

27 Communications

27.05.00 COMMON WORK RESULTS FOR COMMUNICATIONS

1 General

1.1 SYSTEM DESCRIPTION

- .1 Cabling system and subsystem components including cable, termination hardware, supporting hardware, and miscellany to install a complete telecommunications system supporting voice and data.

1.2 REFERENCES

- .1 Telecommunications Industry Association (TIA) / Electronic Industries Alliance (EIA):
 - .1 ANSI/TIA/EIA 606-A, Administration Standard for Commercial Telecommunications Infrastructure
 - .2 J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
 - .3 ANSI/TIA/EIA 568-C.1,C.2 (Part I and II and all associated addendums) Commercial Building Telecommunications Cabling Standard Part 1 General Requirements.
 - .4 ANSI/TIA/EIA 568-C.3 (and all associated addendums) Optical Fibre Cabling Components Standard.
 - .5 ANSI/TIA/EIA 569-A, (and all associated addendums) Commercial Building Standard for Telecommunications Pathways and Spaces.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-10, Canadian Electrical Code.
 - .2 CSA C22.2, No. 226-92 Protectors in Telecommunications Networks.
- .3 Building Industry Consulting Services International (BICSI):
 - .1 BICSI Telecommunications Distribution Methods Manual 12th Edition.
 - .2 BICSI Information Transport Systems Installation Manual 4th Edition.
 - .3 BICSI Customer Owned Outside Plant Manual 4th Edition.
 - .4 ANSI/NECA/BICSI 568-2001 Installing Commercial Telecommunications Cabling.

1.3 SCOPE OF WORK

- .1 The project consists of the fit out of two floors for at 391 York St. Winnipeg, MB.
- .2 The Communications Contractor shall be responsible for

the supply and installation of a complete structured cabling system based on using a star topology for the systems further detailed in this document.

- .3 The specific scope of this project includes but is not limited to the following:
 - .1 Supply and installation of Category 6, 4-pair UTP horizontal copper cabling and related accessories to support end-user data and/or voice applications. Provide qty 3 cables at every workstation outlet supporting 2 data and 1 voice application. Provide qty 1 cable at every fax, printer and wall phone location. Provide qty 1 cable to the center point (above T-bar panels) of each conference room and designated collaboration area for future WI-FI hotspots.
 - .2 Supply and installation of qty 1, 200 pair/24 awg multipair copper cabling and related accessories to support voice over the backbone between TR 1 (Room 143) and Comm 2, Rack 1 (Room 206).
 - .3 Supply and installation of qty 1, 25 pair/24 awg multipair copper cabling and related accessories to support voice over the backbone between the basement Entrance facility (Existing MTS Termination field) and TR 1, Rack 1 (Room 143).
 - .4 Supply and installation of qty 1, 12 strand singlemode optical fibre cable and related accessories to support data and/or voice applications over the backbone between the basement Entrance facility and TR 1, Rack 1 (Room 143).
 - .5 Supply and installation of qty 1, 12 strand singlemode optical fibre cable and related accessories to support data and/or voice applications over the backbone between TR 1 (Room 143) and Comm 2, Rack 1 (Room 206).
 - .6 Supply and installation of qty 2 new 19", 2 post racks, equipment and accessories in each Room (143 and 206).
 - .7 Complete testing of each cable in a timely fashion and in coordination with other trades and services to ensure a completely tested system prior to activation by the client or PWGSC Representative.
 - .6 Supply temporary and final documentation (drawings) as required.
 - .7 Complete all final documentation requirements including documentation and site reviews to provide manufacturer's 20 year application warranty and Cabling System Certification.

1.4 SUBMITTALS

- .1 Certificate of status as qualified and fully authorized system vendor for the cabling manufacturer submitted.
- .2 Submit Product Data: Manufacturer's specifications, technical data and full bill of materials noting delivery dates from receipt of order.
- .3 Submit Reel Tests: OTDR test results of cable reels from on-site spot tests of fibre reels before installation.
- .4 As-Built Drawings:
 - .1 The installation contractor will be provided with 2 sets drawings at the start of the project. One set will be designated as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical Representative upon request during the course of the project. Anticipated variations from the build-to drawings may be for such things as cable routing. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the DCC Representative.
 - .2 The Contractor shall provide the central drawing set to the PWGSC Representative at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labelling for the cabling system.

1.5 INSTALLER QUALIFICATIONS

- .1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- .2 The Communications Contractor to be an authorized installer of the manufacturer providing warranty:
 - .1 Panduit: Mission Critical.
 - .2 Belden: Belden Certified Installer.
 - .3 Hubbell: Hubbell Certified Installer.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.
- .2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature limitations.
- .4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- .5 Do not use damaged materials.
- .6 DCC Representative will advise on material delivery and storage locations.

1.7 PROJECT CONDITIONS

- .1 Do not use materials that are damaged or do not pass on-site testing.
- .2 Verify existing conditions before starting work.
Correct unsatisfactory conditions before proceeding.

2 Products

2.1 NOT USED.

3 Execution

3.1 GENERAL.

- .1 Inside Wiring:
 - .1 Work consists of the installation of new CAT6 copper and OM2 Optical Fibre cabling.
 - .2 Work to be completed as part new fit-up construction.

27.05.26 BONDING AND GROUNDING FOR COMMUNICATIONS

1 General

1.1 SYSTEM DESCRIPTION

- .1 The telecommunications grounding and bonding system is to be used for all telecommunications infrastructure. Telecommunications grounding and bonding is an additional grounding system installed specifically for telecommunications systems.

1.2 SCOPE OF WORK

- .1 Work covered by this Section to consist of furnishing

labour, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labelling of grounding and bonding infrastructure as described on the Drawings and/or required by these specifications.

1.3 REFERENCES

- .1 Refer to Section 27.05.00, para 1.2.

1.4 DEFINITIONS

- .1 TMGB (Telecommunications Main Grounding Busbar). A Copper Ground reference busbar, typically installed in the entrance facility or entrance room, and is bonded to the service equipment ground (power) ground by the interconnecting bonding conductor.
- .2 GE (Grounding Equalizer). The Conductor that interconnects elements of the Telecommunications Grounding Infrastructure.
- .3 TGB (Telecommunications Grounding Busbar). A Copper Ground reference busbar, typically installed in Telecommunications Rooms(TR) and is bonded to the TMGB by the TBB. The TGB references metallic entities in the TR space to ground.
- .4 TBB (Telecommunications Bonding Backbone) An insulated copper conductor that interconnects the TMGB to TGB's.
- .5 BCT (Bonding Conductor for Telecommunications): A conductor that interconnects the telecommunications bonding infrastructure to the buildings service equipment ground.
- .6 EC (Equipment Bonding Conductor) A insulated copper conductor that bonds metallic items and equipment to the TMGB and TGB.
- .7 RBC (Raceway Bonding Conductor) A insulated copper conductor that provided a separate bond for the Cable tray System.
- .8 AWG (American Wire Gauge)

1.5 SUBMITTALS

- .1 Submit to PWGSC Representative shop drawings, product data (including cut sheets and catalog information). Submit shop drawings, product data, and samples with such promptness and in such sequence as to cause no delay in the work or in the activities of separate contractors. The PWGSC Representative will indicate approval of shop drawings, and product data.

1.6 BONDING INSTRUCTIONS

- .1 Bond to ground all racks, metallic backboards, cable

sheaths, metallic hardware, metallic strength members, splice cases, cable trays, communication conduits (in use or left empty), etc. entering or residing in the Telecom Room or distribution points to the respective TGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

- .2 Install all grounding conductors in as straight a path as possible, with any bends respecting the bend radius minimum requirement of 10 times the diameter of the conductor.
- .3 Perform grounding and bonding in accordance with the Canadian Electrical Code latest version.

2 Products

2.1 GROUNDING BUSBARS

- .1 Telecommunications Main Grounding Busbar (TMGB):
 - .1 Predrilled copper busbar, approved by CSA, with holes pre-drilled for use with standard-sized lugs to: ANSI J-STD-607-A.
 - .2 Dimensions 6mm thick, 100mm wide, 508mm long to: ANSI J-STD-607-A.
- .2 Telecommunications Grounding Busbar (TGB):
 - .1 Predrilled copper busbar, approved by CSA, with holes pre-drilled for use with standard-sized lugs to: ANSI J-STD-607-A.
 - .2 Dimensions 6mm thick, 100mm wide, 508mm long to: ANSI J-STD-607-A.

2.2 BONDING CONDUCTORS

- .1 Bonding Conductor for Telecommunications (BCT):
 - .1 Green insulated copper bonding conductor, size as required by CEC.
 - .2 The BC to be, as a minimum, the same size as the TBB.
- .2 Telecommunications Bonding Backbone:
 - .1 Green insulated copper conductor, minimum size of No. 6 AWG. The TBB shall be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG. Insulation shall meet fire ratings of its pathway.
 - .2 Table 1: Sizing of the TBB

TBB length (ft)	TBB Size (AWG)
< 13	6
14-20	4
21-26	3
27-33	2
34-41	1
42-52	1/0

53-66 2/0
> 66 3/0

2.3 BONDING CONDUCTOR TERMINALS

- .1 Two-Hole compression lugs, long barrel type, sized as per AWG of cable.
- .2 High conductivity wrought copper.
- .3 Electro tin plated.
- .4 Hole spacing as per TMGB and TGB.

2.4 BONDING AND GROUNDING CLAMP

- .1 All ground wires originating at the TMGB or TGB to be clamped to the plywood backboard "B" ground wire clamps.
- .2 Mechanically galvanized to ASTM B695.
- .3 Hole diameter: 5.6mm.

3 Execution

3.1 GENERAL INSTALLATION REQUIREMENTS

- .1 Install all Bonding Conductors as per CEC and manufacturers recommended installations procedures.

