

Division 27: Global Communications Specification Document



**Division 27 Master Specification for
Information Transport Systems and Spaces**

May 1, 2014

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SECTION 27 10 01 STRUCTURED CABLING GENERAL REQUIREMENTS

1.1 SCOPE:

This document describes general products and execution requirements relating to furnishing and installing Telecommunications Cabling for Oregon State University. Backbone and horizontal cabling comprised of Copper and Fiber Optic, and support systems are covered under this document. All installations are warranted and shall be pre-registered with Ortronics/Superior Essex before work begins as does Corning Fiber Systems.

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The Horizontal (workstation) Cabling System shall consist of a minimum of (1) Category 3 and (2) Category 6, 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet in office locations unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the appropriate Telecommunications Room (TR) and routed to the appropriate rack or back-board serving that area and terminated as specified in this document.

All cables and related pathways, supports, terminations, and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document and required by contract conditions.

Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, communication room details, equipment racks, cable routing and outlet types will be provided as project specific information by bid specification and/or bid drawings. The contractor shall meet or exceed all requirements for any infrastructure system as detailed within this document. This document shall be referenced within a projects specific scope of work.

1.2 APPROVED CONTRACTOR:

The Telecommunications contractor submitting a response regarding an Oregon State University Voice/Data Infrastructure solicitation must be an approved Ortronics Certified Installer Plus (CIP) **and** a certified Corning Cabling Systems NPI Installer. Solicitation responses from a single contractor not certified by Ortronics and Corning Fiber Systems as (CIP/NPI) will not be accepted. Solicitation responses will only be accepted from firms certified by Corning Cable Systems and Ortronics. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Ortronics CIP Program and as the Corning Cabling Systems Program dictates.

It is the intent of Oregon State University's Campus Infrastructure Standard to ensure that a contractor is both an Ortronics CIP and a Corning NPI installer. Contractors must possess an Ortronics CIP and a Corning NPI certification within the state of Oregon to qualify for solicitation responses.

A contractor that is a valid Ortronics CIP cannot engage a subcontractor to perform any work within the project scope.

A contractor that is a valid Corning NPI cannot engage a subcontractor to perform any work within the project scope.

1.3 SUBMITTALS:

Submit appropriate cut sheets and samples for all products, hardware and cabling as detailed in project specifications and drawings.

Work shall not proceed without OSU Information Services approval of the submitted items.

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1.4 REFERENCES

- A. All work shall be performed in accordance with the following Codes and industry Standards, unless noted otherwise:
1. NFPA 70 – National Electrical Code, current version adopted by local or State AHJ.
 2. ANSI/TIA/EIA 568-C – Commercial Building Telecommunications Cabling Standard, current version.
 3. ANSI/TIA/EIA 569-C – Commercial Building Standard for Telecommunications Pathways and Spaces, current version.
 4. ANSI/TIA/EIA 606-B – Administration Standard for Commercial Telecommunications Infrastructure, current version.
 5. ANSI/TIA/EIA 607-B – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, current version.
 6. IEEE 241 - IEEE Recommended Practice for Electric Power Systems in Commercial Buildings, pertaining to communication systems.

1.5 WARRANTY

- A. Ortronics/Superior Essex nCompass Limited Life Time warranty for horizontal subsystem.
1. nCompass Category 6+ Cabling, Connectivity Hardware and Patch Cables shall be covered by a, nCompass Limited Lifetime warranty labor and application assurance warranty. The application assurance portion shall provide coverage for the cabling system to support the applications that are designed for the specifications outlined in ANSI/TIA/EIA 568-C.0-2. These applications include, but are not limited to 10BASE-T, 100BASE-T, 1000BASE-T and 155 Mb/s ATM.
 2. Corning 25-year Warranty for fiber optic riser and outside plant backbone subsystems.

1.6 SUMMARY

This Section includes general requirements specifically applicable to Division 27.

A. Work Specifically Excluded from Project:

1. Incoming common carrier services.
2. Private Branch Exchange Systems.
3. Wide Area Network Systems.
4. Materials provided by the owner as identified in the Contract Documents.

