities Management & Planning**  
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**Revisions History**

Revision Number	Revision Date	Affected Sections																			
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		27 05 13	27 05 26	27 05 29	27 05 33	27 05 36	27 05 53	27 05 55	27 11 16	27 11 19	27 11 23	27 11 26	27 13 13	27 13 13 13	27 13 23	27 13 23 13	27 15 01 16	27 15 01 19	27 15 43	27 16 19	
R 1.0	April 2015	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
R 1.1	December 2015	✓			✓										✓						
R1.2	February 2017	✓			✓																
R1.4	March 2017	✓			✓															✓	
R 2.0	August 16, 2018	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
R 2.1	September 20, 2018								✓												
R 2.2	October 30, 2019							✓							✓						
R 3.0	July 09, 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
R 3.1	November 12, 2020								✓									✓			

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.3 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.3 27 05 29 Hangers and Supports for Communication Systems
- 1.2.4 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.5 27 05 36 Cable Trays for Communication Systems
- 1.2.6 27 05 53 Identification for Communication Systems
- 1.2.7 27 15 55 Testing for Communication Services
- 1.2.8 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.9 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.10 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.11 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

### 1.3 QUALITY ASSURANCE

- 1.3.1 The contractor shall be certified, along with all technicians who should be properly trained by the manufacturer of a proposed cabling solution, with proof of certification readily available upon request.
- 1.3.2 Only new products listed in this document may be used unless otherwise submitted for approval.
- 1.3.3 The bidder shall demonstrate proven expertise in the implementation of network cabling. Expertise can be illustrated through the inclusion of details of at least two projects involving the design and installation of balanced unshielded twisted pair copper cable and OS2 single-mode fibre backbone cabling systems within the past two years. Names and contact information for each of the two projects shall be included in their bid response.

### 1.4 SCOPE

- 1.4.1 The contractor shall be responsible for the complete supply and installation of the following where required:
- 1.4.2 Communication basket cabling trays, supporting and installation hardware.
- 1.4.3 Horizontal Cabling: **always consult with the UTM I&ITS Designate before procuring materials. Cabling in existing installations may follow legacy standards.** New installations will follow Cat 6A standards, including faceplates, Keystone jacks, patch cords, patch panels, etc.
- 1.4.4 Cabinets and data racks along with associated hardware.
- 1.4.5 Grounding of cable trays and data racks/cabinets.
- 1.4.6 Copper and fibre backbone cabling including all components for a complete end to end system.
- 1.4.7 Testing of all horizontal voice, data, and backbone fibre cabling.
- 1.4.8 Contractor to make all necessary preparations, allowances and precautions to comply with the labour requirements for the job site to ensure that there will not be any disruption of work arising from the successful bidders work or workers.

### 1.5 GENERAL STIPULATIONS

- 1.5.1 The contractor shall furnish all labour, materials, tools and other equipment necessary to provide a complete horizontal and backbone (copper and fibre) cabling system.
- 1.5.2 The contractor shall be responsible for the completion of all work included in the contract and shall employ certified, skilled technicians as necessary to satisfy all work and trades.



- 1.5.3 The contractor shall carefully review all drawings (architectural, mechanical, electrical and communications) associated with the project and carry out the work so as not to delay or interfere with other trades.
- 1.5.4 The contractor must comply with all requirements of the Occupational Health & Safety Act.
- 1.5.5 The contractor shall provide all necessary permits to carry out their work.
- 1.5.6 Local codes shall take precedence over the drawings and specifications, except where the contract documents are more stringent, then the contract documents shall apply.
- 1.5.7 When the installation of the cabling system is completed and ready for acceptance the UTM I&ITS Designate shall be present for testing of the complete system.
- 1.5.8 All testing and retesting shall be done at the contractor's expense.
- 1.5.9 Contractor to provide cable test results 10 (ten) business days prior to the cutover to the UTM I&ITS Designate for review.
- 1.5.10 A DRAFT network drawing, detailing physical port locations, quantities and identifications must be provided ahead of time for I&ITS Network Engineering to configure network equipment. This length of time is variable and is represented as a function of the number of data drops. Each drop requires approximately 7 minutes of configuration time, hence a network map for a building with 500 data drops must be provided at least 8 business days prior to commissioning network equipment: 500 drops x 7 minutes per drop = 3,500 minutes = 58.33 hours; 58.33 / 7.25 working hours per day = ~ 8.04 days.
- 1.5.11 Contractor to provide a finalized network drawing reflecting the cable tray routing and all data drop labels. A network drawing is similar to, but less complex than, an as-built drawing. Its sole purpose is to depict the physical locations of each network wall jack and its associated label on a floor plan.
- 1.5.12 All network drawings and printing of drawings for the UTM I&ITS Designate shall be done at the contractor's expense.
- 1.5.13 The Project Manager and lead technician that start the project must remain on the project until its completion.

## 1.6 FIRE STOPPING

- 1.6.1 The contractor shall seal all openings, new and/or old, they have utilized in floors, ceilings and partitions after all cabling has been completed. The fire stopping system and materials used shall comply with all applicable codes and conform to the acceptable testing methods and current standards in Canada, including, but not limited to, ULC-S115 and CAN/ULC-S101. The acceptability by ULC and by local authorities having jurisdiction, should be confirmed by the contractor to ensure that the test procedures were performed to ULC-S115 and CAN/ULC-S101.
- 1.6.2 The non-permanent intumescent and systems used for sealing the openings shall have a fire rating equal to or greater than the fire rating of the floor/wall/partition assemblies



being penetrated. The contractor shall be responsible for confirming the fire rating of the different assemblies to be penetrated with the UTM designate and for ensuring the use of the proper fire proofing methods accordingly.

- 1.6.3 Provide a non-permanent intumescent or hybrid fire stop system to cap all empty conduit ends, ducts, sleeves and slots, meeting or exceeding the requirements of 1.6.1.
- 1.6.4 Provide a non-permanent intumescent or hybrid fire stop system around all cabling to seal the conduit, cable tray, ducts, sleeves and slot openings, re-sealable with minimal risk of damage to cables, meeting or exceeding the requirements of 1.6.1
- 1.6.5 A non-permanent intumescent or hybrid fire stop system will be used, as per 1.6.3-1.6.4 even when conduits, ducts, sleeves or slots are filled to maximum capacity.
- 1.6.6 Firestopping materials/systems used to fill voids in floors having openings greater than 100 mm in diameter, and which are accessible to the public, shall support floor design loading
- 1.6.7 The contractor shall furnish all labour, materials, tools and other equipment necessary to provide a complete fire stopping system
- 1.6.8 The contractor shall provide data sheets and applicable documentation for the fire stopping systems to be used and to demonstrate that the systems meets or exceeds the requirements of 1.6.1 & 1.6.2 prior to supply, installation and/or construction.

## **1.7 SCHEDULE OF WORK**

- 1.7.1 The contractor shall submit a schedule of work to be approved by the UTM I&ITS Designate. The schedule shall clearly indicate the proposed order in which the various activities will be undertaken and the estimated time required for the completion of the various activities.
- 1.7.2 The schedule of work may be revised periodically during the course of the project and must be approved by the UTM I&ITS Designate.

## **1.8 CLEAN-UP**

- 1.8.1 The working space, telecommunications rooms and office spaces must be swept and free of unused cables, cable clippings, cardboard boxes or any other debris produced by the contractor, on a daily basis, by the end of each day, or as needed during the course of the day. The contractor is responsible for removing all trash to outside garbage containers at least once a day. The contractor shall provide a complete clean-up of the rooms at the end of the project or MAC work activity.
- 1.8.2 Workstation outlet location areas shall be cleaned on an on-going basis each time the contractor completes any MAC work activity in the area.
- 1.8.3 Costs associated for keeping the areas clean are the responsibility of the contractor.



- 1.8.4 Cleanliness of the site to be governed by the General Contractor/Construction Manager who may, after proper notice, back charge the contractor for site clean-up.

## **1.9 DELIVERY AND STORAGE**

- 1.9.1 Delivery and receipt of project materials shall be the sole responsibility of the contractor to receive, move, secure and store all equipment and material. All delivery costs are to be included in the contractor's proposal.
- 1.9.2 All cable to be used in the project shall be stored according to manufacturer's recommendations. In addition, all cable must be stored in a protected area. If cable is stored outside, it must be covered with opaque plastic or canvas for protection from the elements, with adequate ventilation to prevent condensation. If air temperature at the cable storage location will be below 4.4 °C (40 °F), the cable shall be moved to a heated location [minimum 10 °C (50 °F)]. If necessary, cable shall be stored off-site at the contractor's expense.
- 1.9.3 The contractor is allowed one (1) standard size job box on the site during construction. All tools, material and the job box are the sole responsibility of the contractor. The contractor is responsible for the complete storage, handling, moving, delivery and installation of all materials used in the performance of the work.

## **1.10 PROJECT/SITE CONDITION**

- 1.10.1 All bidders to arrange to obtain all necessary or referenced drawings and documents.
- 1.10.2 The contractor is responsible for seeking clarification with the UTM I&ITS Designate on how to address site and technical issues that may arise due to unforeseen difficulties. The contractor is not to operate under assumptions and make design changes without prior approval of the UTM I&ITS Designate. Whenever necessary, clarification must be sought every time unpredictable difficulties arise, from start to completion of a project.
- 1.10.3 No claim for additional payment to be made for extra material or work made necessary by circumstances encountered due to conditions which were made visible upon, or reasonably inferable from thorough examination and review of all associated project documents, drawings and systems, prior to the submission of the response.
- 1.10.4 No claim for additional payment to be made for extra material or work made necessary by circumstances encountered due to conditions which were made visible upon visit to premises. The contractor must be abundantly experienced to infer material and workmanship required to carry out work performed both within visible and obstructed, hidden and underground locations. Such assessment is to be performed prior to the submission of the response
- 1.10.5 During the implementation phase of a project, the contractor is not to deviate, willingly or due to misunderstanding of documentation, from the specifications, diagrams and project documents provided by the UTM I&ITS Designate. Doing so will require immediate corrective action by the contractor and additional costs incurred in order to





match the implementation with the design and specifications of the project will be done without hesitation at the contractor's expenses.

- 1.10.6 The cable routing diagrams only depict the cable routing and cable connectivity requirements. They are not installation drawings. Make all necessary allowances in the bid price to achieve the intent of the drawings.

### **1.11 CUTTING AND PATCHING**

- 1.11.1 Complete all cutting and patching required for the installation of the infrastructure.
- 1.11.2 In existing work and work already finished, cutting, patching and painting will be required by the contractor.
- 1.11.3 Be aware of fire rated partitions and return all services to the condition encountered before start of the work.

### **1.12 SITE RESPONSIBILITIES**

- 1.12.1 All pull strings present at the beginning of the installation must be returned or replaced to the initial state at the end of the communications cabling installation.
- 1.12.2 Do all cutting and patching required for the installation of the infrastructure.
- 1.12.3 The client is not responsible or liable for any missing material and/or tools belonging to the contractor.
- 1.12.4 The contractor is responsible for the removal and re-installation of all ceiling/floor tiles in the areas affected by its work. This is to be completed on a daily basis for the areas affected.
- 1.12.5 Any damage to ceiling tiles during the completion of any work outlined in this document is the responsibility of the contractor. Damage includes breaking, chipping or smudging. The decision with respect to any damage will be made by the General Contractor, Project Manager and the client.
- 1.12.6 The contractor is responsible for the storage and protection of the floor/ceiling tiles that are removed for cable installation.
- 1.12.7 Cabling that is not terminated on both ends, must not, under any circumstances, be abandoned in place. At the completion of work, the contractor is responsible for end-to-end removal of dead and unterminated cables from existing conduits, raceways, fittings, cable trays, wiring troughs and any other apparatus used to protect and route cables, i.e. from 8P8C receptacles (a.k.a. RJ45 jacks) to the cable's termination point (usually a patch panel or network switch). Great care should be taken during the removal process so as to protect the existing live cables from damage.



### **1.13 TERMS AND CONDITIONS**

- 1.13.1 All terms and conditions of the specifications, bid documents and accompanying drawings to be strictly adhered to by the contractor, unless otherwise noted.
- 1.13.2 Any inability to comply with these requirements must be stated in writing, in detail with the response submission. Otherwise, it will be understood that the contractor is bound to the compliance with the stated terms and conditions.
- 1.13.3 Contractor to comply with the G.C. construction and installation schedule.
- 1.13.4 Do not assign or sub-contract any work without prior written consent from the IT department and or communication consultant.
- 1.13.5 Perform the complete installation in accordance with the latest editions of the Ontario and National Building Codes along with any other governing authorities of competent jurisdiction.

### **1.14 COORDINATION**

- 1.14.1 Coordinate telecommunications work with that of the other trades.
- 1.14.2 Contractor to review any interference between general construction, telecommunications, architectural, mechanical, electrical, structural, and other specialty trades involved and bring it to the attention of the G.C.

### **1.15 EQUIPMENT IDENTIFICATION**

- 1.15.1 All telecommunication equipment such as cabinets, racks and similar items shall be identified with labels which, ideally, should not exceed 8cm in length and 4cm in height.
- 1.15.2 Coordinate telecommunications work with that of the other trades.

### **1.16 WARRANTY**

- 1.16.1 Contractor shall warrant the materials and workmanship used in the installation of this project. Components must be covered by a manufacturer's warranty against defects in material and workmanship for a period of at least 25 years from the date test results are submitted to the manufacturer and approved by UTM.
- 1.16.2 All cabling system will meet or exceed the UTP channel transmission requirements specified by ANSI/TIA 568-D.
- 1.16.3 Contractor shall provide all material and labour to make any deficiencies due to faulty materials or workmanship which become apparent within a one-year period.
- 1.16.4 All terminated horizontal cabling runs shall be 100% tested for defects in installation. Cabling system performance under installed conditions should comply to the requirements found in the TIA/EIA-568-C series of standards. All pairs in each installed cable shall be verified prior to system acceptance. Any defect in the cabling system



installation, including (but not limited to) cables, connectors, and cordage shall be repaired or replaced in order to ensure 100% usability of all installed cable runs.

- 1.16.5 The communications contractor shall submit the test results for the project to the UTM I&ITS Designate 10 (ten) business days prior to the cutover, as indicated in 1.5.9.
- 1.16.6 Upon completion of the testing by the contractor for any MAC work, the contractor shall submit to the UTM I&ITS Designate the network drawing, including cable ID numbers related to the cabling completed for the project, 10 (ten) business days prior to the cutover, as indicated in 1.5.10.
- 1.16.7 Failure to provide test results upon request will require the contractor to retest all horizontal and or backbone cabling related to the project and any MAC work with no cost to the client.

### **1.17 SUBMISSIONS**

- 1.17.1 The contractor shall provide product data and shop drawings for all materials proposed for installation under this contract. The product data and shop drawings shall be submitted to the UTM I&ITS Designate for approval before such equipment is purchased and or delivered to the site.
- 1.17.2 Review all aspects of the specifications and drawings and identify any and all issues for inclusion in the contract documents examination report.
- 1.17.3 This section contains the definitions, acronyms and abbreviations that have special technical meaning or are unique to the technical content of this document.

### **1.18 STANDARDS**

- 1.18.1 The design considerations, and installation guidelines provided in this document are in part derived from recommendations found in recognized telecommunications industry standards. The following are used as guidelines.

#### **Spaces and Pathways**

TIA-569-B– Commercial Building Standard for Telecommunications Pathways and Spaces.

#### **Grounding**

ANSI-J-STD-607-B – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

#### **Cabling Systems**

ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises.

ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard.



ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

ANSI/TIA 568-C.3 Optical Fibre Cabling Components Standard.

### **Cabling Administration**

TIA/EIA-606-B – Administration Standard for Commercial Telecommunications Infrastructure

### **Networking**

IEEE Standard 802.3an (2006) – 10GBASE-T

### **Design**

BICSI Telecommunications Distribution Methods Manual (TDMM) – 13th edition.

### **Installation**

BICSI Information Transport Systems Installation Manual (ITSIMM) – 6th edition.

## **1.19 DEFINITIONS**

- 1.19.1 This section contains the definitions, acronyms and abbreviations that have special technical meaning or are unique to the technical content of this document.
- 1.19.2 **Above Finished Floor (AFF)** - Standard mounting height (e.g. 12-inch AFF) for a device using the centre line of the device as the measuring point.
- 1.19.3 **Backbone** - A facility (e.g. pathway, cable or conductors) between the telecommunications room and the main telephone room.
- 1.19.4 **Bonding** - The permanent joining of metallic parts to form an electrically conductive patch that will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.
- 1.19.5 **Cable** - An assembly of one or more conductors or optical fibres within a sheath, constructed so as to permit use of conductors singly or in groups.
- 1.19.6 **Entrance Room** - A space in which the joining of inter or intra-building telecommunications backbone facilities takes place. An entrance room may also serve as the equipment room
- 1.19.7 **Horizontal Cabling** - Portion of the cabling system that extends from the work area outlet, through the cabling in the wall/ceiling/floor and then to the patch panel in the telecommunications room. The system also includes the patch cords at the work area outlet, and patch cords in the telecommunications room.
- 1.19.8 **Intra-building Backbone** - A backbone network providing communications within the building.



- 1.19.9 **Inter-building Backbone** - A backbone network providing communications for more than one building.
- 1.19.10 **Patch Panel** - A cross connect system of connectors that can be mated together to facilitates administration of a cabling system.
- 1.19.11 **Pathway** - A facility for the placement of telecommunication cabling.
- 1.19.12 **Patch Cord** - A length of copper or fibre cable with connectors on each end to be used to join telecommunications circuits/links at the cross-connects. Copper cables will usually, but not always, be of Cat 6A grade. **The UTM I&ITS Designate must be consulted before materials are procured.**
- 1.19.13 **Telecommunications Room (TR)** - An ample space in which the end of horizontal cabling is terminated in data racks. It connects to another TR or to the MTR for intra-building data and voice communication. The facility must be clean, dust-free and include proper air handling to regulate temperature and moisture in order to prevent the lifespan reduction of the equipment.
- 1.19.14 **Main Telecommunications Room (MTR)** - An ample space in which the end of horizontal and backbone cabling are terminated in data racks. It is also a TR and is usually the node assigned for inter-building data and voice communication. The facility must be clean, dust-free and include proper air handling to regulate temperature and moisture in order to prevent the lifespan reduction of the equipment.
- 1.19.15 **Telecommunications Grounding Busbar (TGB)** - A common point of connection for the telecommunications system and bonding to ground. It is located in the telecommunications room.
- 1.19.16 **Telecommunications Main Grounding Busbar (TMGB)** - A common point of connection for the telecommunications system and bonding to ground. It is located in the main telecommunications room.
- 1.19.17 **Wireless Access Point (WAP)** - The central or control point in a wireless cell that acts as a link for data traffic to and from the wireless devices in the cell.