3.2 INSTALLATION OF TEL-ECOMMUNICATIONS GROUNDING SYSTEM

- .1 Install TMGB or TGB's for each Telecommunications Room(TR and other areas that are designated an Telecommunications spaces.
- .2 Bonding conductors to be continuous unbroken and routed in a direct route to point of termination.
- .3 Bonding conductors not to be bent less than 10 times the outside diameter of the conductor.
- .4 Clean TMGB and TGB's prior to terminating conductors.
- .5 Label all telecommunications bonding conductors as close as possible to their termination point to section 27 05 53.
- .6 Bond the TMGB to the service equipment ground, using the most direct route to minimize conductor length using conductor size indicated for the BC.
- .7 Bond all TGB's to TMGB using conductor size indicated for the TBB or GE.
- .8 When multiple TBB's are used in a multi-story building they shall be bonded together on the top floor and at every third floor, at a minimum, using the bonding conductor size indicated for the GE.
- .9 All bonding conductors that originate at the TMGB or TGB to be connected via a 2-hole compression lug on each end to ground the metallic parts.
- .10 Bond the following with the conductor size as indicated for EC to the TMGB or TGB located in telecom space that the TMGB or TGB is located in:

- .1 Telecommunications panel boards directly to the alternating current equipment ground bus.
- .2 Building structural steel.
- .3 Metallic equipment racks (can be bonded to Cable tray)
- .4 Cable shields .
- .5 Primary protection module cases.
- .6 All metallic raceways and cable tray for Telecommunications cabling extending from the same room or space where the TMGB or TGB is located.
- .7 Each metallic conduit or sleeve individually connecting to the ground bushing with a 2-hole compression lug.
- .8 Access control/Intrusion Alarm Systems.
- .9 CCTV systems.
- .10 CATV Systems.
- .11 Other metallic parts as required by the CEC.
- .11 TBB shall be continuous and unbroken; a irreversible crimp connector can be used to service TGB's in the vertical plane.
- .12 Ground secondary telecommunications system to TMGB/TGB.

27.05.28 PATHWAYS FOR COMMUNICATIONS

1 General

1.1 SYSTEM DESCRIPTION

- .1 Empty telecommunications conduit and raceways systems consists of outlet boxes, cover plates, distribution cabinets, conduits, pull boxes, cable trays, sleeves with caps, and fish wires.
- .2 The pathway provides a facility for the placement of telecommunications cabling.

1.2 REFERENCES

- .1 Refer to Section 27.05.00, para 1.2.

1.3 PERMIT AND FEES

- .1 Submit to Inspection Authority and/or Supply Authority necessary number of drawings and specifications for examination and approval prior to the commencement of work.
- .2 Obtain and pay all associated fees and permits necessary for the performance of the work.

1.4 COORDINATION

- 1. Coordinate installation of conduit which penetrates

fire rated walls, floors or ceilings with firestopping work specified in Division 7. Ensure integrity of fire rated element is maintained.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.
- .2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature limitations.
- .4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- .5 Do not use damaged materials.
- .6 DCC Representative will advise on material delivery and storage locations.

2 Products

- 2.1 NOT USED.

3 Execution

- 3.1 NOT USED.

27.05.28.29 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

1 General

1.2 PERFORMANCE REQUIREMENTS

- .1 Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- .2 Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

2 Products

2.1 STRUT TYPE SUPPORT CHANNEL

- .1 U Shape.
- .2 Size: 41mm x 41mm .
- .3 Thickness: 2.5mm.
- .4 Parts and hardware: Zinc coat or provide equivalent corrosion protection.

- .5 Multiple conduit (trapeze) hangers: Not less than 38mm x 38mm (1 1/2 x 1 1/2 inch), 12 gauge steel, cold formed, lipped channels; with not less than 9mm (3/8 inch) diameter steel hanger rods.
- .6 Solid Masonry and Concrete Anchors: Self drilling expansion shields, or machine bolt expansion.
- .7 Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - .1 Allied Tube & Conduit.
 - .2 Cooper B-Line, Inc.; a division of Cooper Industries.
 - .3 ERICO International Corporation.
 - .4 GS Metals Corp.
 - .5 Thomas & Betts Corporation.
 - .6 Unistrut; Tyco International, Ltd.

2.2 INDIVIDUAL CONDUIT HANGERS

- .1 Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

3 Execution

3.1 GENERAL

- .1 Cable tray and ladder racking must be installed to meet the National and local Building codes, CEC and CSA T530 standards. Inaccessible ceiling areas such as lock-in type ceiling tiles, drywall or plaster shall not be used as distribution pathways.
- .2 Cable trays shall be located to suit the application. Also, it shall be accessible for future changes to both the cable tray and cabling system.
- .3 Support cable trays are to suit loading and recommended support requirements in the Canadian Electrical Code, Part 1, for the applicable class. A support shall be placed within a maximum of 610mm on either side of any connection to a fitting.
- .4 Application:
 - .1 Comply with CEC for application of hangers and supports for telecommunications systems except if requirements in this Section are stricter.
 - .2 Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT required by CEC. Minimum rod size to be 9.5mm in diameter.
 - .3 Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted

- support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
- .4 Secure raceways and cables to these supports with two-bolt conduit clamps.
- .5 Support Cable tray of approved types of wall brackets, trapeze supports. Plumbers perforated straps are not permitted means of support.
- .6 Construct rack using steel channel, provide space on each for 25 percent additional conduits or cable trays.
- .7 Cable tray support systems shall be securely and adequately installed to preclude movement of cable tray during pulling operations.
- .8 Maximum Height for installed telecommunications systems is 3352mm.
- .9 No other systems can be attached to the telecommunications cable tray system supports.
- .10 Power or mechanical controls shall not be attached to the telecommunications cable tray system supports.

3.2 INSTALLATION

- .1 Comply with Canadian Electrical Code, Part 1, for installation requirements except as specified in this Article.
- .2 Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 90 kg.
- .3 Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - .1 To Wood: Fasten with lag screws or through bolts.
 - .2 To New Concrete: Bolt to concrete inserts.
 - .3 To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - .4 To Existing Concrete: Expansion anchor fasteners.
 - .5 Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 100 mm thick or greater. Do not use for

- anchorage to light weight aggregate concrete or for slabs less than 100mm thick.
- .6 To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - .4 Support cable tray to suit loading and recommended support requirements in the Canadian Electrical Code, Part 1, for the applicable class. A Support shall be placed within a maximum of 610mm on either side of any connection to a fitting and 1524mm on centre as recommended by the cable tray manufacturer.

27.05.28.33 CONDUIT AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

1 General

1.1 SYSTEM DESCRIPTION

- .1 Empty telecommunications conduit and raceways systems consists of outlet boxes, cover plates, conduits, pull boxes, sleeves with caps, and fish wires.

2 Products

2.1 GENERAL

- .1 Except where otherwise required by Canadian Electrical Code, provide conduit of types specified in Conduit Installation Schedule and sizes indicated on drawings or specified.

2.2 METAL CONDUIT AND TUBING

- .1 Electrical Metallic Tubing (EMT): to CSA C22.2 No. 83-M1985m with fittings as follows:
 - .1 Fitting material for 27mm size conduit and smaller: zinc alloy or zinc coated steel.
 - .2 Fitting material for conduit larger than 25mm: zinc coated steel.
 - .3 Type: compression or set screw.
- .2 Miscellaneous Fittings: locknuts, bushings, reducers, chase nipples, 3 piece unions, split couplings, plugs, and expansion fittings specifically designed for their particular application. All connectors must have an insulated throat or busing installed.
- .3 Fish wire: polypropylene type.

2.3 OUTLETS, JUNCTION AND PULL BOXES

- .1 Pull and junction boxes: to CSA C22.2 No. 40-M1989 and as follows.

- .1 .1 Material: Code gauge steel
- .2 .2 Cover: Screw-on.
- .2 Outlet boxes: to CSA C22.2 No. 18-92 and as follows:
 - .1 Type: ANSI/NEMA OS 1 type, conduit boxes double gang size.
 - .2 Sheet steel boxes: pressed sheet steel, galvanized, blanked for conduit, integral locating lugs.

2.4 CONDUIT INSTALLATION SCHEDULE

- .1 Conduit Type: EMT used for all applications.

2.5 SURFACE MOUNTED RACEWAY

- .1 Surface Raceway is a single channel raceway designed to route, protect and conceal data, voice, video, fibre-optic cables.
- .2 UL and CSA rated 600 V; to UL 5A and CSA C22.2 No. 62.1-03 standards; FT4 rated CE - Compliant.
- .3 one-piece hinged design allows cables to be laid in.
- .4 Tamper resistant one-piece latching surface raceway. Supplied with pre-punched mounting holes.
- .5 Colour: White
- .6 Dimensions: 39 x 22mm.
- .7 Complete with all bend radius control fittings.

3 Execution

3.1 GENERAL CONDUIT INSTALLATION

- .1 Install empty raceway system, including overhead distribution system, fish wire, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable troughs, service poles, miscellaneous and positioning material to constitute complete system.
- .2 Install conduit to CSA C22.10.
- .3 Install non-metallic conduit to manufacturer's written instructions.
- .4 Arrange supports to prevent misalignment during wiring installation.
- .5 Group related conduits; support using conduit rack.
- .6 Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports
- .7 Do not attach conduit to ceiling support wires.
- .8 Arrange conduit to maintain headroom and present neat appearance.
- .9 Route exposed conduit parallel and perpendicular to walls.
- .10 Route conduit installed above accessible ceilings parallel and perpendicular to walls.

- .11 Maintain adequate clearance between conduit and piping.
- .12 A pull box must be installed:
 - .1 After every two bends or offsets totalling more than 180 degrees.
 - .2 Every 30 meters.
 - .3 Pull boxes to be metal construction with hinged cover.
 - .4 Install the appropriate size pull boxes (or the nearest matching size) indicated on the floor plan.
 - .5 A pull box shall not be used in lieu of a bend. All conduits should be aligned and opposite to each other within the pull box.
- .13 Maintain 300mm clearance between conduit and surfaces with temperatures exceeding 40 degrees C.
- .14 Cut conduit square using saw or pipe cutter; de burr cut ends.
- .15 Conduit ends to have bushings to protect optical fibre cable from damage.
- .16 Bring conduit to shoulder of fittings; fasten securely.
- .17 Provide suitable pull string in each empty conduit except sleeves and nipples.
- .18 Ground and bond conduit to Section 27 05 26 - Grounding and Bonding for Communications Systems.