B. The Contractor shall be responsible for:

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1. Providing all additional materials, and the necessary labor and services required to ensure all components of the system are completely installed in accordance with the intent of the Contract Documents.
2. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.
3. Coordinating the details of facility equipment and construction for all specification divisions that affect the work covered under this Division.
Coordinating all activities with the overall construction schedule.
4. Developing bill of materials, perform material management and efficient use of the materials whether they are issued by the Contractor, the owner or purchased by the Contractor.
5. Ensure materials in excess of those required to complete the project are kept in their original condition and packaging for restocking.
Ensure project is properly registered for a nCompass warranty.

C. Intent of Drawings:

1. Communications plan drawings show only general locations of equipment, devices, raceways, cable trays, boxes, etc. All dimensioned locations and elevations are approximate. The contractor is responsible for the field coordination of communications work with the other trades prior to beginning work.
2. The contractor shall be responsible for the proper placement and routing of equipment, cable, raceways, cable tray, and related components; according to the Contract Documents and subject to prior review by contractor.
3. Refer all conflicts between Contract Documents to owner for resolution.

1.7 SYSTEM DESCRIPTION

- A. The owner will implement a comprehensive integrated communications distribution system, as described in paragraph B below, to provide wiring infrastructure which may be used to support one or more of the following services and systems:
 1. Telephony and Data telecommunications.
 2. Wireless systems.
 3. Facilities management systems.
 4. Video telecommunications
- B. The communications distribution system consists of the following major subsystems, as specified elsewhere:
 1. Interbuilding Backbone: The interbuilding subsystem refers to all twisted-pair and fiber optic backbone communications cabling connecting the Main Building Entrance Facility Room

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- (BEF) to each building Main Distribution Frame room (MDF) in all buildings on the campus.
Note: typically outside plant cables.
2. Intra-building Backbone: The intra-building subsystem refers to all twisted-pair and fiber optic backbone communications cabling connecting the Main Distribution Frame room (MDF) to each Intermediate Distribution Frame Room (IDF) in the buildings.
 3. Communication Rooms: Main Distribution Frame (MDF) and Intermediate Distribution Frame (IDF).
 4. Horizontal Distribution: The horizontal distribution subsystem refers to all intra-building twisted-pair and fiber optic communications cabling connecting telecommunication rooms (IDF's) to telecommunication outlets (TOs) located at individual work areas.
 5. Work Area Distribution Subsystem: Patch cords, adapters, and devices located between the TO and station equipment.
- C. The communications distribution system is based on a combination of the following communications transmission technologies as defined by specific project specifications:
1. 100-ohm 4-pair unshielded twisted-pair cable. (Cat 6, Cat 6a)
 2. 100-ohm multi-pair unshielded twisted-pair cable. (Cat 3). Note: nCompass warranty does not apply to 100- ohm multi-pair cables.
 3. OM3 and OM4 multimode fiber optic cable.
 4. 850 nm Laser Optimized 50/125-micron multimode fiber optic cable.
 5. 8.3/125-micron singlemode fiber optic cable.
 6. 8-position telecommunications jacks.
 7. 8-position telecommunications patch panels
 8. Insulation displacement connector (IDC) type field terminated wiring blocks
 9. Factory Terminated copper patch cords
 10. Rack mount fiber optic hardware
 11. Wall mounted fiber optic hardware
 12. Fiber optic connectors.
 13. Factory terminated fiber optic patch cords
- D. The work locations and limits of work are shown on the drawings.

1.8 DESIGN/ENGINEERING REQUIREMENTS

- A. BICSI RCDD Certification is required for anyone performing infrastructure design, specifications and/or drawings for solicitation and construction. All drawings issued for construction shall have valid RCDD stamp.
- B. Compliance by the contractor with the provisions of this specification does not relieve contractor of the responsibilities of furnishing materials and equipment of proper design, mechanically and electrically suited to meet operating guarantees at the specified service conditions.

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- C. The following are incorporated into the design:
1. Minimum communication room size for BEF room shall be no less than 14'x12'.
 2. Minimum communication room size for MDF room shall be no less than 14' x 12'.
 3. Minimum communication room size for an IDF room shall be no less than 10' x 12'.
 4. All pathways, conduits, cable trays, slots and sleeves shall have no less than 50% future fill capacity when project is completed.
 5. All pathways, conduits, cable trays, slots and sleeves shall not have other cabling (fire alarm, Audio Visual, security etc.) routed within or attached to them.
 6. The location of communication rooms is intended to restrict the maximum horizontal subsystem wiring length (defined as a channel between a telecommunications room cross-connect termination field and a served TO) to 295 feet (90 meters).
 7. All communication rooms shall have cooling calculated at 7KW of power consumption for each open frame communications rack. 12KW of power for each Communication cabinet.
 8. It is the intent of this specification to ensure security of communication rooms and sensitive information. Electrical panels, fire alarm panels, and security systems are not to be incorporated into communication room space, racks, cabinets or walls.

