General Technical Specification for ICT Installation Works

TELECOMMUNICATIONS DISTRIBUTION SYSTEM

PART 1: GENERAL

1.1 SUMMARY

The ICT and data systems shall generally be installed as per drawing, and component specifications detailed in the Bills of Quantities (BoQs). The Contractor shall provide both accessible wireways to facilitate the installation in accordance with the design and faceplates of all voice and data; and other communication outlets including CCTV.

The Contractor will liaise with the Telecommunications Service Providers to provide telephone lines; and data bandwidth for internet connectivity as required. Distribution to telephone outlets will be done in trunking using suitable and approved cables. Telephone outlet points will comprise of sockets and moulded boxes.

Data installation will be as per drawing. Structured cabling will be preferred.

a. Section Includes: Equipment, materials, labour, and services to provide a structured cabling infrastructure including, but not limited to:

   1) Raceway, boxes, and cable tray
   2) Cabling terminations
   3) Optical fiber and terminations
   4) Telecommunications outlets
   5) Terminal blocks/cross-connect systems/patch panels
   6) Equipment racks and cabinets
   7) System testing
   8) Documentation and submissions
   9) Removal of abandoned cable, if required

b. Provide all equipment, materials, labour, and services, not specifically mentioned or shown, which may be necessary to complete or perfect all parts of the installation. Ensure that they are in compliance with requirements stated or reasonably inferred by the contract documents.

   As a minimum Category 6a UTP LSOH specification copper cabling will be installed. The Optical Fiber infrastructure will consist of OM3 (Multi mode) fibre Optic Systems.

c. All materials used throughout the installation (UTP cable, connectors Jacks, Patch Panels, Cabinets, Labelling, Grounding and Bonding, Routing within the Data Centre) must be from a single vendor. The mixing of components is prohibited except for Cat3 multipair cable.

1.2 REFERENCES

a. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with international codes, national codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:

ANSI/NECA/BICSI-568-2006 -- Standard for Installing Commercial Building Telecommunications Cabling

ANSI/TIA/EIA Standards:

i. ANSI/TIA/EIA-568-B.1 -- *Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements*

ii. ANSI/TIA/EIA-568-B.2 -- *Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components*

iii. ANSI/TIA/EIA-568-B.3 -- *Optical Fiber Cabling Components Standard*

iv. ANSI/TIA/EIA-569-B -- Commercial Building Standard for Telecommunications Pathways and Spaces

v. ANSI/TIA/EIA-606(A) -- *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

vi. ANSI-J-STD-607(A) -- Commercial Building Grounding and Bonding requirements for Telecommunications

vii. ANSI/TIA/EIA-942 –Telecommunications Infrastructure Standard for DataCenters

viii. TIA-526-7 –OFSTP-7 *Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant*

ix. TIA-526-14A –OFSTP-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant

x. ANSI/TIA/EIA-758(A) -- *Customer-Owned Outside Plant Telecommunications Cabling Standard*

xi. TIA TSB-140 Additional Guidelines for Field Testing Length, Loss and Polarity of Optical Fiber Cabling Systems

b. Install cabling in accordance with the most recent edition of BICSI® publications:

i. BICSI -- *Telecommunications Distribution Methods Manual*

ii. BICSI – Installation Transport Systems Information Manual

iii. BICSI – Network Design Reference Design Manual

iv. BICSI –Outside Plant Design Reference Manual

v. BICSI – Wireless Design Reference Manual

vi. BICSI - Electronic Safety and Security Design Reference Manual

vii. Infocomm/BICSI – AV Design Reference Manual

c. Legal, national, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached. If the contractor notes items in the drawings or the specifications, construction of which would be code violations, the matter should be brought to the attention of the Supervising Engineer. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply. The codes are the minimum standards.

1.3 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

a. All necessary statutory approvals will be done by the contractor on behalf of the Client.

b. As prerequisite to final acceptance, supply to the owner certificates of inspection from an inspection agency acceptable to the owner and approved by the local municipality and utility company serving the project.

1.4 SYSTEM DESCRIPTION

a. A telecommunications cabling system generally consists of a number of work areas serving workstations, printers and other IT components. These are cabled in a star-wired topology to local Telecommunications Rooms (TR's).Depending on the overall infrastructure, the TR's can then be connected to a central Equipment Room (ER), DataCenter (DC) and/or form a part of an overall campus type network.

b. A typical work area will encompass, AS A MINIMUM, a single-gang plate with two standards compliant work area outlets.

c. The work area outlets will be, AS A MINIMUM, Category 6a compliant.

d. The work area outlets consists of individual four-pair data Category 6a cables, installed from work area outlets to a local TR. Terminate data cables on rack mounted modular patch panels, located in the appropriate TR.

f. Vertical/horizontal optical backbone cabling will consist of OM3 (laser enhanced 50/125 µm) multimode optical fiber cable. These will be installed either internally or externally to the building fabric, between the local TR's, ER's & DataCenter, as required..

