

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.
- .2 Include data sheets for cabling, faceplates, terminal cabinets, racks, etc., and proposed cabling testing sheets.
- .3 Submit following:
 - .1 Samples of each type of data/voice jack complete with faceplate;
 - .2 Sample of proposed labelling of components and wiring;
 - .3 Sample of proposed test sheet;
 - .4 Copy of tester calibration certificate;
 - .5 written confirmation that telecommunication system vendor is manufacturer's valid certified system vendor for at least duration of contract work and is in good standing at time of Bid submission;
 - .6 Written evidence (copies of certificates) of vendor and technician qualifications;
 - .7 Copy of system manufacturer's warranty.

1.2 REFERENCE STANDARDS

- .1 Comply with latest editions of following, as applicable for project:
 - .1 ANSI/TIA-568-C, family of Telecommunications Standards, including:
 - .1 ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises;
 - .2 ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard;
 - .3 ANSI/TIA-568-C.2 - Balanced Twisted-Pair Telecommunication Cabling and Components Standard;
 - .4 Issued addenda.
 - .2 ANSI/EIA/TIA 606-B (CSA T528) - Administration Standard for Telecommunications Infrastructure of Commercial Buildings;
 - .3 ANSI/EIA/ TIA-607-B (CSA T527) - Grounding and Bonding Requirements for Telecommunications in Commercial Buildings;
 - .4 ANSI/EIA/TIA-569-C (CSA T530) - Commercial Building Standards for Telecommunications Pathway and Spaces;
 - .5 Latest Building Industry Consulting Service International (BICSI) standards;
 - .6 Applicable local Building Codes.
- .2 Work to be installed by system manufacturers certified system installers/vendors who are certified and experienced in implementing selected data cabling system and to perform related testing programs.
 - .1 System final installation layout to be designed and/or reviewed by a RCDD. Submit shop drawings verifying this requirement.

1.3 WARRANTY

- .1 System manufacturers to provide a minimum twenty (20) year full parts, labour, and performance warranty on all passive components including structural cabling system. These warranties to be provided in written certificate form and that guarantee following:
 - .1 Passive system components, e.g. patch panels, UTP cable and outlet jacks, are free from manufacturing defects in material or workmanship;
 - .2 Approved cabling systems exceed specifications of TIA-EIA 568B.2.1 standards for specified category, in particular for attenuation and near-end cross-talk, loss and bandwidth requirements;
 - .3 installation supports applications for which it was originally designed as well as future versions of system performance specifications and any future applications using TIA/EIA 568B.2.1 component and cabling standards;
 - .4 Replacement or repair of any originally installed registered system component to be completed at no cost for parts and labour to during warranty period. Any components repaired or replaced to be warranted for remainder of warranty.
- .2 System manufacturers to provide in writing to Parks Canada Representative, that in event of demise or failure or change in approved status of installing certified system installer/vendor, manufacturer to be responsible for providing another certified system installer/vendor to fulfil remainder of warranty conditions.
- .3 Claim for repair procedure to comprise of contractor being notified of a problem and who will conduct necessary tests and repairs to correct problem. Should contractor be unable to resolve problem, contractor to contact system supplier who will take necessary action and provide any technical support to correct problem.
- .4 Initial response time to a repair claim for a registered system to be within 4 hours from time Contractor was notified of system fault.
- .5 Ensure that selected network cabling component manufacturer includes a system warranty that is a true "end-to-end" structured cabling system warranty from a single manufacturer, which includes data/voice communications outlet and patch cord at workstation, horizontal copper cabling, and patchpanel and patch cords at LAN room. In addition, this warranty is to be valid with selected fibre optic cabling solution.

1.4 SCOPE OF WORK

- .1 This Section provides minimum standards for provision of a structured cabling system to network computer systems for complex. Requirements for network electronics are responsibility of Parks Canada Representative's Network Integrator. Work includes but is not to be limited to following:
 - .1 provision of fibre optic cabling system; provision of fibre optic cabling for risers and intra-building backbone between LAN closets and for applications as noted on drawings; use of fibre optic backbone cabling to augment system if more than one network switch is used and distance between switches exceeds 90 m (295') and for applications for this project and as required by BICSI standards;
 - .2 Provision of category grade rating Category 5e cabling system for a complete networking within complex which can support use of intelligent network switches with Network Management capabilities;
 - .3 Organized wiring in a structured cabling system using point to point distribution system incorporating modular terminations;

