



RUTGERS

Office of Information
Technology

COMMUNICATIONS DISTRIBUTION SYSTEM REQUIREMENTS

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27.00.00 Communications

27.05.00 Common Work Results for Communications

27.05.26 Grounding and Bonding for Communications Systems

General Requirements

A uniform telecommunications grounding and bonding infrastructure shall be provided for the protection of personnel and equipment conforming to all applicable codes and standards including but not limited to the current National Electric Code (NEC) Articles 250 (Grounding and Bonding) and Chapter 8 (Communications Systems), ANSI/TIA-607-D, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, and the current versions of the National Fire Protection Association (NFPA) publications NFPA 70E "Standard for Electrical Safety in the Workplace", NFPA 75 "Standard for the Fire Protection of Information Technology Equipment" and NFPA 780 "Standard for the Installation of Lightning Protection Systems".

These are minimum requirements and do not replace federal, state, local, or other applicable codes, laws, or regulations, which may have priority.

Grounding and Bonding Infrastructure

All bonding conductors must be sized accordingly, see ANSI/TIA-607-D.

Primary Bonding Busbar / Telecommunications Bonding Conductor

A Primary Bonding Busbar (PBB) must be provided and located in the Telecommunications Entrance Room or Space. Cables and equipment shall be bonded to the PBB as required.

A Telecommunications Bonding Conductor (TBC) shall be run from the service equipment power ground to the PBB. Locate the PBB near the point where backbone cables are terminated while providing the straightest route and shortest distance possible for the Telecommunications Bonding Conductor from the PBB to the service equipment power ground. The TBC shall be equal to or greater in size than the largest TBB conductor (minimum 6 AWG).

The PBB shall be bonded to building steel where accessible with a minimum size conductor of 6 AWG.

Where a panel board for telecommunications is located in the same room or space as the PBB, that panel's ground bus or the enclosure must be bonded to the PBB.

The PBB must be mounted with insulated stand-offs and be mounted at 18 inch above finished floor, unless noted otherwise.

Secondary Bonding Busbar(s) / Telecommunications Bonding Backbone

Each Telecommunications Distributor Room shall have a Secondary Bonding Busbar (SBB) installed and shall be interconnected with the Primary Bonding Busbar (PBB) via the Telecommunications Bonding Backbone (TBB) which must be sized according to ANSI/TIA-607-D and the NEC based on the length of the conductor (minimum 6 AWG). The TBB serves to equalize potential differences and not serve as a ground fault current return path. Cables and equipment shall be bonded as required.

The SBB shall be bonded to the TBB via the Secondary Bonding Conductor (SBC) with a minimum size conductor as large as the largest conductor attached to the associated SBB (minimum 6 AWG).

The SBB shall be bonded to building steel where accessible with a minimum size conductor of 6 AWG.

Where a panel board for telecommunications is located in the same room or space as the SBB, that panel's ground bus or the enclosure must be bonded to the SBB. If one is not present in the same room, that SBB should be bonded to the panelboard that feeds the space.

The SBB must be mounted with insulated stand-offs and be mounted at 18 inch above finished floor, unless noted otherwise.

Whenever two or more vertical TBBs are used in a building, the SBBs shall be interconnected at the top of each riser and at every third floor with a Backbone Bonding Conductor (BBC), in accordance with ANSI/TIA-607-D and the NEC.

Telecommunications Equipment Bonding Conductor (TEBC)

Telecommunications Equipment Bonding Conductors shall be provided connecting the PBB/SBB to equipment racks/cabinets. More than one TEBC may be installed from the PBB/SBB (e.g., a separate TEBC per rack).

Grounding and Bonding Requirements

Main Distribution Frames and Service Entrances

Transient protection devices shall be installed according to the requirements of the NEC. Maximum effort should be made to keep the primary protector grounding conductor as short as practical. See ANSI/TIA-607-D Annex E.

OSP Cable Sheath Grounding

The metallic sheath of communications cables entering buildings shall be bonded to ground as close as practicable to the point of entrance. See NEC Article 805, "Communications Circuits".

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The point of entrance shall be considered to be at the point of emergence through an exterior wall, a concrete floor slab, or from a grounded rigid metal conduit or an intermediate metal conduit grounded to an electrode.

All cables entering and leaving splices shall be bonded together. Bonding shall be done with #6 AWG, or larger, insulated wire. Metallic splice cases shall be bonded to the sheath of the feed cable and the local ground.

Sheath clamps shall be installed such that there will be minimal danger of abrasion to conductors.

Coaxial Cable Grounding

The outer conductive shield of a coaxial cable shall be grounded in the same manner as other telecommunications cable to help limit potential differences between the CATV System and other metallic systems.

Voice Backbone Grounding

Both ends of backbone cables shall be provided with ground clamps and shall be bonded to the PBB and SBBs.

If plenum rated cable conforming to NEC Article 805 type CMP must be used in place of the shielded cable specified, an insulated wire not less than #10 AWG shall be tie-wrapped at regular intervals to the backbone cable (Coupled Bonding Conductor (CBC)) and serve the grounding function of a sheath. The CBC is considered a part of the installed cabling system and not a part of the grounding and bonding infrastructure.

Installation in Conduit

Any grounding or bonding sheath or conductor run through a metallic conduit must be bonded to the conduit at both ends using a #6 AWG, or larger, insulated ground wire.

27.05.28 Pathways for Communications Systems

Equipment and Materials Minimum Requirements

Supply all Equipment indicated for an installation, including but not limited to:

- Mounting brackets
- Grounding and bonding clamps, busbars, wire, etc.
- Hangers, clamps, and other mounting hardware
- Bushings, and other miscellaneous hardware
- Labels, etc.
- Fire-retardant 3/4" plywood backboards painted with a fire resistant, non-conductive, low gloss, light colored paint (fire rating label shall not be painted over).

Cables Not in Raceway

Cable routes shall be coordinated with the Rutgers University telecommunications project manager so as not to block access panels, utilize reserved space, etc.

Cables shall be routed parallel to walls.

The suspension method and height shall be code compliant and subject to approval by Rutgers University.

27.05.29 Hangers and Supports for Communications Systems

Cable Hangers and Supports

Supply all Equipment required for a safe, secure and code compliant installation, including but not limited to:

- Brackets, hangers, clamps, and other mounting hardware
- Bushings, and other miscellaneous hardware

The Contractor shall be responsible to review all cable racking and riser support details and confirm they are adequate to support the maximum loads resulting from the cabling that could be inferred from the current design. It shall be the Contractor's sole responsibility to provide anchors and miscellaneous hardware to insure the structural integrity of the cable supports.

27.05.33 Conduits and Backboxes for Communications Systems

Conduit

Conduit or Electrical Metallic Tubing (EMT) shall contain no more than two (2) 90-degree bends and have an aggregate bend of no more than one-hundred and eighty (180) degrees without a pull box. Pull boxes to be installed in straight sections only.

In new construction, one-inch conduit shall be installed to each WP backbox. Where conduit feeds raceway it shall be sized accordingly taking into consideration the number of cables the raceway will accommodate. Conduit shall stub out above accessible ceiling space. All conduit shall be reamed and bushed.

Install parallel or perpendicular to the floor and walls.

Conduits passing through fire rated construction: Seal opening with approved STI fire stop system.

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Fastening conduit: Conduit must be securely fastened in place by means of approved screws, anchors, supports and fastenings. Arrangement and method of fastening conduit shall be subject to the direction and approval of Rutgers University.

Where riser conduits penetrate floors slabs, rest on each floor with approved beam clamps or pipe straps. Do not support conduit from ductwork, piping or other equipment. Combined strength of supporting equipment and size and type of anchor shall be based on combined weights of conduit, hanger and cables.

Lubricant shall be used for pulls longer than ten feet (10') or containing more than ninety degrees in bends.

Conduit expansion fittings together with bonding jumper shall be provided where each conduit run crosses an expansion joint in concrete structure. Expansion fitting shall be installed on one side of joint with its sliding sleeve flush with joint and a length of bonding jumper in expansion joint equal to at least three times nominal width of joint.

Backboxes

WP's shall be installed using double gang back boxes with single gang mud rings in new construction, Carlon Zip Boxes in existing fishable walls and Wiremold for surface raceway.

Wiremold Part Numbers:

V5744S	Wiremold 500/700 Series Single-Gang Deep Switch and Receptacle Box Fitting in Ivory
V5744	Wiremold 500/700 Series Single-Gang Extra Deep Switch and Receptacle Box Fitting in Ivory
V5744S-2	Wiremold 500/700 Series Two-Gang Deep Switch and Receptacle Box Fitting in Ivory
V5744-2	Wiremold 500/700 Series Two-Gang Extra Deep Switch and Receptacle Box Fitting in Ivory

Sleeves

Sleeves shall be provided in all wall and floor penetrations. All sleeves in floor penetrations and in penetrations in fire-rated walls shall be fire stopped.

Ladder Tray

Where shown, ladder tray shall be provided and installed.

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CPI Part Number: 1250-712
Universal cable runway (Ladder Rack)
9'11"L X 12"W X 1.5"H
Straight sections, Black

All cable trays and ladder racks shall be securely supported from the walls and ceilings, as required.

VELCRO Wraps

Tie wrap cable bundles using VELCRO straps every 4 feet, maximum, and support properly. Cables shall not be supported by sprinkler pipes, hung ceiling tiles, grid or other portions of the ceiling support system.

Tie wraps shall be rated for the purpose and location of installation. (I.e. Plenum rated tie wraps shall be used when installed in plenum spaces above certain hung ceilings).

Measuring Tapes and Pull Lines

Pull lines shall be provided in all empty conduits longer than 10 feet.

Inner duct

All innerduct used within buildings shall be at least riser-rated except in those areas where plenum rating is required by code.

Endot Industries Part Numbers: ENDOCOR/PL (plenum) or equivalent
ENDOCOR/RI (riser) or equivalent

27.05.39 Surface Raceways for Communications Systems

Concealment Required

Except within Horizontal Cross-Connects (HCs) and Main Cross-Connects (MCs) and above accessible ceilings, all wiring shall be within raceway unless otherwise specified by Rutgers. Accessible ceilings shall include any ceilings with a void through which cable can be routed. Use best efforts to conceal wiring within walls and ceilings.