1.5 SUBMITTALS

a. On completion of each work order, the contractor shall submit to the consultant on behalf of the Client all "***as-finished***" and test documentation for the work undertaken. Submittal details itemised below;

i. By submitting the drawings, the contractor represents that he or she has carefully reviewed and verified materials, quantities, field measurements, and field construction criteria related thereto. It also represents that the contractor has checked, coordinated, and verified that information contained within the drawings, conform to the requirements of the work and of the contract documents. The engineer/designer remains responsible for the design concept expressed in the contract documents as defined herein.

ii. The "***as-built***" drawings will be in AutoCAD (DWG) or Microsoft Visio (VSD) format.

iii. The "***as-built***" documentation will consist of the copper and fiber infrastructure, showing cable routes, work area locations, TR/ER/DC locations and all labeling identifiers.

iv. The copper testing documentation will consist of results derived from a Fluke DTX-1800 Cable Analyser.

v. The optical fiber testing documentation will consist of results derived from an Optical Time Domain Reflectometer (OTDR).

b. In the case of a query, the Supervising Engineer should be contacted for any clarification.

c. Submit all drawings as detailed

1.6 QUALITY ASSURANCE

a. Reputable specialist contractors shall be approved by the consultant on behalf of the Client. Experience on jobs of comparable scope; and references from previous Clients will be part of the considerations when approving a contractor.

b. Reputable manufacturer's cabling systems shall be proposed and approved for the work.

c. The contractor shall be an authorised Certified Installer of the identified manufacturer and provide proof thereof.

d. The contractor shall offer a one (1) year warranty on the cable installation. This is in addition to the manufacturers' application and product warranty.

e. Material and equipment shall be new, and conform to grade, quality, and standards specified. Equipment and materials of the same type shall be a product of the same manufacturer throughout.

f. Subcontractors shall be engaged only after approval by the Consultant on behalf of the Client. Such Subcontractors shall assume all rights and obligations toward the Contractor that the contractor assumes toward the owner and engineer/designer.

1.7 WARRANTY

a. The Contractor will maintain and/or replace defective equipment during the defects liability period which should not be less than twelve (12) months.

b. The Contractor shall transfer manufacturers' warranties to the Client in addition to the General System Guarantee. Submit these warranties on each item in list form with "as finished" documentation. Detail specific parts within equipment that are subject to separate conditional warranty.

c. The contractor will obtain sign off for all works undertaken and agree to guarantee the workmanship and functionality of the installation for a period of twelve (12) months. This is in addition to the separate liability with the manufacturer's warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with the Client for secure storage of equipment and materials. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; and remove from site and replace damaged equipment with new equipment.

1.9 SEQUENCE AND SCHEDULING

Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for, installation start date, completion of copper cabling, completion of optical cabling, completion of testing and labeling, cutover and handover.

The Contractor should also ensure that all materials and testing equipment are available in order to meet the schedule.

1.10 USE OF THE SITE

a. Use of the site shall be at the direction of Client or his representative.

b. Access to building wherein the work is performed shall be as directed by the Client

c. In some circumstances, the Client will occupy the premises during the entire period of the project for conducting his or her normal business operations. The contractor will liaise with Client to minimize conflict and to facilitate the owner's operations.

d. Schedule necessary shutdowns of plant services with the Client and obtain written permissions and work permits. Refer to Section 11- *CONTINUITY OF SERVICES* herein.

e. Proceed with the work without interfering with ordinary use of streets, aisles, passages, exits, and operations of Client

1.11 CONTINUITY OF SERVICES

a. The Contractor may not take any action that will interfere with, or interrupt existing operations of the Client unless previous arrangements have been made with Client and all necessary Permits to Work have been issued. The Contractor will be expected to arrange/schedule the work so as to minimise shutdown time.

b. Client personnel will co-ordinate the shutdown of operating systems. The contractor shall give three (3) days' advance notice for systems shutdown.

c. Should services be inadvertently interrupted, the Contractor should immediately report the incident and furnish all necessary labour, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

PART 2 - PRODUCTS

2. 1 MANUFACTURERS

a. Provide products of manufacturers as named in individual articles.

b. Where no manufacturer is specified, provide products of manufacturers in compliance with requirements.

2.2 SUITABILITY

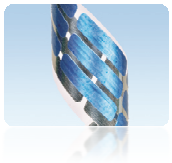
Provide products that are suitable for intended use, including, but not limited to environmental, regulatory, and electrical.