- .4 Provision of data and voice cabling, data and voice communications outlets, patch panels and associated equipment;
- .5 System testing and verification;
- .6 Coordination of system requirements and integration requirements with integrated systems.
- .2 Local area network system must be "protocol neutral" and provide users access into a variety of resources from any location within the Complex. Ethernet backbone to be utilized for system with intelligent network switches coordinating and managing data flow. Wiring configuration is based on a "physical star" topology in which cabling runs emanate in radial pattern from data communications room in which intelligent switches are located.
- .3 Technical features of horizontal copper structural cabling plan include:
 - .1 Use of Category 5e cabling to each data/voice outlet;
 - .2 Use of modular Category 5e jacks at workstation ends of data/voice cabling run;
 - .3 Backward compatibility to categories 5e, 5 and 3.
- .4 Network cabling system vendor to coordinate with Electrical Contractor to ensure that properly sized conduits, back boxes outlet boxes, junction boxes and floor boxes are provided of sufficient size as per EIA/TIA Standards to accommodate required Category rating system wiring and devices, with particular emphasis on bending radii of cabling. Replace to suit, conduit and boxes not meeting required Category rating requirements.
- .5 Design system to support minimum 802.11a/b/g/n/ac standards.

1.5 SYSTEM VENDOR QUALIFICATIONS

- .1 Vendor responsible for provision of system to have following qualifications:
 - .1 Being established communications and electronics contractor that can provide on-site support within 72 hours and holds applicable provincial and local licenses;
 - .2 Be authorized Distributor or established franchisee for manufacturer of product/system proposed with full manufacturer's warranty privileges and be capable of providing post warranty service;
 - .3 Employ technicians who have attended and successfully completed manufacturer's technical certification classes for proposed system;
 - .4 Show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to system on a 24-hour/7-day basis;
 - .5 Maintain at their facility necessary spare parts in proper proportion as recommended by manufacturer to maintain and service equipment being supplied.
- .2 Submit written evidence of qualifications with shop drawings submission.
- .3 Vendors not meeting any of above qualifications may be disqualified at Parks Canada Representative's discretion and be replaced with qualified vendor acceptable to Parks Canada Representative.

PART 2 PRODUCTS

2.1 HORIZONTAL CABLING

- .1 Horizontal cabling to data/voice outlets to be Belden "DataTwist 1200" series, ULC listed and labelled, unshielded twisted pair (UTP) cable and to comply with EIA/TIA TSB-36 requirements for Category 5e transmission. Cable minimum specifications to be:
 - .1 Conductors: 4 pair, 24 AWG. solid copper conductor, unshielded twisted pair;
 - .2 Cable grade: category 5e;
 - .3 Overall sheath: riser rated CMR / plenum rated CMP outer PVC jacket;
 - .4 Outer jacket colour to be of different colours to distinguish different systems as per Parks Canada Representative's direction; confirm colours with Parks Canada Representative prior to ordering.
- .2 Category 5e system to exceed ANSI/TIA/EIA 568-B.2 standard for a Category 5e 4-conductor channel. Demonstrate that proposed manufacturer's solution is guaranteed to exceed Category 5e requirements across entire swept frequency range of 1 – 100 MHz, by margin as per base specified product. Submit with shop drawings, ETL test reports to verify full channel performance of cable.
- .3 Provide plenum CMP rated cabling for applications as required by local authorities and codes.
- .4 Incoming copper cabling to be provided with suitable lightning protection devices. Refer to additional requirements later in this Section.

2.2 OUTLETS

- .1 Data/voice outlets to be based on Belden "CAT5E" series and meet following specifications:
 - .1 faceplates: flush wall mounting, to fit on single gang recessed outlet box, complete with device bracket or provisions that hold jacks securely in place; with top and bottom labelling windows; stainless steel or moulded PVC, of colour and finish reviewed with Parks Canada Representative, mounted to outlet box and bracket with matching screws;
 - .2 modules: Category 5e, eight-position, RJ-45 modular jacks, ISDN (T568A/B) pinned; KeyConnect modular or MDVO style jacks as approved by Parks Canada Representative and reviewed with Parks Canada Representative; icons with suitable identifications; constructed of high impact, flame retardant, thermoplastic; copper wires and connectors;
 - .3 Modules to be of specific colours to identify each system and of pin orientation reviewed with Parks Canada Representative and approved by Parks Canada Representative.
- .2 Wall mounted telephone outlets to include features as follows:
 - .1 Required Category rating modular RJ45 jack mounted securely into faceplate;
 - .2 Wall plate of stainless steel construction;
 - .3 Mounting studs on plate which are positioned to mount standard wall mount telephones with keystone adaptation flush to wall surface;
 - .4 Accept wall mountable phones with short patch cord connections to jack module.

