

Part I General

I.1 REFERENCES

- .1 Latest edition of the following:
 - .1 EIA/TIA-568-A; Commercial Building Telecommunications Cabling Standard (refer to CSA standard CAN/CSA T529-M91, CAN/CSA-C22.2 No. 214-M90).
 - .2 EIA/TIA-569; Commercial Building Standards for Telecommunications Pathways and Spaces (refer to CSA standards CAN/CSA T530-M90).
 - .3 EIA/TIA-570 Residential and Light Commercial Telecommunications Wiring Standard.
 - .4 EIA-TIA-606; The Administration Standard for the Telecommunications Infrastructure of Commercial Building (refer to CSA standard CAN/CSA T528-93).
 - .5 EIA/TIA-607; Commercial Building Grounding and Bonding Requirements for Telecommunications (refer to CSA standard CAN/CSA T527-94).
 - .6 EIA/TIA TSB 67 Transmission Performance Specifications for Field Testing of Twisted-Pair Cabling Systems.
 - .7 EIA/TIA TSB 72 Centralized Optical Fiber Cabling Guidelines.
 - .8 EIA/TIA TSB 75 Cabling practices for Open Offices.
 - .9 NBC National Building Code of Canada.
 - .10 CAN/CSA-C22.1 Canadian Electrical Code Part One.
 - .11 CAN/CSA-C22.1 Canadian Electrical Code Part One Section 60 "Electrical Communication Systems".
 - .12 CAN/CSA-C22.2 No. 0-M91 General Requirements - Canadian Electrical Code, Part Two.
 - .13 CSA C22.2 No. 154-1975 Data Processing Equipment.
 - .14 NRC-CNRC National Building & Fire Codes of Canada.
 - .15 IEEE STD 1100 - 1992 IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment "Emerald Book".
 - .16 ISO/IEC 11801 Generic Cabling for Customer Premises.
 - .17 ANSI X3T9.5 Requirements for UTP at 100Mbps.
 - .18 TBITS-6.9; Canadian Open Systems Application Criteria (COSAC) "Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings", Treasury Board Information Technology Standards.

I.2 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00 - Common Work Results - For Electrical.
- .2 Include:
 - .1 Technical data sheet supplied by cable manufacturer for the cables which are to be used. The data sheets shall include:
 - .1 Mutual Capacitance
 - .2 Impedance
 - .3 DC Resistance
 - .4 Attenuation
 - .5 Near End Crosstalk
 - .6 ACR
 - .7 Delay Skew

- .8 ELFEXT
- .2 Information outlets c/w faceplates.
- .3 Backboards, patch panels, troughs, wire management panels.
- .4 Grounding termination connectors.
- .5 All test equipment.
- .6 Instructions for storage, handling, protection, examination, preparation, operation, and installation of products.
- .3 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

I.3 DESCRIPTION OF SYSTEM

- .1 System to include:
 - .1 A distributed network for the Data Communications cabling system.
 - .2 Information outlets, c/w faceplates, recessed enclosures, located in the work area for connection to communications devices.
 - .3 Unshielded Twisted Pair (UTP) Category 6 (FT6 insulated) copper cable for the Voice Communications horizontal cabling system.
 - .4 All patch panels, troughs, labeling, clamps, bonding clamps, and grounding to provide a complete system as specified.
 - .5 All connector cables, splices, and miscellaneous material to provide a complete system as specified.

I.4 SYSTEM PERFORMANCE

- .1 The Category 6 System shall provide the following:
 - .1 Worst case channel performance requirements at 200 MHz shall be:
 - .1 NEXT power sum rated: 37.1dB
 - .2 Attenuation: 21.7dB
 - .3 power sum rated ACR: 15.4dB
 - .4 ELFEXT power sum rated: 20.2dB
 - .5 Return loss: 12dB
 - .6 Propagation delay: 548ns
 - .7 Delay skew: 50ns

I.5 STANDARDS

- .1 The equipment and installation shall comply with the following current requirements:
 - .1 National Building Code
 - .2 Manitoba Building Code
 - .3 Canadian Electrical Code
 - .4 EIA/TIA and CSA Telecommunications Building Wiring Standards
 - .5 Manitoba Fire Code
 - .6 Local and Municipal By-laws
 - .7 Authorities having jurisdiction

I.6 APPROVED VOICE AND DATA CONTRACTOR

- .1 Voice and Data Communications Cabling System Contractors shall adhere to the following:
 - .1 Contractor shall indicate vendor to be used in bid submission.
 - .2 Vendor must be supported by at least three certified local installers.
 - .3 Contractor shall be certified by the vendor they represent.