2.3 WORK AREA CABLE

Cable Specification

Products manufactured **by Panduit** should as much as possible be supplied. The Panduit "Next Generation" Cat6a Copper Cabling System utilizes a patent pending matrix tape technology in the cable, to achieve channel bandwidth performance well above industry standards.

The twisted-pair conductors shall be a 23 AWG construction, separated by a cross web, with all four pairs surrounded by the matrix tape and a LSZH jacket. This provides superior suppression of PSANEXT & PSAACRF, eliminating the need to field test for alien crosstalk. The innovative cable design shall provide installation flexibility, as cables can be routed in tight bundles through pathways and spaces.



Technical Information

- Certified channel performance in a 4-connector configuration up to 100 meters. It exceeds the requirements of ANSI/TIA/EIA-568-B.2-10 Category 6a and ISO 11801 Class Ea standards, for supporting 10GBASE-T transmission over twisted-pair cabling systems.
- Certified component performance up to 100 meters and exceeds the ANSI/TIA/EIA-568-B.2-10 Category 6a and IEC 61156-5 Category 6a standards for supporting 10GBASE-T transmission over twisted-pair cabling systems.
- Cable Diameter 7.5mm – Smaller cable improves cable routing & management in high density installations
- PoE Compliant – Meets IEEE 802.3af and draft requirements of IEEE 802.3at for PoE Plus. It also has an extended temperature range of 75deg.C for error-free performance in high-density cabinets and cable bundles running PoE Plus applications.
- Conductors/Insulators– 23 AWG solid copper with Polyethylene (PE) insulation
- Installation Tension – 25lbf (110N) maximum
- Cable Jacket – Low Smoke Zero Halogen (LSZH)

2.4 WORK AREA OUTLETS – SURFACE MOUNTED

Single-gang mounting plate with two (2) openings containing either of the following modular jacks. The jacks should be terminated using a non-impact method (non-punchdown) to ensure the integrity and reliability of the system.

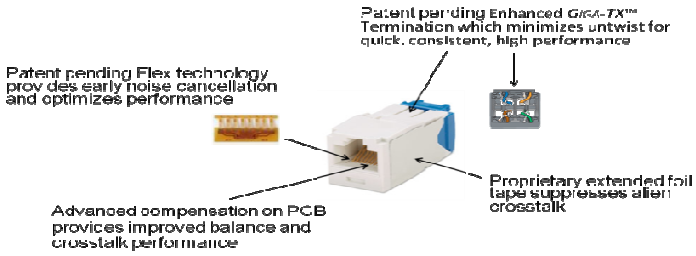
8-pin modular, Category 6a, jack module, designed to exceed ANSI/TIA/EIA-B.2-1 and IEEE 802.3an standards.

The Category 6a 8-position jack module shall terminate Cat6a unshielded twisted 4-pair, 23 AWG, 100 ohm cable and shall not require the use of a punchdown tool. The jack module shall use forward motion termination to optimize performance by maintaining cable pair geometry and eliminating conductor untwist – this forms a part of the four levels of noise suppression offered in the enhanced module, giving superior performance over other solutions.

The blue termination cap shall be color coded for T568A and T568B wiring schemes. The MINI-COM ® TX6A ™ 10GIG™ Jack Module must be Installed as part of a complete TX6A ™ 10GIG™ UTP Copper Cabling System in order to achieve 10GBASE-T Certified performance.

Features:

- Exceed requirements of ANSI/TIA/EIA-568-B.2-10 Category 6A, IEEE 802.3an-2006, and ISO 11801 Class EA channel standards
- Exceed ANSI/TIA/EIA-568-B.2-10 Category 6A and IEC 61156-5 Category 6A component standards
- Meet draft requirements of IEEE 802.3at for PoE Plus
- Each jack is 100% tested to ensure NEXT and RL performance and is individually serialized for traceability
- Utilize patent-pending enhanced Giga-TX™ Technology for jack terminations which optimizes performance by maintaining cable pair geometry and eliminating conductor untwist
- Contacts plated with 50 micro inches of gold for superior performance
- No punchdown tool required; termination tool (EGJT) ensures conductors are fully terminated by utilizing a smooth forward motion without impact on critical internal components for maximum reliability
- Optional termination tool (TGJT) reduces termination time by 25%, ideal for high volume installations
- Can be re-terminated a minimum of twenty times
- Blue termination cap designates 10Gig™ Category 6A performance and provides positive strain relief; helps control cable bend radius and securely retains wires
- Terminate 4-pair, 22 – 26 AWG, 100 ohm, solid or stranded twisted pair cable
- Universal termination cap is color-coded for T568A and T568B wiring schemes
- Accept 6 and 8-position modular plugs without damage
- Can be clearly identified with optional labels and icons
- Compatible with *Mini-Com*® Modular Patch Panels, Faceplates, and Surface Mount Boxes