3.2 OUTLET BOXES

- .1 Outlet Box installation requirements
 - .1 Install telecommunications outlet boxes for voice/data systems at same level as adjacent receptacles and flush to the wall wherever possible. Outlet boxes will be placed above desk height.
 - .2 Where telecommunications outlets are installed in steel stud type systems, provide additional cross bracing and or straps to make the installation completely rigid prior to the application of the wall facing material.
 - .3 Back to back and offset outlets shall not be used. Maintain minimum 150mm between outlet boxes.
 - .4 Apply appropriate acoustic sealing as necessary on back of telecommunications outlet boxes to ensure the STC rating is maintained.
 - .5 Ensure conduits are installed not to de-rate the STC rating of the wall.
 - .6 Ensure telecommunications outlet box is mechanically bonded to the conduit system.

- .7 Conduits must enter the outlet box from the top or bottom.
- .8 Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

3.3 SURFACE MOUNTED RACEWAY

- .1 Mount surface raceway as per manufacturers recommended procedures.
- .2 When transitioning from EMT above the ceiling to wall mounted raceway a "drop ceiling/entrance end fitting" will be used.
- .3 Surface mounted raceways are not permitted to be used on ceilings of any sort.
- .4 Surface raceway shall not be mounted using the adhesive backing. Hardware like gypsum board anchors may be used in gypsum board and a screw/anchor combination may be used in cinderblock. Substitute hardware may be used.
- .5 Include proper fittings must be used while transitioning between distribution mediums. No free air gaps are permitted.

27.05.28.36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

1 General

1.1 SYSTEM DESCRIPTION

- .1 The pathway for inside plant communications systems consists of the hangers, supports, conduit and cable tray infrastructure that comprises of the vertical and horizontal route of telecommunications cabling. The pathway provides a facility for the placement of telecommunications cabling.

1.3 QUALITY ASSURANCE

- .1 All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- .2 Supply all equipment and accessories new and free from defects.
- .3 All items of a given type to be the products of the same manufacturer.

1.4 COORDINATION

- 1. Coordinate installation of conduit which penetrates fire rated walls, floors or ceilings with firestopping work specified in Division 7. Ensure integrity of fire rated element is maintained.

1.5 SUBMITTALS

- .1 Submit Product Data: Manufacturer's specifications, technical data and full bill of materials noting delivery dates from receipt of order.
- .2 Submittals shall be complete, bound under cover and indicating project title, specification section and/or drawings references. Contractor shall review submittals for conformance with Contract Documents, make necessary revisions and submit to DCC Representative, indicating the following:
Manufacturer's name, brand name and catalog sheet(s)
reference of all equipment and materials specified under this Section:
 - .1 Submit drawings of cable tray and accessories including connector assemblies, clamp assemblies, brackets, splice plates, splice bars, grounding clamps and hold down plates showing accurately scaled components.
 - .2 Submit manufacturer's data on cable tray support system including, but not limited to, types, materials, finishes and inside depths.

2 Products

2.1 BASKET TYPE CABLE TRAY

- .1 Basket type tray sections and components:
 - .1 Provide wire basket of types and sizes indicated; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces in compliance with applicable standards.
 - .2 Materials and Finishes: Material and finish specifications for pre-galvanized steel wire are as follows:
 - .1 Black powder coat: Straight sections to be powder coated black with an average paint thickness of 1.2mils (30microns) to 3.0mils (75microns).
- .2 Type of Wire Basket Support System:
 - .1 All straight section longitudinal wires to be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
 - .2 Wire basket to be made of high strength steel wires and formed into a standard 50mm by 100mm wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.

- .3 Wire basket sizes to conform to the following nominal criteria:
 - .1 Straight sections to be furnished in standard 2997mm lengths.
 - .2 Wire diameter to be 5mm minimum on all mesh sections.
 - .3 Wire basket to have a 100mm usable loading depth by 304mm and/or 457mm wide.
- .3 All fittings to be field formed, from straight sections, in accordance with manufacturer's instructions.
- .4 All splicing assemblies to be ULC/CSA approved as an equipment ground conductor (EGC). When using powder coated wire basket as an EGC, the paint must be completely removed at all contact points of splice/ground bolt attachment.
- .5 Wire basket supports to be trapeze hangers or wall brackets provided by manufacturer.
- .6 Trapeze hangers to be supported by 9.5mm diameter rods.
- .7 Special accessories shall be furnished as required to protect, support and install a wire basket support system. **Acceptable Products for Cable ladder rack include: Wire mesh basket tray are Cablofil Part # CF-105/300-EZ, Wire Basket Tray Part # WBT4X12-S, Flextray Part # Ft4x12x10-EG or products of similar specifications.**

2.2 LADDER TYPE CABLE TRAY

- .1 Ladder type trays to consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 304mm on center. Spacing in radiused fittings shall be 228mm and measured at the center of the tray's width. Rungs to have a minimum cable bearing surface of 23mm with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails.
****Each rung must be capable of supporting the maximum cable load, with a safety factor of 1.5 and a 200 pound concentrated load when tested in accordance with NEMA VE-1, section 5.4. Acceptable Products for Cable ladder rack include: Hubbell Part # HLS1012B, Newton #2003-6, Middle Atlantic #CLB-10 or products of similar specifications.**

3 Execution

3.1 GENERAL

- .1 Cable tray and ladder racking must be installed to meet the national and local building codes, CEC and CSA T530 standards. Inaccessible ceiling areas such as lock-in type ceiling tiles, drywall or plaster shall not be used as distribution pathways.
- .2 Cable trays shall be located to suit the application. Also, it shall be accessible for future changes to both the cable tray and cabling system.
- .3 Support cable trays are to suit loading and recommended support requirements in the Canadian Electrical Code, Part 1, for the applicable class. A support shall be placed within a maximum of 610mm on either side of any connection to a fitting.
- .4 J-Hooks will **NOT** be approved for this project.

3.2 INSTALLATION

- .1 Support Cable tray with approved types of wall brackets, trapeze supports. Plumbers perforated straps are not permitted means of supports.
- .2 Centre hung cable tray is not acceptable for telecommunications cabling.
- .3 Conduits and equipment to be independently supported and free from any other mechanical systems.
- .4 Construct rack using steel channel, provide space on each for 25 percent additional conduits
- .5 Conduit and cable tray support systems shall be securely and adequately installed to preclude movement of cable tray during pulling operations.
- .6 Maximum installation height: 3352mm.
- .7 No other systems can be attached to the trapeze supports of the cable tray.
- .8 Power or mechanical controls shall not be attached to telecommunications cable trays.
- .9 Cable trays to be installed at least 300mm away from fluorescent luminaries and shall cross power cables at right angles. Provide minimum 300mm access headroom above the cable tray where practical. "Do not" permit other building components such as: air conditioning ducts to restrict access to trays.
- .10 Cable tray to be supported via Manufactures brackets, or supports manufactured on site using Unistrut, meeting all the manufacturers' requirements for loading.
- .11 Cable tray shall be supported by cantilever brackets, trapeze brackets, or individual rod suspension, Supports to be approved types of wall brackets or trapeze hangers. Additional bracing may be required for seismic restraints.
- .12 Cable tray shall be installed above false ceilings or

- below access floors. Under no circumstances should cable tray be installed above a fixed ceiling. Provide a minimum of three 103mm conduits to transition the fixed ceiling portions. Install additional conduits if the fill rating of the cable require additional conduits.
- .13 Cable Trays installed 150mm above a false ceiling with 300mm clear access above. Cable tray to be installed with separation from sources of EMI and electrical power system as indicated.
 - .14 Communications Cable Tray shall NEVER be run over:
 - .1 Boilers
 - .2 Incinerators
 - .3 Hot Water lines
 - .4 Steam lines
 - .5 Electrical rooms and Closets
 - .6 Washrooms.
 - .15 Support Cable Tray to suit loading and recommended support requirements in the Canadian Electrical Code, Part 1, for the applicable class. A Support shall be placed within a maximum of 610mm on either side of any connection to a fitting and 1524mm on centre as recommended by the cable tray manufacturer. Cable Tray shall be adequately fastened to withstand pulling tensions as per manufacturers recommendations.
 - .16 Remove any burrs, sharp edges, or projections that may damage cables.
 - .17 Install proper manufactured accessories and fittings such as elbows, reducers, crossovers, tees and risers for any change of direction, height or change of direction of the cable tray. Vented accessories shall be used.
 - .18 Install cable tray a minimum of 300mm from fluorescent luminaries, Power cables shall cross at right angles to communications cables with the separation distances as indicated.
 - .19 Install Cable tray either using angle brackets or trapeze, ensure only communications systems can be racked to the bottom of the tray. Electrical power or Mechanical controls shall not be racked or installed using communications equipment supports or hangers.
 - .20 Install Grounding and Bonding in accordance with section 27 05 26. When joining two sections of painted tray, remove paint or other coatings from cable tray and install bonding continuity clips as per manufacturers specifications.
 - .21 Ensure other building components, i.e.: mechanical ducts, sprinkler pipes, luminaries, etc do not restrict access to Communications cable tray.

- .22 Install basket type cable tray to manufacturers specifications.

27.05.53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

1 General

1.1 SYSTEM DESCRIPTION

- .1 Communications Labelling consists of the unique identifiers attached to all telecommunications terminations and systems.

1.2 RELATED SECTIONS

- .1 27 05 00 Common Work Results for Communications.
- .2 27 05 26 Grounding and Bonding for Communications Systems.
- .3 27 05 28.33 Conduit and Backboxes for Communications Systems.
- .4 27 11 16 Communications Cabinets, Racks, Frames and Enclosures.
- .5 27 11 19 Communications Terminations Blocks and Patch Panels.
- .6 27 13 13 Communications Copper Backbone Cabling.
- .7 27 13 23 Communications Optical Fibre Backbone Cabling.
- .8 27 15 13 Communications Copper Horizontal Cabling.
- .9 27 15 23 Communications Optical Fibre Horizontal Cabling.
- .10 27 15 43 Communications Faceplates and Connectors.
- .11 27 16 19 Communications Patch Cords, Station Cords and Cross Connect wire.

1.3 REFERENCES

- .1 Refer to Section 27.05.00, para 1.2.