1.9 PROJECT RECORD DOCUMENTS

- A. Provide detailed project record documentation within 30 days of substantial completion of the work.
1. Maintain separate sets of red-lined record drawings for the communications work which show the exact placement and identification of as-built system components.
 2. Provide communication pathway record drawings which indicate exact placement and routing for all components, e.g., maintenance holes, handholes, conduit, wireway, cable tray, pull boxes, enclosures, telecommunications outlet boxes, etc.
 3. Provide communication room record drawings which indicate exact placement for all components; e.g., conduit, wireway, cable tray, backboards, equipment cabinets, equipment racks, cross-connect equipment, etc.
 4. Provide communication wiring and cabling record "As-Builds" drawings and schedules which indicate exact placement, routing, and connection details for all components, e.g., twisted-pair and fiber optic cables, splices, cable cross-connect termination locations, enclosures, telecommunications outlets, cross-connect jumpers, patch cords, etc.
 5. Provide network schematics when appropriate.

1.10 APPROVALS AND SUBSTITUTIONS

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- A. Substitutions are not authorized without written approval from owners authorized representative through addendum.

PART 2 SECTION 27 11 00 COMMUNICATIONS EQUIPMENT ROOM FITTINGS**2.1 SUMMARY**

- A. The telecommunications spaces will be referred as Building Entrance Facility (BEF), Equipment Room (ER), Telecommunications Room (TR), Telecommunications Enclosure (TE), and Data Center (DC) in this document is intended to house racks, cabinets and equipment necessary for the support of the communications cabling infrastructure.

2.2 TELECOMMUNICATIONS BACKBOARDS

- A. Wall mounted termination block fields shall be mounted on A/C 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with a minimum two coats of white fire retardant paint on all (6) sides. Mounting hardware shall also be painted white for cosmetic purposes.

2.3 FREE STANDING EQUIPMENT RACKS

- A. All racks and wire management shall be Ortronics as specified in project specifications and drawings. The equipment rack shall provide vertical and horizontal cable management and support for patch cords and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Rack shall be black in color.

Equipment Rack as detailed by project specifications and drawings

Approved manufacturers are Ortronics Mighty MO & Mighty MO 6, and misc.

- B. Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes. Earthquake restrictions, requirements, and zoning codes shall be strictly followed.

Racks shall be placed with a minimum of 36-inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in

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front of the row of racks and from the wall at each end of the row.

All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.9 of this document.

Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack

- C.. 7 foot high, 19 inches wide, 16.5 inch channel depth, EIA free-standing rack, UL listed, black finish.
 - 1. Ortronics Mighty Mo 6 OR-MM6716

Refer to Ortronics catalog for additional accessories.

2.4 FREE STANDING EQUIPMENT CABINETS

- A. Modular Freestanding Server Cabinet, 7 foot tall, 42 RUs, 32 inches wide, 42 inches deep, frame configured with cable opening at rear, frame levelers, two pairs of RU labeled mounting rails with 3/8" square holes, full profile mesh front door, split flat rear mesh rear door, two "L" shaped finger managers on rear rails, vertical PDU mount and lacing bar, divider or side panels, solid top panel in front, cable entry top panel in rear, #12-24 cage nuts (50), #12-24 mounting screws (100), additional adhesive rack unit labels.
- B. Modular Freestanding Network Cabinet, 7 foot tall, 32 inches wide, 34 inches deep, frame configured with cable opening at bottom front, frame levelers, two pairs of RU labeled mounting rails, with #12-24 tapped holes, full profile plexiglass front door, full flat solid rear door, two "L" shaped finger managers on front rails, right and left locking side panels, fan top panel in front, cable entry top panel in rear, #12-24 mounting screws (50).
 - 1. Ortronics Mighty Mo Network Cabinet OR-MMC423234-0001I

Refer to Ortronics catalog for additional accessories.