2.5 WORK AREA OUTLETS – FLOOR MOUNTED

Manufacturers approved mounting plate to accommodate, a standard 86mm x 86mm/86mm x 146mm faceplate or LJ6C type housing. These to contain either of the following modular jacks. The jacks should be terminated using a non-impact method (non-punchdown) to ensure the integrity and reliability of the system.

a. 8-pin modular, **Category 6a**, jack module, terminated to T568B specification. Designed to exceed ANSI/TIA/EIA-B.2-1 and IEEE 802.3an standards.

   Category 6A 8-position jack module shall terminate unshielded twisted 4-pair, 22 – 26 AWG, 100 ohm cable and shall not require the use of a punchdown tool. Jack module shall use forward motion termination to optimize Performance by maintaining cable pair geometry and eliminating conductor untwist. The blue termination cap shall be color coded for T568A and T568B wiring schemes. The MINI-COM ® TX6 ™ 10GIG™ Jack Module must be Installed as part of a complete TX6 ™ 10GIG™ UTP Copper Cabling System in order to achieve 10GBASE-T Certified performance.

2.6 COPPER PATCH PANELS

Modular Patch Panels shall be of metal construction with plastic snap-in faceplates which are removable from the front. Patch Panels shall be mounted to standard EIA 19" racks or enclosures. Patch Panels shall be modular, accepting all modules referenced within this document.
They are available in both flat and angled types, in the following configuration:

- 1U 24 Port
- 2U 48 Port

In addition to this, there are a range of High Density modular panels available in the following configuration:

- 1U 48 Port
- 2U 72 Port

Intelligent Physical Layer Patch Panel and Software

The next generation infrastructure management system such as PViQ, provides complete visibility into the physical layer with a unique zero U management design. This is a standard requirement. The Client also requires physical infrastructure mechanism, which will delivery the ability to respond faster to configuration changes,assimilate usage and connectivity data more quickly and save costs associated with troubleshooting network connectivity problems.

2.7 TELECOMMUNICATIONS SERVICE BACKBONE CABLE – INSIDE PLANT

a. Multimode **(OM3) 50/125 µm** optical fiber, with fiber counts as indicated on drawings, with mechanical and transmission performance specifications that meet or exceed ANSI/TIA/EIA-568-B.3

Note: Listed type Low Smoke Zero Halogen (LSZH)

2.8 TELECOMMUNICATIONS SERVICE BACKBONE – OUTSIDE PLANT

a. **Multimode (OM3) 50/125 µm** diameter, armored, gel-filled optical fiber or water blocking equivalent, with number of usable fibers as shown on drawings, which meet or exceed the mechanical and transmission performance specifications listed in ANSI/TIA/EIA-568-B.3 and ANSI/TIA/EIA-758(A).

2.9 OPTICAL FIBER TERMINATION PANELS

19 in. rack mounted modular optical fiber termination panels with routing kits (grommets, saddle kits, spools, strain relief and ID/Caution labels)

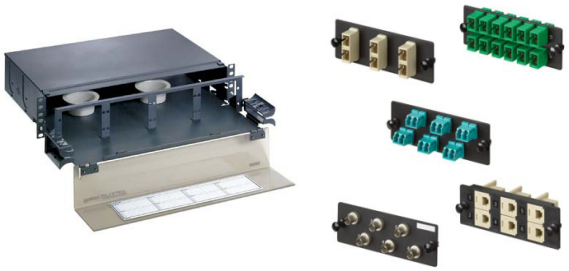
Product specification to suit the specific application

a. 1U Modular Panel suitable to house 4 x Fiber Adaptor Panels (either SC or LC)

b. 2U Modular Panel suitable to house 8 x Fiber Adaptor Panels (either SC or LC)

c. SC Fiber Adaptor Panels in 4, 6, 8 & 12 port options

d. LC Fiber Adaptor Panels in 6 & 8 port options



2.10 SPLICE TRAYS

Sized for Multimode fibers, nonmetallic with clear plastic cover, 12-fiber splice capacity, compatible with splice enclosure and fusion splicing method of termination. A stacking unit should also be capable of housing 4 no. of the splice trays, giving a 48-fiber unit.

2.11 OPTICAL FIBER CONNECTORS

a. Ceramic tipped field installed **568SC connectors**, which exceed the performance specifications in ANSI/TIA/EIA-568-B.3.