2 Products

2.1 PATHWAY SYSTEMS LABELS

- .1 Cable Tray Labels:
 - .1 Machine printed labels 50mm high x 75mm long.
 - .2 White Colour with Black text, Adhesive backed, Polyester type.
 - .3 Font Size: Minimum 6mm.

2.2 GROUNDING AND BONDING SYSTEM LABELS

- .1 GROUND SAFETY LABELS:
 - .1 Pre-manufactured labels 50mm high x 75mm long.
 - .2 Yellow Colour, Green text, non Adhesive backed, Rigid Plastic Tag.

- .4 Font Size: Minimum 6mm.
- .2 GROUNDING CABLE RISER LABELS:
 - .1 Machine printed labels 12.7mm high x 50mm long.
 - .2 White Colour with Black text, non Adhesive backed, polyester polycarbonate data plate.
 - .3 Font Size: Minimum 6mm.
- 2.3 TELECOMMUNICATIONS INFRASTRUCTURE SYSTEM LABELS
 - .1 Copper Riser Labels:
 - .1 Machine printed labels 12.7mm high x 50mm long.
 - .2 White Colour with Black text, non Adhesive backed, polyester polycarbonate data plate.
 - .3 Font Size: Minimum 6mm.
 - .2 Optical Fibre Riser Labels:
 - .1 Machine printed labels 12.7mm high x 50mm long.
 - .2 White Colour with Black text, non Adhesive backed, polyester polycarbonate data plate.
 - .3 Font Size: Minimum 6mm.
 - .3 Horizontal Cable Labels:
 - .1 Machine printed labels 38mm high x 12.7mm long 6.35mm print area.
 - .2 White Colour with Black text, Adhesive backed, Polyester wraparound type.
 - .3 Font Size: Minimum 6mm.
 - .4 Outlet Identification Labels:
 - .1 Machine printed labels 7.3mm high x 75mm long.
 - .2 White Colour with Black text, Adhesive backed, Polyolefin type Laser Printed.
 - .3 Font Size: Minimum 6mm.
 - .5 Rack Identification Labels:
 - .1 Lamacoid 50mm high x 100mm long
 - .2 BLACK in Colour, with White text 25mm high.
 - .3 Font Size: Minimum 6mm.

3 Execution

- 3.1 GENERAL INSTALLATION REQUIREMENTS
 - .1 Install all labels to ensure machine printing does not rub off under normal wear.
 - .2 Label conduit/cable tray system for the following systems:
 - .1 Voice/Data Conduits and Cable Tray: Colour Green.
 - .3 Wall mount IDC colour for communications risers and voice services:
 - .1 Demarcation Point from service provider: Orange.
 - .2 Owner network connection from service provider: Green.
 - .3 Horizontal cable: Blue.
 - .4 Auxiliary circuits, alarms, maintenance, security

and misc: Yellow.

3.2 CONDUIT LABELING

- .1 Network 1 conduit labelling: Label conduits where they penetrate the wall to the telecom outlet. The label shall indicate the pull box or cable tray and the outlet.
 - .1 TRXX 2E01 - PBTRXX-YY where XX = room number and YY is unique sequential number.
 - .2 TRXX 2E01 - CTTRXX-YY where XX = room number and YY is unique sequential number.

3.3 PULL BOX LABELING

- .1 Network 1: Label all pull boxes on the visible exterior with the PB number IE: PBTRXXX-YY where XXX = room number and YY is unique sequential number.

3.4 COPPER BACKBONE LABELING

- .1 Label copper backbone cables at point where cable enters the telecom room or main telecom room.
IE: CR MTR-XXX 1-XXX - CR TR-XXX 1A-XX - 1XXX.

3.5 MULTI MODE FIBRE BACKBONE LABELING

- .1 Label multimode backbone cables at point where cable enters the telecom room or main telecom room.
IE: FOM - MTR-XXX 1-XXX - FOM - TR-XXX 1A-XX - 1XXX where XXX = room number.
- .2 Network 2: riser cabling will be marked within 15cm of the ends with a 1cm wide red tape
- .3 Network 2: Riser fiber cabling will be labeled with the source & destination at each end of the cable e.g "vv/ww/xx/yy/zz-zz" to "vv/ww/xx/yy/zz-zz" where:
 - .1 vv = numeric character(s) identifying the floor.
 - .2 ww-ww = alpha & numeric character(s) the TR or room on the floor.
 - .3 xx = numeric character(s) identifying the rack.
 - .4 yy = alpha character(s) identifying the patch panel.
 - .5 zz-zz = numeric character(s) identifying the cable pair range.

3.6 SINGLE MODE FIBRE BACKBONE LABELING

- .1 Label singlemode backbone cables at point where cable enters the telecom room or main telecom room.
IE: FOS - MTR-XXX 1-XXX - FOS - TR-XXX 1A-XX - 1XXX where XXX = room number.

3.7 RACK LABELING

- .1 Network 1: Label racks in each telecom room or main telecom room. IE: TR-XXX R1, R2, R3 where XXX = room

number.

3.8 PATCH PANEL LABELING

- .1 Label patch panels each telecom room or main telecom room. IE: A, B, C, D etc.

3.9 PATCH PANEL PORT LABELING

- .1 Label all ports in patch panel for each telecom room or main telecom room. 1-X.

3.10 HORIZONTAL CABLING LABELING

- .1 Network 1: Label all horizontal cables 25mm from each end with the patch panel and telecom room designation each telecom room or main telecom room. IE: TR-XXX 2E01.

3.11 TELECOM OUTLET FACEPLATE LABELING

- .1 Label all faceplates with TR designator and label each port with rack/patch panel designator patch panel. IE: TR-XXX, Ports 2E01, 2E02, 2E03, 2E04.

27.11.16 COMMUNICATIONS CABINETS, RACKS, FRAMES AND ENCLOSURES

1 General

1.1 RELATED SECTIONS

- .1 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS.
- .2 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
- .3 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

2 Products

2.1 COMMUNICATIONS RACKS

- .1 Floor Mounted 2-Post Telecommunications Racks:
 - .1 Racks shall meet the following specifications:
 - .2 483mm (19") internal width between rails.
 - .3 2.1m (7'-0") 42RU in height.
 - .4 Black powder coat finish.
 - .5 Complete with double sided 10/32 tapped holes and EIA universal standard hole pattern.
 - .6 Rack to be CUL / UL.
 - .7 Racks to be rated for 1,000 lb. of equipment.
- .2 Floor Mounted 4-Post Telecommunications Rack:
 - .1 Racks shall meet the following specifications:
 - .2 483mm (19") internal width between rails.
 - .3 2.1m (7'-0") 42 RU in height.
 - .4 Black powder coat finish.
 - .5 Complete with double sided 10/32 tapped holes and EIA universal standard hole pattern.
 - .6 Rack to be CUL / UL.
 - .7 Racks to be rated for 1,000 lb. of equipment.
- .3 Wall mount cabinet:

- .1 483mm (19") internal width between rails.
- .2 711mm (28") 12RU in height.
- .3 508mm (20") usable depth.
- .4 Black powder coat finish.
- .5 Complete with double sided 10/32 tapped holes and EIA universal standard hole pattern.
- .6 Rack to be CUL / UL.
- .7 Racks to be rated for 200 lb. of equipment.

3 Execution

3.1 INSTALLATION

- .1 Install racks in accordance with manufacturer's instructions and as indicated.
- .2 Communication rack to be secured to floor using floor mounting anchors.
- .3 Communication rack to be bonded to section 27 05 26.

27.11.19 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

1 General

1.1 RELATED SECTIONS

- .1 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS.
- .2 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
- .3 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

2 Products

2.1 IDC (INSULATION DISPLACEMENT CONNECTOR) PANEL

- .1 Telecommunications Entrance and Riser Termination Blocks:
 - .1 12 Connector mount to accommodate 300 pair Category 3 cables.
 - .2 Recommended management rings.
 - .3 To utilize 25 Pair connector for copper building entrance cable and risers.
 - .4 To utilize designation strips, using machine printed labels for labelling of all connectors.

2.2 CATEGORY 6 PATCH PANELS

- .1 To be made of a steel frame with black powder coat finish, in angled 48-port configuration.
- .2 Shall accommodate at least 48 ports for each rack unit (RU) space (1RU=44.55mm).
- .3 Support applications up to 300 Mhz.
- .4 Accept modular connectors.
- .5 Have port identification on front and rear.
- .6 CSA C22.2 approved or equivalent.
- .7 Mount in 483mm (19") Telecommunications rack.

- .8 To be from same manufacturer as other components (jacks, outlet faceplates, etc) in communications system.

2.3 FIBRE OPTIC PATCH PANEL

- .1 Fits in 483mm rack.
- .2 Capacity: 24, 48 or 144 strands as required.
- .3 Capable of accepting Single and Duplex LC or SC adapter strip inserts.
- .4 Fabricated to ANSI/TIA/EIA specifications.
- .5 From the same company as all other fibre components in the system.

3 Execution

3.1 INSTALLATION

Install termination blocks and patch panels in accordance with manufacturer's instructions and as indicated.

27.11.23 COMMUNICATIONS CABLE MANAGEMENT

1 General

1.1 RELATED SECTIONS

- .1 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS.
- .2 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
- .3 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

2 Products

2.1 VERTICAL CABLE MANAGEMENT SYSTEM

- .1 High density fibre cable managers: 254mm wide, radius "finger duct" style with removable covers mounted to both sides of rack complete with slack management spools
- .2 High density copper cable manager: 254mm wide, radius "finger duct" style with removable covers mounted to one side of rack.

2.2 HORIZONTAL CABLE MANAGEMENT

- .1 2U cable manager:
 - .1 Size: 2 RU, 88.9mm in height.
 - .2 Finish: Black powder coat.
- .3 1U cable manager:
 - .1 Size: 1 RU, 44.45mm in height.
 - .2 Finish: Black powder coat.

3 Execution

3.1 INSTALLATION

- .1 Install cable management in accordance with manufacturer's instructions and as indicated.

27.11.26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND STRIPS

1 General

1.1 RELATED SECTIONS

- .1 27 05 00 COMMON WORK RESULTS FOR COMMUNICATIONS.
- .2 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.
- .3 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

2 Products

2.1 VERTICAL POWER STRIP

- .1 Vertical power strip with a 20 Amp, 125 V, ten NEMA 5-20R receptacles, one 20 Amp thermal breaker, 10' power cord with NEMA L5-20P twist lock plug. c-UL Listed.