## 1.20 ACRONYMS AND ABBREVIATIONS

ACR	Attenuation-to Crosstalk Ratio
ANSI	American National Standards Institute
AWG	American Wire Gauge
BC	Building Conductor
BICSI	Building Industry Consulting Service International
BTU	British Thermal Unit
CATV	Community Antenna Television (cable television)
CCTV	Closed Circuit Television
CSA	Canadian Standards Association
CT	Cable Tray
dB	Decibel



DSL	Digital Subscriber Line
DSU	Digital Service Unit
EMT	Electrical Metallic Tubing
EP	Entrance Point
FOTP	Fibre Optic Test Procedure
Ga	Gauge
Gb	Gigabit
HC	Horizontal Cross-connect
HVAC	Heating, ventilating and air conditioning
Hz	Hertz
IC	Intermediate cross-connect
LAN	Local Area Network
MTR	Main Telecommunications Room
NIC	Network Interface Card
OSP	Outside Plant
OTDR	Optical Time Domain Reflectometer
PB	Pull Box
PE	Polyethylene
RF	Radio Frequency
RFI	Radio Frequency Interference
RMC	Rigid Metal Conduit
SM	Single-mode
TBB	Telecommunications Bonding Backbone
TBBIBC	Telecommunications Bonding Backbone Interconnecting Bonding Connector
UPS	Uninterruptible Power Supply
WAP	Wireless Access Point

## **2. PART 2 - PRODUCTS**

### **2.1. NOT USED**

## **3. PART 3 - EXECUTION**

### **3.1. NOT USED**

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the grounding and bonding for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 29 Hangers and Supports for Communications Systems
- 1.2.4 27 05 33 Conduits and Back Boxes for Communication Systems
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- 1.2.16 27 15 43 Communication Faceplates and Connectors
- 1.2.17 27 16 19 Communication Patch Cords and Cross Connect Wire

### 1.3 REFERENCES

- 1.3.1 Comply with the latest addition of the following applicable specifications and standards except as otherwise shown or specified.
- 1.3.2 Underwriters Laboratories, Inc (UL).
- 1.3.3 ANSI/TIA 607 requirements (current version including all addenda): Commercial Building Grounding and Bonding Requirements for Telecommunications.

### 1.4 QUALITY ASSURANCE

- 1.4.1 All materials, equipment and parts comprising the unit's specified within this document shall be new and unused and of a current manufacture.
- 1.4.2 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### 1.5 SYSTEM DESCRIPTION

- 1.5.1 The main entrance facility/equipment room shall be equipped with a TMGB. The TMGB shall be connected to the building electrical entrance grounding facility. In all other telecommunications rooms there is to be a TGB; these are to be connected back to the TMGB through appropriately sized copper conductors that form the TBB.
- 1.5.2 An electrical engineer is to provide the correct sizing of the ground wire for 1.5.1. Conductors shall be sized according to distance and must be stranded copper with green insulation.
- 1.5.3 In each telecommunications room provide #6 AWG stranded copper with green insulation from the TGB to all metallic components (cable trays, racks and all other enclosures). No serial connections are acceptable.
- 1.5.4 The TMGB must meet ANSI/TIA 607 requirements for network system grounding applications. Must be made of high conductivity copper and tin-plated to inhibit corrosion. Minimum bar size must be 4"W x ¼"H x 12"L with insulators and standoffs. Must be pre-drilled, complete with 12 x ¼" stud holes with ⅝" hole spacing and 6 x ⅜" stud holes with 1" hole spacing.
- 1.5.5 The TGB must meet ANSI/TIA 607 requirements for network system grounding applications. Must be made of high conductivity copper and tin-plated to inhibit corrosion. Minimum bar size must be 2"W x ¼"H x 12"L with insulators and standoffs. Must be pre-drilled, complete with 6 x ¼" stud holes with ⅝" hole spacing and 3 x ⅜" stud holes with 1" hole spacing.
- 1.5.6 The contractor must visually inspect the Grounding and Bonding System for loose connections. A potential difference test must be made between the TMGB and electrical ground, and between the TMGB and each TGB. All test measurements must comply with the ANSI/TIA 607 requirements.



## 1.6 SUBMITTALS

- 1.6.1 Shop drawing to reflect the type and size of the TMGB and the TGB for review.
- 1.6.2 Provide a ground test report in compliance with the ANSI/TIA 607 requirements.

## 2 PART 2- PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- 2.1.1 Thomas and Betts, Chatsworth Products Inc., Burndy, Panduit or approved equal.

## 3 PART 3- EXECUTION

### 3.1 INSTALLATION

- 3.1.1 Bond all telecommunication cable trays, data cabinets, data racks and all other metallic communication infrastructure components to the nearest TMGB or TGB using a minimum of a #6 AWG stranded, green insulated conductor and appropriate 2-hole, long barrel, window lug.
- 3.1.2 Contractor to ensure that the data rack and/or cabinet grounding does not block and/or interfere with any rack mount units in the racks and/or cabinets.
- 3.1.3 Racks and/or cabinets are to be grounded at their top the TMGB or TGB.
- 3.1.4 Bonding connectors shall be continuous and routed in the shortest straight path. Any bends placed in the connector shall be sweeping bends.
- 3.1.5 A yellow ground tag to be supplied and installed by the contractor at the TMGB and TGB that states the following **“IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CONTACT PHONE NUMBER \_\_\_\_\_”**. Verify with the UTM I&ITS Designate the correct phone number.
- 3.1.6 Provide a record of the ground resistance measurements from the ground bus to earth.
- 3.1.7 Furnish all test results to be reviewed by an electrical engineer.
- 3.1.8 All installations must be performed by licensed unionized (IBEW) electricians/telecommunication technicians. The tradesperson must follow the latest safety requirements from the Ministry of Labour.
- 3.1.9 The contractor shall provide installers trained in the applicable codes, regulations and installation standards. Quality workmanship of the highest standard is expected to be delivered by the tradespersons. Acceptance of the work is subject to the approval of the university's designate and IT contact.

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the general requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the hangers and supports for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.5 27 05 36 Cable Trays for Communication Systems
- 1.2.6 27 05 53 Identification for Communication Services
- 1.2.7 27 05 55 Testing for Communication Services
- 1.2.8 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.9 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.10 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.11 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

### **1.3 QUALITY ASSURANCE**

- 1.3.1 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 Hangers and supports are to be supplied and installed as per this document and drawings to support the various cabling from the workstation to the overhead cable tray or to the MTR and/or TR locations.

### **1.5 SUBMITTALS**

- 1.5.1 Shop drawings for each type of product indicated in the following document, including construction details, material descriptions, dimensions of individual components and profiles and finishes for the products listed. Include rated capacities, operating characteristics along with furnished specialties and accessories.

## **2 PART 2- PRODUCTS**

### **2.1 ADJUSTABLE CABLE SUPPORTS**

- 2.1.1 Shall be similar to the one pictured below



- 2.1.2 Suitable for use in air handling spaces.
- 2.1.3 Allow for attachment to ceilings, beams, walls, threaded rods and underfloor supports.
- 2.1.4 Support a minimum cable capacity of 210 Cat 6A.
- 2.1.5 Support a minimum static load of 46kg (100lbs).

### 3 PART 3- EXECUTION

#### 3.1 INSTALLATION

- 3.1.1 The horizontal cabling pathway shall be a self-supporting system.
- 3.1.2 Cable supports shall not be attached to ceiling grid support rods, conduits, water pipes HVAC ducts or lighting fixture wires.
- 3.1.3 The cable supports shall be installed no more that 1.5 meters (48") apart.
- 3.1.4 All cable supports shall be rated for a minimum of Cat 6A for the structured cabling infrastructure.
- 3.1.5 In a ceiling distribution design the cable supports shall be installed at a minimum of 36" clearance between the ceiling tile and the structured cabling pathway.
- 3.1.6 All hangers, rods and supports must be suspended from or attached to the structural steel, concrete slab and or walls with proper hardware designed to support their load bearing rating.
- 3.1.7 Only touch-fasteners (a.k.a. velcro fasteners) shall be used where required. Under no circumstances plastic zip ties and similar products shall be utilized.
- 3.1.8 Where support for horizontal cable is required, the contractor shall install appropriate sized cable supports to support the horizontal cabling listed in this document.
- 3.1.9 To minimize any possibility of disruption, maintain the following minimum clearances from electrical and heat sources when installing cable supports for the horizontal cabling pathway:

<i>CLEARANCES TABLE</i>	
Item	Minimum Clearance
Motor	1.2 m ( 4'-0" )
Transformers	1.2 m ( 4'-0" )
Conduit and cables used for electrical distribution less than 1kV	0.3 m ( 1'-0" )



Conduit and cables used for electrical distribution greater than 1kV	1.0 m ( 3'-0" )
Fluorescent Luminaires	12 cm ( 5" )
Pipes ( gas, oil, water, etc )	0.3 m ( 1'-0" )
HVAC ( equipment, ducts, etc	15 cm ( 6 " )

END OF SECTION



## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the conduits and back boxes for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communication Systems
- 1.2.5 27 05 36 Cable Trays for Communication Systems
- 1.2.6 27 05 53 Identification for Communication Services
- 1.2.7 27 05 55 Testing for Communication Services
- 1.2.8 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.9 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.10 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.11 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire



### **1.3 QUALITY ASSURANCE**

- 1.3.1 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 The conduits and telecommunication boxes are to be supplied and installed as per this document and drawings to support the various cabling from the workstation to the overhead cable tray or to the MTR and/or TR locations.

### **1.5 SUBMITTALS**

- 1.5.1 Shop drawings for each type of product indicated in the following document, including construction details, material descriptions, dimensions of individual components and profiles and finishes for the products listed. Include rated capacities, operating characteristics along with furnished specialties and accessories.

## **2 PART 2- PRODUCTS**

### **2.1 CONDUIT**

- 2.1.1 All indoor conduits shall be thin wall EMT reamed and bushed at both ends.
- 2.1.2 The external surface of all visible indoor conduits shall be painted as to match colours already existing on the surrounding structure so as not to create an unpleasant view.
- 2.1.3 Conduits exposed to the weather, in wet locations, subject to mechanical injury, or in any hazardous locations or where required by code, shall be rigid threaded, galvanized steel conduit.
- 2.1.4 Joints in conduits installed underground, in concrete slab on grade or in a concrete duct bank shall be made completely watertight.

### **2.2 IN SLAB FLOOR BOXES**

- 2.2.1 All in slab floor boxes shall be constructed of galvanized steel and includes a lid assembly.
- 2.2.2 Box equipped with conduit knockouts at each end and on each side for conduit feeds for data cabling and power.
- 2.2.3 The lid to be available either recessed for carpet or tile or a flat flush lid.
- 2.2.4 The lid shall have an open for the easy access for data patch cords and power cords.



- 2.2.5 The floor box shall be a minimum of 12" x 12" x 5" deep.
- 2.2.6 Joints in conduits installed underground, in concrete slab on grade or in a concrete duct bank shall be made completely watertight.
- 2.2.7 Minimum concrete thickness over or around a conduit in a concrete slab shall be 75mm (3").

### **2.3 METAL RACEWAY**

- 2.3.1 The single raceway shall be steel.
- 2.3.2 ScuffCoat scratch-resistant finish.
- 2.3.3 Resists oxidation, corrosion and fading.
- 2.3.4 Can be installed as recessed or surface.
- 2.3.5 Various types of fittings for horizontal and vertical pathways.
- 2.3.6 Use surface mount box for voice and data cabling.

## **3 PART 3- EXECUTION**

### **3.1 INSTALLATION**

- 3.1.1 The inside radius of a bend in a conduit shall be at least 10 times the internal diameter of the conduit.
- 3.1.2 All zone conduits shall be identified and labelled at both ends. Tags shall identify the start and finish of conduit runs. Pull boxes shall be labelled on the exposed exterior.
- 3.1.3 All conduits dedicated for the communication structured cabling system shall not be shared with other services.
- 3.1.4 The telecommunication system shall be labelled green from end to end on conduits and at pull boxes.
- 3.1.5 All conduits shall originate and be physically connected to the MTR, TR, backboards, cable tray and pull boxes.
- 3.1.6 All fittings, connectors and couplings are to be steel.
- 3.1.7 All conduits entering or exiting through the ceilings or walls of the MTR and or TR shall be installed to the basket cable tray in the room and stop 6" above the cable tray.
- 3.1.8 All conduit runs shall follow the building grid lines and shall be concealed where possible.
- 3.1.9 Unless otherwise specified, all conduit runs shall be a maximum of 30 meters (100 feet) in length with a maximum of two ninety-degree bends between pull boxes.





- 3.1.10 A pull box shall be placed in conduit runs where the sum of the bends exceeds 180 degrees, where the overall length of the conduit run is more than 30m, or if there is a reverse bend in the run.
- 3.1.11 In all instances pull boxes shall be placed in straight sections of a conduit run and shall not be used in lieu of a bend. Corresponding ends of the conduit are to be aligned with each other.
- 3.1.12 Conduit fittings or pull elbows fittings shall not be used in place of pull boxes or bends.
- 3.1.13 Pull boxes shall be installed at a reasonable height, in an exposed location and such that access for the installation of cables is not prohibited.
- 3.1.14 Pull boxes shall not be placed in a fixed false ceiling space, unless immediately above a suitably marked and hinged access panel.
- 3.1.15 Provide and install 25mm (1") diameter green dot decals on the ceiling T-bar rail showing location of pull box.
- 3.1.16 Pull boxes shall be constructed and sized in accordance with the Canadian Electrical Code and ANSI/TIA standards of gauge steel and shall have a rust resistant finish.
- 3.1.17 Place pull boxes in readily accessible locations only.
- 3.1.18 Locations and sizes of all pull boxes shall be indicated on the design submission.
- 3.1.19 Pull boxes shall be placed in straight sections of a conduit run and shall not be used in lieu of a bend. Corresponding ends of the conduit are to be aligned with each other. Conduit fittings or pull elbow fittings shall not be used in place of pull boxes or bends.
- 3.1.20 All conduits shall be installed in accordance with the Canadian Electrical Code, Part 1 Section 12, applicable building codes and in accordance with TIA/EIA 569-B.
- 3.1.21 The use of C, LB, LL, LR and T type fittings or elbows fittings is not permitted.
- 3.1.22 Conduits ending in the vicinity of a cable tray shall be terminated at a height of no less than 100mm (4") and no more than 150mm (6") from the top of the cable tray. Conduit runs shall not be punched through the side of the cable tray.
- 3.1.23 The minimum size (inside diameter) for EMT conduit running between the MTR and the telecommunications outlet location is twenty-five millimeters (25mm) (1").
- 3.1.24 The formulas below should be used to calculate the maximum number of UTP cables per conduit size, at a maximum 40% fill ratio. The ensuing chart provides an example for UTP cables (.288OD) in various conduit sizes.



Conduit outside diameter =  $C od$

Conduit wall thickness =  $C wt$

UTP cable outside diameter =  $U od$

(a)  $((C od - C wt * 2)^2) * \Pi * 0.1$

(b)  $(\Pi * (U od)^2) / 4$

(c) TRUNC (a/b)

National Pipe Size (NPS)	Outside Diameter	Wall Thickness (Sch 40 / Std)	Maximum Number of UTP Cables
3/4"	1.050	0.113	3
1"	1.315	0.133	5
1 1/4"	1.660	0.140	9
1 1/2"	1.900	0.145	12
2"	2.375	0.154	20
2 1/2"	2.875	0.203	29
3"	3.500	0.216	45
3 1/2"	4.000	0.226	60
4	4.500	0.237	78

- 3.1.25 Cable fill capacities of conduit, cable tray and raceways shall not be greater than 40%.
- 3.1.26 A pull cord or fish tape shall be installed in all conduits.
- 3.1.27 Conduit must enter the outlet boxes from the top or bottom.
- 3.1.28 The contractor is responsible for cleaning all conduits prior to pulling any cable.
- 3.1.29 The outlet boxes shall be installed in the locations identified on the drawing. The outlet box shall be installed at 300mm (12") AFF or at the same height and within 300mm (12") of the adjacent electrical duplex receptacles, unless otherwise noted on the drawings. Wherever possible, the face of the plastic ring should be installed flush with the finished wall.



- 3.1.30 Back to back outlet boxes shall not be used.
- 3.1.31 Outlet boxes must be equipped with a plaster ring to accommodate the installation of the multimedia faceplate.
- 3.1.32 Plaster rings will be specified as a single or double gang to accommodate cabling requirements.
- 3.1.33 Plaster rings or raised adapter plates shall not reduce the size of the outlet such that two additional outlets could not be added in the future.
- 3.1.34 In slab floor boxes are to be sized to reflect the total quantity of data cabling along with power requirements.
- 3.1.35 If AV cabling is to be combined with data cabling, the in slab floor box needs to be enlarged and reviewed by the IT department for approval.
- 3.1.36 See conduit fill chart in item 3.1.24 related to the size of conduits that are required for the number of data drops for floor boxes.
- 3.1.37 Quality and workmanship shall be at the highest of professional tradesman levels to be accepted for completion.
- 3.1.38 To minimize any possibility of disruption, maintain the following minimum clearances from electrical and heat sources when installing the horizontal conduits for the horizontal cabling pathway:

<b>CLEARANCES TABLE</b>	
Item	Minimum Clearance
Motor	1.2 m ( 4'-0" )
Transformers	1.2 m ( 4'-0" )
Conduit and cables used for electrical distribution less than 1kV	0.3 m ( 1'-0" )
Conduit and cables used for electrical distribution greater than 1kV	1.0 m ( 3'-0" )
Fluorescent Luminaires	12 cm ( 5" )
Pipes (gas, oil, water, etc)	0.3 m ( 1'-0" )
HVAC (equipment, ducts, etc)	15 cm ( 6 " )

- 3.1.39 For concrete wall locations the single channel shall be used and properly secured to the block wall.