Insertion Loss (typical): 10dB Multimode / 15dB Singlemode
Return Loss (typical): >20dB Multimode / >40dB Singlemode

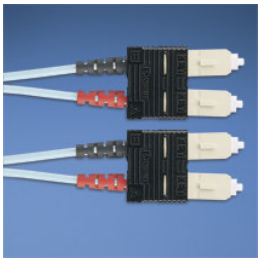
b. Ceramic tipped field installed **568ST connectors**, which exceed the performance specifications in ANSI/TIA/EIA-568-B.3.

Insertion Loss (typical): 15dB Multimode / 20dB Singlemode
Return Loss (typical): >20dB Multimode / >40dB Singlemode

2.12 OPTICAL FIBER JUMPERS

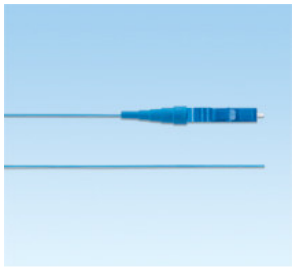
a. Duplex (OM3) Multimode optical fiber jumper cable. Various lengths with 3.0 mm Duplex 568SC or 568ST optical fiber connectors on each end.

b. Duplex (OM3) Multimode optical fiber jumper cable. Various lengths with alternative duplex optical fiber LC connectors on each end.



2.13 OPTICAL FIBER PIGTAILS

a. (OM3) 50/125 Multimode optical fiber pigtail. 1 m long with 3.0 mm Duplex 568SC or 568SC or LC optical fiber connectors on each end.



2.14 EQUIPMENT CABINETS

Overview:

- Cable management should be allowed to support proper bend radius of the cables
- Overhead routing of cables to facilitate the drop of cables from over the head cable management systems
- Access doors should be available to be opened from either direction for ease in access and provide locking mechanism for security

a. The 19 in. equipment rack shall have the following minimum requirements:

1) 800mm x 1044mm x 2134mm (45U)
2) Dual Hinged Door. Welded frame construction
3) Locking front and rear doors
4) Adjustable front and back equipment mounting rails drilled and tapped to EIA-310-D standards
5) 10 position electrical outlet strip
6) Removable side panels
7) Perforated Front & Rear Doors

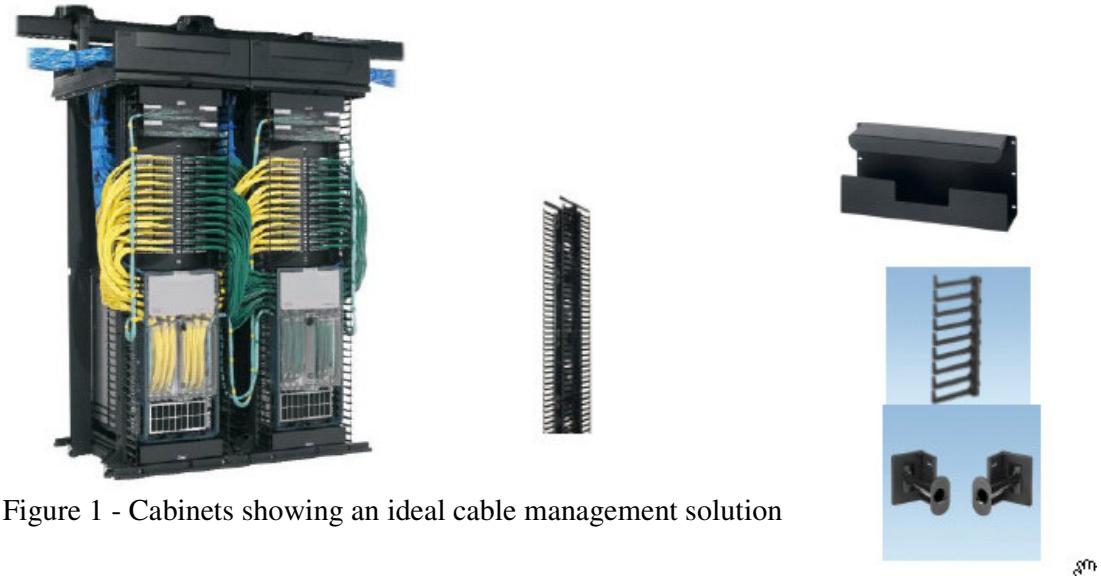


Figure 1 - Cabinets showing an ideal cable management solution

- Designed with the use of CFD (Computational Fluid Dynamics) analysis and thermal lab testing to optimize the thermal performance of network switches requiring side-to-side airflow. Special features should be available to accommodate large switches like Cisco 6500 series switches with side airflow. (see Figure 2)