- .3 Jacks colours and faceplate colours to be of variety to distinguish different systems as per Parks Canada Representative's requirements. Review exact colour finishes and T568 pinning arrangement with Parks Canada Representative prior to ordering.
- .4 Quantity of jacks and configuration of faceplates are as detailed on drawings.
- .5 Provide snap-in plastic dust covers on blank outlets and unused outlets.

2.3 PATCHPANELS

- .1 Belden "CAT5E" series, modular patch panels with features as follows:
- .2 Cat 5e certified, designed for 4-pair UTP cable; panel frames of black powder coated steel construction;
- .3 24 port and 48 port RJ45 jacks, as required; KeyConnect modular or MDVO style jacks as approved by and reviewed with Parks Canada Representative;
- .4 Circuit identification designation strip, snaps onto wiring block;
- .5 Distribution rings, rack mounting hardware and ancillary devices as required.

2.4 PATCHCORDS AND CABLES

- .1 Copper data patchcords to be based on Belden "CAT5E" series, modular, 24 AWG stranded copper, Category 6, ISDN wired.
- .2 Copper patchcords to be factory terminated and tested, and be provided in lengths from 600-2100 mm (2'-7') at patchpanel end to suit specific applications. Lengths to meet manufacturer's requirements to comply with required category grade performance standards. Provide patchcords in quantities to accommodate requirement that each port is active. Unless otherwise noted, patchcords at workstation ends are responsibility of others.
- .3 Include for provision of suitable patchcord extending to Parks Canada Representative's switch/server in room/rack. Confirm exact requirements with and review with Parks Canada Representative.
- .4 Where voice terminations are terminated onto wall mounted blocks, include for required patch cord to extend to rack voice patch panels and patchcords to further extend to Parks Canada Representative switch/server in room/rack. Confirm exact requirements with and review with Parks Canada Representative.
- .5 Fibre optic patch cords to match and be of same manufacturer as fibre optic cabling and be with required terminations. Patch cords to be provided to suit end to end structured cabling system and to accommodate network electronics as directed by and reviewed with Parks Canada Representative. Connector terminations to be SC or LC type, but confirm with and review with Parks Canada Representative prior to ordering.
- .6 Patchcords to be of different colours to distinguish different systems as per Parks Canada Representative's requirements. Review exact colour finishes with Parks Canada Representative prior to ordering.

2.5 PUNCHDOWN BLOCK TERMINATIONS

- .1 Incoming main telephone service cabling to typically be terminated on BIX or 110 mounts and connectors. Horizontal cabling as detailed on drawings to terminate on punchdown blocks.

- .2 Capacity of connectors to be to suit number of conductors. Confirm and coordinate exact type of termination means with local carrier/provider and review with Parks Canada Representative. Mounts to be suitable for wall mounting.
- .3 Category 3, BIX or 110 Series, 100 pair and 300 pair wiring blocks consisting of horizontal index strips with insulation displacement connectors for termination of 4 pair cables; wall mounting block with mounting legs to provide wiring space. Review exact type of terminations with Parks Canada Representative.
- .4 Category 6 or 5e, punchdown block bases for termination of UTP cabling and connecting blocks; finished in white; can be interlocked and stacked to accommodate system capacity; of types to be either rack mounted or panel mounted to suit application and room requirements.
- .5 Cross connect jumper wire, patch cords, cable HUB harness or pigtails as required to extend connections from blocks to patchpanels and to Parks Canada Representative's switches/servers.
- .6 Connecting tool, termination kits, designation strips, labels, and wiring distribution rings.