- .4 Contractor shall be experienced in all aspects of this work and shall have direct experience on recent systems of similar type and size.
- .5 Contractor shall own and maintain tools and equipment necessary for successful installation and testing of UTP and Optical Fiber Voice and Data Communications Cabling Systems and shall have personnel who are adequately trained in the use of such tools and equipment.
- .6 Contractor shall not subcontract any portion of the work out to other contractors.
- .2 The following list of Voice and Data Contractors are approved for this project:
 - .1 Len Andrews Enterprises Inc. att: Len Andrews
538 Templeton Ave. Winnipeg, Manitoba R2V 3S4
Phone: (204) 338-5174 Fax: (204) 338-5199
 - .2 McCaine Electric Ltd. att: John Schubert
106 Lawson Crescent. Winnipeg, Manitoba R3P 2H8
Phone: (204) 786-2435 Fax: (204) 783-2180
 - .3 Static Electric Ltd. att: Richard Robertson
936 Logan Ave. Winnipeg, Manitoba R3E 1P1
Phone: (204) 783-3236 Fax: (204) 786-4823
 - .4 Tri-Star Electric att: Peter Thiessen
203-356 Furby St. Winnipeg, Manitoba R3B 2V5
Phone: (204) 788-4006 Fax: (204) 783-3818
 - .5 Wescan Electric att: Tim Asmundson
1049 Logan Avenue, Winnipeg, Manitoba R3E 1P6
Phone: (204) 786-3384 Fax: (204) 783-2750.

I.7 OPERATION AND MAINTENANCE MANUALS

- .1 Provide Operation and Maintenance data for the Voice and Data Communications Cabling System for incorporation into manual specified in Section 01300 - Submittals.
- .2 Include:
 - .1 Instructions for complete Voice and Data Communications Cabling System to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings with corrections completed and marks removed except for reviewed stamps.
 - .4 Vendor's list of recommended spare parts for system.
 - .5 Provide name, address and telephone number of the Contractors service representative to be contacted during the warranty period.
 - .6 Provide name, address and telephone number of the Vendor's service representative to be contacted during the warranty period.
 - .7 Complete records of all Administration labeling data. Administrative labeling to be in electronic database format on CD, and included on hardcopy of Record Drawings.
 - .8 Complete Record Drawings.

I.8 MANUFACTURERS WARRANTY

- .1 Warranty all passive equipment, materials, installation and workmanship for one(1) year. The warranty must assure the support of all premise standards applications as listed in EIA/TIA standards.

- .2 Warranty all passive equipment, materials, installation and workmanship for fifteen (15) years. The warranty must assure the support of all premise standards applications as listed in EIA/TIA standards.

1.9 TRAINING

- .1 Contractor shall provide two 4 hour on-site training sessions, together with vendor's representative, for Voice and Data Communications Cabling System to operational personal in use and maintenance of system. Contractor shall provide all equipment and personal necessary to video tape training session and submit two copies to owner. Training sessions shall be provided at a time convenient to Owner.
- .2 The Contractor shall provide a technician to assist the owner in cross connecting the voice and data services throughout the facility. Contractor shall also perform cross connecting of the station assignments between the Owners service demarcation.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and materials to be CSA or ULC certified. Where there is no alternative to supplying equipment which is not CSA or ULC certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.
- .2 All cabling and termination hardware shall be of one manufacturer.
- .3 Submit for Consultant's approval, a duplicate list of shop drawings for this project as specified prior to placing of orders for same.

2.2 APPROVED MANUFACTURERS

- .1 The following is a list of approved manufacturers for the voice and data cabling system. Additional approved manufacturers for miscellaneous hardware shall be as noted in specifications.
 - .1 Leviton to match existing.

2.3 J-HOOKS

- .1 Voice and data contractor shall supply all J-hooks as specified in Section 27 05 28.

2.4 FACEPLATE AND PATCH PANEL ICONS

- .1 The following icon descriptions and colors shall be utilized throughout the voice and data networking systems at all workstations and patch panels.
 - .1 Telephone - "Phone", gray
 - .2 Fax - "Fax", gray
 - .3 Modem - "Modem", gray
 - .4 Data LAN - "Data", blue
- .2 Provide blank icons for all unused ports.