2.5 VERTICAL WIRE MANAGERS FOR FREE STANDING EQUIPMENT RACKS

- A. 7 foot high, 10 inches wide, 13 inches deep with dual-hinged door and integral one rack unit high horizontal management, black finish.
 - 1. Ortronics Mighty Mo 6 OR-MM6VMD710

Refer to Ortronics catalog for additional accessories.

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2.6 HORIZONTAL WIRE MANAGERS

- A. At the top and bottom of every rack or cabinet, install the following:
 - 1. OR-60400098

Refer to Ortronics catalog for additional accessories.

2.7 TELECOMMUNICATIONS GROUNDING BUSBAR

- A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the TIA/EIA-607 standard, and shall be installed in accordance with best industry practice. A licensed electrical contractor shall perform installation and termination of the main bonding conductor to the building service entrance ground
- B. Solid copper Bus Bar kit, 12.0 inches long x 4.0 inches wide, wall-mounted, with standoffs.
 - 1. Telecommunications Main Ground Bus Bar Kit OR-GB4X12TGBKIT

Refer to Ortronics catalog for accessories.

2.8 WIRE CABLE TRAY (BASKET TRAY) – COMMUNICATION ROOMS

- A. 12 or 24 inches wide, 4 inches deep, black, 10 foot lengths, steel construction.
 - 1. Cablofil P/N 105/300BL OR P/N 105/600BL
- B. Black basket cable tray shall be required in all communication rooms and shall not have a liner. Cable tray installed buildings will have a color determined by A/E to match building paint schemes and tray liners will be required.
- C. All trays will be grounded per local Electric Code requirements and ANSI/TIA/EIA-607.
- D. All trays shall be cut using the Cablofil tray cutter: COUPFIL or CUTYFIL. All cut cable tray will be filed to remove burrs and painted to match color. All cutting, filing, and painting will be done outside of building.

Refer to Cablofil catalog for additional accessories.

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2.9 INSTALLATION PRACTICES

- A. All materials shall be installed as per the manufacturers' instructions, unless noted otherwise.
- B. Furnish and install telecommunication backboards on wall of communication equipment rooms as indicated. The bottom of the backboards shall be placed approximately twelve inches above finished floor (AFF), and must extend to a minimum height AFF of eight feet. Mount backboards with the smooth side facing away from the wall, and paint the backboard with two coats of fire resistant white paint prior to mounting. A minimum of six appropriate fasteners shall be used for every sixteen square feet of backboard.
- C. Free-standing equipment racks shall be fastened to the communications room floor using a minimum of four 3/8 inch concrete anchors.
- D. Equipment racks shall be positioned according to drawings with a minimum of 3 feet clearance in front and back. The contractor shall field verify the dimensions of the room prior to installation of racks and report any discrepancies to the owner or owners representative.
- E. Vertical wire managers for free-standing racks shall be bolted to the side or front of the rack using the manufacturers recommended hardware.
- F. All equipment racks, cabinets, enclosures, cable tray, conduits, and patch panels shall be bonded to the Telecommunications Grounding Busbar (TMG) (one per Telecommunications Room), which shall be bonded to the Telecommunications Main Grounding Busbar (TMGB), which shall be grounded to the main electrical ground in the main electrical room. Coordinate with electrical contractor. Coordinate exact routing and connection points with the electrical work. All surfaces that are used as a bond shall be filed to bare metal before completing connections.
- G. Install cable tray as shown in drawing package. The locations shown may need to be adjusted slightly in the field to assure proper placement. Note: Drawings may be in Division 16 Electrical.
- H. All tray sections shall be field cut to length as required with a minimum number of splice points. All field cuts shall be made using the manufacturers recommended equipment.
- I. All wire basket cable tray's shall be supported from the building structure using threaded rod and FAS type supports and shall be bonded to ground.

2.10 GROUNDING AND BONDING

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current

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carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

- B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. Entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG green stranded copper bonding conductor and compression connectors.
- D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and busbars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.11 FIRESTOP

- A. All Penetrations through fire-rated building structures (walls and floors) shall be sealed with an approved fire stop system approved by the local fire code. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire-rated structure). Any penetration item, i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

PART 3 SECTION 27 13 00 COMMUNICATIONS BACKBONE CABLING

3.1 RISER CABLE

- A. Voice and Data riser cable shall be plenum rated as detailed within project specifications and drawings. Pair counts shall also be project specific and shall be approved by OSU Information Services.
- B. Voice riser cable shall be category 3, 24AWG and manufactured by Superior Essex, General or Berk-Tek.