Metallic Surface Raceways

Raceway shall be of a type and color approved by Rutgers University. Install parallel or perpendicular to the floor and walls.

Raceways shall include all required fittings, angles, etc. Raceways shall have fitting and/or end cap at each end. All angles shall be made using manufactured fittings, field

cutting and mitering of the raceway will not be permitted. Code and manufacturers minimum bend radii for all cables shall be maintained.

Fastening raceways: Raceways must be securely fastened in place by means of approved screws, anchors, supports and fastenings. Arrangement and method of fastening raceway shall be subject to the direction and approval of Rutgers University. Double sided tape shall not be used in place of screws or other fasteners.

Non-Metallic Surface Raceways

Panduit Part Numbers:

- LD10IW6-A Single-channel surface raceway, 6-foot sections, International White
- LD10IW10-A Single-channel surface raceway, 10-foot sections, International White
- TG70IW8 Pan-Way TG-70 Surface Raceway System Base and Cover

Raceways shall include all required fittings, angles, etc. Raceways shall have a fitting and/or bushing at each end. All angles shall be made using manufactured fittings, field cutting and mitering of the raceway will not be permitted. Code and manufacturers minimum bend radii for all cables shall be maintained.

Surface raceway shall be of a type and color approved by Rutgers University.

The station end of raceways shall be terminated in a box appropriate for the proposed jack.

Raceways shall be installed parallel or perpendicular to the floor and walls.

Fastening raceways: Raceways must be securely fastened in place by means of approved screws, anchors, supports and fastenings. Arrangement and method of fastening raceway shall be subject to the direction and approval of Rutgers University. Double-sided tape shall not be used in place of screws or other fasteners.

27.05.43 Underground Ducts and Raceways for Communications Systems

Conduit

Lubricant shall be used for pulls longer than ten feet (10') or containing more than ninety degrees in bends.

Building Entrance

The OSP facilities shall have 4" (four-inch) diameter conduits arriving at the building Telecommunications Entrance Facility in quantities appropriate with the requirements of the facility.

Duct Types

All ducts shall be Schedule 40, unless otherwise noted.

All PVC single cell duct shall be 4-inch inside diameter Carlon Plus 40 Rigid PVC or approved equal, conforming to NEMA standards TC-2 and UL651.

When installing new ducts that may cross or be in close proximity to High Temperature Hot Water (HTHW) lines, the contractor shall use 4" fiberglass conduit by Champion Fiberglass (PN: CF 40A SW 10).

Newly installed duct banks will require 3 1-1/4" inner ducts installed in one of the 4-inch conduits.

Rigid Conduit Required

Rigid hot dipped galvanized steel 4", Schedule 40, shall be used as part of the duct system where conduits are exposed, cross open ditches, are attached to bridges or similar structure, pass under railway tracks, etc. All exposed LB fittings shall be weatherproof design of the cast malleable iron type with a triple-coat finish of zinc electroplate, dichromate and an epoxy powder coat or approved equal. All exposed pull boxes, junction boxes, etc., shall be NEMA 4 enclosures of rigid hot dipped galvanized steel or approved equal. Galvanized steel conduits shall be used from the inside of buildings to undisturbed earth and from the inside of manholes/handholes to undisturbed earth to prevent a "shearing point" at the building or manhole/handhole edge. Link Seals should be used when penetrating through concrete walls to ensure watertight application. Conduits terminating inside a building or manhole/handhole will be installed so that the conduit extends four (4) inches beyond the surface from which it emanates. Conduits shall be plugged with inserts to ensure that foreign matter does not enter the building. The ends of metallic conduit shall be reamed, bushed and grounded according to the National Electric Code. All conduits are to be installed with a minimum 200-lb. test non-corrosive graduated pull tape. The routing of conduits under the building foundation shall be minimized.

When run inside of buildings, all OSP cables shall be enclosed by conduit or raceway where appropriate, such as when required by Fire Codes, exposed to steam pressure relief valves, or in public areas.

Mechanical Requirements

All conduit and innerduct shall be free from holes, splits, cracks, blisters, inclusions, and other performance affecting imperfections. The bores shall be free from dimensional non-uniformity, and the wall thickness shall be concentric in accordance with sound commercial practices.

Bends

The minimum bend radius for all conduit between pulling points shall be ten times its diameter. There shall be no sharp bends or turns located between pulling locations. PVC elbows shall have a minimum radius of 36".

Where sharp bends or turns are required, prefabricated fittings will be used unless such bends or turns prohibit the pulling of large cables. No conduit or raceway run shall have more than three (3) bends and have an aggregate bend of not more than one-hundred and eighty (180) degrees without the use of a properly positioned manhole, or pull-box.

Where long turns or bends are required in the duct structure, the duct sections shall be formed, provided that large radius turns can be properly made without deformation of the duct cross-section.

Changes in direction of runs exceeding 10 degrees shall be accomplished by field bending conduits with a PVC bender for PVC ducts.

Joints and Fittings

Watertight joints between sections of ducts will be made using appropriate and approved couplings and solvent cement. Conduit fittings located where conduit enters building above grade shall be 4", large radius LB Mogul type fittings, as manufactured by Appleton Electric Company or approved equal.

Duct sections shall be joined by use of couplings installed as recommended by the Manufacturer of duct. Where duct lines enter buildings or manholes, the conduits shall terminate in standard end bells.

Separators

Duct separators shall be placed at intervals of approximately six (6) feet and fastened securely.

Slope

The duct systems shall be sloped to permit penetrating water to drain towards the manhole(s). The highest point of the duct array will be at the center of each run, or the building entry point.

Cleaning and Sealing of Ducts

All conduit and innerduct shall be free of earth, debris, etc. All ducts utilized for cable placement shall be subsequently sealed through use of duct plugs, fire-rated UL listed duct seal putty, foam, etc. to provide a gas and watertight seal around the cables. Conduit shall be thoroughly cleaned before placement. To prevent water from washing mud into the conduits, the ends of the conduits shall be plugged during construction and after the duct line is completed. Particular care shall be taken to keep the conduits clean of concrete or any other substance during course of construction.

Where connection is made to existing duct which is of a different material and shape than the duct being installed, a suitable coupling of the type recommended by the duct manufacturer shall be used.

Trench Depth

The recommended maximum trench depth is five feet. The minimum trench depth shall be no less than 3'-8" under pavement and 2'-6" under lawns. Trenches shall be excavated to a depth 4" below the bottom of the system. The minimum cover from the top of encasement shall be 2'-0" below finished grade or finished paving. If soft spots are encountered, the excavation shall be taken to soil of suitable bearing. Per OSHA requirements, trenches of four feet or greater must be properly sloped, benched, or shored.

Trench Grading

A uniform trench grade shall be maintained to eliminate dips. The trench shall be graded so that it has a fall of four inches in 100 feet toward the lower manhole or from the high point of the section toward both manholes to allow for conduit drainage. The high point of the trench should conform to the high point of the ground surface. Where the ground between manholes is level, use the middle of the section as the high point and grade each way. Where the surface slopes between manholes, establish the trench high point twenty-five feet from the higher manhole and grade toward the lower manhole.

Trench Bedding

The trench base shall be evenly graded to provide an even bedding for the duct bank. Low spots shall be filled and tamped evenly. Ducts shall be placed on top of 4" of sand bedding.

Conduit Placement

PVC duct separators or spacers shall be used every six feet to provide positive construction and spacing of the conduits into a firm, single conduit assembly.

All conduits shall be rodded and mandrelled, and innerducts shall be installed where required. All ducts including inner ducts shall have a 200-pound test strength noncorrosive graduated pull tape installed, and each end shall be sealed with a rubber or plastic duct plug or cap before the section can be accepted.

If it becomes necessary to cut, move, change or reconstruct any surface or subsurface, or connection, such work shall be done to the satisfaction of the University. The Vendor shall provide bridging, hangers or other supports to maintain and support in an entirely safe condition all surface and subsurface structures, and all their appurtenances encountered or affected during this work. For pavement, concrete or asphalt cutters shall be utilized. All cuts shall be replaced score to score. Cuts in sidewalk shall be made from score to score in order to provide uniform replacement of sidewalk.

Sand Filling

The lower part of the trench for its entire length shall be carefully backfilled with clean, uniformly graded sand. The remainder of the trench shall be backfilled with clean subsoil free of clay, organic matter, debris or other unsuitable material.

Concrete

The Vendor shall be responsible for the design mix. Concrete shall have an ultimate compressive strength of 3000 psi at 28 days.

Concrete shall not be placed when the air temperature is expected to fall below 40 degrees F. No frozen materials, nor calcium chloride, salt or other antifreeze material shall be used. For hot weather placement, mixture shall be kept below 90 degrees F.

Back-filling

All backfill materials shall be tamped in layers not to exceed eight-inches (8") in thickness and mechanically compacted to assure a compaction of fill of 95% maximum density.

12" below grade and centered along the duct bank, the Vendor shall place a continuous detectable metallic warning tape labeled "Communications".

After back-filling the trench, the Vendor is responsible for the removal from site and disposal of all unused excavated material.

Required Separation

The following minimum vertical or horizontal separations between telecommunications facilities and other facilities shall be maintained:

- From power or other foreign conduit, a minimum of 3-inches of concrete, or 4-inches of masonry, or 12-inches of well-tamped earth.
- From sewer, water, or other such utility pipes, a minimum separation of 6-inches when crossing and 12-inches when parallel.
- From gas, oil, or other such fuel pipes, a minimum separation of 36-inches whether crossing or parallel.
- From high temperature hot water lines, a minimum of 6 ft. Use 6" of insulating cement or such other quantity and/or type of insulation as designated as a further separator between the duct bank and the high temperature hot water lines.

These are minimum requirements. Note that local codes may require more stringent separations. It is the Vendor's responsibility to conform to all appropriate codes and regulations.