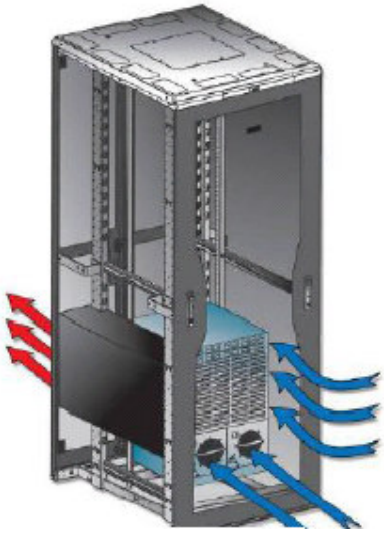


Figure 2 - Cabinet with side passive cooling duct

- The cabinet/racks should be completely self bonded to ensure equi-potential bonding of the entire enclosure
- Easily accessible casters and wheels for moving the cabinets without tilting or lifting
- The device mounting rails should be easily adjustable to accommodate different size equipment
- The rails should be marked with proper U number for ease in identification and installation instructions
- The system must accommodate a variety of vertical cable management system from 4 to 15inches for maximum flexibility
- The system should allow cable trough to support cables with 1.3” bend radius support
- Inset frame posts creating large and accessible vertical pathways for routing cables
- Modular cable management fingers easily mount to the front and/or back of all four cabinet posts
- Innovative, fully integrated, electrically bonded cabinet with a single ground connection to guard against EMI and ESD, and provide a safe current path to ground
- Accommodates equipment mounting depths up to 25.9" (658mm)
- Four adjustable equipment mounting rails – available in cage nut or #12-24 threaded with printed rack space identification
- Side panels include keyed pushbutton latches for ease in access
- Durable black polyester epoxy powder coat finish
- 2500 lbs. (1134 kg) load rating

2.15 CABLE ROUTING SYSTEM

a. The Cable Routing System will be capable of distributing copper and fiber cables from either above or below the racks/enclosures.

b. It will be available in various sizes, to accommodate different applications and cable fills. This will include 2x2, 4x4, 6x4 & 12x4.

c. It will be available in at least 3 different colours to allow differentiation of services.

d. It will feature a rapid assembly method, minimizing the need for tools during installation.

e. It will be manufactured in high impact plastic and offer a totally modular and scalable solution.

PART 3: IMPLEMENTATION

3.1 PRE-INSTALLATION SITE SURVEY

a. Prior to start of systems installation, meet at the project site with Client and representatives of trades performing related work to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Facilitation with the General Contractor will be necessary to plan the crucial scheduled completions of the equipment room and telecommunications closets. Client must approve the Project Plan, Design & Bill of Materials prior to installation.

b. Examine areas and conditions under which the system is to be installed. Do not proceed with the work until satisfactory conditions have been achieved.

c. During the site survey it is the responsibility of the contractor to ensure that all pathways, spaces, containment and general cable routes are suitable for the proposed works.

d. A suitable room should be identified to serve as a Server Room or Data Centre. The server room should be air-conditioned. The capacity of the air-conditioning equipment should be determined in consultation with the Supervising Mechanical Engineer. The materials used in the server room and the entire electrical/data cable works should be non-combustible or of fire retarded quality. Additionally, the partitioning walls of the server room should be of smooth finishes. A suitable fire detection and firefighting system should be installed for safeguarding the server room. Racks and frames in the server room should be of appropriate size; and should be suitably located.

e. All network cables should be separated from electrical and/or radio frequency cables by a distance not less than 5.5 cm. If common ducting is used, then a physical barrier should be provided. For common ducting two or three compartment trunking should be used.

3.2 HANDLING AND PROTECTION OF EQUIPMENT AND MATERIALS

a. The contractor must be responsible for safekeeping of their own and their subcontractors' property, such as equipment and materials, on the job site. Client assumes no responsibility for protection of above named property against fire, theft, and environmental conditions.

3.3 PROTECTION OF OWNER'S FACILITIES

a. Effectively protect the Client facilities, equipment, and materials from dust, dirt, and damage during construction.

b. Remove protection at completion of the work.

3.4 INSTALLATION - GENERAL

a. Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed as part of the contract. Store in areas as directed by Client. Include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and other related work whether or not expressly defined herein.

b. Install materials and equipment in accordance with applicable standards, codes, requirements, and recommendations of national, municipal and local authorities having jurisdiction, and *applicable international*standard and with manufacturer's printed instructions.

c. Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cables.