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C. Data riser cable shall be Corning Interlocking Armor plenum rated MTP-MTP, method A, factory pre-terminated fiber optic cable. Field terminated LC connectors shall not be permitted. Each IDF shall have singlemode and LOMMF/OM4 risers installed.

1. Corning, OM4, colored violet for LOMMF Multimode, 12-strands minimum.
2. Corning singlemode, colored yellow for singlemode, 12-strands minimum.
3. Corning Cassettes terminated with shuttered Duplex LC connectors.

D. Fiber optic riser cable shall be labeled every 20 feet with fixed machine-labeled yellow fiber optic ID tags, with labeling information specified by OSU Network Services, installed at patch panel entry and when passing through a conduit, fire sleeve and/or riser in addition to entering or leaving a room, hallway, ceiling or space.

3.2 CAMPUS BACKBONE CABLE

- A. UTP cable shall be category 3, Pic-Filled, Black jacketed cable with overall sheath. PE-89. Approved manufacturers are General & Superior Essex.
- B. Fiber Cable shall be graded index single mode fiber, non-conductive and be of loose tube construction. Strand counts shall also be project specific. Approved product is Corning ALTOS, minimum 12-strands.
- C. Corning duplex LC connectorized pre-polished pigtail assemblies will be fusion spliced onto all singlemode fiber optic campus backbone cable. Field terminated LC connectors shall not be permitted.
- D. Fusion splice all cables that requiring splicing as detailed in project specifications and drawings. Mechanical splices are not acceptable anywhere within the physical system.
- E. Cable Jacket shall have a permanently attached label that identifies OSU cable number, strand count and destination at ever termination and/or splice as the cabling enters and/or leaves a splice enclosure, vault, hand hole, building, building floor, and patch panels. The tag shall be engraved with black lettering on yellow background with information provided by OSU Network Services.

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1. Example: SM16,1-36 TUNNEL ENTRANCE "D"
2. Example: SM04, 1-12 Plageman Hall, 06-01-2014

3.3 COPPER CABLE PROTECTION UNITS:

- A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG green copper bonding conductor between the protector ground lug and the TC ground point.

3.4 TERMINATION BLOCKS

- A. Cat 3, 110-Style Blocks
 1. Ortronics OR-30200007
- B. Wiring troughs
 1. Vertical backbone managers wall mount 300 pair.
 - a. Ortronics OR-806003194
- C. 110 block labels
 1. Clear plastic holder for 110 blocks with paper inserts, for blocks with legs
 - a. Ortronics P/N OR-70400646

Note: Refer to Ortronics catalog for more complete 110 termination block kits.

3.5 FIBER OPTIC TERMINATION HARDWARE

- A. Fiber Optic Termination Hardware
 1. Corning Fiber Optic Patch Panel Assembly
 - a. CCH-01U
 - b. CCH-04U

Refer to Corning catalog for additional accessories.

3.6 FIBER OPTIC ADAPTER PANELS

- A. Corning Pre-terminated Cassette
 1. Corning Universal Play LC Module, shuttered Duplex LC to MTP

Refer to Corning catalog for additional accessories.

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3.7 OPTICAL FIBER TERMINATION HARDWARE:

- A. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- B. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
- C. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

3.8 BACKBONE CABLE INSTALLATION

- A. Backbone cables shall be installed separately from horizontal distribution cables.
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits.
- D. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- E. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- F. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- G. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- H. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.9 COPPER TERMINATION HARDWARE

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA 568-C (C.1, C.2, C.3) document, manufacturer's recommendations and best industry practices.

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- B. Copper riser shall be terminated on 110 IDC block separate from OSP protection units.
- C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- D. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- E. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel /block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- F. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.
- G. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

PART 4 SECTION 27 15 00 COMMUNICATIONS HORIZONTAL CABLING**4.1 SUMMARY**

- A. The horizontal distribution subsystem refers to all intra-building twisted-pair and fiber optic communications cabling connecting Telecommunication Rooms (TR's) to telecommunication outlets (TO's) located at individual work areas.
- B. Horizontal cabling may consist of a combination of the following types of cable from the TR to the TO:
 - 1. Enhanced Category 6, (100 Ohm, 4-pair, unshielded twisted pair) cables from the TR's to the TO's.) Port 1 or Port 2
 - 2. Laser Optimized OM4, optical fiber cable.
- C. The Horizontal System includes cables, jacks, patch panels, connecting blocks, fiber connectors as well as the necessary support systems, such as cable managers and faceplates.
- D. Telecommunications contractor shall furnish and install all materials necessary for a complete system per project documents.