2.6 EQUIPMENT CABINETS

- .1 Enclosed type, equipment cabinets to be heavy duty type, complete with but not be limited to following requirements:
 - .1 Steel construction frame work with steel or aluminum construction sides, backs, tops and bottom panels;
 - .2 Ventilation fans and louvers;
 - .3 Minimum 1800 mm (70") in height;
 - .4 Polyurethane finish or enamel painted finish to Parks Canada Representative's approval;
 - .5 Double sided 12/24 tapped holes;
 - .6 Sized and spaced for standard EIA 19" racking;
 - .7 Heavy duty base with provision for bolting to floor;
 - .8 High capacity cable organizer channel with snap on cover;
 - .9 full height front and back hinged lockable doors with handle operators with locks and keys; keys to be keyed alike as per Parks Canada Representative's direction;
 - .10 Full height vertical cable channels 150 mm x 150 mm (6" x 6") on both sides of rack;
 - .11 Horizontal cable management channel – minimum one for each patch panel;
 - .12 Front and rear cable management provisions (typically only last 150 mm (6") of cabling to connector to be loose and not in channel);
 - .13 rack mounted multi- outlet power strips with surge protection, integral breaker, pilot light and power cord with twist lock type plug and receptacle provisions; number of outlets to be same as number of active devices housed in equipment enclosure;
 - .14 Required mounting hardware, label kits, Velcro style fasteners and ancillary devices.

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- .2 Include grounding provisions for each cabinet, to meet previously listed standards, which include but are not limited to following provisions:
 - .1 Copper ground strip mounted on side rail extending full height of rack;
 - .2 Equipment jumper kits, to bond network equipment to rack ground strip;
 - .3 Common bonding network to rack jumper kit, to bond rack to room common bonding network;
 - .4 Hardware including, copper compression HTAPS, paint piercing washer kits, bonding screws and electrostatic discharge port kits.
 - .3 Wall mounted equipment enclosures to be provided where required with similar applicable features as per specified floor mounted products, but sized to suit application and complete with wall mounting hardware and hinged feature to allow access to rear of cabinet.
 - .4 Cabinets to be of size and quantity to accommodate respective number of patch panel ports to suit number of required drops, quantity of network electronic components as directed by Parks Canada Representative's network integrator, uninterruptible power supply unit, and an additional 20% spare capacity for future expansion.
 - .5 Acceptable manufacturers are:
 - .1 Listed structured cabling system manufacturers;
 - .2 Devtek;
 - .3 Cable-Talk;
 - .4 Hoffman;
 - .5 Cannon;
 - .6 Hammond Manufacturing;
 - .7 Or equivalent as approved by the Departmental Representative meeting the above specification.

2.7 LIGHTNING PROTECTION

- .1 Provide protection of communication lines, as recommended by referenced codes and standards including UL-497. Products to be equivalent to Porta Systems Corp series 606 "Protector Pack" blocks. Exact type of product to be confirmed with product manufacturer to accommodate number of incoming pairs and type of conductors. Generally, base design requirements on following:
 - .1 for voice/data communications: required category grade rating rated protector blocks with protection modules of ultra-low capacitance solid state technology to protect frequencies up to 250 MHz; blocks to include required solid state modules to suit conductor pair counts, mounting bracket and cover;
 - .2 Protection requirements at service entrance to also be confirmed with service provider;
 - .3 Protection blocks to be provided with mounting provisions to suit design application, i.e. wall mounting at conductor building entrance or rack mounting.
- .2 Contact manufacturer and review system requirements to determine exact product requirements for lightning protection. Ensure that main incoming lines and both ends of lines running between buildings are provided with adequate lightning protection to recommendations of system manufacturer.

- .3 Install devices in accordance with device manufacturer's instructions.

2.8 WIRELESS LAN INFRASTRUCTURE

- .1 Provisions for a wireless LAN infrastructure to be provided with 100% coverage of entire complex, utilizing structured network cabling system as a rough-in for future wireless access points (WAP) located in ceiling spaces. Generally, quantity of outlets to be identified on drawings, but Electrical Divisions Contractor to perform site signal survey/audit of coverage areas and confirm if additional rough-in jacks are required. Prepare audit immediately after structure of concrete and metal studs are in place. Submit copy of audit to Parks Canada Representative to review.
- .2 Locations may generally be shown on drawings, however, following criteria to be followed:
 - .1 Back-of-house above accessible ceiling tile or high up in open ceiling areas as reviewed with Parks Canada Representative;
 - .2 Public spaces priority;
 - .3 In service areas adjacent public areas;
 - .4 In light cove if WAP is hidden;
 - .5 With access panel (location identified).

2.9 ACCEPTABLE STRUCTURED CABLING SYSTEM MANUFACTURERS

- .1 Horizontal copper structured cabling infrastructure is to be end-to-end solution from a single manufacturer, which includes data communication outlets and patch cords at workstations, and patch panels and patch cords at LAN/Telecommunication rooms. To this horizontal network is integrated fibre optic cabling infrastructure from same manufacturer or approved listed herein, maintaining full warranty requirements for systems comprising this Section.
- .2 Acceptable structured cabling system manufacturers are:
 - .1 Belden;
 - .2 Commscope Systimax/Uniprise;
 - .3 Panduit;
 - .4 Hubbell;
 - .5 Leviton.