2.5 FACEPLATES

- .1 Faceplates shall accept dual port installation kits.
- .2 Faceplates shall accept a minimum of four workstation jacks as specified.

- .3 Faceplates shall be iconable.
- .4 Faceplates shall be provided with integral administrative labeling strips.

2.6 CATEGORY 6 WORKSTATION JACKS

- .1 Jacks shall incorporate insulation displacement connections specified for 24 AWG wire.
- .2 Jacks shall be 8 position, 8 conductor modular type.
- .3 All unused jack locations shall be installed with blank inserts.
- .4 The connecting hardware for the enhanced Category 56 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the connecting hardware provided.
- .5 Jacks shall be an unshielded T568A wiring configuration.

2.7 ENHANCED CATEGORY 56 PATCH PANELS

- .1 Patch Panels shall be 8-position, 8-conductor modular jack on face to 110 terminations on rear of panel. Wiring patterns to be T568A; 48 port capacity.
- .2 All patch panels shall be CSA or ULC approved and shall be of one manufacturer.
- .3 Termination blocks shall have the following characteristics:
 - .1 Type: all plastic insulants.
 - .2 Termination type: insulation displacement, dry, gas tight.
 - .3 Wire Size supported: 24AWG
 - .4 Retermination rate: greater than 200.
 - .5 Wire insertion force (24AWG): 59-127 Newtons.
 - .6 Wire retention force: (24AWG): 8lbs Horizontal. 1.8 lbs Vertical.
 - .7 Insulation resistance: 100M ohms
 - .8 Dielectric strength: 2.0kV at 60 Hz.
 - .9 The patch panels for the Category 6 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the patch panels provided.
- .4 Designation strips shall be provided for each jack. All cables shall be terminated in numerical sequence and labeled as per approved labelling scheme.

2.8 CATEGORY 6 PATCH CABLES

- .1 Shall meet EIA/TIA 568A standards.
- .2 24 AWG stranded tinned copper, insulated with high density polyethylene data grade cordage. The cord shall be jacketed in flame retardant PVC.
- .3 Shall be four pair configuration and terminate with eight pin modular plug.
- .4 Capable of high data rates to support voice, data, and video applications.
- .5 DC resistance per lead: 94 ohms/100m maximum.
- .6 DC resistance unbalanced: 5% maximum.
- .7 Mutual capacitance: 6.6nF/100m maximum.
- .8 Characteristic Impedance: 100 ohms % @ 1 to 100 MHz.

- .9 The patch cables for the Category 6 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the Category 6 patch cables provided.

Part 3 Execution

3.1 EQUIPMENT

- .1 Provide a minimum of 1m clearance between exposed live parts of equipment and cross connect fields.
- .2 Racks and cabinets shall be secured and grounded to communications ground with a #2 RW90 insulated green copper ground.
- .3 Racks and cabinets shall be located so as to provide 800mm clearance in front and behind each rack or cabinet as measured from the outermost point of the rack, cabinet, or equipment which is mounted within the rack or cabinet.
- .4 Wall mounted equipment, racks, cabinets or brackets shall be mounted on 19mm3/4" backboard 2.1m7 ft. to the top AFF.
- .5 Equipment shall be mounted on backboards, racks, or cabinets a minimum of 300mm12in AFF.
- .6 Equipment shall be mounted to provide a minimum clearance of 300mm12in from end walls.
- .7 Equipment connected directly to a cross connect shall be connected with cables not more than 3m/10ft in length.
- .8 Install the surge suppressor power bar on the rack designated for active electronics as directed on site.

3.2 J-HOOKS

- .1 Voice and data contractor to install all J-hooks as specified in Section 27 05 28.

3.3 CONNECTORS AND FACEPLATES

- .1 Modular jacks shall be mounted with the contacts up.
- .2 Four pair 100 ohms UTP cable:
 - .1 Terminate each four pair 100 ohms UTP cable directly to an 8 position, 8 conductor modular jack assembly at the work area.
 - .2 Terminate all 8 position, 8 conductor modular jacks as per T568A pin assignment.

3.4 UTP PATCH CABLES

- .1 Patch cables shall not exceed a combined length of 6m/20ft in a channel.
- .2 Provide all patch cables required to cross connect and connect all patch panels and active electronics, and telephone cross connects throughout the communications system including the telephone demarcation field.
- .3 Provide 3m patch cables for all workstations.