- 3.1.40 If more than two data cables are to be installed at a single location the metal raceway is to be sized to accommodate the total number of data cables using the 40% fill ratio.
- 3.1.41 At the faceplate location a surface wiremold box is to be connected using proper mounting hardware to install voice and data cabling in a communication faceplate.

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the cable tray for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communication Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 53 Identification for Communication Systems
- 1.2.7 27 05 55 Testing for Communication Services
- 1.2.8 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.9 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.10 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.11 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire



### **1.3 QUALITY ASSURANCE**

- 1.3.1 Comply with EIA/TIA 569-B Commercial Building Standard for Telecommunication Pathways and Spaces.
- 1.3.2 Only products and applications listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 Provide an appropriate cable tray solution within the ceiling space of an area as indicated on the drawings.
- 1.4.2 Cable tray supports shall be installed at intervals of no more than 6 feet. At each interval, appropriate support (trapeze hangers, central hangers, cantilever arms) will be selected from the products listed in this document (Section 2) based on the following criteria:
  - 1.4.2.1 If the cable tray is to be installed on or against a wall, cantilevered arms shall be used to support the tray (see 2.3 of this document).
  - 1.4.2.2 If the ceiling area does not have enough clearance to accommodate two support rods per support point, a cable tray system based on the T-shape tray will be installed.
  - 1.4.2.3 In all other cases, a trapeze cable tray mounting method will be used. This is the least desirable solution and should be avoided.
- 1.4.3 Coordinate layout and installation of cable trays and their suspension system with other construction that penetrates ceilings or is supported by them, including all light fixtures, HVAC equipment, fire suppression system and partitions.
- 1.4.4 Cable tray systems should be designed and installed with adequate room around the cable tray to allow for the setup of cable pulling equipment. Also, space around the cable tray provides easy access for installation of additional cables or the removal of surplus cables. See subsection 3.1.12 for details.
- 1.4.5 Provide all fittings and miscellaneous hardware necessary to provide complete cable tray solution. Miscellaneous hardware includes, but is not limited to: coupling nuts, hex nuts, clamps, washers, bolts, hinges, splices, expansion joints and couplers.

### **1.5 SUBMITTALS**

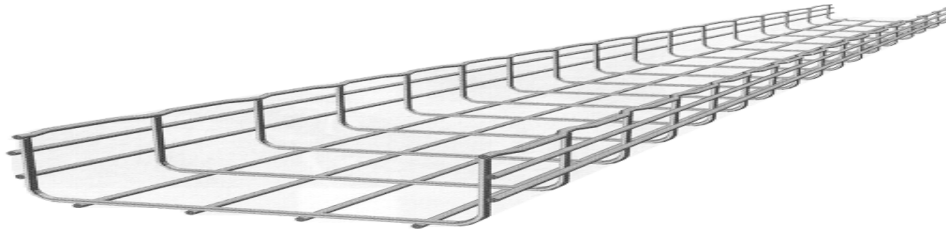
- 1.5.1 Shop drawing to reflect the type, size and material finish of the cable tray for review.
- 1.5.2 Provide fabrication and installation details of the cable trays along with all components and attachments including clamps, brackets, hanger rods, splice plate connectors, expansion joint assemblies, straight lengths and all fittings.



## 2 PART 2- PRODUCTS

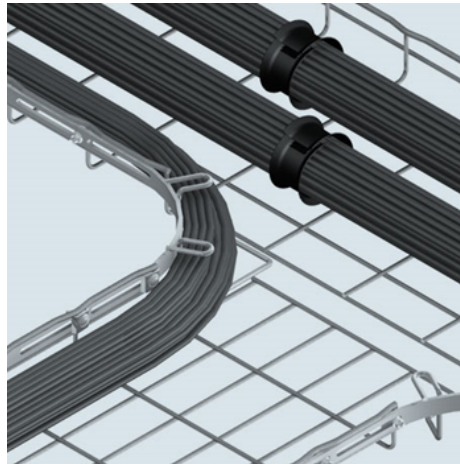
### 2.1 CABLE TRAYS

- 2.1.1 Cable tray material must be steel mesh or Aluminum Association Alloy 6063, similar to this picture:



**Overhead Basket Cable Tray**

- 2.1.2 Straight sections shall be supplied in standard 10 foot (3.05m) lengths
- 2.1.3 All bends in cable tray, including 90°, 45° bends, and tee intersections shall be “radius bends” with a minimum internal bend radius of 5”. See below picture as example:



- 2.1.4 Minimum height of cable tray for horizontal cabling is 2 inches.
- 2.1.5 Width of cable tray will be selected based on available clearance in selected cable tray pathway. Largest cable tray width available which still fits in selected pathway with appropriate clearance will be provided. For example, if the pathway is 25” wide, and minimum horizontal clearance is 10” on each side, then the maximum available width for cable tray is 5”. If cable tray is available in widths of 4”, 6”, and 8”, then 4” wide cable tray must be supplied and installed.
- 2.1.6 Minimum width of cable tray is 4 inches. If available space in a given pathway does not allow for a cable tray width of at least 4 inches, contractor shall report to the UTM I&ITS Designate for further instructions.



- 2.1.7 Must conform to NEMA VE1 standards for load capacity.
- 2.1.8 Must be certified E-30 to E-90 for fire and heat resistance.

## 2.2 DROP OUTS

- 2.2.1 Must be used anywhere cabling enters or exits the cable tray at an angle greater than 30°.
- 2.2.2 Must be compatible with existing or new cable tray (compatible fasteners & supports).
- 2.2.3 Examples are provided on the pictures below:



## 2.3 CABLE TRAY SUPPORTS – CANTILEVER ARMS

- 2.3.1 Must be compatible with cable tray and allow for cable tray to be securely fastened to a wall.
- 2.3.2 Must be able to support between 68kg and 136kg (150 ~ 300 lbs) loads per span, based on width of cable tray:
  - 2.3.2.1 For cable width of 4", each support must support up to 68kg (150lbs).
  - 2.3.2.2 For cable width of 6", each support must support up to 82kg (180lbs).
  - 2.3.2.3 For cable width of 8", each support must support up to 104kg (230lbs).
  - 2.3.2.4 For cable width of 12", each support must support up to 136kg (300lbs).



## **2.4 CABLE TRAY SUPPORTS – CENTRAL HANGERS**

- 2.4.1 Must be compatible with cable tray and allow for cable tray to be securely fastened to a wall.
- 2.4.2 Must be able to mount on  $\frac{3}{8}$ " threaded rod.
- 2.4.3 Must include protective sleeve around threaded rod to protect cables from friction damage.
- 2.4.4 Must be able to support between 68kg and 136kg (150 ~ 300 lbs) loads per span, based on width of cable tray:
  - 2.4.4.1 For cable width of 4", each support must support up to 68kg (150lbs).
  - 2.4.4.2 For cable width of 6", each support must support up to 82kg (180lbs).
  - 2.4.4.3 For cable width of 8", each support must support up to 104kg (230lbs).
  - 2.4.4.4 For cable width of 12", each support must support up to 136kg (300lbs).

## **2.5 CABLE TRAY SUPPORTS – TRAPEZE SUPPORTS**

- 2.5.1 Must be compatible with cable tray and allow for cable tray to be securely fastened to a wall
- 2.5.2 Must be able to mount on  $\frac{3}{8}$ " threaded rod.
- 2.5.3 Must be able to support between 68kg and 136kg (150 ~ 300 lbs) loads per span, based on width of cable tray:
  - 2.5.3.1 For cable width of 4", each support must support up to 68kg (150lbs).
  - 2.5.3.2 For cable width of 6", each support must support up to 82kg (180lbs).
  - 2.5.3.3 For cable width of 8", each support must support up to 104kg (230lbs).
  - 2.5.3.4 For cable width of 12", each support must support up to 136kg (300lbs).



### **3 PART 3- EXECUTION**

#### **3.1 INSTALLATION**

- 3.1.1 Contractor shall be responsible for the complete supply and installation of the overhead basket type cable tray along with the installation of all supports, dropouts (waterfalls) fittings, connectors threaded rods, bolts, brackets, clips, and miscellaneous hardware for a complete basket cable tray and support system.
- 3.1.2 Install overhead basket type cable tray as shown on the drawings, sketches and be securely attached under the installation guidelines of the cable tray manufacturer.
- 3.1.3 The basket cable tray supports can be installed on either side of the tray or supported in the centre of the cable tray.
- 3.1.4 There shall be no sharp edges on any cable trays, exposed rods, bolts, nuts etc.
- 3.1.5 Cut back all exposed hanging rods to a maximum of 2" to prevent accidental injury.
- 3.1.6 Cable tray is to be properly supported at the end of the tray at the wall locations in the TR locations.
- 3.1.7 Contractor to supply and install properly sized and the correct quantity of dropouts (waterfalls) at the cabinet and or data rack locations for the total number of data cables plus 50% growth.
- 3.1.8 The basket tray is to be cut to accept the waterfalls within the cable tray. No cabling shall run over the side of or under the cable tray.
- 3.1.9 Ground cable trays as per Section 27 05 26.
- 3.1.10 Quality and workmanship shall be the highest of professional tradesman levels to be accepted for completion.
- 3.1.11 The contractor shall provide installers trained in the installation of the cable tray, regulations and installation standards.
- 3.1.12 Clearances:
  - 3.1.12.1 Minimum of 6" vertical clearance from the top of the cable trays installed in tiers except where cables of 2" in diameter or greater are installed, then the clearance shall be 12".
  - 3.1.12.2 Minimum of 12" vertical clearance from the top of the cable trays installed to all ceilings, heating ducts, heating equipment and 6" for short length obstructions.
  - 3.1.12.3 Minimum of 10" horizontal clearance from the side of the cable tray mounted adjacent to each other or to walls or obstructions.
  - 3.1.12.4 Clearances for cable trays shall be in accordance with the Canadian Electrical Code C22.1-09.
  - 3.1.12.5 To minimize any possibility of disruption, maintain the following minimum clearances from electrical and heat sources when installing basket tray:



<b>CLEARANCES TABLE</b>	
<b>Item</b>	<b>Minimum Clearance</b>
Motor	1.2 m ( 4'-0" )
Transformers	1.2 m ( 4'-0" )
Conduit and cables used for electrical distribution less than 1kV	0.3 m ( 1'-0" )
Conduit and cables used for electrical distribution greater than 1kV	1.0 m ( 3'-0" )
Fluorescent Light Fixtures	12 cm ( 5" )
Pipes (gas, oil, water, etc)	0.3 m ( 1'-0" )
HVAC (equipment, ducts, etc)	15 cm ( 6 " )

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the identification for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communication Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 55 Testing for Communication Services
- 1.2.8 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.9 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.10 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.11 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire



### 1.3 QUALITY ASSURANCE

- 1.3.1 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### 1.4 SYSTEM DESCRIPTION

- 1.4.1 The contractor shall furnish all labour, materials, tools and other equipment necessary to provide a complete labelling system for the horizontal and backbone (copper and fibre) cabling system.
- 1.4.2 The contractor shall be responsible for completion of all work included in the contract and shall employ certified, skilled technicians as necessary to satisfy all work and trades.

## 2 PART 2 - PRODUCTS

- 2.1 All adhesive cable labels shall meet the legibility, defacement, and adhesion requirements specified in UL 969 (Ref. D-16). In addition, the labels shall meet the general exposure requirements in UL 969 for indoor use.
- 2.2 Cable wrap labels shall be self-laminating vinyl construction with a white printing area and a clear tail that self-laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times.
- 2.3 Use label sheets designed for laser/inkjet printers size 7.6mm x 15.5mm (0.3in x 0.61in). E.g. Panduit part number C061X030FJJ
- 2.4 Labels must use font 'Liberation Sans Narrow'. This is a family of open source fonts, free for use, that can be downloaded at: <https://pagure.io/liberation-fonts/>

## PART 3- EXECUTION

### 3.1 INSTALLATION

- 3.1.1 All labelling should be unique across the entire intra-building and/or inter-building wiring infrastructure.
- 3.1.2 Labels are to be mechanically printed using a laser/inkjet printer.
- Font size 8 is the preferred size. However, font sizes 7 or 6 should be used if the entire information cannot fit adequately on the first or second lines of the label, as detailed further in this section. The following is an example mockup of a patch panel labelling.



- 3.1.3 Handwritten labels are not permitted.
- 3.1.4 Labels obscured from view will not be acceptable and will be replaced by the contractor at no cost to the client.
- 3.1.5 One label should be attached to the front of the workstation faceplate, one to the front of the patch panel, and one within 10cm (approximately 4 inches) of each end of the horizontal Cat 6A UTP cable. The labelling scheme for the horizontal cabling is as follows:

All labelling and patching schedules to come from UTM. The UTM I&ITS Designate will produce the schedules (an example follows below) in a spreadsheet for the data communications cabling contractor to use to print complete labels.

Room	Cabling Number	Patch Panel	Patch Panel Port	Patch Panel Position	TR Room	Label	Chassis	Switch Number	Switch Port
1074c	001	4	7	151	1091	D-1091-151 / D-1074C-001	1	1	16

From the example above, "D-1091-151 / D-1074C-001" represents a TWO-LINE label. The / (slash) represents a new line. This label will be seen as such when on the rack itself:

D-1091-151  
D-1074C-001

These labels are to be A SINGLE PIECE affixed above the port they are labelling and cannot be cut in half and affixed above and below the port. The following is the information breakdown:

D = Data

1091 = Data communication closet room number



151 = The physical position in the patch panel of the cable in question. This number ranges from 001-048 on the first (TOP) patch panel, followed by 049-096 on the second patch panel (NEXT DOWN FROM THE TOP), followed by 097-144 on the third patch panel, and so on.

/ = New line

D = Data

1074C = The room where the other end of the cable terminates, typically an office or classroom.

001 = The cable number for this cable in the area where the far side terminates. These numbers MUST be unique and can never be reused inside the same area.

- 3.1.6 If adding voice and/or data cabling to an existing telecommunication room, a hybrid labelling scheme between the existing format in the area and the format described in 3.1.6 must be used. Since UTM has a large number of legacy labelling formats across campus, contractors MUST seek clarification about the hybrid scheme with the appropriate UTM I&ITS Designate, on a per case basis.
- 3.1.7 Each fibre port on the fibre strip in all fibre patch panels shall be labelled.
- 3.1.8 Example F-01, F-02, F-03 etc.
- 3.1.9 Each fibre patch panel shall indicate the destination along with fibre count in large font for ease of reading.
- 3.1.10 Example: **12-STRAND SM DV2045A to IB073.**
- 3.1.11 Cabling contractor to supply and leave in the TR 25% spare labels for future use.

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the testing for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communication Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.9 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.10 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.11 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire



### 1.3 SYSTEM DESCRIPTION

- 1.3.1 The contractor shall furnish all labour, materials, tools and other equipment necessary to provide manufacturer-certified test results, and minimum 25-year warranty for the voice, data, and backbone (copper and fibre) cabling system.
- 1.3.2 The contractor shall be responsible for the completion of all work included in the contract and shall employ certified, skilled and trained technicians as necessary to satisfy all work and trades.

## 2 PART 2- PRODUCTS

### 2.1 NOT USED

## 3 PART 3- EXECUTION

### 3.1 VOICE AND DATA TESTING

- 3.1.1 Cabling test results for every UTP cable, voice and data, must be provided at least 5 business days before commissioning of any data drop. Such results must be provided as both PDF and native tester files (e.g. FLW file). Full bandwidth, graphical results of all tests must be provided for all cables.
- 3.1.2 All tests will be full certification tests to current industry standards. All test results to be submitted to the manufacturer to produce a full certification report and warranty certificate covering the installed infrastructure for a minimum of 25 years.
- 3.1.3 All terminated horizontal voice and data cable runs shall be tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements found in the ANSI/TIA-568-C series of standards. All pairs in each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation, including (but not limited to) cables, connectors, and cordage shall be repaired or replaced in order to ensure total usability of all installed runs.
- 3.1.4 The contractor shall field test all four pairs of communications data UTP cable runs using the Permanent Link testing method. Cable test results for newly installed cables must **surpass** the accepted ANSI/TIA-1152 Level III and ANSI/TIA-568-C.2 standards parameters, in that cables with Marginal Passes are deemed unsatisfactory and must be repaired prior to system acceptance. Work done on existing cables, due to moves or

changes, whose results are Marginal Passes must be brought up to the UTM I&ITS Designate's attention prior to system acceptance.

3.1.5 Acceptable testers are as follows:

3.1.5.1 Fluke DSX 5000 or equivalent.

3.1.5.2 Fluke DSX 8000 or equivalent.

3.1.6 Upon completion of the testing by the contractor, the contractor will submit the test results for the various work activities to the UTM I&ITS Designate.

3.1.7 Failure to provide UTP test results will require the contractor to retest all horizontal voice and data cabling related to the project with no cost to the client.

3.1.8 All horizontal permanent link tests are to be performed using one of the approved testers (3.1.5), equipped with the most recent version of its firmware, calibrated within one year of testing date, and in accordance to ANSI/TIA-1152 standard.

3.1.9 Ensure all launch testing cables and connectors are within the parameters set by the manufacturer for the number of insertions for copper.

3.1.10 The technicians must be able to provide successful completion documents for one of the approved testers (3.1.5) training courses upon request.

## 3.2 FIBRE TESTING

3.2.1 Cabling test results for every fibre strand end point must be provided at least 5 business days before commissioning of any fibre pair. Such results must be provided as both PDF and native tester files (e.g. FLW file).

3.2.2 All tests will be full certification tests to current industry standards. All test results to be submitted to the manufacturer to produce a full certification report and warranty certificate covering the installed infrastructure for a minimum of 25 years.