Innerduct

Innerduct shall be 1-1/4" I.D. as manufactured by:

- Dura-Line Figure-8 Duct (or equivalent), standard Figure-8 aerial conduit with an Extra High Strength (EHS) flooded galvanized support strand for outdoor aerial runs.
- Endot Industries Enduct 166/11 with minimum 900 lb. pull tape is acceptable for use in non-aerial applications.
- Endot Industries Endocor 1250 with minimum 900 lb. pull tape is acceptable for use in non-aerial applications.
- Manufacturer's recommended installation guidelines must be followed.

Manholes

Placement

Manholes shall be placed in accordance with University documents and drawings.

Maximum Run Length

Maximum distances between manholes and from manholes to buildings shall not be greater than 600 feet for a straight run or for a run containing an aggregate of 45-degree bend, and 400 feet for a run containing an aggregate of 90-degree bend. The total number of bends in a conduit run shall not exceed two 90-degree bends or equivalent of sweeps and radius bends. Each bend will have a minimum radius in accordance with existing standards (ten times the I. D. Minimum for the bend radius). Exceptions dependent upon actual physical limitations shall be reviewed on a per-case basis.

Type

Manholes shall be pre-cast steel reinforced concrete construction with a minimum test strength of 4000 psi at delivery and 5000 psi at 28 days with rubber gasket joints. All pre-cast manholes to be designed to minimum standards for vehicular traffic loads. A PVC water barrier shall be installed at all construction joints. Splayed duct entry points at one or both sides of an end wall are preferred. Conduit entry points shall be at opposite ends of the manhole and not through the side walls. Shop submittal shall be made for each manhole size and type to be used by Vendor. These drawings shall also include all hardware, frames and covers.

All manholes, even those to be used as pull points for straight-through cable runs, shall be planned as potentially housing splices or bends. These shall be sized 6'Wx12'Lx7'D (interior) in-line manholes allowing two splicing bays and 6'Wx8'Lx7'D (interior) auxiliary manholes as needed. Prefabricated manholes preferred whenever possible. Wall to be 6" thick. Base, as a minimum, shall be 6" thick with #4 bars, 12" o.c. both ways. In

instances where the depth of the duct bank (or other considerations) require the manhole to be placed below normal depth, the manhole roof shall be placed at normal depth below ground level and the headroom shall be increased. This eliminates the need for deep collars and also provides better lighting and ventilation in the manhole.

Joint use manholes will not be permitted.

In existing non-waterproofed pre-cast manholes with bonded steel, a welded or clamped bonding insert attached to rebar, or in new or existing waterproofed manholes, a driven ground rod with an associated bonding ribbon is required to ground all racking. A ground identification plate shall be placed equidistant from each end wall and seven inches (7") below the manhole roofline.

Pulling irons shall be set in concrete walls opposite duct entrances to provide points of attachment for blocks, sheaves and tackle necessary for cable installation. The pulling irons shall provide a clear opening of approximately three-inches (3") in the eye. The pulling irons should be placed in the walls opposite each duct entrance, from six to twelve inches below the ducts with which they are associated, and in line with the centerline of the duct bank.

A sump of at least twelve inches (12") in diameter by at least eight inches (8") deep shall be provided. Manholes shall be provided with a sump cast into the floor into which a portable sump pump can be installed. Floor shall slope to sump. All hardware in manholes must be galvanized.

Frames and Covers

All manhole frames and covers shall be sized at thirty-inches (30") diameter. Manhole covers shall be round, having a standard manhole frame and cover. A minimum cover of twelve-inches (12") to accommodate potentially heavy vehicular traffic shall be provided. A pre-cast concrete grade ring, pre-cast collar or equivalent, shall be employed to obtain the minimum required cover.

The manhole opening shall be placed at the center of the manhole except where the opening would be within three feet (3') of obstructions. In such cases, the opening shall be relocated to the furthest end of the manhole from the obstruction.

All manhole frames and covers must meet industry standards for vehicular traffic loads. The manhole cover shall be clearly labeled in accordance with University approved naming conventions. Unless otherwise specified by local regulations, solid covers rather than perforated covers shall be used.

Coring

All holes required in concrete structures for installation of outside plant shall be mechanically cored. Rigid galvanized metallic conduit shall be installed for PVC ducts. Such rigid galvanized metallic conduit shall extend into the manhole and nine feet into undisturbed earth to prevent shearing and shall connect to the PVC ducts.

Damp-proofing

The manholes shall be damp-proofed with cold applied asphalt bituminous damp-proofing or approved equal. Asphalt bitumen material shall conform to Federal Specification SS-C-153C, Type 1 and shall be Trowell Mastic as manufactured by W. R. Meadows, Inc. or approved equal.

The application of damp-proofing shall be trowel applied to seal penetrations, small cracks and honeycomb in substrate and duct bank entry and exit points. The application shall be in one coat, continuous and uniform at a rate of 0.08 gallons per square foot for 1/8" thickness. All exterior manhole surfaces, top, bottom and sides shall be damp-proofed.

Manhole Racks and Supports

All manholes shall be equipped with the following interior hardware:

Permanent manhole steps solidly embedded in a minimum of three-inches of cement mortar shall be placed in the manhole neck. The steps shall be formed from 3/4-inch diameter rod of hot-dipped galvanized steel and shall be in the shape of a U with hooked ends and a dropped front so that a foot cannot slide off their sides.

Standard manhole ladders with one end having hooks to engage a manhole step shall be provided for each manhole. The steps and ladders shall be positioned in such a way as to allow the workers to face oncoming traffic. A 6' 6" galvanized straight steel ladder is required when the chimney height is 12 inches or less. When the chimney height is 12 inches or more, a hooked ladder is required and manhole steps are to be provided at 12-inch intervals. All ferrous metal shall be galvanized.

Cable racks, cable rack supports, cable rack hooks and locking clips shall be used to support and secure cables and splice cases. If necessary, corner brackets shall also be provided. All of the above hardware and accessories shall be galvanized. The cable rack supports shall be secured to the walls by means of 1/2" by 2-1/2" galvanized machine bolts which are screwed into concrete inserts that are cast in place. If the concrete inserts have not been placed, drill at appropriate locations and install 1/2" by 2-1/2" double expansion shield anchors.

Handholes

Handholes are only permitted, upon approval by Rutgers University, in routes having less than four (4) ducts where no branches are required, or in other areas where manhole construction is not feasible or desirable.

Riser Pole Guards

All OSP conduits terminating at a riser pole shall be suitably sealed to prevent infiltration by weather and pests. Contractor shall provide riser pole guards to cover cables/innerduct from the point where they emerge from the OSP conduit. Guard shall be heavy duty schedule 40 PVC and shall be mounted to the pole per manufacturer's specifications. Similar to Carlton PV-Mold non-metallic pole riser system with appropriate adapters and

couplings. Pole guards shall be sealed at the top with hydraulic cement to prevent entry by squirrels or other vermin.

Restoration Requirements

The Vendor shall repair all Rutgers University grounds and property to their pre-construction condition using materials of same or better type or quality. This includes, but is not limited to, repaving, reseeding, walls, fences, landscaping, utilities, signs, painting, curbing, etc. All Bituminous materials should be used where necessary for roads, parking areas, and footpaths. Restoration shall follow the original construction drawings, shop drawings, other documentation and visual observation, in order to match the existing conditions. Prior to restoration the Vendor shall submit a plan to the University for approval.

Rutgers University reserves the right to inspect all materials to be used in the restoration process, and to demand changes in type and quality in order to meet Rutgers University standards. Such changes will be at the Vendor's expense unless Rutgers University requires materials of a higher quality than original.

In all cases concerning determination of "original condition", Rutgers University will be the judge and have final approval.

The Vendor shall be responsible for cleaning-up and restoring work areas to at least their original condition.

27.05.53 Identification for Communication Systems

CAD Standards

All drawings shall be created and supplied in AutoCAD Release 2017 or greater, format.

File Names

File name Nomenclature shall have the following structure: XXXX-TX

The first four digits XXXX represent the building number.

The subsequent characters represent:

T0- Telecommunications symbols, legends, cover sheet

T1- Telecommunications plans

T2- Telecommunications riser diagrams, elevations, detail sheets

e.g. A file that represents the second drawing for Building 3004 may be named 3004-T12.

The cover page shall be named XXXX-T0 where XXXX represents the Building Number (e.g. 3004).

Plan Numbering

Plans shall be numbered with the following structure: T1-X

The cover page shall be T01.

The Legend/Symbol page shall be T02

Subsequent drawings shall be

T1B = Basement

T1LL = Lower Level

T1SB = Sub Basement

T1M = Mezzanine

T11 = 1st floor

T12 = 2nd floor, etc.

Detail sheets shall be numbered with the following structure:

T21 details, elevations, Riser etc.

XREFS

All xrefs are to be inserted into sheet file(s) as an Attachment or Overlay using no Path as the Path type. The drawings can be moved as needed and still maintain its links. Eliminating any further maintenance to re-link the xrefs.

Xrefs can be bound as inserts. Binding an xref to a drawing makes the xref a permanent part of the design drawing. Keeping all files together as a package allows functionality in any situation. This method is preferred.

All files shall be purged of redundant/useless info prior to submission.

The CAD drawings are created with “Smart Blocks”, attributes that contain the following information: Wall Plate ID #'s (WP), Floor number, Room number, and partial Face Plate information (FP). These “Smart Blocks” are inserted into the CAD floor plans per drawing scale and provide a behind the scenes data base of the above information as well as the cable ID numbers.