3 Execution

3.1 INSTALLATION

- .1 Install vertical power strips in accordance with manufacturer's instructions and as indicated.

27.13.13 COMMUNICATIONS COPPER BACKBONE CABLING

1 General

1.1 SYSTEM DESCRIPTION

- .1 The Communications Backbone Cabling links the Entrance Facility (EF) to the Telecom Room(s) (TR) and specialized Equipment Rooms. It also provides the inter-building cabling required connecting the outside plant to EF. The Cabling is configured in a Star-Configuration where the EF is the hub and all telecom rooms are directly connected to the TF by the way of conduits.

1.2 RELATED SECTIONS

- .1 Section 27.05.00 - COMMON WORK RESULTS FOR COMMUNICATIONS
- .2 Section 27.15.43 - COMMUNICATIONS FACEPLATES AND CONNECTORS
- .3 Section 27.11.19 - COMMUNICATIONS TERMINAL BLOCKS AND PATCH PANELS.
- .4 Section 27.05.53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.3 QUALITY ASSURANCE

- .1 Departmental Representative to be invited to witness and/or review field-testing.
 - .1 PWGSC Representative to be notified of the start date of the testing phase two (2) business days before testing commences.
 - .2 PWGSC Representative will select a random sample of 5% of the installed links. The Departmental Representative will test these randomly selected links and the results stored. The results obtained will be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to the Crown.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or UL label where applicable.
- .2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature limitations.
- .4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- .5 Do not use damaged materials.
- .6 PWGSC Representative will advise on material delivery and storage locations.

1.5 PROJECT CONDITIONS

- .1 Do not use materials that are damaged or do not pass on-site testing.
- .2 Verify existing conditions and before starting work. Correct unsatisfactory conditions before proceeding.

2 Products

2.1 COMMUNICATIONS BACKBONE COPPER CABLING

- .1 INSIDE ARMOURED BACKBONE CABLING
 - .1 Construction: 24 AWG solid copper.
 - .2 Meet or exceed ANSI/TIA/EIA 568-A and CSA T528 specifications for Category 3 transmission characteristics.

- .3 To be rated ARMM as per CSA 22.2 No 214-94.
- .4 Jacket to be printed at intervals indicating cable code, AWG, CSA Listing, date and manufacturing traceability.
- .5 Longitudinally applied, transversely corrugated .2mm aluminum shield bonded to jacket.
- .6 PVC jacket colour Grey.
- .7 Descending length markings starting at highest number and ending at 0.
- .8 Rated for 10Mb/s and voice applications.
- .9 Pair count: as indicated on drawings.

2.2 INSULATION DISPLACEMENT MOUNT

- .1 Wall mount frame used to support insulation displacement connector (IDC) strips.
- .2 Construction: 16 gauge steel backplate with steel or plastic sides to support connector strips
- .3 Capacity: 10 or 12 connector strips.

2.3 INSULATION DISPLACEMENT CONNECTOR STRIP

- .1 Rectangular connector strip that accomodates the termination of 25 copper pairs per strip.
- .2 Facilitates termination of copper pairs via punch-down.
- .3 Fit in corresponding mount.

3 Execution

3.1 INSTALLATION

- .1 Install all cable in accordance with manufacturer's instructions.
- .2 Install directly from the Entrance Facility (EF) to each telecom room installed in 100mm conduits.
- .3 Terminate Cabling in MTR on IDC wall mounted distribution with other end terminated on patch panels, one pair per port, in each connected telecom room or equipment room.

27.13.23 COMMUNICATIONS OPTICAL FIBRE BACKBONE CABLING

1 General

1.1 SYSTEM DESCRIPTION

- .1 The Communications Backbone Cabling links the Entrance Facility (EF) to the Telecom Room(s) (TR) and specialized Equipment Rooms. It also provides the inter-building cabling required connecting the outside plant to EF. The Cabling is configured in a Star-Configuration where the EF is the hub and all telecom rooms are directly connected to the EF by the way of conduits.

.
1.2 RELATED SECTIONS

- .1 Section 27.05.00 - COMMON WORK RESULTS FOR COMMUNICATIONS
- .2 Section 27.15.43 - COMMUNICATIONS FACEPLATES AND CONNECTORS
- .3 Section 27.11.19 - COMMUNICATIONS TERMINAL BLOCKS AND PATCH PANELS.
- .4 Section 27.05.53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.3 REFERENCES

- .1 Refer to Section 27.05.00, para 1.3.

1.4 QUALITY ASSURANCE

- .1 Departmental Representative to be invited to witness and/or review field-testing.
 - .1 PWGSC Representative to be notified of the start date of the testing phase two (2) business days before testing commences.
 - .2 PWGSC Representative will select a random sample of 5% of the installed links. The Departmental Representative will test these randomly selected links and the results stored. The results obtained will be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to the Crown.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or UL label where applicable.
- .2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature limitations.
- .4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- .5 Do not use damaged materials.
- .6 DCC Representative will advise on material delivery and storage locations.

1.6 PROJECT CONDITIONS

- .1 Do not use materials that are damaged or do not pass on-site testing.
- .2 Verify existing conditions and before starting work. Correct unsatisfactory conditions before proceeding.

1.7 SUBMITTALS

- .1 Submit Reel Tests: OTDR test results of cable reels from on-site spot tests of fibre reels before installation.
- .2 As-Built Drawings:
 - .1 The installation contractor will be provided with 2 sets drawings at the start of the project. One set will be designated as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical Representative upon request during the course of the project. Anticipated variations from the build-to drawings may be for such things as cable routing. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the DCC Representative.
 - .2 The Contractor shall provide the central drawing set to the PWGSC Representative at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labelling for the cabling system.

2 Products

2.1 COMMUNICATION OPTICAL FIBRE BACKBONE CABLE

- .1 12 strand Single Mode optical fibre cable
 - .1 Construction: Non conductive, Dielectric, ONFR rated jacket.
 - .2 Composition:
 - .1 Core Diameter: 9 microns.
 - .2 Clad diameter: 125 microns.
 - .3 Class IV a Dispersion-Unshifted single mode optical fibres to ANSI/EIA/TIA-492BAAA;
 - .4 Transmission windows: 1310nm and 1550nm;
 - .5 Minimum dispersion of 1301nm, maximum dispersion of 1321nm.
 - .6 Maximum Attenuation: 0.5 db/km at 1310 or 1550 nm.

- .7 Colour: Yellow
- .3 Maximum tensile load:
 - .1 Short term: 2700N (600 lbf).
 - .2 Long term: 600N (135 lbf).
- .4 Fire rating: OFNR / FT-4
- .5 Minimum bend radius 100mm.

3 Execution

3.1 OPTICAL FIBRE CABLE

- .1 Install Optical Fibre backbone cable to manufacturers' specification.
- .2 Adhere to manufacturer's published specifications for pulling tension, bend radius and sidewall pressure.
- .3 Use only cable pathways (conduit and tray) supplied.
- .4 Cables are to run continuously from terminal point to terminal point, splicing of cables will not be accepted.
- .5 Cables to be supported throughout the entire run.
- .6 All equipment shall be installed in a neat and professional manner, arranged for convenient operation, testing and future maintenance.
- .7 All fibre cables shall be installed and terminated by technicians experienced in the installation and termination of fibre cables.
- .8 In the TR, provide a minimum 3m and maximum 4m of slack. Loop at the TRs to be contained within the fibre enclosure.
- .9 Within TRs, cables to be snugly wrapped using hook and loop (velcro) reusable cable ties, a minimum of every 1m for cable organization. Hook and loop (velcro) ties shall be tightened so as not to deform cable jackets and thus affect cable performance.

3.2 OPTICAL FIBRE TESTING

- .1 General
 - .1 All tests performed on optical fibre cabling that use a laser or LED in a test set to be carried out with safety precautions to: ANSI Z136.2.
 - .2 All cables, patch panels and associated components to be fully assembled and labelled prior to field-testing. Any testing performed on incomplete systems to be redone on completion of the work.
- .2 Optical Fibre Cable Testing
 - .1 Field-test instruments to have the latest software and firmware installed.
 - .2 Link test results from the OLTS (Optical Loss Test Set) and OTDR (Optical Time Domain

Reflectometer) to be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

- .3 Testing to be performed on each cabling segment (connector to connector).
- .4 Testing of the cabling to be performed using high-quality test cords of the same fibre type as the cabling under test.
- .5 Test all optical cables with a OLTS (Optical Loss Test Set) using procedures outlined below. Measured results to be +/- 1 dB of submitted loss budget calculations. If figures are outside of this range, test cable with an OTDR to determine the cause and repair or replace any damaged connectors or cable. All optical fibre strands must be:
 - .1 Tested and conform to ANSI/TIA/EIA-568-B.1 and B.3 standards.
 - .2 Performed on both single mode and multimode cables per section 11.3.3.2 of TIA/EIA/548-B.1 and section 7 of TIA/EIA-568-B.3.
 - .3 Performed on all applicable wavelengths - singlemode 1300 & 1550 nm, multimode 850 & 1310 nm.
- .3 Test Results Documentation
 - .1 Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., "as saved in the field-test instrument". The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
 - .2 The test results documentation shall be available for inspection by the DCC Representative or the DCC Representative's representative during the installation period and shall be passed to the DCC Representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as built information.
 - .3 The database for the complete project, to be stored and delivered on CD-ROM prior to Owner acceptance of the project. This CD-ROM shall

- include the software tools required to view, inspect, and print any selection of the test reports.
- .4 Circuit IDs reported by the test instrument should match the specified label ID.
 - .5 The detailed test results documentation data is to be provided in an electronic database for each tested optical fibre and shall contain the following information.
 - .1 The identification of the customer site as specified by the end-user.
 - .2 The name of the test limit selected to execute the stored test results.
 - .3 The name of the personnel performing the test.
 - .4 The date and time the test results were saved in the memory of the tester.
 - .5 The manufacturer, model and serial number of the field-test instrument.
 - .6 The version of the test software and the version of the test limit database held within the test instrument.
 - .7 The fibre identification number.
 - .8 The length for each optical fibre.
 - .9 Optionally the index of refraction used for length calculation when using a length capable OLTS.
 - .10 Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
 - .11 Test results to include OTDR link and channel traces and event tables at the appropriate wavelength(s).
 - .12 The length for each optical fibre as calculated by the OTDR.
 - .13 The overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements.