2.10 ACCEPTABLE CONTRACTORS

- .1 Contractor selected for installation of structured cabling system to provide confirmation of following:
 - .1 Detailed knowledge and experience in fibre optic cabling and category grade rating copper UTP wiring installations;
 - .2 Detailed knowledge and experience in installation of intelligent server/switches equipment;
 - .3 Experience in troubleshooting and problem solving in data communication networks.
 - .4 Ability to provide system manufacturer's certified warranties;
 - .5 Certified and valid proof of being system manufacturer's authorized vendor.

- .2 Refer also to supplier requirements specified in Part 1.

PART 3 EXECUTION

3.1 INSTALLATION OF STRUCTURED CABLING – GENERAL

- .1 Properly handle and install structured network cabling in accordance with manufacturer's specifications. Avoid undue pulling tension, abrasion, or rough handling to ensure that cables will permit transmission up to required category rating design speed for cables. Install cables without splices or cuts to ensure elimination of reflections, discontinuities, impedance mismatches, etc. maximum horizontal length of copper cabling from workstation to network switch is not to exceed 90 m (295') or less if recommended by system manufacturer to meet required category grade rating performance standards. Maximum length of patch cables (either cross connects or interconnecting with electronic equipment to connect devices at work area outlet), to be a total of 10 m (30'). Maintain system manufacturer's minimum channel lengths as confirmed with system manufacturer. Provide cable loops in accordance with manufacturer's instructions.
- .2 Unless otherwise noted or where cable tray is shown for such use, run cabling in conduit. Install pull cords for future use, in conduits extending between floors.
- .3 Generally, no more than two 90-degree changes in direction are recommended for cable installed in conduit without pullboxes and not more than 40% fill ratio. Confirm exact conduit bending radii restrictions and fill ratios with system manufacturer and comply with those standards.
- .4 With consideration in minimizing alien crosstalk to levels as per BICSI standards and manufacturer's standards, dress cables in a neat and orderly fashion from entrance of communications closet to relay racks using vertical and horizontal cable management trays and paths. Do not exceed manufacturer's distance limitations to maintain required category rating performance standards.
- .5 Care to be taken to ensure that during installation, nicks, abrasions, burning and scuffing of cable is prevented. Replace cables found to be damaged regardless of whether cable passes category grade rating or fibre performance testing standards.
- .6 Secure bundled cables transitioning between floors via ladder cable tray, to vertical ladder sections with Velcro wraps. Use waterfall (rounded transition) fittings for cable changing from a horizontal path to a vertical one. This is to maintain minimum bend radius for cabling system. Support cables running through risers between floors such that they are properly supported for their weight, especially in situations with high pair count cables and large bundles.
- .7 Electrical Contractor and telecommunication system vendor to provide coordination of structured cabling system with other building systems as required. Review data outlet and connection requirements with various system vendors and provide data drops to equipment as required. Size head end equipment to accommodate these additional outlets.
- .8 Required necessary drilling and anchoring components to be installed before any horizontal cable is installed.
- .9 Route horizontal cable into equipment racks/enclosures and neatly bundle with Velcro cable ties. Maximum number of cables per bundle to be 25.
- .10 Securely mount fire retardant plywood on wall in each telecommunications room or closet.

- .11 Cables wraps are to be Velcro type and are not to be over tightened.
- .12 Provide grounding and bonding requirements as specified in Section entitled Grounding and Bonding.

3.2 INSTALLATION OF PATCHPANELS AND ACCESSORIES

- .1 Provide patchpanels onto racks in locations. Provide terminating hardware and connectors to suit incoming and outgoing cabling. Clearly identify each port. Provide patch cords as required. Install devices in accordance with system manufacturer's requirements.
- .2 Terminate both data and voice horizontal cabling onto patchpanel punchdowns using manufacturer's recommended tools. Bundle cabling in neat configuration and secure to patchpanels and rack assemblies. Typically dedicated separate patch panels are required for data and voice.
- .3 Install rack enclosures on walls. Neatly bundle wiring within wiring management channels. Do not over tighten Velco straps. Ground racks as required.