- .4 Install patch cables in an organized manner, neatly laced within the wire management provided.

3.5 HORIZONTAL CABLING

- .1 Horizontal cabling shall be installed in a star topology.
- .2 Cables shall be "combed" within cable tray in an organized manner.
- .3 Bridged taps shall not be used within the horizontal cabling system.
- .4 Hard splices shall not be used within a twisted pair horizontal cabling system.
- .5 Equipment shall not be connected directly to horizontal cables.
- .6 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded. Minimum bend radii for UTP cable is four (4) times the cable diameter, manufacturers recommendations may be greater.
- .7 Cables shall be bundled with Velcro cable straps. No tyrap are permitted. Velcro cable straps are for bundling only, Velcro cable straps shall not support the weight of the cable.
- .8 When terminating cable in connecting hardware insure that the amount of untwisted wire of UTP cable at the termination does not exceed 13mm.
- .9 Ensure cable is mounted, terminated, and managed to meet manufacturers specifications.
- .10 Horizontal cabling shall not exceed a distance of 90 meters from cross connect to information outlet.
- .11 Provide 3m10ft coil of slack in the Telecommunications Closet in the cable tray above the equipment rack.
- .12 UTP cable at the information outlet shall be provided with 300mm12in coil of slack in the cable tray prior to entering conduit stub.
- .13 All horizontal cabling shall maintain the following distances from EMI producing equipment:
 - .1 1.2m48in: motors or transformers
 - .2 1.0m40in: conduit and/or cables used for electrical power distribution with voltages greater than 300V.
 - .3 300mm12in: conduit and/or cables used for electrical power distribution with voltages less than 300V.
 - .4 300mm12in: fluorescent lighting.
 - .5 When horizontal cabling is required to cross fluorescent lighting, conduit and/or cables used for power they shall cross perpendicular to each other.
- .14 When a building lightning protection system is utilized the communications cabling shall not be installed closer than 1.8m6ft from any lightning protection system conductors.
- .15 All horizontal cabling that penetrates fire rated barriers must be provided with fire stop to meet local fire codes.

3.6 ADMINISTRATION

- .1 Labeling shall be as per EIA/TIA 606 standards.

- .2 All administrative labeling shall be typewritten with electronic label maker printed on self-adhesive ribbon or on integral labeling strip provided with equipment. Clean area where label will be applied with alcohol or equivalent cleaner to remove dirt and grease.
- .3 Workstation and Horizontal Patch Panel labeling:
 - .1 RI-1000/2000
 - R R - Rack, C - Cabinet
 - I Rack or Cabinet #
 - 1000 sequential cable identification number
 - 2000 room number or workstation location
 - .2 Provide icons as specified on workstation devices and patch panels.
- .4 Backbone Patch Panel labeling:
 - .1 D1000-RI/C2
 - D D - data backbone, T - telephone backbone
 - 1000 sequential cable identification number
 - R Head end; R - rack, C - cabinet
 - I Head end rack or cabinet identification
 - C Intermediate end; R - rack, C - cabinet
 - 2 Intermediate end rack or cabinet identification
 - .2 Provide icons as specified on workstation devices and patch panels.
- .5 All horizontal and backbone cabling shall be provided with cable labeling identification at both ends. Provide clear plastic cover over cable labeling.
- .6 All administrative labeling shall be recorded on as-built drawings and included in the Operation and Maintenance Manuals.
- .7 The use of colored backboards, connections, covers, or labels are an approved method of color coding for the cross connect fields.

3.7 TESTING

- .1 UTP Cabling:
 - .1 Testing shall be made in accordance with EIA/TIA TSB67 and EIA/TIA-568A Annex A.
 - .2 Test kit must have been calibrated/re-calibrated within one year prior to test results submitted. Provide a dated paper copy of the calibration/re-calibration report. Include serial number(s), firmware version and date of manufacturer. An accredited laboratory that is traceable to NIST must have completed the calibration.
 - .3 Only special adapters and/or special patch cables or OEM of test kit are allowed to be used to perform a Channel Link test.
 - .4 Test results must show a "headroom" figure for each cable.
 - .5 Test reports must be from software/firmware that is the latest version.
 - .6 Test kit must test for stray noise on the cable prior to performing test.
 - .7 The following tests shall be performed and recorded on all the individual Voice and Data Communications cables from both directions using a level 2 tester at 100MHz sweeps.
 - .1 Continuity or wiremap testing consisting of:
 - .1 Open/short testing.