3.2.3 All fibre backbone cable runs shall be 100% tested for defects in installation and its performance verified under installed conditions according to the requirements found in the TIA/EIA-568-C series of standards. All strands in each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation, including (but not limited to) cables, connectors, and cordage shall be repaired or replaced in order to ensure 100% usability of all installed runs.

3.2.4 All testing to be done with the fibre in its final installed position and configuration. NO testing to be done with strands that are not connected to the appropriate final patch panel assemblies.

3.2.5 Acceptable testers are as follows:



- 3.2.5.1 Fluke DSX 5000 or equivalent.
- 3.2.5.2 Fluke DSX 8000 or equivalent.
- 3.2.6 All fibre tests are to be performed using one of the approved testers equipped with the most recent version of its firmware and in accordance to ANSI/EIA/TIA-568-C series of standards.
- 3.2.7 Tester to be calibrated within one year of testing date.
- 3.2.8 Contractor must have up to date training for one of the approved testers being used to test any type of optical fibre, including all necessary launch cables and connectors.
- 3.2.9 Testing method shall be Tier 1 and test for the following parameters, at the very least:
  - Link Insertion Loss (attenuation).
  - Continuity.
  - Connector Polarity.
  - Length.
- 3.2.10 Testing of all fibre strands MUST be completed using the 1-jumper method as stated in the EIA/TIA 568-C standard (1-jumper) so that all strands are tested in pairs and not singularly.
- 3.2.11 Measurement of end-to-end attenuation at 850nm and 1300nm wavelengths for all connectorized fibres in accordance with the loss test procedure defined by EIA/TIA-526-14, Method B: Optical Power Loss measurements of installed fibre cable plant. Attenuation to be measured from both ends of each strand at both wavelengths (bi-directional testing of all strands).
- 3.2.12 The maximum overall attenuation loss from end to end shall be less than 3dB.
- 3.2.13 The contractor shall have access to an OTDR for troubleshooting issues during the project.
- 3.2.14 All installed fibres and connectors must meet or exceed the minimum specifications of the manufacturer. Any fibres or connectors failing to meet these specifications to be promptly replaced or repaired by contractor at no additional cost to the client.
- 3.2.15 All installed fibres and connectors shall maintain a maximum total optical attenuation of <0.5 dB through any installed strand pair. Any fibres or connectors failing to meet these specifications to be promptly replaced or repaired by contractor at no additional cost to the client.
- 3.2.16 All repairing must be completed at least 10 business days prior to the area move-in date or system cut-over date.
- 3.2.17 Failure to provide fibre test results will require the contractor to retest all optical fibre strands related to the project with no cost to the client.

- 3.2.18 Provide adequate personnel for immediate on-site problem determination and correction during the move-in date(s) and occupancy by the owner and for a reasonable period of time thereafter.
- 3.2.19 All defects and deficiencies which originate or become evident during the warranty period to be repaired or replaced without additional expense to the client within 5 business days. All such work must be performed at a time which is acceptable to the client, which may be outside regular working hours.
- 3.2.20 Contractor to provide a letter of certification within 2 weeks of substantial completion. This letter shall include: notification of the installation, verification of performance of the installed system, manufacturers certification number, identification of installation by location and project number and a copy of the warranty certification request form.

### 3.3 COPPER BACKBONE TESTING

- 3.3.1 Cabling test results for every backbone UTP cable must be provided at least 5 business days before commissioning of any data drop. Such results must be provided as both PDF and native tester files (e.g. FLW file). Full bandwidth, graphical results of all tests must be provided for all cables.
- 3.3.2 All tests will be full certification tests to current industry standards. All test results to be submitted to the manufacturer to produce a full certification report and warranty certificate covering the installed infrastructure for a minimum of 25 years.
- 3.3.3 All copper backbone cable runs shall be tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements found in the ANSI/TIA-568-C series of standards. All pairs in each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation, including (but not limited to) cables, connectors, and cordage shall be repaired or replaced in order to ensure total usability of all installed runs.
- 3.3.4 The contractor shall field test all four pairs of communications data UTP cable runs using the Permanent Link testing method. Cable test results for newly installed cables must **surpass** the accepted ANSI/TIA-1152 Level III and ANSI/TIA-568-C.2 standards parameters, in that cables with Marginal Passes are deemed unsatisfactory and must be repaired prior to system acceptance. Work done on existing cables, due to moves or changes, whose results are Marginal Passes must be brought up to the UTM I&ITS Designate's attention prior to system acceptance.
- 3.3.5 Acceptable testers are:
  - 3.3.5.1 Fluke DSX 5000 or equivalent.
  - 3.3.5.2 Fluke DSX 8000 or equivalent.
- 3.3.6 Upon completion of the testing by the contractor, the contractor will submit the test results for the various work activities to the UTM I&ITS Designate.

- 3.3.7 Failure to provide UTP test results will require the contractor to retest all horizontal voice and data cabling related to the project with no cost to the client.
- 3.3.8 All horizontal permanent link tests are to be performed using one of the approved testers (3.3.5), equipped with the most recent version of its firmware, calibrated within one year of testing date, and in accordance to ANSI/TIA-1152 standard.
- 3.3.9 All installed backbone copper and connectors must meet or exceed the minimum specifications of the manufacturer. Any pairs or connectors failing to meet these specifications to be promptly replaced or repaired by contractor at no additional cost.
- 3.3.10 All testing and repairing must be completed at least two weeks prior to the area move-in date or system cut-over date.
- 3.3.11 All copper backbone test results/reports to be submitted to the UTM I&ITS Designate for review and comment at least two weeks prior to any move in date.
- 3.3.12 Failure to provide test results upon request will require the Communication Cabling Contractor to retest all copper cabling with no cost to the client.
- 3.3.13 Provide adequate personnel for immediate on-site problem determination and correction during the move in weekend and occupancy by the owner and for a reasonable period of time thereafter.
- 3.3.14 All defects and deficiencies which originate or become evident during the warranty period to be repaired or replaced without additional expense to the client within 24 hours (1 day). All such work must be performed at a time which is acceptable to the client which may be outside regular working hours.
- 3.3.15 Contractor to provide a letter of certification within 2 weeks of substantial completion. This letter shall include: notification of the installation, verification of performance of the installed system, manufacturers certification number, identification of installation by location and project number and a copy of the warranty certification request form.

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the telecommunication rooms (TRs), cabinets, racks, frames and enclosures for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communication Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 15 55 Testing for Communication Services
- 1.2.9 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.10 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.11 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

### **1.3 QUALITY ASSURANCE**

- 1.3.1 Only new products listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 TRs are secure facilities whose primary purpose is to house network equipment for data communication. Analogue telephone lines (PSTN) cabling may be terminated in them with prior approval of the UTM I&ITS Designate.
- 1.4.2 TR access is restricted to I&ITS personnel.
- 1.4.3 Equipment unrelated to a TR's primary purpose cannot enter, pass through, or be installed in them. This includes but it is not limited to: Building Automation System devices, Audio-Visual devices and supporting equipment (e.g. switches), and servers/workstations of any kind.
- 1.4.4 Materials unrelated to a TR's primary purpose cannot be stored in them, including but not limited to: cleaning supplies, furniture, and office supplies.
- 1.4.5 TRs in new buildings should be stacked in a straight vertical line to facilitate a clear vertical riser to be used for isolated communication system components, such as fibre optics, and isolated performance-based grounding. They should be situated as close to the centre of the section / floor / building to be cabled to maximise the area the facility will support and minimise the length of cable runs.
- 1.4.6 The data racks and or cabinets to be supplied and installed as per this document and drawings are to house the various cabling and network hardware associated with this project.

### **1.5 SUBMITTALS**

- 1.5.1 Shop drawings for each type of product indicated in the following document, including construction details, material descriptions, dimensions of individual components and profiles and finishes for the data racks and cabinets. Include rated capacities, operating characteristics along with furnished specialties and accessories.

## **2 PART 2- PRODUCTS**

### **2.1 FLOORING SYSTEM**

- 2.1.1 The floor finishing in TRs should be of Electrostatic Dissipative (ESD) type. Acceptable products are ESD Vinyl Flooring or ESD epoxy resin system complete with electrode earthing points.

The ESD system must withstand heavy foot and rolling load traffic, increase safety and prevent damage to electronic equipment by providing a continuous static dissipative surface throughout the space to earth ground as per ANSI/TIA-607 specifications (current version including all addenda), have low maintenance and be easy to clean.

### **2.2 DATA RACK**

- 2.2.1 Always consult with the UTM I&ITS Designate before procuring materials. Racks added to an existing installation must match model and maker of existing racks. New installations: two-post Distribution Rack System. Frame constructed of rugged 11 GA (0.120") steel, robotically welded and rigid.
- 2.2.2 Standard with 19" EIA 10-32 tapped mounting holes with permanently marked U-spacing identification.
- 2.2.3 5/16" sturdy steel base with anchor holes for mounting to floor.
- 2.2.4 Rack is standard with 1 copper 10-32 x 0.5" L double ground stud.
- 2.2.5 All racks come standard tapped double-sided.

### **2.3 DATA CABINET**

- 2.3.1 Frame constructed of rugged 11 GA (0.120") steel, robotically welded and rigid.
- 2.3.2 Frames are to be constructed of rugged heavy gauge steel.
- 2.3.3 All welded construction.
- 2.3.4 30"W x 36"D x 83" high foot print.
- 2.3.5 Lockable perforated split front doors.
- 2.3.6 Lockable perforated split rear doors.
- 2.3.7 Solid side panels.
- 2.3.8 Two sets of mounting angles (front and back) punched to EIA/TIA universal spacing cage nuts.
- 2.3.9 Minimum one two post ground lug.
- 2.3.10 The top lid of the cabinet is to have a minimum of six 4" holes (2 for fans and 4 for cabling). Include plates for holes not used.



- 2.3.11 One set of two fans with minimum of 6-foot power cords to connect to power bar at the rear of cabinet.
- 2.3.12 Cabinet colour is **BLACK**.
- 2.3.13 Two vertical wire managers (3-1/2" w x 9"d).
- 2.3.14 Frame constructed of rugged 11 GA (0.120") steel, robotically welded and rigid.

### **3 PART 3- EXECUTION**

#### **3.1 INSTALLATION**

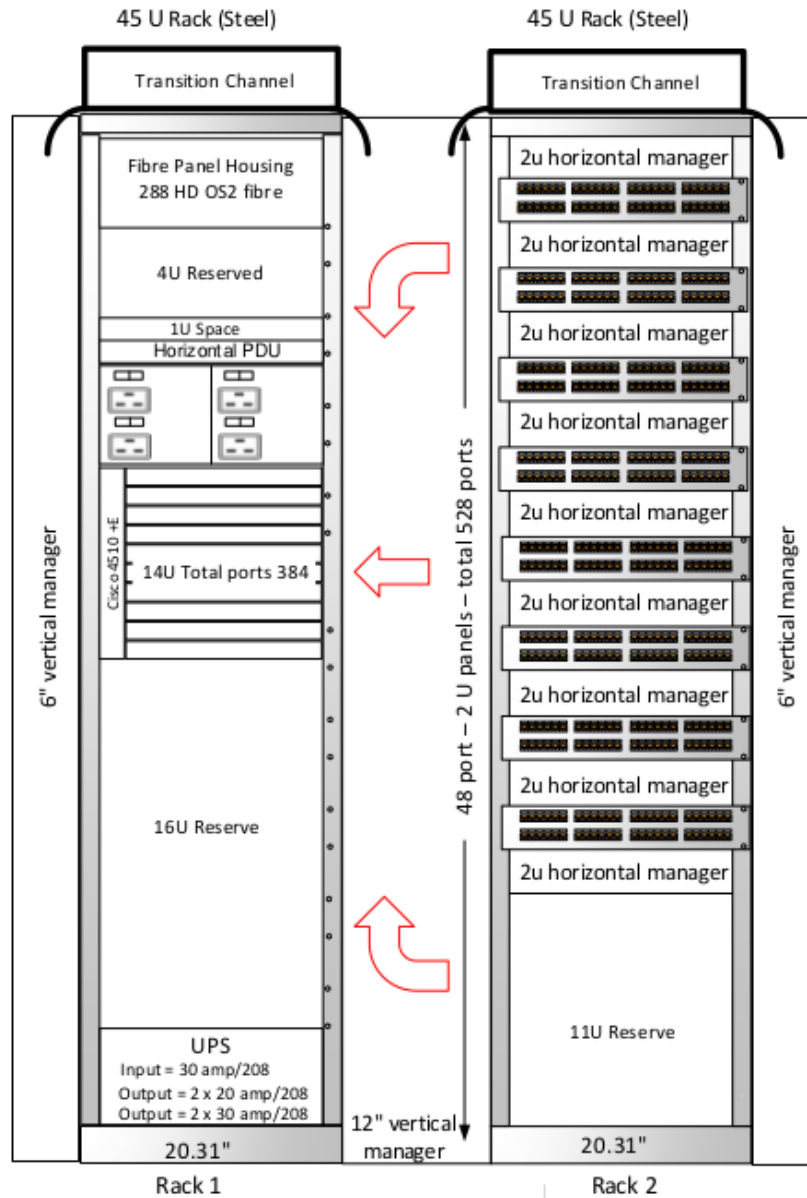
- 3.1.1 Installation of the ESD flooring system must follow the manufacturer's instructions and recommendations.
- 3.1.2 Install data racks along with vertical wire managers in the MTR or TR location as identified within this document and associated drawings.
- 3.1.3 Utilize proper fasteners for the vertical wire managers, power bars and all accessories as per manufacture's recommendations and in the various documents.
- 3.1.4 Bolt the racks to the floor using the appropriate size bolts to ensure the stability of the racks.
- 3.1.5 Gang racks with appropriate size bolts to ensure stability of the racks.
- 3.1.6 Refer to the Grounding and Bonding Section for more information for grounding of data racks and cabinets.
- 3.1.7 Install data cabinets along with vertical wire managers in the computer room location as identified within this document and associated drawings.

Power Requirement per Chassis rack

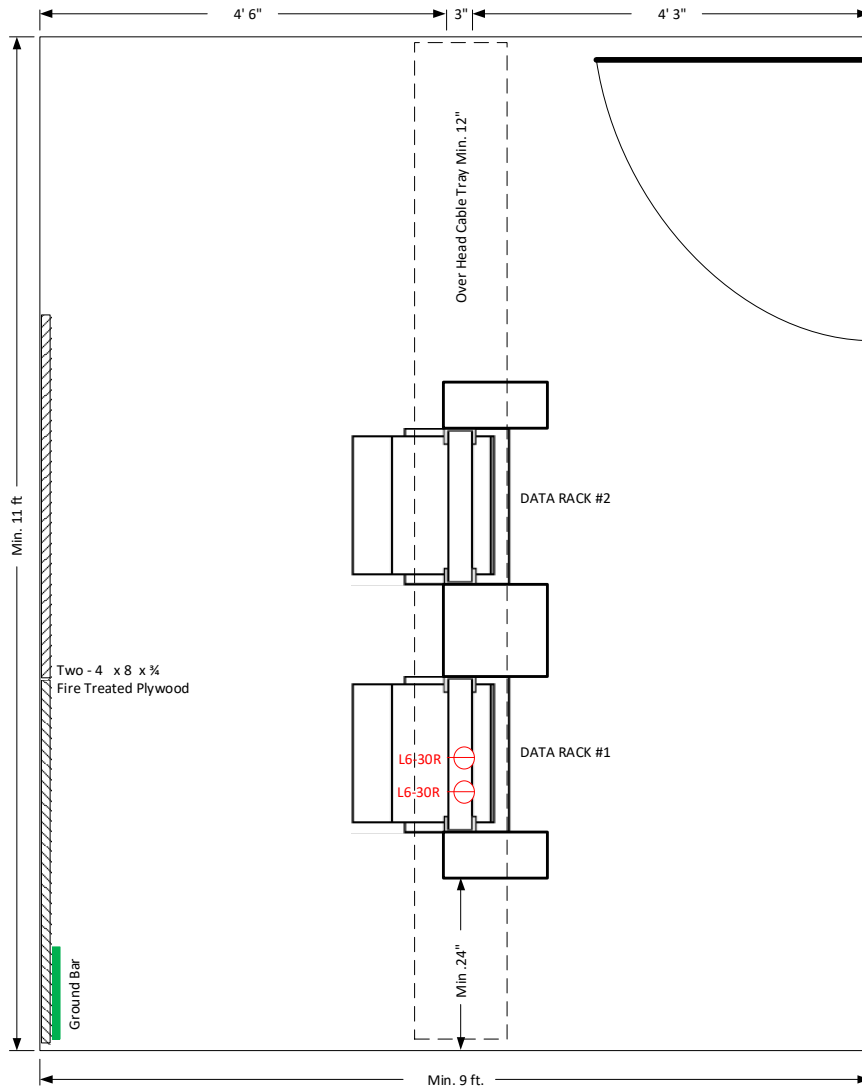


## TYPICAL RACK LAYOUT One Chassis mount

Total Cable density 384



← Denotes cable movement



**NOTES:**

- ① Minimum of 36" of clearance is required in front of the data racks to the drywall or any other devices located on the wall in front of racks (electrical and security panels).
- ② Minimum of 54" of clearance is required behind the data racks.
- ③ Minimum of 24" of clearance is required from the side of the vertical wire managers to wall.
- ④ Overhead cable tray to be a minimum of 12" wide x 4" high and be secured at each end and from above to prevent swaying.
- ⑤ Bottom of overhead cable tray to be minimum 12" above data racks.
- ⑥ Exact location of overhead tray may change due to site conditions.