3.3 INSTALLATION OF TERMINATION HARDWARE

- .1 For main telephone service incoming conductors to main communication closets and other conductors as detailed, provide required punchdown connectors and mounts on hardwood backboards on walls or on racks. Refer to drawing details. Design system layout to best suit incoming and outgoing cables. Properly punchdown cabling with manufacturer's required tool and label each connector as required.
- .2 Run interconnect cables neatly secured and bundled across connectors and between banks of mounts. Use D-rings to their full advantage. Neatly bundle pigtails and secure to IDC connectors.
- .3 Where wall mounted, align mounts in straight formations to provide a neat installation and to minimize interconnect wiring lengths.
- .4 Where horizontal cables are terminated to patchpanels, provide appropriate patch cords/jumper cables to interconnect patchpanel ports to respective wall mounted punchdown blocks.
- .5 Clearly and properly identify each cable and block terminations.
- .6 Co-ordinate with Parks Canada Representative's network integrator to determine exact requirements for telephone service interconnections.

3.4 COPPER CABLE INSTALLATION

- .1 Run horizontal, UTP cables continuous from end to end with no splices. Install horizontal cables in Star topology, emanating from rack mounted patchpanel(s) and terminating on data outlet faceplates in rooms or other workstation locations.
- .2 Install conductors in cable tray and conduit runs designated for data and voice conductors. Do not fasten conductors and conduit to suspended ceiling support systems. Support conduit to building structure slab independent of other support.
- .3 Terminations to involve as little outer jacket removal as possible and cable pairs "untwisting" is to not exceed 6 mm (1/4").
- .4 Provide slack cable to allow for minor workstation relocations. Provide a coil of slack cable of an approximate 2 m (6') length for each workstation outlet run.

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- .5 Where conduits and/or cable tray is not being provided, conductors within accessible ceiling spaces to be properly bundled using "Velcro" type wraps and supported with "J" hooks. Secure "J" hooks to ceiling slab structure. Install conductors following building lines. Do not fastened conductors to suspended ceiling support systems. Obtain Parks Canada Representative's approval in use of "J" hooks. Unless otherwise noted, drops down from ceiling spaces to consist of cabling installed in vertical conduits running down within walls to outlet boxes and terminating onto jacks.
 - .6 For main voice backbone cabling from main telecom room, provide 110 connectors and mounts on hardwood backboards on walls, as required. Design system layout to best suit incoming and outgoing cables. Properly punchdown cabling with manufacturer's required tool and label each connector as required.
 - .7 Run interconnect cables neatly secured and bundled across connectors and between banks of mounts. Use D-rings to their full advantage. Neatly bundle pigtails and secure to BIX/110 connectors.
 - .8 Align mounts in straight formations to provide a neat installation and to minimize interconnect wiring lengths.
 - .9 Coordinate with Parks Canada Representative's network integrator to determine exact requirements for telephone service interconnections.
 - .10 Provide jumpers/pigtails to interconnect backbone wiring to rack mounted voice patch panels where horizontal voice cabling is terminated.
 - .11 For horizontal copper backbone cabling, multi- pair conductor cabling is preferred. If available only in limited number of pair cabling, provide multiple runs to provide quantity as identified on drawings, and increase conduit diameters to suit exact number requirements, in accordance with of standards and codes.

3.5 PENETRATION THROUGH FIREWALLS

- .1 Provide a conduit sleeve where horizontal cables penetrate firewalls. Size conduit sleeve at 40% fill ratio with a plastic bushing at both ends.
- .2 After conduit sleeve is installed, fill opening around conduit with firestop and smoke seal materials.

3.6 INSTALLATION OF OUTLETS

- .1 Connect each outlet with a 4-pair, UTP cable. Test and identify each outlet and faceplate. Wire and connect jacks back to respective dedicated racks in LAN/TEL rooms. As detailed and as required to accommodate incoming telephone/voice lines, extend voice cabling from voice patch panels to wall mounted 110 connectors, providing patch cords, cross connects/jumpers, etc. as required.
- .2 Provide outlet jack/faceplate configuration as detailed on drawings.
- .3 Drawings identify data jacks for wireless access point receivers (antennae). These locations are approximate. Confirm exact locations during onsite radio frequency studies. Allow for jacks to be repositioned up to 4 m (15') to suit results of studies. Perform studies after completion of construction of interior structures. If studies are not performed at discretion of Parks Canada Representative, leave slack coiled length of cable on each run, allowing for repositioning and review with Parks Canada Representative.