Database Systems

Telecommunications OSP Identification

PATHWAYS:	IDENTIFIER:
DUCTBANK	DB - 3 LETTER CAMPUS - SEQUENTIAL #

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PATHWAYS:	IDENTIFIER:
CONDUIT	CD - 3 LETTER CAMPUS - SEQUENTIAL #

SPACES:	IDENTIFIER:
ENTRANCE FACILITY	EF - 4 DIGIT BUILDING # - ROOM #
MANHOLE	MH - 3 LETTER CAMPUS - SEQUENTIAL #
VAULT/HUT	VT - 3 LETTER CAMPUS - SEQUENTIAL #
PULL/SPLICE BOX	PB - 3 LETTER CAMPUS - SEQUENTIAL #
HANDHOLE	HH - 3 LETTER CAMPUS - SEQUENTIAL #
PEDESTAL	PD - 3 LETTER CAMPUS - SEQUENTIAL #
UTILITY POLE	UP - 3 LETTER CAMPUS - POLE #

WIRING SYSTEM:	IDENTIFIER:
BACKBONE CABLE (OSP)	CBF (or V, C) - 3 LETTER CAMPUS ID - SEQUENTIAL #
VOICE TERMINATION HARDWARE (OSP)	TH - BLDG # - ROOM #
FIBER TERMINATION HARDWARE (OSP)	TH - BLDG # - ROOM # - 400 THROUGH 499
VIDEO TERMINATION HARDWARE (OSP)	TH - BLDG # - ROOM # - 500 THROUGH 599

Telecommunications ISP Identification

HORIZONTAL CABLING SYSTEM:	IDENTIFIER:
VOICE CABLE	CHV – BLDG # - 4 DIGIT SEQUENTIAL CABLE NUMBER PER FLOOR
DATA CABLE	CHD – BLDG # - 4 DIGIT SEQUENTIAL CABLE NUMBER PER FLOOR
VIDEO CABLE	CHC – BLDG # - 4 DIGIT SEQUENTIAL CABLE NUMBER PER FLOOR
FACEPLATE	FP – BLDG # - ROOM # - SEQUENTIAL NUMBER PER ROOM

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HORIZONTAL CABLING SYSTEM:	IDENTIFIER:
DATA TERMINATION HARDWARE (HORIZONTAL)	TH – BLDG # - ROOM # - 100 THROUGH 199
VOICE TERMINATION HARDWARE (HORIZONTAL)	TH – BLDG # - ROOM # - 200 THROUGH 299
FIBER TERMINATION HARDWARE (HORIZONTAL)	TH – BLDG # - ROOM # - 300 THROUGH 399
VIDEO TERMINATION HARDWARE (HORIZONTAL)	TH – BLDG # - ROOM # - 500 THROUGH 599

RISER WIRING SYSTEM:	IDENTIFIER:
VOICE RISER & TIE CABLE	CRV – BLDG # - SEQUENTIAL #
FIBER OPTIC RISER CABLE	CRF – BLDG # - SEQUENTIAL #
VIDEO RISER CABLE	CRC – BLDG # - SEQUENTIAL #
VOICE TERMINATION HARDWARE (RISER & TIE)	Cable ID and Pair SEQUENTIAL # CRV – BLDG # - SEQ
FIBER TERMINATION HARDWARE (RISER)	TH – BLDG # - ROOM # - 300 THROUGH 399
VIDEO TERMINATION HARDWARE (RISER)	TH – BLDG # - ROOM # - 500 THROUGH 599

GROUNDING & BONDING SYSTEM:	IDENTIFIER:
PRIMARY BONDING BUSBAR (PBB)	PBB – BLDG# - ROOM# - SEQUENTIAL #
TELECOMMUNICATIONS BONDING CONDUCTOR (TBC)	TBC – BLDG# - #
SECONDARY BONDING BUSBAR (SBB)	SBB - BLDG# - ROOM# - SEQUENTIAL #
TELECOMMUNICATIONS BONDING BACKBONE (TBB)	TBB – BLDG# - SEQUENTIAL #
BONDING CONDUCTOR	BC – BLDG# - ROOM# - SEQUENTIAL#
COUPLED BONDING CONDUCTOR	CBC – BLDG# - SEQUENTIAL # NOTE: SEQUENTIAL # TO MATCH SEQUENTIAL # OF ASSOCIATED CABLE

Telecommunications Cabling Templates

Horizontal cable template
VOICE HORIZONTAL TEMPLATE

VOICE HORIZONTAL TERMINATION HARDWARE RECORD

BLDG.# _____	BLDG. NAME _____
ER/TC RM.# _____	FL.# _____
TERMINATION HARDWARE # TH- _____ - _____ - 2	
<small>BLDG#</small>	<small>ER/TC RM#</small>
<small>TH#</small>	

CHECK ONE			
FT-100		FT-300	
FT-200		OTHER	

ROW	POS 1	POS 2	POS 3	POS 4	POS 5	POS 6	ROW
1	V	V	V	V	V	V	1
2	V	V	V	V	V	V	2
3	V	V	V	V	V	V	3
4	V	V	V	V	V	V	4
5	V	V	V	V	V	V	5
6	V	V	V	V	V	V	6
7	V	V	V	V	V	V	7
8	V	V	V	V	V	V	8
9	V	V	V	V	V	V	9
10	V	V	V	V	V	V	10
11	V	V	V	V	V	V	11
12	V	V	V	V	V	V	12

Notes: CAD - Red Out of Sequence - Yellow Duplication of Cable # - Blue After Field Investigation: FP & UNK - Purple

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DATA HORIZONTAL TEMPLATE

DATA HORIZONTAL TERMINATION HARDWARE RECORD

BLDG.# _____	BLDG. NAME _____
ER/TC RM.# _____	FL.# _____
TERMINATION HARDWARE # TH- _____ - 1 _____	
BLDG#	ER/TC RM#
TH#	

CHECK ONE	
24 PORT	
48 PORT	

Page 2 of 15

PORT NUMBERING SEQUENCE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48

POS 1	POS 2	POS 3	POS 4	POS 5	POS 6
<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>
POS 7	POS 8	POS 9	POS 10	POS 11	POS 12
<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>
POS 13	POS 14	POS 15	POS 16	POS 17	POS 18
<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>
POS 19	POS 20	POS 21	POS 22	POS 23	POS 24
<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>
POS 25	POS 26	POS 27	POS 28	POS 29	POS 30
<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>
POS 31	POS 32	POS 33	POS 34	POS 35	POS 36
<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>
POS 37	POS 38	POS 39	POS 40	POS 41	POS 42
<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>
POS 43	POS 44	POS 45	POS 46	POS 47	POS 48
<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>	<input type="text" value="D"/>

Notes CAD	Red	Order Sequence	Yellow	Duplication of Cable #	Blue	After Field Investigation	FP & UNK	Purple
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Riser cable template
VOICE RISER / TIE TEMPLATE

CRV (VOICE RISER) TERMINATION HARDWARE RECORD

CROSS CONNECT FROM VOICE STATION CABLE TO VOICE RISER

BLDG.# _____		BLDG. NAME _____																																								
<table border="1" style="width:100%; border-collapse: collapse;"> <tr><td align="center">FROM</td></tr> <tr><td>CHECK ONE</td></tr> <tr><td>EF <input type="checkbox"/></td></tr> <tr><td>ER <input type="checkbox"/></td></tr> <tr><td>TC <input type="checkbox"/></td></tr> <tr><td>ROOM # _____</td></tr> </table>	FROM	CHECK ONE	EF <input type="checkbox"/>	ER <input type="checkbox"/>	TC <input type="checkbox"/>	ROOM # _____	<table border="1" style="width:100%; border-collapse: collapse;"> <tr><td align="center" colspan="2">CABLE NUMBER:</td></tr> <tr><td align="center" colspan="2">CRV - -</td></tr> <tr><td align="center">BLDG #</td><td align="center">CABLE #</td></tr> </table>	CABLE NUMBER:		CRV - -		BLDG #	CABLE #	<table border="1" style="width:100%; border-collapse: collapse;"> <tr><td align="center">TO</td></tr> <tr><td>CHECK ONE</td></tr> <tr><td>EF <input type="checkbox"/></td></tr> <tr><td>ER <input type="checkbox"/></td></tr> <tr><td>TC <input type="checkbox"/></td></tr> <tr><td>ROOM # _____</td></tr> </table>	TO	CHECK ONE	EF <input type="checkbox"/>	ER <input type="checkbox"/>	TC <input type="checkbox"/>	ROOM # _____	<table border="1" style="width:100%; border-collapse: collapse;"> <tr><td align="center" colspan="6">CABLE SIZE CHECK ONE</td><td align="center">OTHER</td></tr> <tr> <td align="center">25 PR</td> <td align="center">50 PR</td> <td align="center">100 PR</td> <td align="center">200 PR</td> <td align="center">300 PR</td> <td align="center">PR</td> <td></td> </tr> <tr> <td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td> </tr> </table>	CABLE SIZE CHECK ONE						OTHER	25 PR	50 PR	100 PR	200 PR	300 PR	PR								
FROM																																										
CHECK ONE																																										
EF <input type="checkbox"/>																																										
ER <input type="checkbox"/>																																										
TC <input type="checkbox"/>																																										
ROOM # _____																																										
CABLE NUMBER:																																										
CRV - -																																										
BLDG #	CABLE #																																									
TO																																										
CHECK ONE																																										
EF <input type="checkbox"/>																																										
ER <input type="checkbox"/>																																										
TC <input type="checkbox"/>																																										
ROOM # _____																																										
CABLE SIZE CHECK ONE						OTHER																																				
25 PR	50 PR	100 PR	200 PR	300 PR	PR																																					

PAIR	PAIRS	PAIRS	PAIRS	PAIRS	PAIRS	PAIRS	PAIR
1	1 - 4	5 - 8	9 - 12	13 - 16	17 - 20	21 - 24	25
	V	V	V	V	V	V	
26	26 - 29	30 - 33	34 - 37	38 - 41	42 - 45	46 - 49	50
	V	V	V	V	V	V	
51	51 - 54	55 - 58	59 - 62	63 - 66	67 - 70	71 - 74	75
	V	V	V	V	V	V	
76	76 - 79	80 - 83	84 - 87	88 - 91	92 - 95	96 - 99	100
	V	V	V	V	V	V	
101	101 - 104	105 - 108	109 - 112	113 - 115	116 - 119	120 - 124	125
	V	V	V	V	V	V	
126	126 - 129	130 - 133	134 - 137	138 - 141	142 - 145	146 - 149	150
	V	V	V	V	V	V	
151	151 - 154	155 - 158	159 - 162	163 - 166	167 - 170	171 - 174	175
	V	V	V	V	V	V	
176	176 - 179	180 - 183	184 - 187	188 - 191	192 - 195	196 - 199	200
	V	V	V	V	V	V	
201	201 - 204	205 - 208	209 - 212	213 - 215	216 - 219	220 - 224	225
	V	V	V	V	V	V	
226	226 - 229	230 - 233	234 - 237	238 - 241	242 - 245	246 - 249	250
	V	V	V	V	V	V	
251	251 - 254	255 - 258	259 - 262	263 - 266	267 - 270	271 - 274	275
	V	V	V	V	V	V	
276	276 - 279	280 - 283	284 - 287	288 - 291	292 - 295	296 - 299	300
	V	V	V	V	V	V	