27.15.13 COMMUNICATIONS COPPER HORIZONTAL CABLING

1 General

1.1 SYSTEM DESCRIPTION

- .1 Cabling system is based on home run cabling requirements. Distribution is achieved above Ceiling through use of individual 4-pair Category 6 rated

cables and components. The cable will distribute telecommunication signals from patch panels located in the telecommunications room.

1.2 RELATED SECTIONS

- .1 Section 27.05.00 - COMMON WORK RESULTS FOR COMMUNICATIONS.
- .2 Section 27.15.43 - COMMUNICATIONS FACEPLATES AND CONNECTORS.
- .3 Section 27.05.53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.3 REFERENCES

- .1 Refer to Section 27.05.00, para 1.2.

1.4 QUALITY ASSURANCE

- .1 Departmental Representative to be invited to witness and/or review field-testing.
 - .1 PWGSC Representative to be notified of the start date of the testing phase two (2) business days before testing commences.
 - .2 PWGSC Representative will select a random sample of 5% of the installed links. The DCC Representative will test these randomly selected links and the results stored. The results obtained will be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to the Crown.

2 Products

2.1 GENERAL

- .1 .All components used must make up a certified system and be from the same manufacturer.

2.2 COMMUNICATION COPPER CABLE

- .1 Four pair, UTP (unshielded twisted pair) Copper Cable
 - .1 Description: Cat 6 cable, designed for horizontal network applications.
 - .2 Operating characteristic:
 - .1 Performs to TIA/EIA-568-C.2-1 & C22.2 No. 214-02
 - .2 Minimum bandwidth: 300 MHz
 - .3 Conductor size: 23 or 24 AWG
 - .3 Fire rating: OFNR / FT-4

- .4 Maximum Pulling Tension: 11.34 Kg
- .5 Colour: Blue

3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
Notify PWGSC Representative of conditions that would affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 COPPER CABLES

- .1 Install copper cables to manufacturers' specifications and industry best practices, as indicated.
- .2 Adhere to manufacturer's published specifications for pulling tension, bend radius and sidewall pressure.
- .3 Use only cable pathways (conduit and surface mounted raceway) installed to support cables.
- .4 Cables are to run continuously from terminal point to terminal point, splicing of cables will not be accepted.

3.3 COPPER CABLE TESTING

- .1 General
 - .1 All testing must conform to ANSI/TIA/EIA 568-C.1, C.2 and C.2-1 standards, specifically the permanent link test method. The following technical acceptance tests shall be performed on all Category 6. telecommunication cable pairs to confirm their integrity, following installation and using the Permanent Link Test Configuration as specified in TIA/EIA-568-C.2-1.
 - .2 All cables, patch panels and associated components to be fully assembled and labelled prior to field-testing. Any testing performed on incomplete systems to be redone on completion of the work.
- .2 Copper Cable Testing
 - .1 Field-test instruments to have the latest software and firmware installed.
 - .2 Permanent link test results from the instrument to be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
 - .3 Test each cabling segment (connector to connector).
 - .4 Test each cabling using high-quality test cords

- of the same type as the cabling under test.
- .5 The test parameters for Cat 6 are defined in TIA Cat 6 standard, which refers to the ANSI/TIA/EIA-568-C.2 standard. The test of each link shall contain all of the following parameters detailed in the standard. In order to pass the test, all measurements (at each frequency in the range from 1 MHz through 300 MHz) must meet or exceed the limit value determined in the above-Mentioned standard:
- .3 Test Results Documentation
 - .1 Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., "as saved in the field-test instrument". The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
 - .2 The test results documentation shall be available for inspection by Departmental Representative during the installation period and shall be passed to the Departmental Representative within 5 working days of completion of tests on cabling served by a telecommunications room.. The installer shall retain a copy to aid preparation of as-built information.
 - .3 The database for the complete project, to be stored and delivered on CD-ROM prior to Departmental Representative's acceptance of the project. This CD-ROM shall include the software tools required to view, inspect, and print any selection of the test reports.
 - .4 Circuit IDs reported by the test instrument should match the specified label ID.
 - .5 The detailed test results documentation data is to be provided in an electronic database for each tested optical fibre and shall contain the following information.
 - .1 The identification of the customer site as specified by the end-user.
 - .2 The overall Pass/Fail evaluation of the link-under-test.
 - .3 The name of the standard selected to execute the stored test results.
 - .4 The cable type and the value of NVP (used for length calculations.

- .5 The date and time the test results were saved in the memory of the tester.
- .6 The brand name, model and serial number of the tester.
- .7 The identification of the tester interface.
- .8 The revision of the tester software and the revision of the test standards database in the tester.
- .9 The test result information must contain information on each of the required test parameters that are listed in ANSI/TIA/EIA-568-C.2 standard.

27.15.43 COMMUNICATIONS FACEPLATES AND CONNECTORS

1 General

1.2 REFERENCES

- .1 Refer to Section 27.05.00, para 1.3.

1.3 QUALITY ASSURANCE

- .1 Departmental Representative to be invited to witness and/or review field-testing.
 - .1 PWGSC Representative to be notified of the start date of the testing phase two (2) business days before testing commences.
 - .2 PWGSC Representative will select a random sample of 5% of the installed links. The DCC Representative will test these randomly selected links and the results stored. The results obtained will be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to the Crown.

2 Products

2.1 GENERAL

- .1 All components used must make up a certified system and be from the same manufacturer

2.2 OUTLET BOX FACEPLATE

- .1 Outlet Box Faceplate:
 - .1 Accept Keystone style connector.
 - .2 Colour: White.
 - .3 Capacity: 4 ports.

- .4 Accept blanks for unused ports.
 - .2 System Furniture Faceplate
 - .1 Accept Keystone style connector.
 - .2 Colour: White.
 - .3 Capacity: 4 ports.
 - .4 Accept blanks for unused ports.
 - .5 Fit into system furniture opening.
 - .3 Faceplate Blank Module
 - .1 1 position blank to fill opening of unused faceplate port.
 - .2 Colour: white - to match faceplate colour.
- 2.3 COPPER CABLE CONNECTORS
 - .1 UTP Connectors:
 - .1 Modular Jack - Voice / Data:
 - .1 Meet or exceed Cat 6 parameters as specified in ANSI/TIA/EIA.
 - .2 Description: RJ45, 8-position, 8-wire universal module
 - .3 Connector Type: Keystone.
 - .4 Colour: White for workstation side; Black for telecom room side.
- 2.4 WALL MOUNTED KEYSTONE PHONE JACK
 - .1 stainless steel plate complete with integral mounting lugs for placement of telephone.
 - .2 Dimensions: 69.8mm width x 114.3mm height.
 - .3 Complete with single opening Category 6 keystone jack module, pinned to T568A wiring scheme.
- 2.5 OPTICAL FIBRE CONNECTORS
 - .1 Optical Fibre Connectors.
 - .1 Multi Mode Connector:
 - .1 Field install epoxy / heat cured connector
 - .2 Connector Type: LC.
 - .3 Insertion Loss: 0.3 dB or less and no more than 0.75 dB per mated pair.
 - .4 Fabricated to ANSI/TIA/EIA specifications
 - .5 From the same company as all other fibre components in the system.
 - .2 Single Mode Connector
 - .1 Field install epoxy / heat cured connector
 - .2 Connector Type: LC.
 - .3 Ultra polished (UPC).
 - .4 Insertion Loss: 0.3 dB or less and no more than 0.75 dB per mated pair.
 - .5 Fabricated to ANSI/TIA/EIA specifications
 - .6 From the same company as all other fibre components in the system.
- 2.6 OPTICAL FIBRE ADAPTER STRIP

- .1 Single Mode Fibre Adapter Panel:
 - .1 Fit within rack patch panels.
 - .2 Capacity: 6 or 12 port.
 - .3 Zirconia ceramic split sleeve.
 - .4 From the same company as all other fibre components in the system.
 - .5 Suitable for connection to LC type connectors
- .2 Multi Mode Fibre Adapter Panel:
 - .1 Fit within rack patch panels.
 - .2 Capacity: 6 or 12 port.
 - .3 Zirconia ceramic split sleeve.
 - .4 Capable of supporting transmission rates up to and including 10Gig.
 - .5 From the same company as all other fibre components in the system.
 - .6 Suitable for connection to LC or SC type connectors as required.

3 Execution

3.1 COPPER CABLE CONNECTORS

- .1 Install copper connector to manufacturers' specifications.
- .2 Label to section 27 05 53.

3.2 OUTLET BOX FACEPLATE

- .1 Install faceplate to manufacturers' specifications.
- .2 Install faceplate blanks in all empty ports.

3.3 OPTICAL FIBRE CONNECTORS

- .1 Install optical fibre connector to manufacturers specification.
- .2 Label to section 27 05 53.

27.16.19 COMMUNICATIONS PATCHCORDS AND CROSS CONNECT WIRE

1 General

1.1 RELATED SECTIONS

- .1 Section 27.05.00 - COMMON WORK RESULTS FOR COMMUNICATIONS
- .2 Section 27.05.53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.2 REFERENCES

- .1 Refer to Section 27.05.00, para 1.3.

1.3 QUALITY ASSURANCE

- .1 Departmental Representative to be invited to witness and/or review field-testing.

- .1 PWGSC Representative to be notified of the start date of the testing phase two (2) business days before testing commences.
- .2 PWGSC Representative will select a random sample of 5% of the installed links. The DCC Representative will test these randomly selected links and the results stored. The results obtained will be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to the Crown.