4.2 HORIZONTAL CABLING

- A. Voice - Superior Essex grade Cat 3, colored Grey, Plenum
- B. Data – Superior Essex DataGAIN Cat 6, colored Green, Plenum

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***NOTE: Berk-Tek Lanmark 1000 Green Plenum is authorized for remodel work within an existing building where Berk-Tek has been previously installed.**

- C. Fiber Optic – Corning OM4, colored Violet Plenum, Duplex LC.

4.3 MODULAR JACKS

- A. Work area outlet jack
 - 1. Ortronics voice – OR-6373003, 8 POS, Fog White T568B
 - 2. Ortronics data – OR TJ600-25, 8 POS, Green T568B

- B. Multimode fiber modular adapter
 - 1. 2-strand fiber optic TracJack modular adapter, Duplex LC type connectors, ceramic alignment sleeves with 180-degree exit
 - a. Ortronics OR-63700075
 - 2. 2-strand fiber optic TracJack modular adapter, Duplex LC type connectors, ceramic alignment sleeves with 45-degree exit
 - a. Ortronics OR-63700080

4.4 WORK AREA OUTLETS

- A. Flush mounted faceplates
 - 1. Work Area Outlet: Six port TracJack faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a single gang wall box.
 - a. Ortronics OR-40300545, fog white.
 - 2. Wall Phone: One port TracJack faceplate with mounting lugs for wall phone, constructed from stainless steel, mounts within a single gang wall box, RJ45.
 - a. Ortronics OR-403STJ1WP.

- B. Dust covers
 - 1. Single port dust cover for modular openings, color to match faceplate.
 - a. Ortronics OR-42100002, fog white.

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4.5 110 TERMINATION BLOCKS

- A. Wiring Troughs
 - 1. Horizontal trough for routing of patch cords and cross-connect wire, with mounting legs.
 - a. Ortronics OR-30200140.
- B. 110 block labels (Cat 3)
 - 1. Clear plastic holder for 110 blocks with paper inserts, for blocks with legs
 - a. Ortronics OR-70400646.
 - b. Ortronics OR-70400680.

4.6 PATCH PANELS

- A. Category 6 modular patch panels
 - 1. 48 port, 8P8C modular jack panel, high density, 6 port modules, Category 6, IDC terminals, T568A/B wiring scheme.
 - a. Ortronics Angled OR-PHA66U48

4.7 EXECUTION: WORK AREA OUTLETS

- A. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.
- B. Data jacks, unless otherwise noted in drawings, shall be located in the right side position(s) of each faceplate.
- C. Voice jacks shall occupy the left position(s) on the faceplate.

4.8 EXECUTION: HORIZONTAL DISTRIBUTION CABLE INSTALLATION:

- A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit. Cable raceways shall not be filled greater than the TIA/EIA-569-B maximum fill for the particular raceway type or 40% (Initial Installations).
- C. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- D. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- E. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

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- F. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall cable(s) rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe, and/or HVAC system ducting.
- G. Horizontal distribution cables shall be bundles in groups of no more than 50 cables when being supported by J-Hook or trapeze systems. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance. An exception to this rule is when cable is installed in cable tray systems.
- H. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- I. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
- J. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
- K. Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
- N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

4.9 UNSHIELDED BALANCED TWISTED PAIR CABLE INSTALLATION PRACTICES

- A. Cable shall be installed in accordance with Ortronics and Berk-Tek recommendations and best industry practices.
- B. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- C. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- D. The cable's minimum bend radius and maximum pulling tension shall not be exceeded Bend radius for UTP = 4 x Cable OD, FTP = 4 x Cable OD.
- E. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
- F. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

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G. Separation from Power Lines:

1. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
 - a. Open or Nonmetal Communications Pathways:
 - 1) 12 inches from electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3 kVA.
 - 2) 36 inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - 3) 48 inches from large electrical motors or transformers.
 - b. Grounded Metal Conduit Communications Pathways:
 - 1) 2 1/2 inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
 - 2) 6 inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
 - 3) 12 inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - 4) 3 inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
 - 5) 6 inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

4.10 UNSHIELDED BALANCED TWISTED PAIR TERMINATION

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.0 document, manufacturer's recommendations and best industry practices.
- B. All 4 pair cables shall be terminated on the jack and patch panels using T568-B wiring scheme.
- C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable and 4 times for FTP cables.
- E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

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- F. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
- G. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- H. The cable jacket shall be maintained as close as possible to the termination point. Cable shall not have more than 1.0” removed.

4.11 OPTICAL FIBER CABLE INSTALLATION PRACTICES

- A. Place fiber optic cable so as to maintain the minimum cable bend radius limits specified by the manufacturer or ten times the cable diameter, whichever is larger.
- B. Use care when handling fiber optic cable. Carefully monitor pulling tension so as not to exceed the limits specified by the manufacturer.
- C. There shall be no splicing of Horizontal fiber optic cable.

4.12 TESTING PROCEDURES

- A. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- B. All cables shall be tested in accordance with this document, the ANSI/TIA standards, the Ortronics procedures and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
- C. Cables, jacks, connecting blocks, and patch panels shall be in their final position with the building energized.
- D. All Unshielded Balanced Twisted Pair cables shall be tested as follows:
 - 1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using an approved Ortronics certification tester (Fluke or Agilent) for category 6a, category 6, and category 5e performance compliance as specified in ANSI/TIA-568-C.
 - 2. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.
 - 3. Testing shall be accomplished with an approved Ortronics certification tester (Fluke)

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4. The basic tests required are:
 - a. Wire Map
 - b. Length (feet)
 - c. Insertion Loss (dB) (Formerly Attenuation)
 - d. NEXT (Near end crosstalk) (dB)
 - e. Return Loss (dB)
 - f. ELFEXT (dB)
 - g. Propagation Delay (ns)
 - h. Delay skew (ns)
 - i. PSNEXT (Power sum near-end crosstalk loss) (dB)
 - j. PSELFEXT (Power sum equal level far-end crosstalk loss) (dB)

Cat 6 Ortronics NetClear GT2 shall be tested to a Cat 6 auto test to 250 MHz.

ALL TEST RESULTS WILL PROVIDE FOR 5dB OF HEADROOM (NEXT) AS PER THE nCOMPASS 6+ SOLUTION GUARANTEE.

5. All test results shall be provided in the approved certification testers original software format on a CD, with the following minimum information per cable:
 - a. Circuit ID
 - b. All information from 1.2D.4 above.
 - c. Test result, "Pass" or "Fail"
 - d. Date and Time of test
 - e. Project Name
 - f. NVP
 - g. Version of software

Note: No asterisk * will be accepted by Ortronics. These results shall be retested and submitted after a PASS is received.

6. A software copy of the test results, in the original tester software format, shall be provided to the Owner and Ortronics.
7. Contractor shall provide a fully functional version of the tester software for use by the Owner in reviewing the test results.
8. Any failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs), must be reported in writing to the Owner immediately, along with a copy of the test results.

E. All Optical Fiber shall be tested as follows:

1. Testing procedures shall be in accordance with the following:

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- a. ANSI/TIA/EIA-568-C
 - b. ANSI/TIA/EIA-568-C.1
 - c. ANSI/TIA/EIA-568-C.0
 - d. ANSI/TIA/EIA-526-7
 - e. ANSI/TIA/EIA-526-14, Method B
 - f. Proposed TSB-140 Tier one Fiber Certification, C
2. Test Equipment
 - a. Certification tester (Fluke).
 3. Testing
 - a. All optical fibers shall be tested at both the 850 nm and 1300 nm wavelengths for multimode, 1310nm and 1550nm wavelengths for Singlemode, end-to-end insertion loss. Telecommunications Room (TR) to Telecommunications outlet (TO).Telecommunications outlet (TO) to Telecommunications Room (TR). Maximum insertion loss for all horizontal fiber optic cables without a consolidation point shall not exceed 2.0 dB.

NOTE: Horizontal fiber runs TR to TO, TO to TR, shall be tested at the wavelength of operation to the desk top applications.