3.7 SEPARATION OF DATA COMMUNICATION CABLES FROM SOURCES OF ELECTROMAGNETIC INTERFERENCE

- .1 Separate data communication cables from sources of electromagnetic radiation in accordance with standard ANSI/TIA/EIA-569 and following:
 - .1 FT-6 rated data cabling raceway and power conductors (2 KVA power circuits) raceway require 125 mm (5") clearance;
 - .2 For fluorescent luminaires, required clearance is 300 mm (12");
 - .3 Clearance increases up to 600 mm (24") for power circuits over 5 KVA;
 - .4 For large motor, transformers, power panels, etc., required clearance is 1m (39");
 - .5 Route cables to avoid direct contact with steam piping, hot water piping or other heat sources to avoid thermal degradation.

3.8 INSTALLATION OF RACKS

- .1 Provide racks and secure to floor with bolts and concrete anchors.
- .2 In locations where more than one rack is required, butt multiple racks together. Provide wiring channel interconnection such that wiring from rack to another is not exposed.
- .3 For open racks, provide metal raceway chimney channel for conductors extending down from ceiling, such that wiring is not exposed. Secure channel to rack and ceiling.
- .4 Run wiring neatly bundled within wiring management channels. Do not over tighten Velcro tie wraps such that they deform cable jacket. Velcro straps to easily slide along length of cable. Velcro tie wraps used in plenum spaces to be CMP/FT-6 rated.
- .5 Protect cable from any obstructions using appropriate grommeting in roof of rack.
- .6 Properly ground and bond rack and equipment to room ground bus as per specifications and to standards of TIA/EIA 607.

3.9 INSTALLATION OF EQUIPMENT ENCLOSURES

- .1 Provide equipment enclosures and secure to wall/floor/ceiling as required with suitable anchors.
- .2 In locations where more than one enclosure is required, butt multiple enclosures together. Provide wiring channel interconnection such that wiring from enclosure to another is not exposed.
- .3 Provide metal raceway chimney channel for conductors extending down from ceiling, such that wiring is not exposed. Secure channel to enclosure and ceiling.
- .4 Provide suitable power supply to cabinets having fans and other active components or designated as such.
- .5 Run wiring neatly bundled within wiring management channels. Do not over tighten Velcro tie wraps such that they deform cable jacket. Velcro straps to easily slide along length of cable. Velcro tie wraps used in plenum spaces to be CMP/FT-6 rated.
- .6 Protect cable from any obstructions using appropriate grommeting in roof of enclosure.
- .7 Properly ground and bond enclosure and equipment to room ground bus as per specifications and to standards of TIA/EIA 607.

3.10 SYSTEM IDENTIFICATION

- .1 Provide a complete identification system that clearly designates following:
 - .1 Horizontal cable;
 - .2 Workstation (or faceplate);
 - .3 Horizontal/passive patchpanel port;
 - .4 Switch/active patchpanel port;
 - .5 Patch cords;
 - .6 Switch rack.
- .2 Obtain Parks Canada Representative's approval of identification format, prior to start of work. Format to comply with Parks Canada Representative's standards. Submit proposed identification system and nomenclature with shop drawing submission.
- .3 Labels:
 - .1 Labels for outlet and patch panel identification to be typewritten/computer printed self-adhesive type with white printing area at outlet location and on face of patch panel; legible permanent marker on inside of outlet box cover; use minimum font size Arial 10 point.
 - .2 Number and identify each computer hub rack with a 20 mm x 50mm (¾" x 2") engraved lamacoid plate, with white letters on black background. For letters and numbers use Arial 24 font size. Fasten nameplates with minimum two metal screws.
 - .3 Cable Identification:
 - .1 Permanently identify horizontal UTP cables at both ends of cable, placed within 13 mm (½") at outlet location and 50 mm (2") at rack location and inside of outlet cover in following manner:

"CABLE # / RACK # / PATCH PANEL PORT # / OUTLET #"
 - .4 Faceplate:
 - .1 Label data ports: "Closet / Patch Panel/Port Number", where closets to be numerically assigned, patch panels to be sequentially alphabetically assigned beginning at top of rack and ports sequentially numerically assigned related to number of ports per patch panel.
 - .2 Label voice ports: "Port Number/Level/Closet", where ports are sequentially numerically assigned, level refers to floor level on which communication closet is located and closets to be numerically assigned as per data ports.
 - .5 Patchpanel And Patch Cord Identification:
 - .1 Identify patchpanel ports in simple numeric form approved by Parks Canada Representative.
 - .2 Identify patch cords at both ends in simple numeric form, not necessarily corresponding to port numbers and be approved by Parks Canada Representative.