Switch port assignment template
SWITCH PORT TO PATCH PANEL ASSIGNMENT TEMPLATE

CISCO DATA SWITCH PORT PATCH AUDIT

BLDG.# _____	BLDG. NAME _____
ER/TC RM.# _____	FL.# _____
DATA SWITCH NAME _____	

CHECK ONE	
24 PORT	
48 PORT	

TYPICAL CISCO PORT NUMBERING SEQUENCE

1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48

POS 1	POS 2	POS 3	POS 4	POS 5	POS 6
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POS 7	POS 8	POS 9	POS 10	POS 11	POS 12
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POS 13	POS 14	POS 15	POS 16	POS 17	POS 18
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POS 19	POS 20	POS 21	POS 22	POS 23	POS 24
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POS 25	POS 26	POS 27	POS 28	POS 29	POS 30
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POS 31	POS 32	POS 33	POS 34	POS 35	POS 36
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POS 37	POS 38	POS 39	POS 40	POS 41	POS 42
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POS 43	POS 44	POS 45	POS 46	POS 47	POS 48
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Notes: CAD	Red	Order Sequence	Yellow	Duplication of Cable #	Blue	After Field Investigation FP & UNK	Purple
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27.08.00 Commissioning of Communications

Testing

Acceptance Testing

Acceptance Testing for the Communications Distribution System shall be incremental and based upon testing, inspection, and documentation review by Rutgers University. Acceptance testing for the Communications Distribution System shall also minimally include:

- Inspection of the installation to insure compliance with the standards indicated.
- Receipt and review of the cable test and repair records.
- Receipt and review of all other required plant documentation such as as-built floor plans; Main Cross-connect (MC), Intermediate Cross-connect (IC) and Horizontal Cross-connect (HC) plans; CAD drawings and cable management database updates; etc.
- The University will oversee random tests of installed cables.

Cable Testing

Using a method approved by Rutgers and conforming to ANSI/TIA standards, the Vendor shall test every copper/coax/fiber cable on an end-to-end basis after splicing and termination.

Each defective cable will be corrected or the cable must be replaced at the Vendor's expense.

UTP

A pair shall be deemed defective if either or both conductors are open, either or both conductors are shorted to ground or another conductor, or tip and ring are reversed. Cables shall be deemed defective if found non-compliant with ANSI/TIA-568.2-D.

No irreparable defective pairs are permitted in new horizontal cables. After correction of termination-related problems, new horizontal cables containing any irreparable defects shall be replaced at the Vendor's expense.

Cabling shall be tested using an approved cable tester. All test results shall be submitted electronically, in a format as directed by Rutgers University.

Fiber

Vendor shall be responsible for damages to cables during shipment and during handling and/or storage prior to installation. All fiber shall be tested prior to installation to insure cable integrity and to identify any damage. Rutgers will not accept damaged cables under any condition.

All fiber cable will be tested for loss and according to the manufacturer's specifications. Final tests shall be performed after all the cable has been installed, spliced, and terminated. Loss measurements shall be made with an optical power meter. An Optical Time Domain Reflectometer (OTDR) shall be used to verify length and quality. Testing shall be conducted at both operating wavelengths. At a minimum, link attenuation measurements must be made on all intra-building fiber backbone cables, and OTDR traces will be required where OSP fiber cables have been terminated and/or spliced.

Acceptable electronic media of the OTDR trace record will be required as part of the acceptance requirements. The OTDR trace must be legible and must clearly identify which optical fiber cable and strand has been tested, the printed name of the person conducting the test and the date of the test. Actual cable lengths from cable footage markings shall be documented.

Any cable, which is found to be defective, shall be repaired or replaced at the Vendor's expense.

The backbone multimode fiber optic cables must be tested for link attenuation in one direction at both 850 nm and 1300 nm in accordance with ANSI/TIA-526-14-C, Annex A, One-cord reference method. The single-mode backbone links must be tested in one direction at 1310 nm and 1550 nm in accordance with ANSI/TIA-526-7-A, Method A, One-cord reference method.

Acceptable loss limits will be based on the following link attenuation equation (see ANSI/TIA-568.3-D):

Link Attenuation = Cable Attn + Connector Loss + Splice Loss

Cable Attn (dB) = Attenuation Coefficient (dB/km) * Length (km)

Attenuation Coefficient:

- 3.00 dB/km @ 850 nm for multimode
- 1.50 dB/km @ 1300 nm for multimode
- 1.00 dB/km @ 1310 nm for single-mode inside plant cable
- 1.00 dB/km @ 1550 nm for single-mode inside plant cable
- 0.50 dB/km @ 1310 nm for single-mode indoor-outdoor cable
- 0.50 dB/km @ 1550 nm for single-mode indoor-outdoor cable
- 0.40 dB/km @ 1310 nm for single-mode outside plant cable

0.40 dB/km @ 1550 nm for single-mode outside plant cable

Connector Loss (dB) = number of connector pairs * connector loss (dB)

= 2 * 0.75 dB

= 1.5 dB

Splice Loss (dB) = number of splices (S) * splice loss (dB)

= S * 0.3 dB

Horizontal fiber optic cables must be tested for link attenuation in one direction in accordance with ANSI/TIA-526-14-C, Annex A, One-cord reference method. The tests should be performed at 850 nm and the maximum attenuation for the link shall be based on the following link attenuation equation (see ANSI/TIA-568.3-D):

Link Attenuation = 3.0 dB/km * Length (km)

+ number connector pairs * 0.75 dB

+ number of splices * 0.3 dB

OTDR traces will be required where horizontal fiber cables have been spliced.

Coax

All backbone coax shall be sweep-tested across the full operating frequency range (50MHz to 1000MHz).

All connectorized Series 6 and Series 11 cables shall be tested in accordance with ANSI/TIA-568.4-D.

27.10.00 Structured Cabling

The ISP infrastructure includes the pathway, fiber optic cabling, and copper cabling used to deliver data, voice, television, and application-specific networks within the institution buildings. The ISP infrastructure includes the distributor rooms (TRs) that house the cable connections and equipment to power and manage the data, voice, and application-specific networks.

A TR will serve no more than one floor above or below, within Ethernet distance.

27.11.00 Communication Equipment Room Fittings

The Contractor shall be responsible for providing and implementing any infrastructure necessary in the Communication Equipment Rooms in a proper, workman-like, and neat manner.

TR Ceiling

TR must have a ceiling at least 8 feet 6 inches or solid walls up to the deck above; false ceilings are not permitted. Always follow fire code requirements.

Fire-stopping

Conduit and wall penetrations must have fire-stop systems installed.

Fire Protection System

At the minimum, a TR will have a smoke and heat sensor connected to the building fire panel. Follow the codes and standards for each building.

TR Door Size

At least a 3 ft. x 7 ft. door or a caged door.

TR Floor

No carpet allowed. Tile preferred.

TR Temperature Range

64 F to 75 F. Must have temp/humidity monitor system.

Humidity Range

30% to 55% humidity range. Drip pan from above if leaks from above are possible.

HVAC Solutions Allowed

24 hours a day x 7 days a week HVAC with positive pressure and a minimum one air change per hour. Accomplished with building or dedicated room HVAC.

TR Electrical

TRs should have a dedicated electrical panel in them.

TR must have dedicated 20-amp circuits.

TR must have one dedicated 30-amp outlet per two 19-inch racks.

The UPS rack must be a 4-post rack.

5kva UPS needs L6-30 input

Racks and equipment must be properly grounded.

TR Lighting

Coverage so that both sides of the racks and backboard are lit - lighting should not interfere with cabling into the room.

Shared Use

TR must not be shared with any janitorial services or other storage. Equipment not related to the support of the TR (e.g., building electrical distribution, plumbing) should not pass through the TR.

Security

The room must be secured and accessible only by authorized personnel. Room should have card swipe access. Core and distribution rooms should have security cameras as well.

Technology Design Considerations

Voice and data have to be consolidated in the same TRs. If the TR needs electrical, the TR will be built to accommodate power over Ethernet electronics. Access from the building exterior to all TRs must be permitted 24x7x365 to permit maintenance and repairs.

27.11.13 Communications Entrance Protection

Grounding and Bonding Requirements

Appropriate Bonding and Grounding Busbars, conductors and transient protection devices shall be provided for the protection of personnel and equipment conforming to all applicable codes and standards.

Grounding and bonding shall conform to the requirements of the National Electrical Code (NEC), the National Electrical Safety Code (NESC), the American National Standards Institute/Telecommunications Industry Association (ANSI/TIA-607-D) and any local authorities having jurisdiction.

27.11.16 Communications Cabinets, Racks, Frames, and Enclosures

Overall assumptions for each TR

The data racks are standard 19-inch racks x 7 feet high, floor and top-braced, with working clearance (3 feet front, back, and side) around the rack(s). The TR should conform to National Electric Code standards.

TR sizes

1 Rack	=	10'	x	8'
3 Racks	=	10'	x	12'
5 Racks	=	10'	x	16'
>5 Racks	=	16'	x	16'

Racks

Use the data network ports at capacity to evaluate the TR. Calculate the number of racks based on 240 ports per rack. Use this calculation to make sure that the TR is large enough to house the needed racks.

Wall-mounted racks could be allowed for use in TRs that house fewer than 96 ports. If more than, 96 ports, floor-mounted, 7-foot racks should be used.

Equipment Rack

Panduit Part Number:

R2P Two-post Rack System, Aluminum, 45 RU

Chatsworth Products Part Number:

55053-703 Standard Rack 3"D; 7'H x 19"W; Grounded; UL Listed;
Black

All closet Equipment Racks must be securely bolted to the floor and supported at the top via cable tray.