4.13 TESTING AND ACCEPTANCE

GENERAL:

- A. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C.1, C.2. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- B. All cables shall be tested in accordance with this document, the ANSI-TIA/EIA standards, the Ortronics, Superior Essex and Corning Certification Program Information Manuals and best Industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the owners authorized representative for clarification and resolution.

COPPER CHANNEL TESTING:

- A. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a level IIe or level III test unit for category 5e or category 6, performance compliance, respectively.

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- B. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals. Crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
- C. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI-TIA/EIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
- D. Category 6 and 6E:
1. Follow the Standard requirements established in ANSI/TIA/EIA-568-C.1, C.2:
 2. A level III test unit is required to verify category 6 performance and must be updated to include the requirements of ANSI/TIA/EIA-568-C.1.
 3. The primary field-test parameters leading to Pass/Fail criteria used to verify installed horizontal cabling are listed below. These parameters are defined in ANSI/EIA/TIA-568-C.1.

Wire Map

Length

Insertion Loss

Near-end cross talk (NEXT) loss

Power sum near-end cross talk (PSNEXT) loss

Equal-Level-far-end cross talk (ELFEXT)

Power sum equal-level-far-end cross talk (PSELFEXT)

Return Loss

Propagation Delay

Delay Skew

Approved test unit manufacturer is Fluke DTX. Other test units are unacceptable. The Fluke DTX shall have the latest Linkware software version installed at time of project testing.

FIBER TESTING:

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- A. For horizontal and riser cabling system using multimode optical fiber, attenuation shall be measured bi-directionally at both 850 nanometer (nm) and 1300 nm operating windows using an LED light source and power meter.
- B. For horizontal and riser cabling system using single mode optical fiber, attenuation shall be measured bi-directionally at both 1310 nanometer (nm) and 1550 nm operating windows, using an LASER light source and power meter.
- C. Campus Backbone multimode fiber cabling shall be tested with OTDR at both 850 nm and 1300 nm bi-directionally.
- D. Campus Backbone single mode fiber cabling shall be tested with OTDR at both 1310 nm and 1550 nm bi-directionally.
- E. Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14A, Method B Standard.
- F. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. **ONLY BASIC LINK TEST IS REQUIRED.** The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
- G. Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.

4.14 SYSTEM DOCUMENTATION

- A. Per project contract documents.

4.15 TEST RESULTS:

- A. Submit completed test results with close out documentation on CD-ROM. Hard copy printed results are also required to be submitted via 3 ring binder(s), tabbed by EF/MC/IC/TC/ER/TR Binder shall be labeled with Oregon State University Project name and project number. This applies to all Horizontal copper and all fiber optic test results.
- B. Horizontal Cat. 3, Cat. 6, and Cat 6E cabling shall be tested with Fluke DTX 1800 Level III tester. Test results produced by other testers **WILL NOT** be accepted. A summary report will accompany the individual graph format test results. Test results shall have the Technicians

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names, correct date and time. Test results without the correct information and not in colored graph format shall not be accepted.

4.16 IDENTIFICATION AND LABELING:

- A. OSP copper labels shall be engraved. OSP copper labels shall be white letters on black background.
- B. OSP Singlemode fiber optic labels shall be engraved, black letters on yellow background.
- C. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device. Specific labeling information shall be project specific and the information will be given to the contractor by OSU Network Services.
- D. All horizontal cables are to be labeled using a machine printed label at each end of the cable approximately 6 inches of the termination point. Handwritten labels shall not be used.
- E. All patch panel ports and TO ports shall be labeled with the cable, network, TR room #, and port identifier.
- F. All inside building cabling, termination, hardware, protection units, patch panels, and work area outlets shall comply with ANSI/TIA/EIA 606 labeling standard color codes.
- G. Labeling scheme information and format to be provided by OSU Network Services.
 - 1. Note all labeling information on the as-built drawings.

4.17 FINAL ACCEPTANCE & SYSTEM CERTIFICATION:

- A. Completion of the installation, in-progress inspections, receipt of the test and as-built documentation, and successful performance of the cabling system will constitute completion of the system. Upon successful completion of the installation and subsequent inspection, Oregon State University shall be provided with a numbered certificate, from Ortronics or Superior Essex and/or Corning if applicable, registering the installation.