Where manufacturer does not provide bending radii information, minimum bending radius shall be 4 times cable diameter for Copper and 10 times for Fiber. Arrange and mount equipment and materials in a manner acceptable to Client.

d. Penetrations through floor and fire-rated walls shall utilize intermediate metallic conduit (IMC) or galvanized rigid conduit (GRC) sleeves and shall be firestopped after installation and testing, utilizing a firestopping assembly approved for that application.

e. Install work area cabling to the nearest telecommunications room (TR), unless otherwise noted.

f. Installation shall conform to the following basic guidelines:

1) Use of approved wire, cable, and wiring devices

2) Neat and uncluttered wire termination

g. Attach cables to permanent structure with suitable attachments at intervals of no less than 600mm. Support cables installed above removable ceilings – DO NOT LAY DIRECTLY ON THE CEILING.

h. Install adequate support structures to allow for 3 mtrs of service slack at each TR.

i. Support riser cables every three (3) floors and at top of run with cable grips.

This should be reduced to twenty four (24) when using Cat 6a

j. Install cables in one continuous piece. Splices shall not be allowed except as indicated on the drawings or noted on the drawings. No splices shall be allowed in Copper Cables.

k. Provide overvoltage protection on both ends of cabling exposed to lightning or accidental contact with power conductors.

l. Connectivity between any two buildings will be provided via diverse routes

m. Optical Fiber will be used to interconnect all data services between buildings.

n. Optical Fiber will be used as the data backbone between floors.

3.5 INSTALLATION OFUNSHIELDED TWISTED PAIRS (UTP)

Cable Infrastructure – Method of Installation

The design of the cable installation will comply withTIA/EIA-568-B. All cable routes will be as per the approved drawings from Client. The cables to be supplied with the factory test certificates for each drum.

a. The longest cable will be laid first to minimize wastage

b. Bending of the cable shall be kept to an absolute minimum.

c. The minimum bend radius of the cable is 25mm at any point, with zero stretching stress, following installation.

d. Cables will not be stressed by over-tight cable ties. Hook and Loop Ties will be used to segregate the cables and manage them, not to flatten or change the geometry.

e. Hook and Loop Ties will be used sparingly to hold the cables onto vertical cable trays or ducts; the usual procedure is to have a cable tie every 600mm.

f. When cables pass through holes in walls or floors precautions will be taken to remove the sharp edges, which will damage cable beyond repair.

g. Cables will not be tied to ceiling supports or rest on the false ceiling. They will always be secured in Conduits or PVC Pipes / trunking.

h. For fiber optic cables, extreme care is taken during the laying of the cables; the minimum bend radius allowed is 10) times the diameter of the cable used.

i. Patchpanel and outlet will be modular. The jacks should also be available in a minimum of (10) ten different colours, to allow differentiation between services.

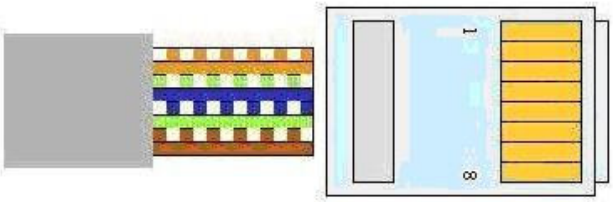
Termination

Work Place Outlets

Terminations at all work area outlets shall be made in accordance with theTIA/EIA Standards. All RJ45 jacks shall be terminated using the EIA/TIA 568B pin out. The Twisting of each pair is kept as close to the connectors as possible while terminating to lessen the FEXT (Far End Cross Talk).

It is recommended that all terminations utilize jacks that have a non-impact method oftermination and have an integral design that automatically maintains cable geometry and eliminates conductor untwist.

Network pinout T568B		
pin	colour	signal
1	white+orange	Tx +
2	orange	Tx -
3	white+green	Rx +
4	blue	
5	white+blue	
6	green	Rx -
7	white+brown	
8	brown	



Patch Panel

Terminations at patch panels shall be made in accordance with the TIA/EIA Standards. All RJ45 jacks shall be terminated using the EIA/TIA 568B pin out. The Twisting of each pair is kept as close to the connectors as possible while terminating to lessen the NEXT(Near End Cross Talk). Each patch panel shall be tagged using plastic tags engraved with 5mm characters, attached permanently and firmly to the cabinet at a suitable location and documented.

It is recommended that all terminations utilize jacks that have a non-impact method of termination and have an integral design that automatically maintains cable geometry and eliminates conductor untwist.