- .2 Polarity testing.
- .3 Pair transposition testing.
- .2 Signal Attenuation test.
- .3 Near End Crosstalk (NEXT) at both Telecommunications Closet and information outlet.
- .4 DC loop resistance test.
- .5 length in meters
- .8 Tests shall be performed on the individual links. Link test to TSB 67.
- .9 Cables not complying with EIA/TIA 568A Category 5 standards for 100MHz or passing TSB 67 test guidelines shall be identified to the Consultant for corrective action which may include replacement at no additional expense to the owner.

END OF SECTION

Part I General

I.1 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Include:
 - .1 J-Hooks
- .3 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

I.2 REFERENCES

- .1 Latest edition of the following:
 - .1 EIA/TIA-569; Commercial Building Standards for Telecommunications Pathways and Spaces (refer to CSA standards CAN/CSA T530-M90, CAN/CSA-C22.2 No. 214-M90)
 - .2 EIA/TIA-607; Commercial Building Grounding and Bonding Requirements for Telecommunications (refer to CSA standard CAN/CSA T527)
 - .3 NBC National Building Code of Canada
 - .4 CAN/CSA-C22.1 Canadian Electrical Code Part One
 - .5 CAN/CSA-C22.1 Canadian Electrical Code Part One Section 60 "Electrical Communication Systems".
 - .6 CAN/CSA-C22.2 No. 0-M91 General Requirements - Canadian Electrical Code, Part Two.
 - .7 NRC-CNRC National Building & Fire Codes of Canada
 - .8 IEEE STD 1100 - 1992 IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment "Emerald Book"

I.3 DESCRIPTION OF SYSTEM

- .1 System to include:
 - .1 The communications horizontal cabling pathway shall consist of [an open cabling][a conduit raceway][a cable tray] system.
 - .2 The Voice Communications backbone cabling pathway shall consist of [an open cabling][a conduit raceway][a cable tray] system.
 - .3 The Data Communications backbone cabling pathway shall consist of [an open cabling][a conduit raceway][a cable tray] system.
 - .4 All backboards, cable support hardware, clamps, bonding clamps, and grounding to provide a complete system as specified.

I.4 STANDARDS

- .1 The equipment and installation shall comply with the following current requirements:
 - .1 National Building Code
 - .2 Manitoba Building Code
 - .3 Canadian Electrical Code
 - .4 EIA/TIA and CSA Telecommunications Building Wiring Standards
 - .5 Manitoba Fire Code
 - .6 Local and Municipal By-laws
 - .7 Authorities having jurisdiction

I.5 OPERATION AND MAINTENANCE MANUALS

- .1 Provide Operation and Maintenance data for Voice and Data Communications Pathway for incorporation into manual specified in Section 01300 - Submittals.
- .2 Include:
 - .1 Technical data - illustrated parts lists with parts catalogue numbers.
 - .2 Copy of approved shop drawings with corrections completed and marks removed except for reviewed stamps.
 - .3 Complete Record Drawings.

Part 2 Products

2.1 MATERIALS

- .1 Equipment and materials to be CSA or ULC certified. Where there is no alternative to supplying equipment which is not CSA or ULC certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.
- .2 Submit for Consultant's approval, a duplicate list of shop drawings for this project prior to placing of orders for same.

2.2 EQUIPMENT BACKBOARDS

- .1 Equipment backboards shall be [19mm][3/4in] plywood backing, located as shown on drawings.

2.3 J-HOOKS

- .1 [50mm][2in] diameter loop c/w retainer clip.
- .2 J-hooks shall be c/w mounting hardware to fasten to structure. Mounting to the ceiling grid system is not allowed.
- .3 Acceptable Manufacturer: B-Line

2.4 EMT CONDUIT

- .1 Refer to Section 26 05 34.
- .2 Minimum trade size shall be [19mm][3/4 in].
- .3 Flexible conduit shall only be utilized for connections from modular furniture to junction boxes.
- .4 The use of 90 degree Condulets is not allowed.