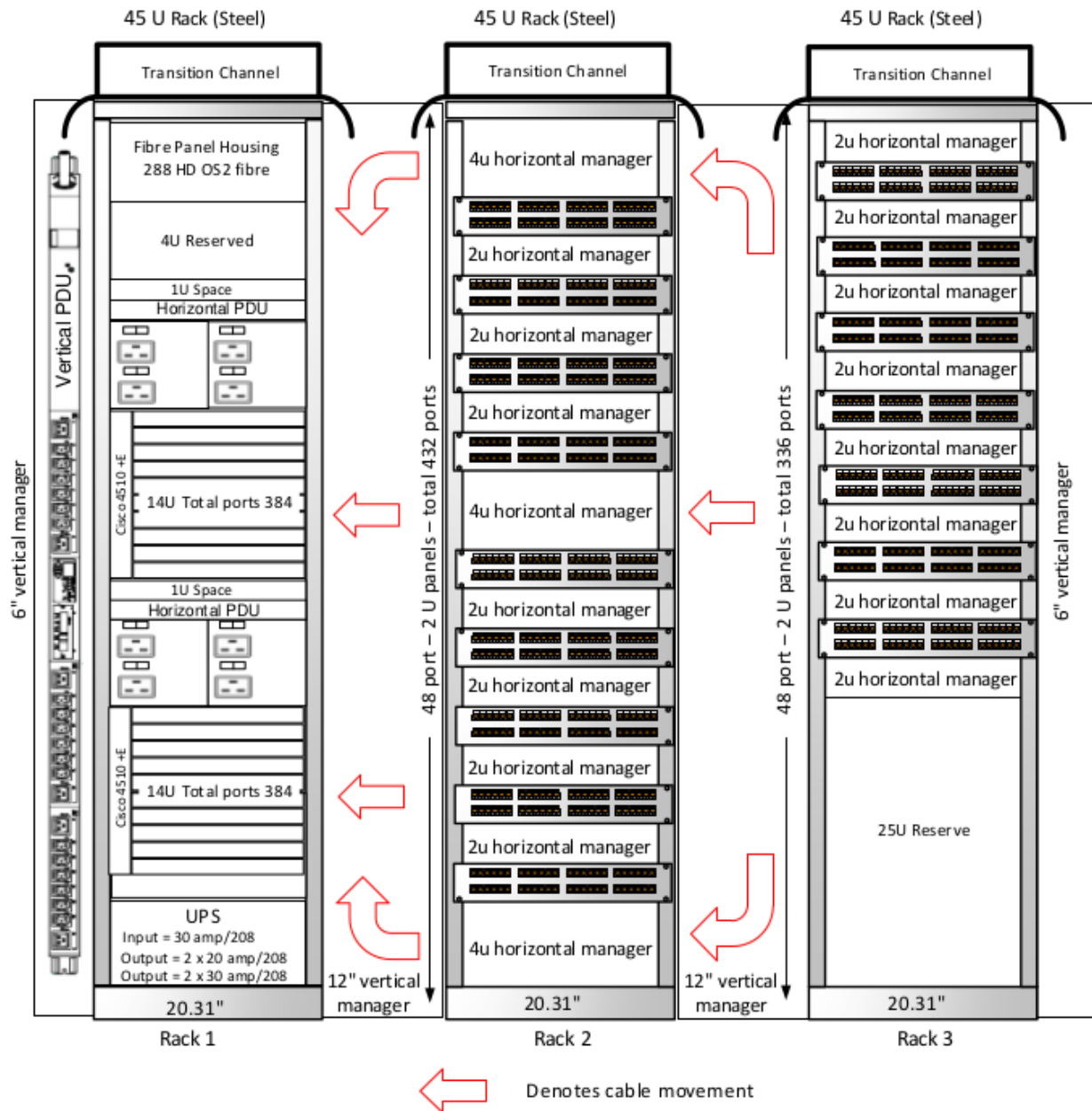
Not to Scale

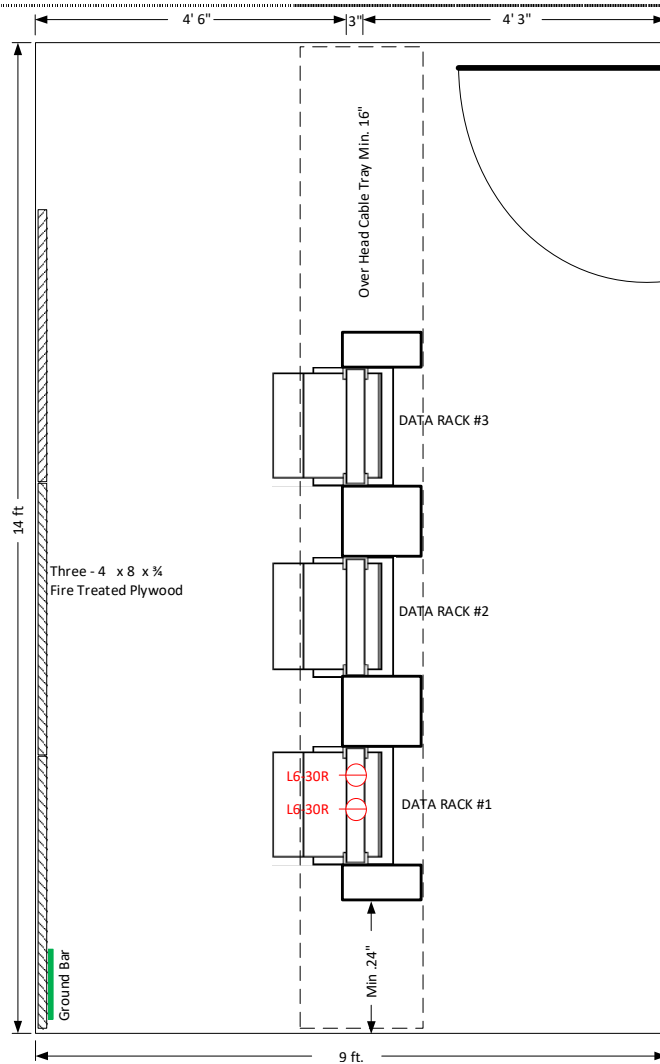
Power Requirement per Chassis rack



## TYPICAL RACK LAYOUT 2 Chassis Main distribution

Total Cable density 768





**NOTES:**

- ① Minimum of 36" of clearance is required from the data racks to the drywall or any other devices located on the wall in front of racks (electrical and security panels).
- ② Minimum of 54" of clearance is required behind the data racks.
- ③ Minimum of 24" of clearance is required from the side of the vertical wire managers to wall.
- ④ Overhead cable tray to be a minimum of 16" wide x 4" high and be secured at each end and from above to prevent swaying.
- ⑤ Bottom of overhead cable tray to be minimum 12" above data racks.
- ⑥ Exact location of overhead tray may change due to site conditions.

Not to Scale

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the communication termination blocks and patch panels for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communication Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 15 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 23 Communications Cable Management and Ladder Rack
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- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire



### **1.3 QUALITY ASSURANCE**

- 1.3.1 Only new products listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 The connecting hardware provides the means of transporting signals between the telecommunication outlet/connector and the horizontal cross connect location in the MTR or TR locations.

### **1.5 SUBMITTALS**

- 1.5.1 Shop drawings for each type of product indicated in the following document, including construction details, material descriptions, dimensions of individual components and profiles and finishes for the termination blocks and patch panels. Include rated capacities, operating characteristics along with furnished specialties and accessories.

## **2 PART 2- PRODUCTS**

### **2.1 MODULAR PATCH PANELS**

- 2.1.1 Always consult with the UTM I&ITS Designate before procuring materials. Patch panels added to an existing installation must match model and maker of existing panels. New installations: rack-mountable, modular, flat, 48 ports (2U), Keystone style.
- 2.1.2 All patch panels mount in 19" EIA standard mountings.
- 2.1.3 Pinout termination sequence is 568A.
- 2.1.4 Patch panels will be black.

### **2.2 GIGABIX MOUNTS**

- 2.2.1 To be used only on a per-case basis. Must be approved by the UTM I&ITS Designate prior to any work is performed, or equipment is ordered by the contractor.

### **3 PART 3- EXECUTION**

#### **3.1 INSTALLATION**

- 3.1.1 The patch panels will be installed beginning at the top of the passive data rack with a 2U horizontal wire manager installed in between each data patch panel as per section 27 11 23.
- 3.1.2 If existing patch panels are full, the contractor is to install new, black, 48-port patch panels (match existing) that is to be properly secured to the existing 19" data rack.

**END OF SECTION**





## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the communication cable management and ladder rack for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communication Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 15 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communications Termination Blocks and Patch panels
- 1.2.11 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire



### **1.3 QUALITY ASSURANCE**

- 1.3.1 Only new products listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 The cable management to be supplied and installed as per this document and drawings for proper routing of fibre and UTP patch cords from the network hardware associated with this project.

### **1.5 SUBMITTALS**

- 1.5.1 Shop drawings for each type of product indicated in the following document, including construction details, material descriptions, dimensions of individual components and profiles and finishes for the cable management. Include rated capacities, operating characteristics along with furnished specialties and accessories.

## **2 PART 2- PRODUCTS**

### **2.1 VERTICAL WIRE MANAGERS**

- 2.1.1 Frame shall be black with a smooth paint finish, single sided vertical manager with door and back-cover.
- 2.1.2 Fabricated of 16 GA (0.060") steel.
- 2.1.3 Channel style supports heavy cable load, while maintaining clean concealed appearance.
- 2.1.4 The vertical cable manager shall have a hinged door with a positive locking mechanism (non-magnetic).
- 2.1.5 The vertical wire manager shall have stiffeners welded inside for additional strength.
- 2.1.6 The openings for cable routing shall have finger type openings to ensure smooth transition of the patch cords without removing the patch cord from the patch panel or switch.
- 2.1.7 The vertical wire managers shall have the ability to fasten cable ties externally to the rear of the cable manager.
- 2.1.8 Each vertical wire manager shall have at least three (3) easily removable metal or plastic patch cord spools for ease of patch cord management.
- 2.1.9 The horizontal patch cord spools are to be at least expandable to 10".
- 2.1.10 The vertical wire managers shall be a minimum of 12" wide x 9" deep.
- 2.1.11 The end vertical wire managers shall be a minimum of 6" wide x 9" deep.

### **2.2 HORIZONTAL WIRE MANAGERS**

- 2.2.1 To be used only in existing TR locations.
- 2.2.2 Fabricated of 16 GA (0.060") steel.
- 2.2.3 All managers mount in 19" EIA standard mountings
- 2.2.4 Designed to hide and organize cabling.
- 2.2.5 Shall have a hinged door with a positive mechanism (non-magnetic).
- 2.2.6 Shall have at least a 7" deep profile to maintain proper bend radius of the patch cables.



- 2.2.7 Shall have openings for cable routing. Shall have finger type openings to ensure smooth transition of the patch cords without removing the patch cord from the patch panel or switch.
- 2.2.8 Shall be a minimum of 3-1/2" high x 7" deep (2U).

### **3 PART 3- EXECUTION**

#### **3.1 INSTALLATION**

- 3.1.1 Install vertical wire managers to the data racks in the MTR or TR location as identified within this document and associated drawings.
- 3.1.2 Utilize proper and all fasteners for the vertical wire managers.
- 3.1.3 The 2U horizontal wire manager shall be installed before and after every 48-port patch panel.

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the communication rack mounted power distribution units for communications systems work specified within.
- 1.1.3 Contractor to provide, install, and commission PDUs, power cables, UPSes, as per UTM specification, in TR. Proper grounding/bonding following industry best-practices (ANSI/TIA-607) must be ensured.
- 1.1.4 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.5 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communication Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 15 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communications Termination Blocks and Patch panels
- 1.2.11 27 11 23 Communications Cable management and Ladder Rack
- 1.2.12 27 13 13 Communications Copper Backbone Cabling
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling

- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

### **1.3 QUALITY ASSURANCE**

- 1.3.1 Only new products listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 The vertical power bars to be supplied and installed as per this document and drawings for network hardware associated with this project.

### **1.5 SUBMITTALS**

- 1.5.1 Shop drawings for each type of product indicated in the following document, including construction details, material descriptions, dimensions of individual components and profiles and finishes for the vertical power bars and the standoff brackets. Include rated capacities, operating characteristics along with furnished specialties and accessories.

## **2 PART 2- PRODUCTS**

### **2.1 VERTICAL POWER DISTRIBUTION UNITS**

- 2.1.1 Fabricated from 18 GA (0.048") steel.
- 2.1.2 Power bars mount into 19" EIA cabinet frames or network racks.
- 2.1.3 Must support a zero U installation method.
- 2.1.4 Must support dual Ethernet for daisy-chain connectivity.
- 2.1.5 Must support Visible Light Communication (VLC) technology for out of band monitoring.
- 2.1.6 Features breaker protection with reset button, three-stage surge protection, L6-30P input power, illuminated power switch showing power "ON", and colour-coded power outlets that are ORANGE and GREEN.
- 2.1.7 Must have a standard 10' power cord.
- 2.1.8 Standard Metered single phase 30 amp 208/240V capacity.

- 2.1.9 Digital meters must report at a minimum current in amps for each load bank.
- 2.1.10 Must have a minimum of 6 (six) C19 and 18 (eighteen) C13 connectors.

## **2.2 HORIZONTAL POWER DISTRIBUTION UNITS**

- 2.2.1 Fabricated from 18 GA (0.048”) steel.
- 2.2.2 Power bars mount into 19” EIA cabinet frames or network racks.
- 2.2.3 Must support dual Ethernet for daisy-chain connectivity.
- 2.2.4 Must support Visible Light Communication (VLC) technology for out of band monitoring.
- 2.2.5 Features breaker protection with reset button, three-stage surge protection, L6-30P input power, illuminated power switch showing power “ON”, and colour-coded power outlets that are ORANGE and GREEN.
- 2.2.6 Must have a standard 10’ power cord.
- 2.2.7 Standard Metered single phase 30 amp 208/240V capacity.
- 2.2.8 Digital meters must report at a minimum current in amps for each load bank.
- 2.2.9 Must have a minimum of 4 (four) C19 and 4 (four) C13 connectors.

## **3 PART 3- EXECUTION**

### **3.1 INSTALLATION**

- 3.1.1 Power distribution units, their installation and configuration are to be approved on a case by case basis. The size of the telecommunications facility and the type of equipment to be installed will govern the type and size of power distribution unit to be used.
- 3.1.2 UTM I&ITS will produce a rack diagram detailing how the approved PDUs are to be installed for a given project.
- 3.1.3 This information and approval can only come from the UTM I&ITS Designate.

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the copper cable splicing and terminations for the communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and bonding for Communication Systems
- 1.2.4 27 05 29 Hangers and Supports for Communications Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 05 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.11 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.12 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.13 27 13 13 Communications Copper Backbone Cabling
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors



1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

**1.3 QUALITY ASSURANCE**

- 1.3.1 All materials, equipment and parts comprising the unit's specified within this document shall be new and unused and of a current manufacture.
- 1.3.2 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

**1.4 SYSTEM DESCRIPTION**

- 1.4.1 This copper cabling is designed to be a backbone for analog telephone lines only.
- 1.4.2 This copper backbone cabling serves to interconnect the main PSTN demarcation point and the distributed analog voice demarcation points throughout the university.
- 1.4.3 Copper backbone cabling and its connecting hardware provides the means of transporting voice signals between the analog voice telecommunication room and the horizontal cross-connect location in the main PSTN demarcation room.
- 1.4.4 The copper backbone cabling shall contain no more than two transition points between the telecommunication room and the PSTN demarcation room.
- 1.4.5 Splices shall not be installed in the backbone cabling.
- 1.4.6 The backbone design is based on a star topology from each TR location to the designated demarc TR location.

**1.5 SUBMITTALS**

- 1.5.1 Shop drawings shall be submitted for each type of product indicated or equivalent in the following document.

## **2 PART 2- PRODUCTS**

### **2.1 BIX HARDWARE**

- 2.1.1 The 250 and 300 pair mounts can be wall mounted or installed in BIX frames.
- 2.1.2 These mounts feature an interlocking design to allow them to be stacked for larger cross-connect installations.
- 2.1.3 Can be assembled with interlocking distribution rings into easily expandable wall mounted installations.
- 2.1.4 The distribution ring is used for wall mount installations providing a cross-connect channel for jumper wires.
- 2.1.5 The distribution rings interlocks with all BIX type mounts.
- 2.1.6 The BIX distribution connector (1A) is a 25pr connector.
- 2.1.7 Each connector is equipped with 50 double-ended insulation displacement connection (IDC).

### **2.2 ENTRANCE PROTECTION**

- 2.2.1 Circa Telecom Building Entrance Products (or equivalent).
- 2.2.2 Corning QTPET Building Entrance Products (or equivalent).

## **3 PART 3- EXECUTION**

### **3.1 COPPER BACKBONE INSTALLATION**

- 3.1.1 The copper backbone shall be installed in the appropriate conduits, pathways and routes that have been approved for inter-building and intra-building.
- 3.1.2 One 200pr OSP cable (or equivalent) shall be installed from the campus PSTN demarc to the TR location designated as the demarcation location for that building.
- 3.1.3 The copper backbone cabling is to be protected at each building location using either one of the two following products:
  - Circa Telecom Building Entrance Products (or equivalent).
  - Corning QTPET Building Entrance Products (or equivalent).
- 3.1.4 All copper cable pairs are to be protected 100% using solid state protection modules.