- .4 Identification Log:
 - .1 Record cable and workstation identification in a hard copy "CABLE IDENTIFICATION LOG" which is to be handed over to Parks Canada Representative after cable testing and certification is complete. Forward duplicate copy to Parks Canada Representative.

3.11 CABLE TESTING AND SYSTEM CERTIFICATION

- .1 Testing and verification to be performed to standards listed herein this Section and in accordance with system manufacturer's testing and certification procedures.
- .2 Structured cabling system certification to include 100% cable testing and verification for an EIA/TIA required category grade rating solution.
- .3 Perform verification of each cable and document on a cable testing sheet forming part of hard and soft copy documentation supplied at end of installation. Testing sheets to list detailed performance test measurements as requested and as required to prove compliance with referenced standards. Also include summary sheet of passes, failures and rectified failures. Submit sample of test sheet with shop drawings.
- .4 Testing Procedures:
 - .1 Perform testing using Category 6 testers such as Fluke Networks Versiv family, or equivalent Microtest or Scope Communications. Tester to meet TIA/ISO certification standards for Levels IIe, III, IIIe, IV and V. Submit with shop drawings copy of calibration certificate issued by tester manufacturer's authorized technician identifying calibration within one year of use for testing on this project. Testing to include, but not be limited to following:
 - .1 Wire map;
 - .2 Cable length;
 - .3 Attenuation;
 - .4 Near end crosstalk (next);
 - .5 Power sum near end crosstalk (PSNEXT);
 - .6 Equal level far end crosstalk (ELFEXT);
 - .7 Power sum equal level far end crosstalk (PSELFEXT);
 - .8 Return loss;
 - .9 ACR;
 - .10 Power sum ACR;
 - .11 End to end continuity;
 - .12 Opens or shorts;
 - .13 Pair polarity.
 - .2 Field testing units for multimode fibre optic cabling to comply with ANSI/TIA-526-14-B. Field testing units for singlemode fibre optic cabling to comply with ANSI/TIA/EIA-526-7.

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- .3 Tester to include required modules for certification testing of fibre optic cabling. Perform fibre testing on each fibre in completed end-to-end system. Do not splice cables except where approved by Parks Canada Representative. Testing to consist of an end-to-end power meter test performed per TIA/EIA-455-53A and. Provide system loss measurements at 850 and/or 1300 nanometers for multi-mode fibres and 1310 and/or 1550 nanometers for single mode fibres. These tests also include continuity checking of each fibre.
 - .4 For horizontal cabling system using multi-mode optical fibre, measure attenuation in one direction at either 850 nanometer (nm) or 1300 nm.
 - .5 Test backbone multi-mode fibre cabling at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in at least one direction.
 - .6 Conduct test set-up and performance in accordance with ANSI/TIA/EIA-526-7 and/or ANSI/TIA/EIA-526-14 Standards, and to manufacturer's application guides.
 - .7 Perform attenuation testing with a stable launch condition using two-meter jumpers to attach test equipment to cable plant. Light source to be left in place after calibration and power meter moved to far end to take measurements.
 - .8 Acceptable loss measurements for 50 micron laser optimized solution at 850 nm wavelength is not to exceed 2.5 db.
 - .9 Since optical signal attenuation at one wavelength is independent of attenuation at a second wavelength, measure attenuation of channel at both standard wavelengths (850nm and 1300nm) for backbone links.
 - .10 Replace cable not passing testing procedure, in its entirety. No splicing is permitted.
 - .5 Reports:
 - .1 Submit test results to system manufacturer and obtain manufacturer's certificate of approval of system. Submit detailed indexed test report in a 3 - ring binder with manufacturer's certificate of approval of installation and testing of system and covering letter from company responsible for installation and testing of system stating accuracy of report. Letter to be signed by company's authorized testing technician. Document testing and reports with date and time of testing, testing technician's name and signature and specification Section number that test fulfilled.
 - .2 Submit minimum 2 hard copies of report and including digital format loaded on USB type memory flash drive.

3.12 SYSTEM TRAINING AND INSTRUCTIONS

- .1 Provide training of Parks Canada Representative's designated staff on principles of connections and operations to system. Clearly instruct on procedures of disconnections and reconnections to accommodate changes and relocations of connected equipment.

END OF SECTION