3.6 INSTALLATION OF OPTICAL FIBER

Cable Infrastructure – Method of Installation

The design of the cable installation will comply withTIA/EIA-568-B. All cable routes will be as per the approved drawings from Client. The cables to be supplied with the factory test certificates for each drum.

a. Each fibre core shall be tested and documented, pre- and post- installation.

b. All cables to be laid in single run and each cable to be tagged at the time of it being laid.

c. The longest runs of the cables shall be laid first, to minimise the wastage due to cut lengths.

d. The cables shall not be stressed tighter than the specified minimum-bending radius – Check manufacturers guidelines.

e. The cable drum shall be placed on jacks. The cable will be unrolled while laying, using rollers at bends and other locations where found necessary.

f. Fiber works shall be carried out by personnel utilizing the necessary safety equipment for body and eye protection.

g. All cut pieces of fiber generated during splicing, shall be collected in the disposal bin

Termination

a. The optical fiber shall enter the enclosure directly and be secured via a compression gland

b. The optical fibers will be terminated core for core at both ends, using the industry standard colour coding.

c. The optical fibers will terminate with either SC or LC connectors, with the appropriate dust caps fitted.

i. All fibers will be terminated

j. Slack spools and splice trays will be used to effectively manage the fiber and adhere to the bend radius requirements.

k. All Termination points will be provided with warning labels.

g. Fiber core terminations shall utilize active core alignment fusion splicing, with pigtails having ceramic-ferruled connectors. Splice protectors will be housed in a splice cassette, with an average splice loss being not more than 0.02dB and the maximum splice loss within 0.3dB.

h. The fiber cables are spliced to the respective pigtails using a Fujikura Fusion Splicer or approved equivalent.

i. The Fiber Stripper (Fujikura or approved equivalent) should be a hand held thermal device, which is used to strip the jacket and the cladding of the fiber to enable the proper fusing of the bare fiber.

j. A High Precision cleaver (Fujikura or approved equivalent) should be used for cutting the fiber to the correct length, before placing the bare fiber into the fusion splicer.

3.7 GROUNDING & BONDING

a. Grounding shall conform to the revant international standards and manufacturer's grounding requirements as minimum.

b. The bonding of racks and cabinets, patch panels and active element of the network, shall also conform to relevant standards.

c. Connect cabinets, racks, and frames to single-point ground which is connected to building ground system via a minimum #6 AWG green insulated copper grounding conductor.

d. All racks and cabinets will be connected individually to the Common Bonding Network (CBN) – daisy chaining of equipment is prohibited.

e. Use only manufacturers approved grounding and bonding solutions

3.8 LABELING & ADMINISTRATION

Labeling shall conform to ANSI/TIA/EIA-606(A) standards. In addition, provide the following:

a. Label each work area outlet with permanent self-adhesive label with minimum 8mm high characters.

b. Label each cable with permanent self-laminating label with minimum 5mm high characters, in the following locations:

   1) Inside receptacle box at the work area.

   2) Behind the communication closet patch panel.

c. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications closet location that is specific to the facilities terminated therein.

d. Use color-coded modular jacks at the patch panel & work area outlets, that conforms to ANSI/TIA/EIA-606(A) standard color codes for termination blocks.

e. Mount termination blocks on color-coded backboards.

f. Labels shall be machine-printed. Hand-lettered labels shall not be acceptable. Use a manufacturers approved labeling system.

g. Label cables, outlets, patch panels, and punch blocks with room number in which outlet is located, followed by a single letter suffix to indicate particular outlet within room, i.e., S2107A, S2107B. Indicate riser cables by an R then pair or cable number.

h. Mark up floor plans showing outlet locations, type, and cable marking of cables.

3.9 TESTING - COPPER

Testing shall conform to ANSI/TIA/EIA-568-B.1 standard. Testing shall be accomplished using Level III field testers (Fluke1800)

3.10 TESTING – OPTICAL FIBER

Initially test optical cable with a light source and power meter utilizing procedures as stated in ANSI/TIA/EIA-526-14A: *OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant* and ANSI/TIA/EIA-526-7 *Measurement of*

Optical Power Loss of Installed Multimode Fiber Cable Plant.

In addition perform optical time domain reflectometer (OTDR) testing on each fiber optic conductor. Measured results shall be plus/minus 1 dB of submitted loss budget calculations.

3.11 INTELLIGENT INFRASTRUCTURE MANAGEMENT (IIM)

a. The contractor must have undertaken the manufacturers' certified training for the design and installation of the IIM solution and hold the vendors formal accreditation.

b. The contractor must be able to demonstrate previous knowledge and experience with IIM solutions.

c. The contractor must offer a comprehensive support package for the IIM solution.

3.12 FIELD QUALITY CONTROL

a. The Contractor shall employ suitable personnel during the course of the installation to provide coordination of work of this specification and of other trades, and provide technical information when requested by other trades. This personnel shall be responsible for quality control during installation, equipment set-up, and testing.

b. Installation personnel shall meet manufacturer's training and education requirements for implementation of extended warranty program.

PART 4: CERTIFICATION

The Contractor shall prepare a **Completion Certificate** for the entire installation. The certificate shall be verified by the supervising Engineer before being submitted to the Client.