Free-standing Equipment Cabinet

Chatsworth Products, Inc. Part Number:

M1050-742	M-Series Cabinet System & Accessories 7'H 45U Cabinet 19"EIA, 27.3in W x 39.6in D, Solid Top and Sides, Perforated Doors
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Wall Mounted Rack

Where required wall mounted racks shall be provided.

Chatsworth Products Part Number:

13604-718	EasySwing Wall-Mount Rack; 19U 38.5"H x 19"W x 18.0"D; Black
11960-718	Fixed Wall-Mount Equipment Rack; 12U x 19"EIA Width x 18"D; Black
11961-718	Fixed Wall-Mount Equipment Rack; 20U x 19"EIA Width x 18"D; Black

Additional Frames, Racks and Cabinets

Additional Frames, Racks and Cabinets shall be provided as required for the individual project.

Velcro Straps

Velcro straps shall be provided and installed as required.

D rings

Contractor shall provide all D rings and related hardware as required to properly support cables.

27.11.19 Communications Termination Blocks and Patch Panels

Wall field terminations must be above 1 foot and below 6 feet. Wall field is calculated to accommodate 12 horizontal feet of termination equipment installed on open wall space.

27.11.23 Communications Cable Management and Ladder Rack

Cable Trays and Ladder Racks

RUTGERS, THE STATE UNIVERSITY OF NJ

27 10 00 Structured Cabling

Ladder tray shall be provided and installed.

Chatsworth Products Part Number:

10250-724	Universal Cable Runway; 24"W x 1.5"H x 9.96"L; Cable Capacity - 1894; Black
11421-724	Wall Angle Support Kit, For 24" (610 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
10608-001	Vertical Wall Brackets, 1 pair, Steel, Gold.
40164-001	Cable Runway Ground Strap Kit

Panduit Part Numbers:

FR4X4YL6	Fiber-Runner 4X4 Routing Systems, 6ft lengths, Yellow
FRHC4YL6	Fiber-Runner 4X4 Snap-On Hinged Cover, 6ft lengths, Yellow

or

Panduit Wyr-Grid Overhead Cable Tray Routing System:

WG12BL10	Wyr-Grid Pathway Section, Steel, 118.4in x 12.5in x 2.1in, Black powder coated
WGCB12BL	Wyr-Grid Cantilever Bracket used to support the 12" Wyr-Grid Pathway along a wall
GACBJ612U	Auxiliary cable bracket jumper for bonding pathway sections; #6 AWG

Cable Management - Vertical and Horizontal

Vertical:

Panduit Part Number:

WMPV45E	Front and rear vertical manager. Dimensions: 83.0"H x 4.9"W x 12.0"D
PRV8	Vertical cable manager includes four PRSP7 slack spools

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27 10 00 Structured Cabling

PRD8 Dual hinged metal door. Dimensions: 82.8"H x 8.1"W x 1.6"D

Horizontal:

Panduit Part Number:

WMPSE Horizontal Cable Manager Front and Rear 1 RU

WMP1E Horizontal Cable Manager Front and Rear 2 RU

Optical Fiber Panels

Provide Optical Fiber Panels as required.

Fiber Splice/Termination

Provide Fiber Splice/Termination Hardware as required.

27.11.26 Communications Rack Mounted Power Protection and Power Strips

Supports POE for all switches, long run-time UPS systems.

Power Strips/PDUs

Power strips/PDUs shall be provided and installed as indicated on the design drawings.

Raritan PDU Part Number PX3-5201R

27.13.00 Communications Backbone Cabling

27.13.13 Communications Copper Backbone Cabling

Copper Voice Backbone - Inside Plant

Copper voice backbone cable used in the inside plant shall be:

Mohawk Part Numbers: M58 Series (Cat 5e)

Mohawk-(or approved equal) 24 AWG solid copper conductors grouped in 25 pair binders, riser-rated outer jacket conforming to NEC Article 805 "Communications Circuit" type CMR.

Where cable runs through ducts, plenums or other spaces used for environmental air,

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cables shall be run in conduit or plenum rated cable shall be used. Plenum rated copper voice backbone cable used in the inside plant shall be:

Mohawk (or approved equal) 24 AWG solid copper conductors grouped in 25 pair binders, plenum rated outer jacket conforming to NEC Article 805 "Communications Circuit" type CMP.

The manufacturer's minimum bend radius specifications shall not be exceeded.

Copper Voice Backbone - Outside Plant

Copper voice backbone cable used in the outside plant shall be:

Superior Essex (or approved equivalent), 24 AWG solid copper conductors grouped in 25 pair binders, with a moisture proofing filling compound and with a corrugated aluminum shield with a polyethylene outer jacket, conforming to ANSI/ICEA S-84-608-2011; RDUP 7 CFR 1755.890 (PE-89). Cable shall be suitable for direct burial, installation in duct or installation aerially when attached to a support strand.

Superior Essex Part Number: SEALPIC - FSF Series.

Superior Essex 09-100-02 50pr PE89 OSP Copper Cable

Superior Essex 09-104-02 100pr PE89 OSP Copper Cable

The manufacturer's minimum bend radius specifications shall not be exceeded.

The corrugated shield of the cable shall be bonded to the Primary Bonding Busbar.

27.13.13.13 Communications Copper Cable Splicing and Terminations

Copper Voice Connectors

Copper voice backbone cables shall be terminated on wall-mounted 110-style blocks.

110-style blocks shall be:

Panduit Part Numbers:

GPKBW24Y 96-pair (24-port) Category 6 punch down base field termination kit with legs

GPKBW72Y 288-pair (72-port) Category 6 punch down base field termination kit with legs

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All pairs of the backbone cable shall be terminated on each end, using a combination of five (5) C4 and one (1) C5 connector blocks per 25 pair. When required the contractor shall provide cross-connects using 4 pair cross-connect wire. Wire troughs shall be installed above and below all 110-style blocks.

Panduit Part Number:

P110JTW-X Jumper trough with legs

OSP Cables shall be terminated on suitable protector blocks, as required.

27.13.23 Communications Optical Fiber Backbone Cabling

Fiber Backbone – Inside Plant (ISP)

Inside Cable Characteristics

Fiber intra-building backbone cables shall be Corning (or approved equal) MIC type dual window, 900 micron tight-buffered, 50/125 laser optimized (/OM4) multimode and 8.2/125-micron, low water peak, single-mode as required, and comply with NEC Article 770 "Optical Fiber Cables" type OFNR or OFNP, as appropriate. Performance requirements must meet or exceed ANSI/TIA-568.3-D requirements for optical fiber cabling systems.

50 Micron Laser Optimized Multimode

Inside 50-micron multimode fiber cable shall be Corning MIC type OM4 tight-buffered fiber, :

Corning Part Numbers, (OFNP rated cable):

nnnT88-33190-29, nnn = number of strands (for 012-024 strands)
MIC cable OM4

nnnT88-33190-A3, nnn = number of strands (for 012-024 strands)
MIC interlocking armored cable OM4

Corning Part Numbers, (OFNR rated cables):

nnnT81-33190-24, nnn = number of strands (for 012-024 strands)
MIC cable OM4

Single-mode OS2

Inside single-mode fiber cable shall be:

Corning Part Numbers (OFNP rated cable):

nnnE88-33131-29, nnn = number of strands (for 012-024 strands)
MIC cable

nnnE88-33131-A3, nnn = number of strands (for 012-024 strands)
MIC interlocking armored cable

Corning Part Numbers (OFNR rated cables):

nnnE81-33131-24, nnn = number of strands (for 012-024 strands)
MIC cable

Plug & Play Universal Systems MTP Connector Trunks - 50 Micron Laser Optimized Multimode

Inside 50-micron multimode Plug & Play fiber cable shall be Corning EDGE Solutions or EDGE8 Solutions:

Corning Part Number (OFNP rated cable for EDGE Solutions):

G7575nnQPNDDUxxxF, nn= number of strands (for 12–96); xxx = length (ft)
OM4, Non-armored plenum trunks, Non-pinned MTP to Non-pinned MTP

Corning Part Number (OFNP rated cable for EDGE8 Solutions):

GE5E5nnQPNDDUxxxF, nn = number of strands (for 08–96); xxx = length (ft)
OM4, Non-armored plenum trunks, Pinned MTP to Pinned MTP

Fiber Backbone – Outside Plant

Outside Cable Characteristics (Aerial/Duct)

The cable shall be of loose-tube design.

Single-mode

Outside single-mode fiber cable shall meet the following specifications:

ALTOS Cable:

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Corning Part Number:

nnnZU4-T4F22D20 nnn = number of strands (012-072).

nnnEU4-T4100D20 nnn = number of strands (096-288).

FREEDM Riser Rated Cable:

Corning Part Number:

nnnESF-T4101D20 nnn = number of strands (002-024).

nnnEUF-T4101D20 nnn = number of strands (036-288).

FREEDM Plenum Rated Cable:

Corning Part Number:

nnnESP-T4101D20 nnn = number of strands (006-012).

nnnEWP-T4101D20 nnn = number of strands (024-072).

8.3/125 micron, single-mode, dual window, 250-micron buffer, waterblocked, loose tube.

Installation of Fiber

All cables shall be inspected as they are pulled off the reel for any obvious defects. Report immediately any defects to Rutgers University and halt further use of the cable from that reel, pending a determination of the quality of the reel by the manufacturer.

All cables shall be continuous with no factory or field splices unless approved by Rutgers University. Pulling and laying cable on sharp edges is not permitted.

All fiber cable must be installed in accordance with manufacturer recommended tensile and bending specifications.

Pulling tension shall be constantly monitored when using a mechanical pulling device such as a winch. Care should be taken so that pulls are not designed too close to the maximum value of tension.

Ideally, there shall be no more than two 90-degree changes of direction in any single pull. If there are more than two 90-degree changes of direction, however, back-feeding or center pulling techniques must be used.

No residual tension shall remain on the cable after pulling except what is due to the cable's weight in a vertical rise, which shall not exceed 135 pounds.

Vertical cables shall be supported via use of a split mesh grip.

The manufacturer's minimum bend radius specifications shall not be exceeded.