2.5 OUTLET BOXES

- .1 Spider Outlet Boxes:
 - .1 Flush wall mounted 1, 2, 4, or 6 gang outlet boxes c/w knock outs on top and bottom of each gang.
 - .2 Minimum depth: [70mm][2-3/4in].
 - .3 Accepts standard type duplex outlets.
 - .4 Refer to detail sheets for faceplate configurations.
 - .5 Acceptable manufacturer: Spider Mfg.
- .2 Electro-Galvanized Outlet Boxes:

- .1 Flush wall mounted electro-galvanized steel device box [100mm][4in] square x [65mm][2-1/2in] deep.
- .2 Single or two gang raised plaster rings with squared corners as required.
- .3 Accepts standard type duplex outlet.
- .4 Refer to detail sheets for faceplate configurations.

Part 3 Execution

3.1 COMMUNICATIONS PATHWAY

- .1 All communication pathways shall maintain the following distances from the equipment listed:
 - .1 motors or transformers [1.2m][4ft]
 - .2 wire in conduit and/or cables >300V [1.0m][3ft]
 - .3 wire in conduit and/or cables <300V [300mm][12in]

3.2 EQUIPMENT BACKBOARDS

- .1 Equipment backboards shall be rigidly secured and painted with a ASA #61 industrial gray nonconductive fire-retardant overcoat.

3.3 J-HOOKS

- .1 J-hooks shall be installed by Voice and Data Communications Cabling System Contractor who is certified by the vendor they represent.
- .2 J-Hooks may be used to support the horizontal cabling from the conduit stubs at the work station to the patch panels in the wiring closets. Provide all J-Hooks as required.
- .3 J-Hooks shall be fastened to the building structure at a maximum of [1m][3ft] intervals with a maximum cable sag of [100mm][4 in.] between supports. All cables shall be completely supported by the J-hooks so that no weight is transferred to any other fixture or ceiling space structure.
- .4 Maximum of 50 - 4 pair UTP cables per J-Hook or 10 - 25 pair UTP cables per J-Hook.
- .5 J-hooks shall be installed so that cable pathway from workstation is routed to the nearest point of main cable pathway or cabletray located in accessible ceiling space.
- .6 Install main cable pathway runs over accessible corridor areas whenever possible and along lines parallel to building structure.

3.4 CONDUITS

- .1 Refer to Canadian Electrical Code Section 12.
- .2 Refer to Section 26 05 34.
- .3 Conduit sleeves shall be installed with acceptable fire stop to meet local fire codes.
- .4 Conduit sleeves shall extend a minimum of [100mm][4in] above the finished floor.
- .5 Spare sleeves with no cables installed within them shall be fitted with an acceptable firestop.
- .6 Raceways shall enter Communication Cabling Wiring Closets at a minimum height of [2.4m][8ft] AFF.

- .7 Conduit runs shall not contain more than two (2) 90 degree bends between pull points or pull boxes.
- .8 Conduits shall have long sweep bends.
- .9 Continuous conduit runs shall not exceed [30m][100ft] without a pull point or pull box.
- .10 Conduits shall be reamed to eliminate sharp edges.
- .11 Conduit couplings and connectors shall be steel type.
- .12 Steel connectors shall be terminated with an insulated bushing.
- .13 Pull boxes shall be installed in such a manner that the conduits that enter the pull box shall be aligned at opposite ends from each other, the cable shall not have a bend within the pull box.
- .14 Conduit runs shall remain clear of areas in which flammable material may be stored. Conduits shall not be installed adjacent to sources of heat.
- .15 All conduits shall be left with a nylon pull cord with a minimum test rating of [90kg][200lbs].
- .16 Provide one [25mm][1in] conduit stubbed up to accessible ceiling space from a two gang communications outlet.
- .17 Conduits stubbed up from communications outlet shall be routed to the nearest point of the cable tray. Conduits shall terminate onto the cable tray with conduit to tray adaptors.
- .18 Conduit fill shall be as per cable manufacturers recommendations, but shall in no case exceed the maximum fill allowed by code.

3.5 OUTLET BOXES

- .1 Fill boxes with paper, sponges, foam, or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .2 Information outlet boxes shall not be placed back to back when servicing adjacent rooms, there shall be a minimum of [200mm][8in] offset between boxes.
- .3 Mount communication outlet boxes at the same height as the electrical power outlets unless noted otherwise. Communication outlets shall be mounted adjacent (within 4in) to power outlets.

END OF SECTION