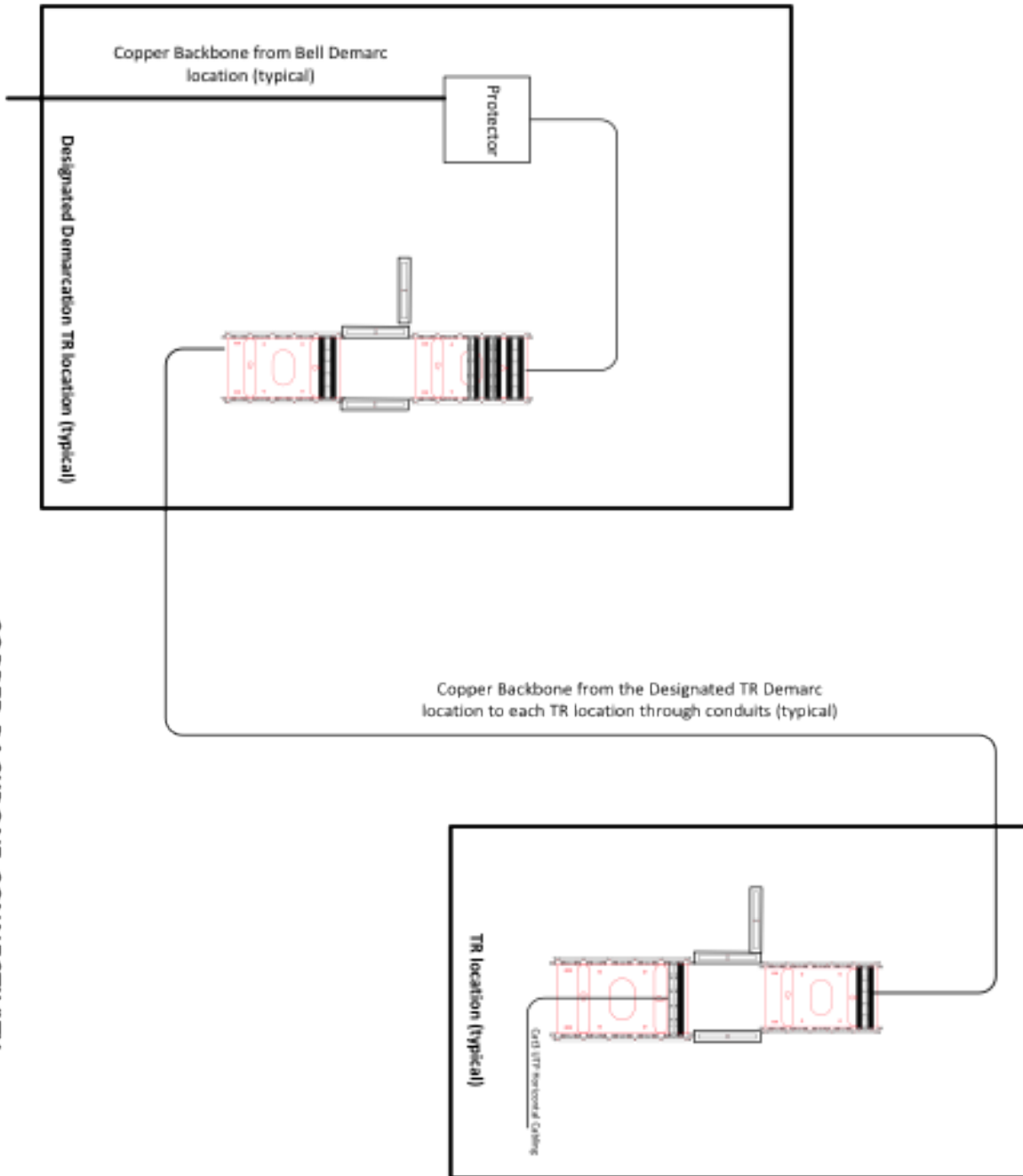
- 3.1.5 The copper stub cabling from the protectors is to be terminated in a 300-PR GIGABIX type hardware on BIX1A wafers with associated designations strips with proper coloured labels on the fire treated plywood in the PSTN demarc room and the designated TR demarcation room in the building.
- 3.1.6 The metallic sheath of all backbone cables shall be grounded using the appropriate manufacturer's bond clamp for the specific size of cable with a green #6 ground wire to the TGB.
- 3.1.7 The voice 25pr copper intra-building backbone shall be installed in conduit in plenum rated areas or in cable tray in non-plenum areas from the TR demarc location to the various TR locations on the floors.
- 3.1.8 For certain TR locations terminate the copper backbone cable on the designated GigaBIX 25pr connectors mounted in GigaBIX mounts in the TR room and on BIX1A1 connectors mounted in 300-PR GIGABIX mounts at the PSTN demarc location (no substitutes).

## **3.2 GENERAL INSTALLATION INFORMATION**

- 3.2.1 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the owner of the cabling system.
- 3.2.2 All backbone cables shall be identified by a self-adhesive label in accordance with the System Documentation section of this document, TIA/EIA-606-B, and section 27 05 53
- 3.2.3 The copper backbone shall be installed using the appropriate conduits, pathways and routes that have been approved.
- 3.2.4 Refer to section 27 05 36 for additional information on clearances.



**COPPER BACKBONE CONNECTIVITY**



**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the copper backbone for the communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communication Systems
- 1.2.4 27 05 29 Hangers and Supports for Communications Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 05 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.11 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.12 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.13 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.14 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

### **1.3 QUALITY ASSURANCE**

- 1.3.1 All materials, equipment and parts comprising the unit's specified within this document shall be new and unused and of a current manufacture.
- 1.3.2 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 This copper cabling is designed to be a backbone for analog telephone lines only.
- 1.4.2 This copper backbone cabling serves to interconnect the main PSTN demarcation point and the distributed analog voice demarcation points throughout the university.
- 1.4.3 Copper backbone cabling and its connecting hardware provides the means of transporting voice signals between the analog voice telecommunication room and the horizontal cross-connect location in the main PSTN demarcation room
- 1.4.4 The copper backbone cabling shall contain no more than two transition points between the telecommunication room and the PSTN demarcation room.
- 1.4.5 Splices shall not be installed in the backbone cabling.
- 1.4.6 The backbone design is based on a star topology from each TR location to the designated demarc TR location.

### **1.5 SUBMITTALS**

- 1.5.1 Shop drawings shall be submitted for each type of product indicated or equivalent in the following document.

## 2 PART 2- PRODUCTS

### 2.1 COPPER OSP BACKBONE CABLE (INTER-BUILDING)

- 2.1.1 The OSP-rated cable type is a rugged multi-pair cable series that meets and exceeds ANSI/TIA/EIA-568-A for Category 3 transmission characteristics.
- 2.1.2 Conductors 24 AWG solid copper.
- 2.1.3 Cable core-25pr cables all twisted placed in a cable core. 50pr cables and more are formed by binder groups of 25pr.
- 2.1.4 The copper cable is filled with waterproofing compound and wrapped with a non-hygroscopic core tape.
- 2.1.5 The copper cable shall have a flooding compound applied over the core and all surfaces of the shielded armour to resist moisture entry and corrosion.
- 2.1.6 The copper cable shall have a black polyethylene jacket, printed at intervals indicating cable code AWG listings (NRC Code and or CSA), verification, date, time, machine code and length (meters/feet).
- 2.1.7 The copper cable shall be terminated in protector type housings at each end of the cable and all copper pairs terminated on BIX type 1A connectors in BIX10A mounts at each end on plywood.

### 2.2 COPPER BACKBONE CABLE (INTRA-BUILDING)

- 2.2.1 The riser-rated cable type is a rugged multi-pair cable series that meets and exceeds ANSI/TIA/EIA-568-A for Category 3 transmission characteristics.
- 2.2.2 Conductors 24 AWG solid copper.
- 2.2.3 Insulation: Inner layer Polyolefin, Outer layer Polyvinyl Chloride.
- 2.2.4 Cable core-25pr cables all twisted placed in a cable core. 50pr cables and more are formed by binder groups of 25pr.
- 2.2.5 PVC jacket is gray.
- 2.2.6 Printed at intervals indicating cable code AWG listings (NRC Code and or CSA), verification, date, time, machine code and length (meters/feet).

## 3 PART 3- EXECUTION

### 3.1 NOT APPLICABLE

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the optical fiber splicing and terminations for the communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communication Systems
- 1.2.4 27 05 29 Hangers and Supports for Communications Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 05 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.11 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.12 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.13 27 13 13 Communications Copper Backbone Cabling
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- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire





### 1.3 QUALITY ASSURANCE

- 1.3.1 All materials, equipment and parts comprising the unit's specified within this document shall be new and unused and of a current manufacture.
- 1.3.2 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### 1.4 SYSTEM DESCRIPTION

- 1.4.1 Backbone cabling system connects all campus buildings and TRs together, comprising both inter-building and intra-building cabling. It includes backbone cables, intermediate and main cross-connects, mechanical terminations, patch cords and jumpers used for backbone-to-backbone cross connections.
- 1.4.2 The fibre backbone cabling shall contain no more than two transition points between TRs.
- 1.4.3 Splices shall not be installed in the backbone cabling.
- 1.4.4 The backbone design is based on a star topology from each TR location to the designated demarc TR location.
- 1.4.5 **Inter-building** backbone cabling shall consist of two paths, as geographically distinct as possible. One of the paths will be used to connect the building's MTR (endpoint A) to an existing TR located elsewhere on campus (endpoint B), henceforth known as fibre path (A↔B). The second path will either connect endpoint A to a third TR located elsewhere on campus (endpoint C), henceforth known as fibre path (A↔C), or to endpoint B over a separate conduit, henceforth known as fibre path (A↔B)'. Path option (A↔C) is always preferred over path option (A↔B)'. The UTM I&ITS Designate will identify for the contractor the building's MTR and determine which path option should be used, on a per case basis.
- 1.4.6 The number of OS1 and/or OS2 optical fibre strands for **inter-building** communication will either be 2 x 24 strands (amounting to 48 strands in total, henceforth known as option 1), or 2 x 48 strands (amounting to 96 strands in total, henceforth known as option 2). For option 1: the first bundle of 24 fibre strands will take fibre path (A↔B), and the second bundle of 24 fibre strands will either take fibre path (A↔C), or fibre path (A↔B)'. For option 2: the first bundle of 48 fibre strands will take fibre path (A↔B), and the second bundle of 48 fibre strands will either take fibre path (A↔C), or fibre path (A↔B)'. The UTM I&ITS Designate will determine which one of the options should be used on a per case basis.
- 1.4.7 **Intra-building** backbone cabling shall connect all TRs to the MTR in a given building. It consists of two paths (path A and path B) between each TR and the MTR, as geographically distinct as possible in the building. The UTM I&ITS Designate will identify for the contractor the building's TRs and MTR, and determine the path options on a per case basis.



- 1.4.8 The number of OS1 and/or OS2 optical fibre strands for intra-building communication will be 2 x 12 strands per TR to the MTR. The first bundle of 12 fibre strands will take path A identified in 1.4.7 (above). The second bundle of 12 fibre strands will take path B, also identified in 1.4.7 (above). As an example, consider a building with 3 TRs and 1 MTR. The first TR will have 12 strands of fibre between it and the MTR over path A, and another 12 strands of fibre between it and the MTR over path B. This process should repeat for the second and third TRs, which brings the total count of fibre strands for intra-building network connectivity, for this particular example, to 72 strands. The UTM I&ITS Designate will identify for the contractor the building's TRs and MTR, and determine the path options on a per case basis.

## 1.5 SUBMITTALS

- 1.5.1 Shop drawings shall be submitted for each type of product indicated or equivalent in the following document.
- 1.5.2 Upon completion the contractor must provide the manufacturer 25 Year warranty in name of client within ten (10) business days of project completion.

## 2 PART 2 - PRODUCTS

### 2.1 FIBRE BACKBONE CABLE

- 2.1.1 OS1 and/or OS2 single-mode optical fibre, depending on the case, is to be provided between TRs on campus, both for inter-building and intra-building deployments.
- 2.1.2 Fibre optic cables must be colour-coded as defined in the ANSI/TIA-598D scheme. The scheme shall apply to buffer tubes, fibre groups, fibre units and fibre strands.
- 2.1.3 **Inter-building** fibre shall be Belden (or equivalent), OSP-type cabling (Out Side Plant). It must be fully water blocked, loose tube, indoor/outdoor, gel-filled, plenum rated. Sheath consisting of an overall jacket and one or more layers of dielectric material applied over the core. Depending on the installation, armoured fibre may be required; The contractor should seek clarification with the UTM I&ITS Designate **prior** to purchasing the fibre cable.
- 2.1.4 **Inter-building** fibre requires a tracer/locator wire (2.1.5 below) **and** detectable warning tape (2.1.6 below) to be placed with direct burial cable, pipe and microduct installation (air-assisted cable).
- 2.1.5 A tracer/locator wire shall have a solid or stranded copper conductor, as per ASTM B-1, B-3, or B-8 (Standard Specification for Soft Drawn Bare Copper Wire). Insulation shall be yellow in colour and must have high molecular weight polyethylene (HMWPE) ASTM D-1248.



- 2.1.6 A detectable warning tape shall be orange in colour and be installed above the cable as set by the A.P.W.A standard. Sizes and dimensions of the tape are determined by the depth the cable is buried:

Warning Tape Width / Recommended Depth:

2" width for up to 12" depth

3" width for up to 18" depth

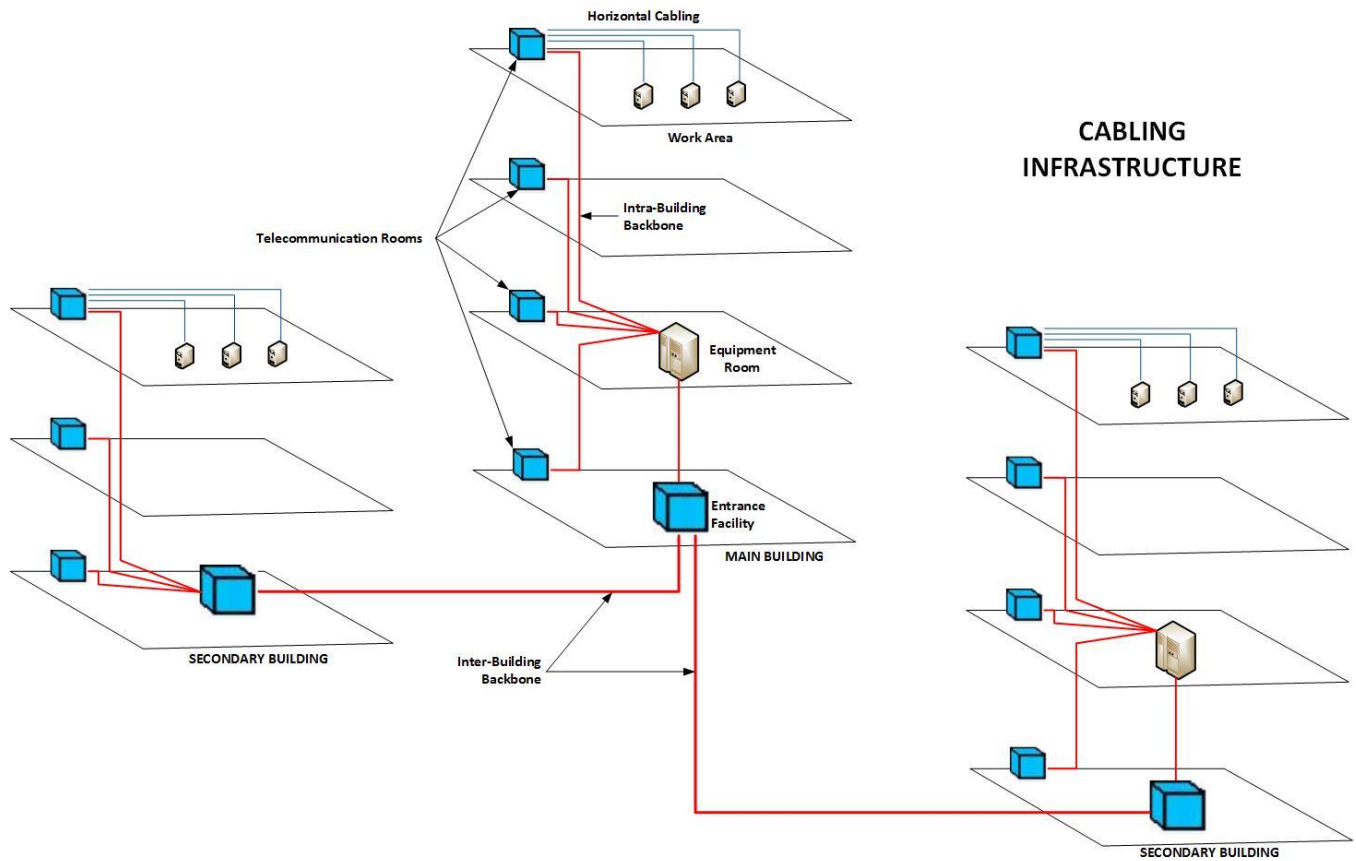
6" width for up to 24" depth

- 2.1.7 **Intra-building** fibre must be indoor/outdoor, tight buffer, plenum rated and installed in conduit.
- 2.1.8 **Intra-building** fibre installed in a cable tray must be with an interlocking aluminium armoured sheath. Armour must be bonded at both ends to earth ground.

### 3 PART 3 – EXECUTION

#### 3.1 UNDERGROUND CONDUITS: INSTALLATION

- 3.1.1 Fibre optic installations must be recorded in a professional manner including, but not limited to, proper route drawings, fibre strand assignments, loss readings and OTDR traces.
- 3.1.2 Newly installed conduits should be a minimum size of 4", complete with a pull cable.
- 3.1.3 For every 100-metre segment:
- The segment run shall be as straight as possible. If bends are required, the sum of all bend angles may add up to maximum 90 degrees (e.g. 1 x 95° bend, or 2 x 45° bends, 1 x 45° bend + 3 x 15° bends, and so on).
  - A junction box must be installed.
  - Lubricants compatible with the cable jacket must be used.



END OF SECTION

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the optical fiber splicing and terminations for the communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communication Systems
- 1.2.4 27 05 29 Hangers and Supports for Communications Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 05 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.11 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.12 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.13 27 13 13 Communications Copper Backbone Cabling
- 1.2.14 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.15 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.16 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.17 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors

1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

### 1.3 QUALITY ASSURANCE

- 1.3.1 All materials, equipment and parts comprising the unit's specified within this document shall be new and unused and of a current manufacture.
- 1.3.2 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### 1.4 SYSTEM DESCRIPTION

- 1.4.1 Backbone cabling system connects all campus buildings and TRs together, comprising both inter-building and intra-building cabling. It includes backbone cables, intermediate and main cross-connects, mechanical terminations, patch cords and jumpers used for backbone-to-backbone cross connections.
- 1.4.2 The fibre backbone cabling shall contain no more than two transition points between TRs.
- 1.4.3 Splices shall not be installed in the backbone cabling.
- 1.4.4 The backbone design is based on a star topology from each TR location to the designated demarc TR location.
- 1.4.5 Definition for **inter-building** backbone cabling: refer to 27 13 23, section 1.4.
- 1.4.6 Definition for **intra-building** backbone cabling: refer to 27 13 23, section 1.4.
- 1.4.7 Fusion splicing must be used for fibre termination.
- 1.4.8 Fibre cables must be identified by means of rigid PVC tags that clearly denotes building and TR numbers.