Lubricant approved by the cable manufacturer must be used when installing fiber cable. The lubricant must be manufacturer guaranteed to be non-destructive to the cable sheath, the conduit, or any portion of the innerduct. Furthermore, the lubricant must be manufacturer guaranteed not to harden, cake, or deteriorate with age so as to "glue" the cable to the conduit over time.

All backbone cables shall employ industry standard color coding.

No more than 50 feet of OSP backbone cable may be installed in a building without conduit. Where more than 50 feet of OSP backbone cable is required in a building, the cable shall be installed in Rigid Metal or Intermediate Metal conduit or Indoor/Outdoor rated cable shall be used. Where conduit or Indoor/Outdoor cable cannot be used, splicing may be necessary.

Service Loop

A service loop of at least 10' shall be provided within 6' of the fiber panel. Service loops shall be securely fastened to the backboard or ladder tray with appropriate fasteners, maintaining the proper bend radius at all times.

27.13.23.13 Communications Optical Fiber Splicing and Terminations

Termination

All fiber strands shall either be terminated or coiled in an approved fiber connector housing or coiled in an approved fiber splice housing.

Pigtailed Splice Cassette

To be used with Corning LANscape Pretium Solutions Product.

Corning Part Numbers

Single-Mode SC Connectors:

CCH-CS12-59-P00RE	CCH Pigtailed Splice Cassette, 12 F, SC UPC duplex, Single-mode (OS2), single-fiber (250 μm)
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Multimode SC Connectors:

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CCH-CS12-E7-P00TE CCH Pigtailed Splice Cassette 12 F, SC duplex, 50
µm multimode (OM3/4)

Single-Mode LC Connectors:

CCH-CS12-A9-P00RE CCH Pigtailed Splice Cassette 12 F, LC UPC
duplex, Single-mode (OS2), single-fiber (250 µm)

Multimode LC Connectors:

CCH-CS12-E4-P00QE CCH Pigtailed Splice Cassette 12 F, LC duplex,
aqua, 50 µm multimode (OM4)

UniCam Fiber Connectors

Single-mode and multimode cabling installations require SC or LC type connectors (and connector panels) with ceramic ferrules and composite housings. All paired SC connectors must be joined together with SC duplex clips.

Corning Part Numbers:

Single-Mode SC Connectors:

95-200-41 UniCam single-mode SC connector with composite
housing/ceramic ferrule, UPC polish

Multimode SC Connectors:

95-050-41-X UniCam 50-micron multimode connector with ceramic
ferrule for laser optimized multimode fiber OM3/OM4
compatible.

SC Duplex Clips: 95-400-03-BP

Multimode LC Connectors:

95-050-99-X UniCam Connector, LC 50 µm multimode (OM3/OM4)

Corning UniCam connectors shall be installed using a Corning UniCam Termination Kit.

UniCam™ High-Performance Toolkit 2

TKT-UNICAM-PFC2

Maximum allowable connector loss:

Loss (max) < 0.75 dB per SC Connector Pair

Corning FAN-BT25-06 (6 fiber tubes) and FAN-BT25-12 (12 fiber tubes) buffer tube fan-out kits or equivalent must be used on loose tube cables.

Fiber Housings

Terminations shall occur in approved wall-mountable or rack-mountable connector housings.

Corning Part Numbers:

Wall-mountable Closet Housings:

WCH-02P	Holds 2 CCH connector panels/cassettes
WCH-04P	Holds 4 CCH connector panels/cassettes
WCH-06P	Holds 6 CCH connector panels/cassettes
PWH-02P	Accepts up to 2 CCH panels or modules (Pretium)
PWH-04P	Accepts up to 4 CCH panels or modules (Pretium)
PWH-06P	Accepts up to 6 CCH panels or modules (Pretium)
PWH-12P	Accepts up to 12 CCH panels or modules (Pretium)

Rack-mountable Closet Connector Housings:

CCH-01U	Closet Connector Housing (CCH), one rack unit, holds two CCH connector panels
CCH-02U	Closet Connector Housing (CCH), two rack units, holds four CCH connector panels
CCH-03U	Closet Connector Housing (CCH), three rack units, holds six CCH connector panels
CCH-04U	Closet Connector Housing (CCH), four rack units, holds 12 CCH connector panels
PCH-01U	Pretium Connector Housing, one rack unit, holds two CCH connector panels
PCH-02U	Pretium Connector Housing, two rack units, holds four CCH connector panels
PCH-04U	Pretium Connector Housing, four rack units, holds 12 CCH connector panels

Connector Panels:

CCH-CP06-59	Closet Connector Housing (CCH) Panel, SC adapters, Duplex, UPC, 6 F, Single-mode (OS2)
CCH-CP12-59	Closet Connector Housing (CCH) Panel, SC adapters, Duplex, UPC, 12 F, Single-mode (OS2)
CCH-CP12-E7	Closet Connector Housing (CCH) Panel, SC adapters, Duplex, 12 F, 50 µm multimode (OM3/OM4)
CCH-CP12-E4	Closet Connector Housing (CCH) Panel, LC Adapters Duplex, 12 F, 50 µm multimode (OM3/4)
CCH-UM12-57-93T	Plug & Play Universal Module, SC, Low-Loss, 12 F, SC Duplex to MTP, 50 µm multimode (OM3)
CCH-UM12-57-93Q	Plug & Play Universal Module, SC Low-Loss, 12 F, SC Duplex to MTP, 50 µm multimode (OM4)

Fiber Splicing

Where splicing of backbone cables is approved, the location of all splices shall be identified and all splices shall be accessible.

Only low-loss, low-reflectance fusion splices will be allowed. No splicing will be allowed without owner's prior approval. Final approval in the method of splicing/connectorization rests with the University.

Maximum allowable splice loss:

Loss (max) < 0.3 dB per Fusion Splice

All splices shall be made in splice trays inside a Splice Case, wall-mountable Closet Housing or a rack mountable Closet Splice Housing.

Corning Part Numbers:

Splice Cases:

SCF-4C18-01-36	Splice Closure Fiber (SCF), preloaded with splice trays, 36 single-fiber splice capacity, 4-in diameter, 18-in dome length
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SCF-6C22-01-72	Splice Closure Fiber (SCF), preloaded with splice trays, 72 single-fiber splice capacity, 6-in diameter, 22-in dome length
SCF-6C28-01-144	Splice Closure Fiber (SCF), preloaded with splice trays, 144 single-fiber splice capacity, 6-in diameter, 28-in dome length

CommScope Part Numbers:

Splice Cases:

FOSC450-D6-6-NT-0-D6V	Fiber Optic Splice Closure, Gel Cable sealing, no pre-installed tray, 6 cable attach., six ground feedthrough lugs, with test valve
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Wall-mountable Closet Housings:

WCH-SPLC-4-8	WCH Splice Tray Holder Old WCH-04P and WCH-06P; accommodates (8) 0.2 in Type 2R or (4) 0.4 in Type 4R reduced-length splice trays
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Rack-mountable Splice Housings:

CCS-01U	Closet Connector and Splice Housing (CCS), holds 2 CCH connector panels, 2 2R/2S or 1 4R/4S splice trays
CSH-05U	Closet Splice Housing (CSH), 5U, holds (22) 0.2-in splice trays.)
CSH-05U-F	Closet Splice Housing (CSH) 5U, holds (14) 0.4-in splice trays

Splice Trays:

M67-041-C	Splice Tray, RTV splices, clear cover, 0.2-in, 12 F
M67-060	Splice Tray, RTV Splices, Reduced length, 0.2-in, 12 F
M67-076	Splice Tray, mass fusion splices or heat-shrink fusion splices, 0.4-in; six mass fusion splices or 12 heat-shrink fusion splices

27.13.33 Communications Coaxial Backbone Cabling

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Coax Backbone – Inside Plant

Coaxial backbone cables shall be;

Quad Shield, 500 series Flexible Feeder and must comply with NEC Article 820 Community Antenna Television and Radio Distribution Systems type CATVR.

Times Fiber Communications, Inc.

Part Number: 02852R-TX15AQ-VBR or
approved equal

Where cable runs through ducts, plenums or other spaces used for environmental air, cables shall be run in conduit or plenum rated cable shall be used. Plenum rated coaxial backbone cables shall be:

Solid Aluminum Shield, 500 series Trunk and must comply with NEC Article 820 Community Antenna Television and Radio Distribution Systems type CATVP.

CommScope Part Number: P3 500 JCAP
(or approved equal)

The manufacturer's minimum bend radius specifications shall not be exceeded.

Coax Backbone – Outside Plant

Coaxial backbone cables shall be Flex Outdoor External Trunk:

Quad Shield, Flexible Feeder, polyethylene outer jacket, single flooded. Cable shall be suitable for installation in duct.

Times Fiber Communications, Inc.

Part Number: TX15AQ-FEB (02858) or
approved equal

Aerial rated cable shall be provided where cable run aerially. When run aerially, cables shall be attached to a support strand. Aerial rated coaxial backbone cables shall be:

Solid Aluminum Shield, dielectric core, fully bonded copper clad center conductor, medium density polyethylene jacket, 500 series Trunk.

CommScope Part Number: P3 500 JCA or approved equal

The manufacturer's minimum bend radius specifications shall not be exceeded.

27.15.00 Communications Horizontal Cabling

27.15.01 Communications Horizontal Cabling Applications

27.15.01.23 Audio-Video Communications Horizontal Cabling

Specific Wiring Plans, WP101 through WP 118, are designed for in-room cable runs used for conferencing and telepresence equipment. Since these WPs don't terminate in a typical Distributor Room they are handled differently by the cable management system. Following is a list of Telepresence WPs:

WP101 (TP: 1 UTP Data)
WP102 (TP: 2 UTP Data)
WP103 (TP: 2 UTP Data/2 STP Data)
WP104 (TP: 5 UTP Data/2 STP Data)
WP105 (TP: 5 UTP Data)
WP106 (TP: 4 UTP Data/2 STP Data)
WP111 (TP: 1 UTP Data - configured per installation)
WP112 (TP: 1 STP Data male RJ45 in 6"x6"x3" box)
WP113 (TP: 2 UTP Data - configured per installation)
WP114 (TP: 3 UTP Data - configured per installation)
WP115 (TP: 4 UTP Data - configured per installation)
WP116 (TP: 1 UTP Data male RJ45 in 6"x6"x3" box)
WP117 (TP: 5 UTP Data - configured per installation)
WP118 (TP: 6 UTP Data - configured per installation)

27.15.13 Communications Copper Horizontal Cabling

Cat 6A cable is recommended for new horizontal cable installations. New horizontal cable drops will be based on a minimum of two cables for each work area outlet.