2 Products

2.1 VOICE / DATA PATCH CORDS

- .1 Factory Manufactured and tested.
- .2 Cabling shall meet or exceed category 6 requirement as per ANSI/TIA/EIA-568-C.2.
- .3 CSA certified as CMR per CSA Standard C22.2, no 214-94.
- .4 Data Cables:
 - .1 MTR/TR:
 - .1 Type: Non-booted.
 - .2 Colour: White.
 - .3 Quantity: One (1) per Network 1 outlet drawing symbol.
 - .4 Length: 66% of total quantity: 2.0m
34% of total quantity: 1.5m
 - .2 Workstation/Office:
 - .1 Type: Booted.
 - .2 Colour: White.
 - .3 Quantity: One (1) per Network 1 outlet drawing symbol.
 - .4 Length: 100% of total quantity: 3.0m
- .5 Voice Cables
 - .1 MTR/TR:
 - .1 Type: Non-booted.
 - .2 Colour: Blue.
 - .3 Quantity: One (1) per Network 1 outlet drawing symbol.
 - .4 Length: 66% of total quantity: 2.0m
34% of total quantity: 1.5m
 - .2 Workstation/Office:
 - .1 Type: Booted.
 - .2 Colour: Blue.
 - .3 Quantity: One (1) per Network 1 outlet

drawing symbol.

.4 Length: 100% of total quantity: 3.0m

2.2 CROSS CONNECT WIRE

- .1 One pair, UTP (unshielded twisted pair) Copper wire
 - .1 Description: Cat 3 wire, for use between incoming cables and station equipment in a Telecommunications Room or at a Main Cross-Connect.
 - .2 Operating characteristic:
 - .1 Performs to TIA/EIA-568-C.2-1 & C22.2 No. 214-02
 - .2 Conductor size: 24 AWG
 - .2 Colour: white/blue
 - .3 Length: 305m spool.

3 Execution

3.1 INSTALLATION

- .1 Cross-connect:
 - .1 Coordinate installation of cross-connect jumpers with PWGSC Representative prior to starting work.
 - .2 Plan and route cross-connect jumpers for voice circuits and data circuits through the jumper rings on the frames such that they are not intermixed haphazardly. Keep voice and data cross-connect jumpers segregated as possible.
 - .3 Provide 50mm minimum and 100mm maximum service loop in each cross-connect jumper for voice and data circuits at each end.
 - .4 Cross-connect jumpers shall be uniform in shape.
- .2 Patch Cords:
 - .1 Install Patch cable in vertical and horizontal cable management between telecommunications devices and patch panels.
 - .2 Provide 2 Work area patch cords per Telecommunications Outlet and 2 Patch Cords per Telecommunication Outlet in MTR and TR's.
 - .3 Provide 15% spare patch cable, work area cords and ancillary cables of each cable type to DCC Representative upon completion of the testing.

1 GENERAL

1.2 GOVERNING CLAUSE

For brevity, this specification shall omit such phrases as "Contractor shall furnish and install" and "unless otherwise indicated or specified", but these phrases are nevertheless implied. Mention of materials or actions requires the Contractor to furnish and install such materials or take such actions so as to satisfy the intent of the specification. Any exceptions to this clause shall be specifically noted in the specification or drawings.

1.3 CONTRACTOR RESPONSIBILITY

Notwithstanding the detailed information contained in this specification, the Contractor is responsible to see that a complete and functioning system is installed. The Contractor shall notify the owner, prior to bidding, of any errors or omissions in the system design that, in his opinion, will prevent the system from achieving the intent of the specification. After acceptance of the bid, the Contractor is responsible to supply such materials and take such actions so as to satisfy the intent of the specification without claim for additional compensation.

1.4 INTENT OF SPECIFICATION

1.4.1 Reliability

One intention of this specification is to provide a centralized sound system that will operate reliably for at least three (3) years without equipment failure. Any equipment that requires continual maintenance, or that has a known record of failures, is not acceptable.

1.4.2 Sound Masking Signal

One intention of this specification is to provide a broad band random signal at the locations shown in the drawings in the frequency range 100 Hz to 10000 Hz (sound masking) capable of being adjusted in 1/3 octave bands to achieve a level and spectrum shape that will provide a specified degree of speech privacy in those areas covered by the signal.

1.5 SCOPE OF WORK

1.5.1 Work Included

Work shall include the furnishing of all materials, labor, tools, and transportation necessary to complete the installation of the sound

system described in this specification and shown in the drawings. The work shall include, but not be limited to:

- a) One sound masking system for each of the renovated floors
- b) Layout of loudspeakers
- c) Design of centralized equipment to power loudspeakers
- d) Installation of equipment in rack cabinet.
- e) Internal wiring of rack.
- f) Installation of speakers and other equipment external to rack cabinet.
- g) Wiring of all external equipment.
- h) Making equipment function as intended.
- i) Documentation of performance, functions and wiring.
- j) Installation and pulling wires in conduit.
- k) Installation of junction boxes.
- l) Installation of power receptacles.
- m) Providing vertical access for wire runs.
- n) Providing and installing return air baffles.

1.6 CONTRACTOR QUALIFICATIONS

If requested by Owner, the Contractor shall furnish evidence of his qualifications to perform the work specified. Evidence shall include a listing of major lines of equipment for which he is a distributor or dealer, and a list of projects of similar scope and size that have been completed satisfactorily and ownership of a sound level meter or real time analyzer that is capable of measuring sound levels in one-third octave bands.

1.7 BIDDING REQUIREMENTS

1.7.2 Bid Content

All bids must be based on the materials and work specified herein. Each bid shall be accompanied by a complete list, including quantities, of equipment to be furnished under this specification. The Contractor shall submit specification sheets on any equipment. Any variations from the specification shall be noted in the bid. Alternate bids also may be presented.

1.8 APPLICABLE LAWS AND INSURANCE

The Contractor shall comply with all applicable laws, regulations, and codes and shall obtain any necessary permits or licenses required to execute the work specified herein, without additional compensation. The Contractor shall submit a Certificate of Insurance to Owner prior to commencement of work.

1.9 SHOP DRAWINGS

1.9.1 Submittals

The Contractor shall submit a copy of the system design to the Departmental Representative, or his representative, for review and approval. Such drawings shall be submitted within thirty (30) days of receipt of contract. Drawings shall indicate complete details of work to be performed. Submittals shall include, but not be limited to:

- a. A plan of loudspeaker location, orientation, and mounting details.
- b. Proposed panel labeling.
- c. Layout of equipment in rack cabinet.
- d. System schematic showing internal rack wiring.
- e. Specification sheets of equipment to be supplied.

1.9.2 Approvals

Written approval must be received by the Contractor prior to fabricating or installing any materials. Approval of shop drawings or other submittals indicates only that the manufacturer has been accepted and the equipment quality is acceptable. It assumes that the installation will be in compliance with the intent of the specification, and with applicable laws.

1.10 INSTALLATION PROCEDURES

1.10.1 Packing

All materials and equipment shall be new and shall be delivered in containers marked with the manufacturer's name and model number. The material shall be stored in a safe, dry place. Custody of the equipment shall remain with the Contractor until it has been transferred to the Owner or his representative. It is the responsibility of the Contractor to remove all packing materials.

1.10.3 Coordination

The Contractor shall coordinate his work with other trades and the Departmental Representative so as not to interfere with other work in progress.

1.10.4 Loudspeaker Installation

Masking loudspeakers shall be hung in the ceiling plenum and not be attached to the suspended ceiling. Unknown constraints may require the speakers to be hung at horizontal locations other than shown in the drawings; the Contractor should be prepared to do this without additional compensation. Speakers must be at least four (4) feet horizontally from a return air grille in the suspended ceiling, and

two (2) feet from an air duct or large structural beam. Speakers must be kept clear of junction boxes and controls for air conditioning. Speakers must be at least four (4) feet horizontally from any light fixture that has large (one inch or larger) openings to the plenum. When a speaker must be moved horizontally, other adjacent speakers must be moved also to make the spacing between the speakers' uniform in the distance between the moved speaker and the nearest wall. Speakers shall not be hung from conduit runs, other wires, or sprinkler pipes. If the speakers are mounted facing upward, the bottom of the speaker assembly shall be approximately one quarter of the distance from the suspended ceiling to the structural ceiling; in no case shall the assembly be closer than six (6) inches from the suspended ceiling. If the speakers are mounted facing horizontally, the speaker shall be at one-half the distance from suspended ceiling to structural ceiling and shall face as called for in the drawings. If a speaker faces an air duct within four (4) feet, the speaker shall be rotated forty five (45) degrees from its planned orientation. It is recommended that, prior to installation, the loudspeakers be laid out on the floor below the location for installation, the ceiling tiles be opened and the ceiling plenum inspected. In this way any required horizontal adjustments can be made before hanging. In addition it is recommended that each masking speaker be checked to insure that the tap setting is correct. Normal tap settings are one (1) Watt; deviations from this will be shown on the drawings. Further, it is recommended that wiring be done from the home run outward and that a low level masking or radio signal be placed on the home run so as each speaker is installed a correct connection can be identified by hearing the sound.

Hang speakers 150mm above the ceiling tile, firing up.

1.10.5 Ceiling Materials

The Contractor shall open and then close any ceiling materials moved by his activity. Contractor shall be liable for any damage to ceiling materials. Care must be exercised to avoid soiling the ceiling materials. Any materials soiled must be cleaned. If a fiberglass material is used, any fiberglass remaining on the underside must be removed when the ceiling is closed.

1.10.6 Wire Runs

The wiring layout in the drawings, when present, is to show which speakers are to be connected to a zone. The actual wiring need not be the same as shown in the drawings, but shall connect all speakers in a zone. Notation of actual wiring shall be made on the Master drawings. Wiring between speakers may be point-to-point unless otherwise instructed by the Owner or required by local codes. Contractor should be prepared to bring wire to the structural ceiling for runs from

speaker to speaker without additional compensation. Wires shall not be so slack as to touch the suspended ceiling below; they should be supported as frequently as necessary to avoid such contact, and meet local codes. Strain relief shall be provided at each speaker.

1.11 AS-BUILT DRAWINGS

The Contractor shall keep a "Master" set of drawings on the job site, marking all changes made during installation. Upon completion of the work, Contractor shall provide one (1) copy of the Master drawing to the Owner or his representative. Additions and deletions shall be clearly marked on the copy. If a change is not clear, an explanation shall be attached.