### 1.5 SUBMITTALS

- 1.5.1 Shop drawings shall be submitted for each type of product indicated or equivalent in the following document.
- 1.5.2 Upon completion the contractor must provide the manufacturer 25 Year warranty in name of client within ten (10) business days of project completion.



## **2 PART 2- PRODUCTS**

### **2.1 FIBRE PATCH PANEL-SYSTEMS AND ENCLOSURE**

- 2.1.1 An ultra high-density rack-mount fibre connectivity system shall be used for cross-connecting or interconnecting purposes.
- 2.1.2 The ultra high-density rack-mount fibre connectivity system must allow splice cassettes using LC manufactured pigtailed.
- 2.1.3 The fibre optic patch panel shall be mounted in a 482mm (19”) rack or cabinet.
- 2.1.4 The fibre optic patch panel may vary from 1U to 4U high and will be black in colour.
- 2.1.5 The unit shall have patch cord routing guides that allow a transition and segregation for fibre optic patch cords to exiting the sides of the fibre patch panel.
- 2.1.6 The splice cassette shall be complete with HD OS2 blue, 12 port, 24 fibre LC adapter.
- 2.1.7 Splice cassettes are to be identical in all manner on both sides of a given fibre run.
- 2.1.8 Standard manufactured OS2 LC pigtailed are to be used with each ultra high-density rack-mount fibre connectivity system splice cassette, complete with splice protectors.
- 2.1.9 The OS2 LC connector shall have a ceramic ferrule and a factory PC polish.

## **3 PART 3- EXECUTION**

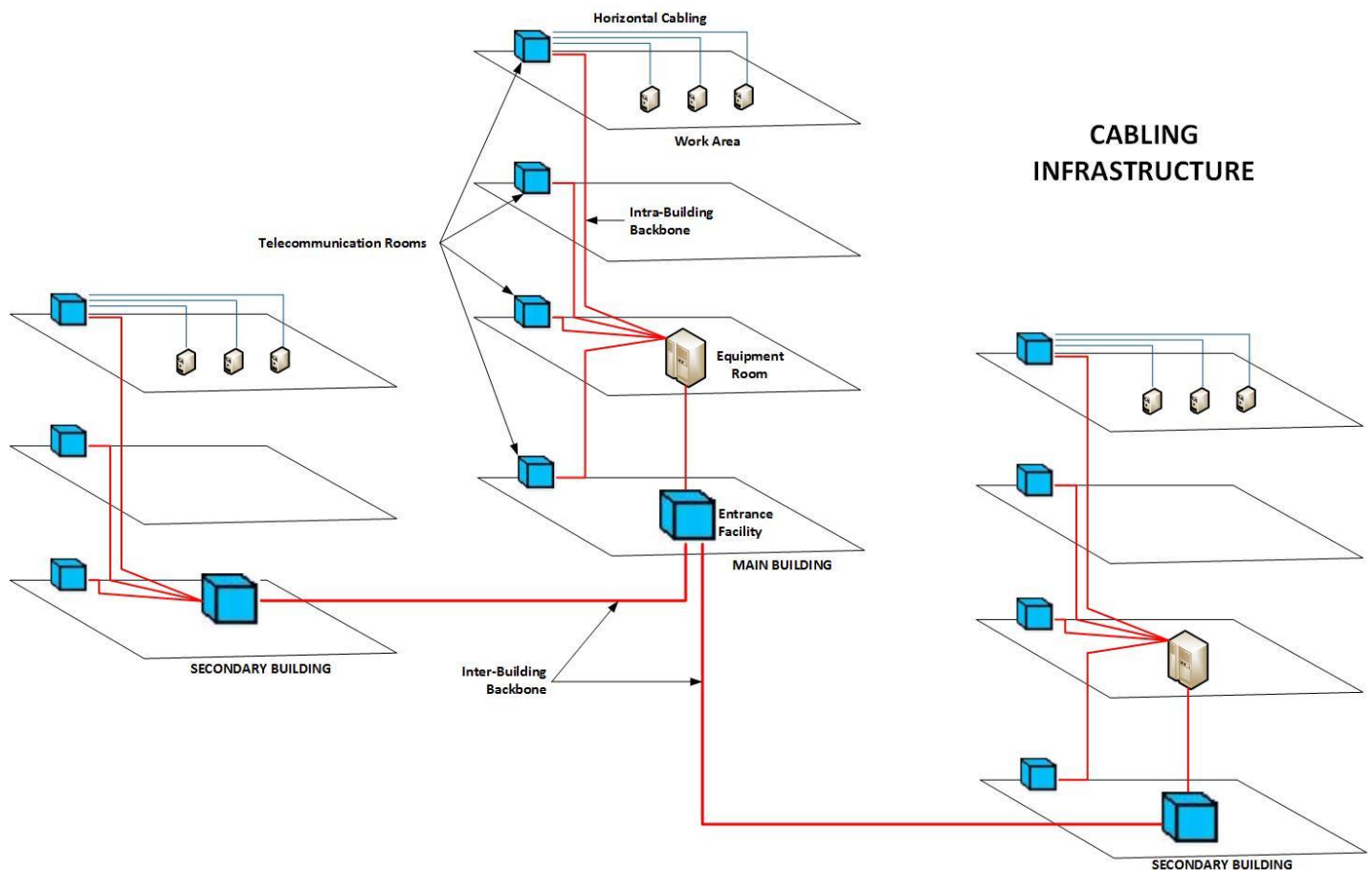
### **3.1 FIBRE BACKBONE INSTALLATION**

- 3.1.1 The backbone fibre installation shall comply with the ANSI/TIA 607 requirements (current version including all addenda).
- 3.1.2 Installation of inter-building cabling: refer to 27 13 23, section 1.4.
- 3.1.3 Installation of intra-building cabling: refer to 27 13 23, section 1.4.
- 3.1.4 When installing the fibre optic cable into the fibre optic patch panel, secure the aramid yarn to the patch panel with the tie down provided.
- 3.1.5 Terminate the fibre optic cable in the appropriate rack mounted fibre patch panel located at the top of the data rack using the “LC” type connector in the TR, MTR and data centre.
- 3.1.6 Exposed fibre shall be protected with yellow innerduct.



### 3.2 GENERAL INSTALLATION INFORMATION

- 3.2.1 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the owner of the cabling system.
- 3.2.2 All backbone cables shall be identified by a self-adhesive label in accordance with the System Documentation section of TIA/EIA-606-B.
- 3.2.3 The fibre backbone shall be installed and the appropriate conduits, pathways and routes that have been approved.



END OF SECTION



## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the horizontal voice cabling for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communications Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 05 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.11 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.12 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.13 27 13 13 Communications Copper Backbone Cabling
- 1.2.14 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.15 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.16 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.17 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

### **1.3 QUALITY ASSURANCE**

- 1.3.1 All materials, equipment and parts comprising the unit's specified within this document shall be new and unused and of a current manufacture.
- 1.3.2 Only new products and applications listed in this section may be used unless otherwise submitted for approval.
- 1.3.3 All horizontal voice cabling must be certified to manufacturer's warranty of at least 25 years.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 The horizontal voice cabling and its connecting hardware provides the means of transporting signals between the telecommunication outlet/connector and the horizontal cross connect location in the MTR or TR locations. This cabling and its connecting hardware are called the "Permanent Link" a term that is used in testing protocols.
- 1.4.2 The horizontal voice cabling shall not contain any transition points or consolidation points between the horizontal cross-connect and the telecommunications outlet/connector. If a transition point or consolidation point is necessary for the functionality of the horizontal voice cabling, a request shall be submitted to the UTM I&ITS Designate for approval.
- 1.4.3 Bridge taps and splices shall not be installed in the voice horizontal cabling.
- 1.4.4 The maximum distance for horizontal voice cabling is 90m (295 feet).

### **1.5 PERFORMANCE REQUIREMENTS**

- 1.5.1 The complete end-to-end horizontal cabling system shall meet or exceed the requirements for Cat 6A cabling as specified by the TIA/EIA-568-C.2 Telecommunication Cabling Standard.
- 1.5.2 The complete end-to-end horizontal cabling system shall meet or exceed the requirements for Class E cabling as specified by the ISO/IEC 11801 International Standard.

### **1.6 SUBMITTALS**

- 1.6.1 Shop drawings shall be submitted for each type of product indicated or equivalent in the following document.

## **2 PART 2- PRODUCTS**

### **2.1 BALANCED TWISTED-PAIR CABLES**

- 2.1.1 Voice cabling shall be 4-pair balanced twisted pair Cat 6A UTP, plenum rated (CMP) cables for all cabling projects
- 2.1.2 Cat 6A cable jacket colour: to be determined by the UTM I&ITS Designate.
- 2.1.3 The cable conductors shall be 23 AWG solid copper.
- 2.1.4 The outside diameter (OD) shall be no greater than 6.73mm (0.265").
- 2.1.5 The minimum bend radius shall be no greater than four times the OD of the cable.

## **3 PART 3- EXECUTION**

### **3.1 VOICE CABLE INSTALLATION**

- 3.1.1 The contractor shall clarify with the UTM I&ITS Designate the ANSI/TIA termination standard that must be employed, prior to commencing the work.
- 3.1.2 No voice cable shall exceed 90 meters. Any cables longer than 90 meters shall be reported immediately to the UTM I&ITS Designate.
- 3.1.3 Pair untwist at the termination point shall not exceed 13mm (0.5").
- 3.1.4 Bend radius of the cable along its pathway and at the termination areas shall not be less than four times the OD of the cable.
- 3.1.5 The pulling tension on any 4-pair balanced UTP cable shall not exceed 110N (25lbf).
- 3.1.6 All cable ties shall be black, touch-fasteners (a.k.a. velcro fasteners) style.
- 3.1.7 No plastic cable ties are allowed. If found on site during any phase of the project the plastic cable ties will be removed by the contractor at the contractor's expense.
- 3.1.8 All exposed cables in TRs are to be placed in a neat and professional manner and routed in accordance with the specifications and drawings provided.
- 3.1.9 If installing horizontal voice cabling outlets/connectors through floors/walls and into furniture access locations, all exposed cabling at the workstation between the wall/floor and the furniture access locations is to be wrapped with black split loom tubing, size and length as required to suit.
- 3.1.10 Cable raceways shall not be filled greater than the TIA/EIA-569-B recommended maximum fill for the particular raceway type, or 40% whichever is less.
- 3.1.11 Cable support systems shall be provided and installed by contractor everywhere along the cable pathway and shall adhere to the following:



- 3.1.11.1 Existing cable tray and adjustable cable support as defined in sections 27 05 29 and 27 05 36 shall be used where available. Existing cable supports not specified in those documents (e.g. J-hooks) shall not be used for new cabling, new cable supports shall be installed adjacent to them
- 3.1.11.2 All cable support systems shall be self-supporting.
- 3.1.11.3 At no point shall cable(s) rest on acoustic ceiling grids, water pipes, metal conduits, ceiling panels or any other structure not defined as a cable support.
- 3.1.11.4 Horizontal voice cabling shall be supported by use of cable trays where clearances allow for the installation of cable trays. See section 27 05 36 for details on cable tray systems and minimum required clearances.
- 3.1.11.5 Where clearances do not allow for the installation of cable trays, contractor shall submit a request to the UTM I&ITS Designate for additional instructions. UTM I&ITS may, at its own discretion, lower the minimum required clearances to allow for the installation of cable tray, or instruct contractor to use alternate cable supports as defined in sections 27 05 29 and 27 05 33.
- 3.1.12 Horizontal voice cables shall be bundled in groups of no more than 16 cables. Cable bundle quantities in excess of 16 cables may cause deformation of the bottom cables within the bundle, which will degrade the performance of those cables.
- 3.1.13 The horizontal voice cable shall be installed above fire-sprinkler systems and shall not be attached to such systems or any associated ancillary equipment or hardware. The cabling system and its associated pathways shall be installed so that they do not obscure any valves, fire alarm conduit(s), boxes, or other control devices.
- 3.1.14 Any voice cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the owner of the cabling system.
- 3.1.15 All voice cables shall be identified by a self-adhesive label in accordance with the Identification for Comm. System section of this specification, Section 27 05 53.
- 3.1.16 Any voice cable located on a penthouse level for other services (BAS, elevator room, mechanical room, electrical room) shall be installed to the closet TR location via conduit.
- 3.1.17 All voice cables must be terminated on the same floor as the workstation location. The exception to this rule is item 3.1.16.
- 3.1.18 Termination jacks on both ends of the permanent link shall be Keystone style T568A/B. Colour to be determined by the UTM I&ITS Designate.
- 3.1.19 To minimize any possibility of disruption, maintain the following minimum clearances from electrical and heat sources when routing cables:



<b>CLEARANCES TABLE</b>	
<b>Item</b>	<b>Minimum Clearance</b>
Motor	1.2 m ( 4'-0" )
Transformers	1.2 m ( 4'-0" )
Conduit and cables used for electrical distribution less than 1kV	0.3 m ( 1'-0" )
Conduit and cables used for electrical distribution greater than 1kV	1.0 m ( 3'-0" )
Fluorescent Light Fixtures	12 cm ( 5" )
Pipes (gas, oil, water, etc)	0.3 m ( 1'-0" )
HVAC (equipment, ducts, etc)	15 cm ( 6 " )

END OF SECTION

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the horizontal data cabling for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communications Systems
- 1.2.4 27 05 29 Hangers and Supports for Communications Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 05 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.11 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.12 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.13 27 13 13 Communications Copper Backbone Cabling
- 1.2.14 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.15 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.16 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.17 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.18 27 15 43 Communication Faceplates and Connectors
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire

### **1.3 QUALITY ASSURANCE**

- 1.3.1 All materials, equipment and parts comprising the unit's specified within this document shall be new and unused and of a current manufacture.
- 1.3.2 Only new products and applications listed in this section may be used unless otherwise submitted for approval.
- 1.3.3 All horizontal data cabling must be certified to manufacturer's warranty of at least 25 years.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 The horizontal data cabling and its connecting hardware provides the means of transporting signals between the telecommunication outlet/connector and the horizontal cross connect location in the MTR or TR locations. This cabling and its connecting hardware are called the "Permanent Link" a term that is used in testing protocols.
- 1.4.2 The horizontal data cabling shall not contain any transition points or consolidation points between the horizontal cross-connect and the telecommunications outlet/connector. If a transition point or consolidation point is necessary for the functionality of the horizontal data cabling, a request shall be submitted to the UTM I&ITS Designate for approval.
- 1.4.3 Bridge taps and splices shall not be installed in the data horizontal cabling.
- 1.4.4 The maximum distance for horizontal data cabling is 90m (295 feet).

### **1.5 PERFORMANCE REQUIREMENTS**

- 1.5.1 The complete end-to-end horizontal cabling system shall meet or exceed the requirements for Cat 6A cabling as specified by the TIA/EIA-568-C.2 Telecommunication Cabling Standard.

### **1.6 SUBMITTALS**

- 1.6.1 Shop drawings shall be submitted for each type of product indicated or equivalent in the following document.

## 2 PART 2- PRODUCTS

### 2.1 BALANCED TWISTED-PAIR CABLES

- 2.1.1 Always consult with the UTM I&ITS Designate before procuring materials. Data cabling added to an existing installation must match the manufacturer of the current infrastructure, i.e. must match maker of existing cables, connectors, patch panels and racks. This is best-practice and allows new cables to be added to an already certified infrastructure.
- 2.1.2 Data cabling shall be 4-pair balanced twisted pair Cat 6A UTP, plenum rated (CMP) cables for all cabling projects.
- 2.1.3 The horizontal Cat 6A data cable jackets shall be **blue** in colour, and its hue shall be as close as possible to colour code #0000FF.
- 2.1.4 The cable conductors shall be 23 AWG solid copper.
- 2.1.5 The outside diameter (OD) shall be no greater than 6.73mm (0.265").
- 2.1.6 The minimum bend radius shall be no greater than four times the OD of the cable.

## 3 PART 3- EXECUTION

### 3.1 DATA CABLE INSTALLATION

- 3.1.1 The contractor shall clarify with the UTM I&ITS Designate the ANSI/TIA termination standard that must be employed, prior to commencing the work
- 3.1.2 No data cable shall exceed 90 meters. Any cables longer than 90 meters shall be reported immediately to the UTM I&ITS Designate.
- 3.1.3 Pair untwist at the termination point shall not exceed 13mm (0.5").
- 3.1.4 Bend radius of the cable along its pathway and at the termination areas shall not be less than four times the OD of the cable.
- 3.1.5 The pulling tension on any 4-pair balanced UTP cable shall not exceed 110N (25lbf).
- 3.1.6 All cable ties shall be black, touch-fasteners (a.k.a. velcro fasteners) style.
- 3.1.7 No plastic cable ties are allowed. If found on site during any phase of the project the plastic cable ties will be removed by the contractor at the contractor's expense.
- 3.1.8 All exposed cables in TRs are to be placed in a neat and professional manner and routed in accordance with the specifications and drawings provided.
- 3.1.9 If installing horizontal data cabling outlets/connectors through floors/walls and into furniture access locations, all exposed cabling at the workstation between the



wall/floor and the furniture access locations is to be wrapped with black split loom tubing, size and length as required to suit.

- 3.1.10 Cable raceways shall not be filled greater than the TIA/EIA-569-B recommended maximum fill for the particular raceway type, or 40% whichever is less.
- 3.1.11 Cable support systems shall be provided and installed by contractor everywhere along the cable pathway and shall adhere to the following:
  - 3.1.11.1 Existing cable tray and adjustable cable support as defined in sections 27 05 29 and 27 05 36 shall be used where available. Existing cable supports not specified in those documents (e.g. J-hooks) shall not be used for new cabling, new cable supports shall be installed adjacent to them
  - 3.1.11.2 All cable support systems shall be self-supporting.
  - 3.1.11.3 At no point shall cable(s) rest on acoustic ceiling grids, water pipes, metal conduits, ceiling panels or any other structure not defined as a cable support.
  - 3.1.11.4 Horizontal data cabling shall be supported by use of cable trays where clearances allow for the installation of cable trays. See section 27 05 36 for details on cable tray systems and minimum required clearances.
  - 3.1.11.5 Where clearances do not allow for the installation of cable trays, contractor shall submit a request to the UTM I&ITS Designate for additional instructions. UTM I&ITS may, at its own discretion, lower the minimum required clearances to allow for the installation of cable tray, or instruct contractor to use alternate cable supports as defined in sections 27 05 29 and 27 05 33.
- 3.1.12 Horizontal data cables shall be bundled in groups of no more than 16 cables. Cable bundle quantities in excess of 16 cables may cause deformation of the bottom cables within the bundle, which will degrade the performance of those cables.
- 3.1.13 The horizontal data cable shall be installed above fire-sprinkler systems and shall not be attached to such systems or any associated ancillary equipment or hardware. The cabling system and its associated pathways shall be installed so that they do not obscure any valves, fire alarm conduit(s), boxes, or other control devices.
- 3.1.14 Any data cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the owner of the cabling system.
- 3.1.15 All data cables shall be identified by a self-adhesive label in accordance with the Identification for Comm. System section of this specification, Section 27 05 53.
- 3.1.16 Any data cable located on a penthouse level for other services (BAS, elevator room, mechanical room, electrical room) shall be installed to the closet TR location via conduit.
- 3.1.17 All data cables must be terminated on the same floor as the workstation location. The exception to this rule is item 3.1.16.



- 3.1.18 Coloured jacks will be used to differentiate cable types. The colour scheme for 8P8C modular connector jacks (a.k.a. RJ45) is the following:

Description	Cable Type
Keystone Style T568A/B, Blue	Workstation Data Cabling
Keystone Style T568A/B, Colour to be determined by the UTM I&ITS Designate	Voice Cabling
Keystone Style T568A/B, Yellow	Security Cabling (e.g. security cameras)
Keystone Style T568A/B, Orange	Wireless Access Point Data Cabling
Keystone Style T568A/B, Red	Building Automation Data Cabling

- 3.1.19 To minimize any possibility of disruption, maintain the following minimum clearances from electrical and heat sources when routing cables:

<b>CLEARANCES TABLE</b>	
<b>Item</b>	<b>Minimum Clearance</b>
Motor	1.2 m ( 4'-0" )
Transformers	1.2 m ( 4'-0" )
Conduit and cables used for electrical distribution less than 1kV	0.3 m ( 1'-0" )
Conduit and cables used for electrical distribution greater than 1kV	1.0 m ( 3'-0" )
Fluorescent Light Fixtures	12 cm ( 5" )
Pipes (gas, oil, water, etc)	0.3 m ( 1'-0" )
HVAC (equipment, ducts, etc)	15 cm ( 6 " )

**END OF SECTION**

## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the faceplates and connectors for the communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communication Systems
- 1.2.4 27 05 29 Hangers and Supports for Communications Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 05 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
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- 1.2.15 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.16 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.17 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.18 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.19 27 16 19 Communication Patch Cords and Cross Connect Wire



### **1.3 QUALITY ASSURANCE**

- 1.3.1 All materials, equipment and parts comprising the unit's specified within this document shall be new and unused and of a current manufacture.
- 1.3.2 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 The horizontal voice and data connectors provide the means of transporting signals between the telecommunication outlet/connector and the horizontal cross connect location in the MTR or TR locations.

### **1.5 PERFORMANCE REQUIREMENTS**

- 1.5.1 The voice and data connecting hardware shall match the horizontal voice and data cabling specifications for performance.

### **1.6 SUBMITTALS**

- 1.6.1 Shop drawings shall be submitted for each type of product indicated or equivalent in the following document.

## **2 PART 2- PRODUCTS**

### **2.1 UTP CONNECTORS**

- 2.1.1 Minimum rates for the 8P8C modular connector jacks (a.k.a. RJ45) are as follows: insertion loss 0.10dB @ 100MHz, return loss 27dB @ 100MHz.
- 2.1.2 The PSANEXT isolation between modules must be greater than 70dB @ 100 MHz when connectors are mounted side by side, top to bottom in a 48 ports 1U configuration.
- 2.1.3 Colour details for 8P8C modular connector jacks are found in section 27 15 01 19 – 3.1.18.

### **2.2 FACEPLATES**

- 2.2.1 Available in 2, 4 and 6 port configurations for greater workstation outer density.
- 2.2.2 Faceplates shall be available in multiple colours to match any suit décor.
- 2.2.3 Faceplates are compatible for Cat 6A 8P8C modular connector (Keystone).
- 2.2.4 Space to facilitate outlet labelling identification and ease of network management.

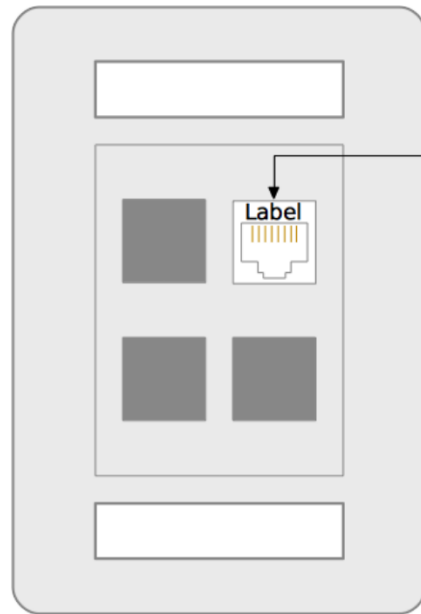


- 2.2.5 Blanks supplied to fill all unused ports.
- 2.2.6 Faceplates to fit over standard NEMA type outlet boxes or wall mounting bracket for flush mounting installations
- 2.2.7 Faceplates shall be able to fit over an interface adaptor boxes for surface mount installations.

### 3 PART 3- EXECUTION

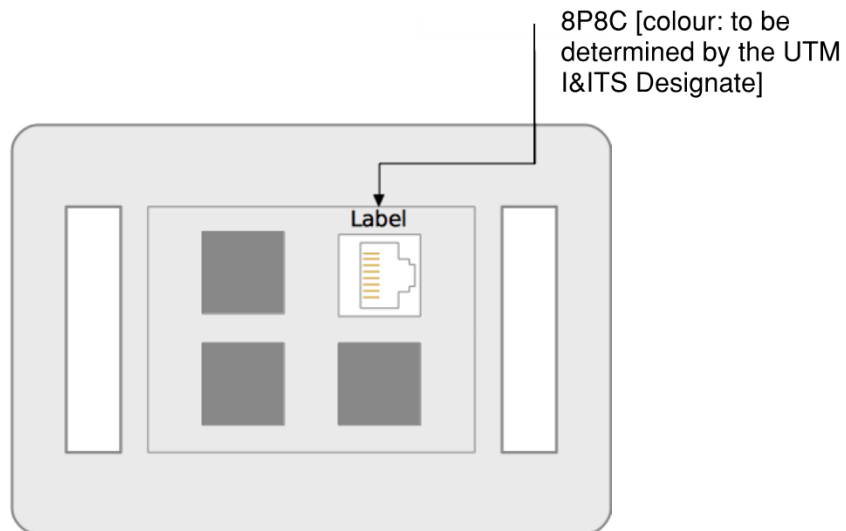
#### 3.1 VOICE CONNECTOR TERMINATION

- 3.1.1 At the workstation faceplate terminate each voice cable on an 8P8C modular connector jack wired TIA/EIA-568A ISDN standard.
- 3.1.2 For all voice locations there shall be one Cat 6A voice cable terminated at each end as per this document.
- 3.1.3 The voice 8P8C modular connector jack shall occupy the far right position of the 4-port faceplate (top to bottom).
- 3.1.4 Use blanks for all unused ports. Blanks to match faceplate colour.
- 3.1.5 Where communications are ganged with electrical décora type, inserts are to be used and the colour is to match electrical.
- 3.1.6 Where the voice cabling is terminated at a furniture workstation the 4-port faceplate shall be installed in an interface surface adaptor box and secured to the furniture base using short self-tapping screws. (***Do not install the self-adhesive product that is with the interface surface adapter box.***)
- 3.1.7 Include all necessary furniture adaptors/spacers/surface boxes/Keystone type jacks and any other hardware required to ensure the faceplate can be properly installed/secured to the furniture while maintaining a proper bend radius.
- 3.1.8 Include all necessary adaptors/spacers/surface boxes/Keystone type jacks and any other hardware required to ensure the faceplate can be properly installed in the floor box while maintaining a proper bend radius.
- 3.1.9 Any voice cable damaged or exceeding recommended installation parameters during termination shall be replaced by the contractor prior to final acceptance at no cost to the owner of the cabling system.
- 3.1.10 All voice cables shall be identified by a self-adhesive label in accordance with the Identification for Comm. System section of this specification, 27 05 53.
- 3.1.11 Each voice cable shall be clearly labeled on the cable jacket within 4 inches of the termination behind the connector at the faceplate. Labels obscured from view will not be accepted and will be replaced by the contractor at no cost to the client.



8P8C [colour: to be determined by the UTM I&ITS Designate]

**Wall Faceplate**



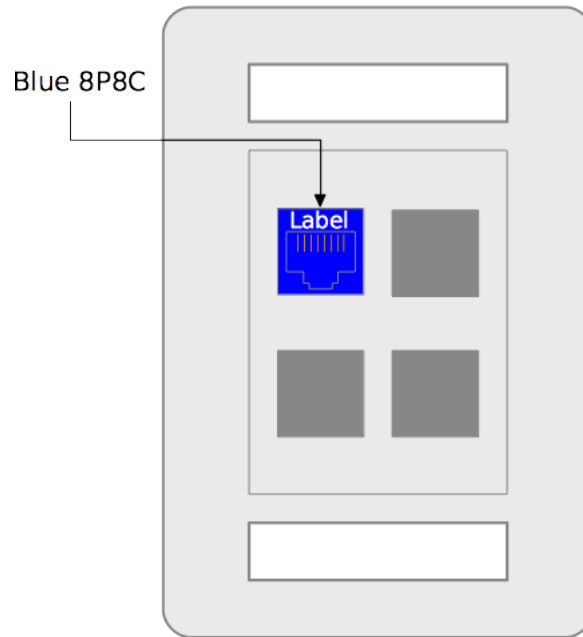
8P8C [colour: to be determined by the UTM I&ITS Designate]

**Horizontal Faceplate**

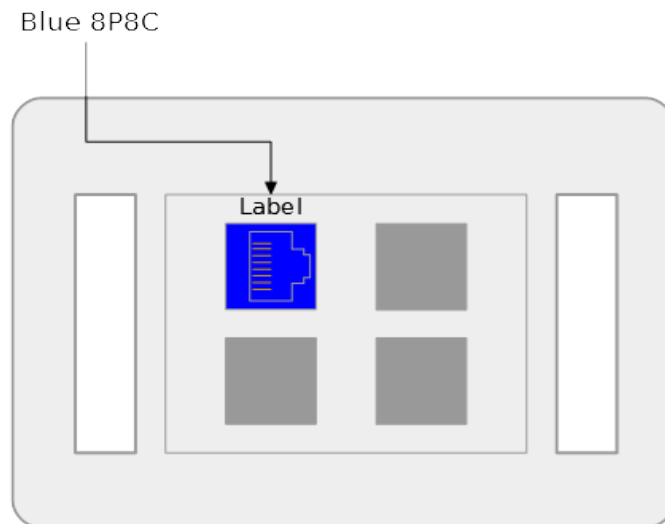


### 3.2 DATA CONNECTOR TERMINATION

- 3.2.1 At the workstation faceplate terminate each data cable on a blue 8P8C modular connector Keystone jack wired TIA/EIA-568A ISDN standard.
- 3.2.2 The data 8P8C modular connector jack will be blue in colour and shall occupy the top left position of the 4-port faceplate (top to bottom).
- 3.2.3 Use blanks for all unused ports. Blanks to match faceplate colour.
- 3.2.4 Where communications are ganged with electrical décora type inserts are to be used and the colour is to match electrical.
- 3.2.5 Where the data cabling is terminated at a furniture workstation the 4-port faceplate shall be installed in an interface surface adaptor box and secured to the furniture base using short self-tapping screws. (**Do not install the self-adhesive product that is with the interface surface adaptor box**).
- 3.2.6 Include all necessary furniture adaptors/spacers/surface boxes/Keystone type jacks and any other hardware required to ensure the faceplate can be properly installed/secured to the furniture while maintaining a proper bend radius.
- 3.2.7 Include all necessary adaptors/spacers/surface boxes/Keystone type jacks and any other hardware required to ensure the faceplate can be properly installed in the floor box while maintaining a proper bend radius.
- 3.2.8 Any data cable damaged or exceeding recommended installation parameters during termination shall be replaced by the contractor prior to final acceptance at no cost to the owner of the cabling system.
- 3.2.9 All data cables shall be identified by a self-adhesive label in accordance with the Identification for Comm. System section of this specification, 27 05 53.
- 3.2.10 Each data cable shall be clearly labeled on the cable jacket within 4 inches of the termination behind the connector at the faceplate. Labels are to be a self-laminating wrap around style. Labels obscured from view will not be accepted and will be replaced by the contractor at no cost to the client.
- 3.2.11 The data cabling will be terminated on either existing patch panels or on new 48-port patch panels. I&ITS designate to confirm per project.
- 3.2.12 If existing patch panels are full, the contractor is to install new, black 48-port patch panels (match existing) that is to be properly secured to the existing 19" data rack.
- 3.2.13 If a new patch panel is installed below an existing full panel, a 2RU horizontal cable manager will be installed above the new panel to preserve the interlacing of patch panels and horizontal cable manger as per section 27 11 23.
- 3.2.14 Pair untwist at the termination point shall not exceed 13mm (0.5in).
- 3.2.15 All cable ties shall be black, touch-fasteners (a.k.a. velcro fasteners) style.



**Wall Faceplate**



**Horizontal Faceplate**

**END OF SECTION**



## **1 PART 1- GENERAL**

### **1.1 WORK INCLUDED**

- 1.1.1 Comply with the General requirements and documents referred to within.
- 1.1.2 Provide labour, materials, products, equipment and services to complete the patch cords, station cords and cross-connect wire for communications systems work specified within.
- 1.1.3 To be read in conjunction with associated electrical and communication specification sections.
- 1.1.4 The contractor should seek clarification from the UTM I&ITS Designate on site conditions and on any technical, work and/or premises-related questions without delay.

### **1.2 RELATED DOCUMENTS**

- 1.2.1 Drawings and general provisions of the contract, including general and supplementary conditions apply to this section. Refer to the following for additional information.
- 1.2.2 27 05 13 Communication Services
- 1.2.3 27 05 26 Grounding and Bonding for Communication Systems
- 1.2.4 27 05 29 Hangers and Supports for Communications Systems
- 1.2.5 27 05 33 Conduits and Back Boxes for Communication Systems
- 1.2.6 27 05 36 Cable Trays for Communication Systems
- 1.2.7 27 05 53 Identification for Communication Systems
- 1.2.8 27 05 55 Testing for Communication Services
- 1.2.9 27 11 16 Communication Cabinets, Racks, Frames and Enclosures
- 1.2.10 27 11 19 Communication Termination Blocks and Patch Panels
- 1.2.11 27 11 23 Communications Cable Management and Ladder Rack
- 1.2.12 27 11 26 Communications Rack Mounted Power and Power Strips
- 1.2.13 27 13 13 Communications Copper Backbone Cabling
- 1.2.14 27 13 13 13 Communications Copper Cable Splicing and Terminations
- 1.2.15 27 13 23 Communications Optical Fibre Backbone Cabling
- 1.2.16 27 13 23 13 Communications Optical Fibre Splicing and Terminations
- 1.2.17 27 15 01 16 Voice Communications Horizontal Cabling
- 1.2.18 27 15 01 19 Data Communications Horizontal Cabling
- 1.2.19 27 15 43 Communication Faceplates and Connectors

### **1.3 QUALITY ASSURANCE**

- 1.3.1 Only new products and applications listed in this section may be used unless otherwise submitted for approval.

### **1.4 SYSTEM DESCRIPTION**

- 1.4.1 The data UTP and fibre patch cords provide the means of transporting signals between the telecommunication outlet/connector and the horizontal cross-connect location in the MTR or TR locations.

### **1.5 PERFORMANCE REQUIREMENTS**

- 1.5.1 The fibre patch cords shall match the single-mode backbone fibre.

### **1.6 SUBMITTALS**

- 1.6.1 Shop drawings shall be submitted for each type of product indicated or equivalent in the following document to be approved prior to installation.



## 2 PART 2 - PRODUCTS

### 2.1 UTP PATCH CORDS

- 2.1.1 All data patch cords shall conform to the requirements of the ANSI/TIA 568-D series or the latest edition of the Commercial Building Telecommunication cabling Standard for horizontal cabling section.
- 2.1.2 The cordage shall use 28 AWG small diameter solid copper conductors.
- 2.1.3 The nominal cable diameter of the cordage shall be no greater than 4.72 mm (0.186 in). The minimum bend radius shall be no greater than four times the nominal cable diameter of the cordage.
- 2.1.4 Patch cords are to be available in the following colours and lengths.

LENGTH	COLOUR
1.2m	Blue (colour code #0000ff)
2.1m	Blue (colour code #0000ff)
3.0m	Blue (colour code #0000ff)

### 2.2 OPTICAL FIBRE PATCH CORDS (OS1/OS2 SINGLE-MODE)

- 2.2.1 Dual fibre optic patch cords, OS1 and/or OS2 single-mode equipped with LC to LC connectors.
- 2.2.2 Patch cords are to be factory assembled and not site prepared.
- 2.2.3 Patch cords shall be the shortest length possible that can be correctly installed. Clarify with the UTM I&ITS Designate if any of the following lengths are acceptable: 1.2m (4'), 2.1m (7') and 3m (10').

## 3 PART 3 - EXECUTION

### 3.1 INSTALLATION

- 3.1.1 Install the Cat 6A UTP patch cords from the network switches to the data patch panel using the horizontal and vertical wire managers as per the supplied patching and labelling schedule received from the UTM I&ITS Designate.
- 3.1.2 Supply a Cat 6A UTP patch cord for the workstation, and connect it to the data jack on the faceplate. One per data drop installed.

**END OF SECTION**