1.12 SYSTEM WARRANTY

The contractor shall maintain the system for a period of three (3) year and shall answer all service calls or requests for information within a forty eight (48) hour period. The warranty shall not apply to owner supplied equipment. The Contractor shall repair or replace all improperly functioning equipment supplied by him, and correct all deficiencies of installation without charge to the Owner or other contractors for a period of three (3) years from the date of acceptance. Contractor will remove and reinsert equipment, and shall repair or replace any defective equipment as soon as possible. Improper functioning, for warranty purposes, means failure of the system to meet the intent of the specification because of internal defects not caused by the Owner or his representative. It does not include such Owner caused malfunctions as accidental turning off of the system, readjustment of the controls, retuning of the system, or injury to the system beyond normal wear. If a telephone coupler is supplied by others, and the signal from the coupler is inadequate or inoperative, the Contractor shall be required to demonstrate that such is the case, to avoid unnecessary warranty repair of the system. The Contractor shall notify Owner after any service call whether it was a warranty call or not. Owner shall be billed for any non-warranty calls.

1.13 CLEANUP

The Contractor shall arrange to have all debris generated by him removed from the job site. Any wire or other materials left on the floor shall be picked up; all ceiling materials shall be inspected, and repositioned or cleaned as necessary. All tools shall be removed from the site and the rack closed and locked. Keys shall be given to the Owner, and one set of Master drawings shall be left in the rack until the final drawings are provided.

1.14 Instruction

The Contractor shall be prepared to provide up to two (2) hours of instruction on use and operation of the system to personnel designated by the Owner to receive such instruction.

2.0 SYSTEM EQUIPMENT

The quantities for each item of equipment specified are listed below. The Contractor shall verify that the quantities given are the same as in the drawings.

2.1 SOUND MASKING GENERATOR AND EQUALIZER

The sound masking generator shall be capable of providing four separately equalized channels of random noise in the frequency range 20 to 10000 Hz. The masking source shall be DSP based, shall generate white or pink noise and shall be digital with a repeat time of 200 minutes. The signal shall contain no observable periodicities or transients. The generator shall contain an internal clock that is capable of changing the output level of the unit any amount at any time-of-day for any day-of-the-week. The generator shall contain a ramp-up function that permits the initial output level to start low and, over a period of up to 250 days, increase the level to that for which equalization has been set. The equalizer section shall contain active, adjustable 1/3 octave filters in the frequency range 20 Hz to 20 kHz. Gain adjustment in any filter band shall be 0.1 dB with a range of +9 dB to -27 dB. It shall have both high and low pass filters with adjustable roll off frequencies from 20 Hz 10 kHz and with at least a 12 dB per octave slope. The outputs shall be 600 ohms on removable "Phoenix" style connectors. The unit shall operate on 110V AC, 60 Hz, and be mountable in a standard nineteen (19) inch rack and shall be 1 3/4 inches high. Equalization shall be through a software connection to the unit.

Use the Pink Noise setting

The sound masking generator and equalizer shall be an ASP-MG24-TDB, Atlas Sound DSP Masking Generator.

2.3 LOUDSPEAKER ASSEMBLY

The loudspeaker shall be designed for ease of installation in a plenum space. The assembly shall consist of an eight (8) inch diameter loudspeaker with a magnet size of ten (10) ounces. It shall have an input transformer with 0.25, 0.5, 1, 2, or 4 watts taps; the taps being available externally with a labeled rotary switch. Wiring connections shall be made through a conduit connector on the unit. The enclosure shall have at least 712 cubic inches volume. The assembly

shall be capable of being oriented horizontally or vertically upward or downward through the repositioning of external hanging brackets.

Tap loudspeakers at 1W.

The loudspeaker assembly shall be: M1000, Atlas Sound Masking Loudspeaker

2.4 PRECISION ATTENUATORS

The attenuators shall be mounted on a blank panel with six (6) holes and shall be rack mountable. Unused holes shall be plugged with a color matching plug. Each attenuator shall have the power rating listed below and shall have ten (10) detented steps each step being a change of 1.5 dB. Each attenuator shall have label plate showing the step position. Each attenuator shall be labeled to identify the zone number, but not the area to which the zone is connected.

The mounting panel shall be: ATPLATE-052, Precision Attenuator Mounting Panel (Atlas Sound)

The precision attenuators shall be: E408-100, Precision attenuator 100W.

2.5 RACK CABINET AND HARDWARE

The cabinet shall have three sections; a front panel locking door, a center section for mounting equipment, and a rear section for wall mounting. The cabinet shall be of frame and panel type with a fifteen (15) inch deep center section. Unused rack space shall be filled with blank panels. The cabinet shall have the standard nineteen (19) inch wide mounting. The height shall be as shown below.

The rack cabinet shall be:

WMA10-23 Rack cabinet, Wall Mount, 10 Rack Units
WMA12-23 Rack cabinet, Wall Mount, 12 Rack Units
WMA16-23 Rack cabinet, Wall Mount, 16 Rack Units
WMA24-23 Rack cabinet, Wall Mount, 24 Rack Units
WMA35-23 Rack cabinet, Wall Mount, 35 Rack Units

The power strip shall be:

AP-S15 Atlas AC Outlet Strip, 6 Outlets
Quantity:

The blank panels shall be:

CB1 Blank Panel, 1 Rack Unit (Atlas Sound)
Quantity:
CB2 Blank Panel, 2 Rack Units (Atlas Sound)

Quantity:

CB3 Blank Panel, 3 Rack Units (Atlas Sound)

Quantity:

CB4 Blank Panel, 4 Rack Units (Atlas Sound)

2.6 CABLES AND CONTROL WIRING

2.6.1 Marking

Cables and control wire shall be stranded copper. Each cable terminated in the rack cabinet shall be marked for identification purposes and this mark shall be shown in the Master Drawing at the appropriate point. The marking shall identify both the Channel (equalizer) and Zone (area covered), such as C1Z2.

2.6.2 Separation

Each of the different signal level groups shall be physically separated both inside and outside the rack cabinet.

2.6.3 Speaker Level Home Run Wiring

Loudspeaker home run wiring shall be at least #18 gauge AWG. If used in a return air plenum, it shall be jacketed with UL rated material for plenum use, otherwise the jacketing may be PVC.

The speaker level wiring shall be:

25224 Wire, 18 Gauge, Plenum Rated (West Penn)

224 Wire, 18 Gauge, PVC (West Penn)

2.6.4 Speaker Level Zone Wiring

Loudspeakers shall be connected within a zone with wiring that is at least #20 gauge AWG. If used in a return air plenum, it shall be jacketed with UL rated material for plenum use, otherwise the jacketing may be PVC.

The speaker level wiring shall be:

25222 Wire, 20 Gauge, Plenum Rated (West Penn)

222 Wire, 20 Gauge, PVC (West Penn)

2.6.5 Line Level Wiring

Line level wiring shall be at least #20 gauge AWG. If used in a return air plenum, it shall be jacketed with UL rated material, otherwise the jacketing may be PVC.

3.0 INITIAL TESTS AND ADJUSTMENTS

3.1 OPERATION OF THE SYSTEM

Under NO circumstances shall the Contractor turn the system on without having ALL power amplifier level (volume) controls fully off. When turned on for testing purposes, the system should be brought up to a level of about 45 dBA, but not when normal occupants are present. Upon completion of tests, the system should be turned down to a level that is just barely audible when no other sounds, except air conditioning interference.

3.2 TESTS

The following tests shall be performed by the Contractor:

- a. Make sure ALL loudspeakers are working. This is best done during installation.
- b. Make sure there are speakers in all specified areas.
- c. Make sure all labels reflect the correct operation.
- d. Make sure each item of equipment is functioning, including equalizers.
- e. Make sure each attenuator actually changes level in the correct area.
- f. Make sure the installation is the same as specified.
- g. With the sound masking signal on and the amplifier(s) adjusted at a working level 10dB above the ambient sound level, check for hum, buzz, rattle, or other operating deficiencies.
- h. Walk through each masked area and look for any open return air grilles that may provide excessive masking levels and note their locations on the Master Drawing.

If changes were required, mark them on the Master Drawings. In particular, mark altered speaker locations, and note the actual zone wiring arrangement.

4.0 SYSTEM TESTS AND EQUALIZATION

4.1 RESPONSIBILITY

The Acoustical Consultant shall perform the following items of this section. Contractor shall have one person, who is familiar with the system, present to make any adjustments deemed necessary by the Consultant to meet the intent of the specification.

4.2 SPATIAL UNIFORMITY TEST

Measure sound level at locations no greater than 15 feet on-center to determine compliance with the following performance: for 75 percent of the locations tested, the local variance of the sound pressure level

shall not exceed 6 dB for the 500-Hz octave band, 3 dB for the 1000, 2000, and 4000 Hz octave bands. In addition, the average range of deviation for all locations shall not exceed 2 dB in the 250 to 4000-Hz octave bands.

4.2 EQUALIZATION ADJUSTMENTS

The sound level of the masking system shall be adjusted to provide a Privacy Index of 95% in closed offices and 80% or better in open offices. This shall be done by measurement of the noise reduction (inter-zone attenuation) in a sufficient number of representative closed and open offices in each zone to determine the sound reduction spectrum between offices or between workstations. These data shall be used in a computer program to determine the optimum sound masking spectrum to achieve the required Privacy Indices. If there is paging, the sound masking spectrum shall be used in determining the spectrum level of the paging system to achieve a Privacy Index of 20% or less (good speech intelligibility).

4.3 WALK-THROUGH TEST

Perform a walk-through test to determine whether listeners moving throughout the covered spaces are unable to discern speaker locations.

4.4 RETEST

The Contractor shall correct deficiencies identified by tests and observations and the system will be retested—until meeting specified requirements.

4.5 RECORDS

The generator settings shall be stored to a diskette and one copy provided to the owner. A second copy shall be retained by the Consultant. Record on the drawings the final tap settings for all masking speakers. Measure and record the final voltage output for each channel of the generator and each channel of the power amplifier(s). With a felt tip pen, mark on the rear panel of each amplifier, the desired volume setting. Record the initial and desired attenuator settings.

4.6 REPORT

Provide a written report to the owner that contains:

- a. The privacy levels (Privacy Index) achieved in each zone
- b. The sound masking levels and spectra for each zone.
- c. Any workstations or closed offices that have deficient speech privacy
- d. The settings noted in Section 4.6

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END OF SECTION.