The following types of cable shall be used in horizontal wiring plans:

"Voice", "Data" and "Intelligent Building Systems" cable shall be plenum rated 4-pair, solid copper conductors, unshielded twisted pair, ANSI/TIA-568.2-D Cat 6A (Cat 6) cable conforming to NEC Article 805 "Communications Circuits" type CMP. The following shall be provided (or approved equal):

GenSPEED® 10 MTP™ Small Diameter Cat 6A Cable:

Part Numbers: 7151849 (Blue for Data)

7151850 (White for Analog Voice)

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Contractor may be asked to provide pricing for alternate Category 6 cables.

General GenSPEED Cat 6 Part Number: 7131800 (Blue for Data and Intelligent Building)

7131801 (White for Voice)

Contractor shall confirm with Rutgers University for each specific project which Category WPs (6A or 6) will be provided and installed.

Horizontal Data cables shall be terminated in equipment racks on 24 port and/or 48 port patch panels.

Panduit Part Numbers:

UICMPP24BLY	Mini Com 24-port modular patch panel (1RU)
UICMPP48BLY	Mini Com 48-port modular patch panel (2RU)
UICMPPA24BLY	Mini Com 24-port modular angled patch panel (1RU)
UICMPPA48BLY	Mini Com 48-port modular angled patch panel (2RU)
QPP24BL	24-port patch panel in black accepts QuickNet pre-terminated cassettes and patch panel adapters (1 RU)

ANSI/TIA-568.2-D Compliant

All equipment, installation methods, and testing associated with UTP horizontal cables and connecting hardware shall be consistent with and certified to the ANSI/TIA-568.2-D requirements.

Installation of Horizontal Cabling

All cabling shall be installed in accordance with all applicable codes and standards.

The electrical characteristics of the cables being installed are adversely affected by compression or kinking. Measures shall be employed to ensure that the cables are not walked on, pulled tight around corners, kinked, etc.

Sufficient slack shall be provided to minimize the possibility of abrasion damage or kinking.

Cables run above hung ceilings and in other concealed spaces shall be supported, from the structural ceiling above, with J-Hooks, trapezes or other approved methods.

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Submit method of support to Rutgers University, for approval, prior to use. Cables shall not be supported by sprinkler pipes, hung ceiling tiles, grid or other portions of the ceiling support system.

27.15.23 Communications Optical Fiber Horizontal Cabling

Fiber horizontal cables shall be Corning (or approved equal) MIC type, plenum rated, dual window, 900 micron tight-buffered, 50-micron Laser Optimized Multimode and comply with NEC Article 770 "Optical Fiber Cables", type OFNP. Performance requirements must meet or exceed ANSI/TIA-568.3-D requirements for optical fiber cabling systems. Where permitted, riser rated cable may be used.

Corning Part Numbers:

002T58-31390-24

OM4 Indoor Plenum-rated MIC 2.0-mm Zipcord cable

002T51-31390-24 (riser)

OM4 Indoor Riser-rated MIC 2.0-mm Zipcord cable

27.15.33 Communications Coaxial Horizontal Cabling

"FTV" coaxial cables (broadcast) shall be plenum rated type RG6 Quad Shield and must comply with NEC Article 820 "Community Antenna Television and Radio Distribution Systems" type CATVP. Use CATVR where allowed.

CommScope Part Numbers: 2227V (plenum) or approved equivalent
F6SSVR (non-plenum) or approved
equivalent

"FTV" coaxial cables shall be terminated on the station end with an "F" connector.

Corning-Gilbert Part Numbers: GF6AHSUSA

"RTV" coaxial cables (SDI camera) shall be plenum rated type RG6 and must comply with NEC Article 820 "Community Antenna Television and Radio Distribution Systems" type CATVP. Use CATVR where allowed.

Belden Part Numbers: 1695A (plenum) or approved equivalent
1694A (non-plenum) or approved equivalent

"RTV" coaxial cables shall be terminated on the station end with a "BNC" connector.

Belden Part Numbers: FSNS6BNCU

27.15.43 Communications Faceplates and Connectors

T568B Compatibility

Elements of the voice and data distribution system, including cable, termination methods, and jacks, must be compatible with ANSI/TIA-568.2-D. Rutgers standard uses modular jacks with pin/pair assignments defined by jack designation T568B.

Faceplates/Jacks

The most commonly used Wiring Plans (WP) are listed in the table below. For a complete list see the TIS Wiring Plan document:

Types of Wiring Plans
WP1 (1 Voice/1 Data)
WP3 (1 Voice)
WP5 (1 Data)
WP5AP (1 Data)
WP5W (1 VoIP Wall Phone)
WP6 (2 Data)
WP6AP (2 Data)
WP7 (3 Data)
WP8 (4 Data)
WP9 (1 Voice/3 Data)
WP10 (1 Wall Telephone)
WP11 (1 Voice/2 Data)
WP12 (2 Voice/1 Data)
WP13 (2 Voice/2 Data)
WP47 (4 Data/1 FTV)
WP62 (1 FTV)
WP64 (2 Data/1 FTV)
WP67 (1 Data/1 FTV)
WP69 (6 Data)
WP77 (10 Data)

Note: FTV is Forward TeleVision (Broadcast).
RTV is Return TeleVision (SDI Camera)
All Station Fiber is duplex.

Following is a description of the most common WP types that are currently used by Rutgers University (for a complete list see the TIS Wiring Plan document). Rutgers University will decide the category of cable for each specific project.

WP1 (1 Voice/1 Data)

Wiring Plan WP1 and others containing voice and data shall consist of one voice and one data cable. At the station end, the voice and data cables shall be terminated on an eight-position ANSI/TIA-568.2-D designation T568B modular jack. At the HC end, the voice cable shall be terminated on a 110-style wall-mounted, punch-down block and the data cable shall be terminated on an ANSI/TIA-568.2-D wiring designation T568B, modular jack, wall or rack mounted as appropriate.

WP3 (1 Voice)

WP3 shall consist of a single voice cable. At the station end, the cable shall be terminated on an eight-position ANSI/TIA-568.2-D designation T568B modular jack. At the Horizontal cross-Connect (HC) end, the cable shall be terminated on a 110-style wall-mounted punch-down block.

WP5 (1 Data)

WP5 shall consist of a single data cable for connecting a computer workstation. At the station end, the data cable shall be terminated on an eight-position ANSI/TIA-568.2-D designation T568B modular jack. At the Horizontal Cross-connect (HC) end, the data cable shall be terminated on an ANSI/TIA-568.2-D designation T568B modular jack, wall or rack mounted as appropriate.

WP5AP (1 Data)

Same as WP5 without faceplate; includes twenty-foot slack coil for connecting to wireless access points.

WP5W (1 VoIP Wall Phone)

WP5W shall consist of a single data cable to support a VoIP wall phone. At the station end, all four pairs of the cable shall be terminated on an eight-position modular ANSI/TIA-568.2-D designation T568B wall phone jack mounted in a stainless-steel mounting plate. Jack shall be mounted at a height of 42" for handicap access. At the Horizontal Cross-connect (HC) end, the cable shall be terminated on an ANSI/TIA-568.2-D designation T568B modular jack, wall or rack mounted as appropriate.

WP6 (2 Data)

WP6 shall consist of two data cables. Terminations and cable runs as per WP5.

WP6AP (2 Data)

Same as WP6 without faceplate; includes twenty-foot slack coil for connecting to wireless access points.

WP7 (3 Data)

WP7 shall consist of three data cables. Terminations and cable runs as per WP5.

WP8 (4 Data)

WP8 shall consist of four data cables. Terminations and cable runs as per WP5.

WP9 (1 Voice/3 Data)

WP9 shall consist of one voice cable and three data cables. Terminations and cable runs as per WP1.

WP10 (1 Wall Telephone)

WP10 shall consist of a voice cable to support a wall phone. At the station end, all four pairs of the voice cable shall be terminated on an eight-position modular ANSI/TIA-568.2-D designation T568B wall phone jack mounted in a stainless-steel mounting plate. Jack shall be mounted at a height of 42" for handicap access. At the Horizontal cross-Connect (HC) end, the cable shall be terminated on a 110-style wall-mounted punch-down block.

WP11 (1 Voice/2 Data)

WP11 shall consist of one voice cable and two data cables. Terminations and cable runs as per WP1.

WP47 (4 Data/ 1 FTV)

WP47 shall consist of four data cables and one quad shield RG-6 coaxial cable. Terminations and cable runs as per WP2.

WP62 (1 FTV)

WP62 shall consist of one quad shield RG-6 coaxial cable. At the station end the coax cable shall be terminated on an F-coupler. At the Horizontal Cross-connect (HC) end a 10-foot coil of coax cable shall be coiled on the ladder tray above the video field.

WP64 (2 Data/1 FTV)

WP64 shall consist of two data cables and one quad shield RG-6 coaxial cable. Terminations and cable runs as per WP2.

WP67 (1 Data/1 FTV)

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WP67 shall consist of one data cable and one quad shield RG-6 coaxial cable. Terminations and cable runs as per WP2.

WP69 (6 Data)

WP69 shall consist of six data cables. Terminations and cable runs as per WP5.

WP77 (10 Data)

WP77 shall consist of ten data cables. Terminations and cable runs as per WP5.

Table Notes

Each four-pair UTP voice/data cable will terminate on an eight-position modular jack using ANSI/TIA-568.2-D wiring designation T568B. Duplex fiber will terminate in multimode SC connectors and connect to the outlet 568SC (duplex SC) adapter. FTV coax will terminate in F-type connectors and connect to F-type coupler modules at the outlet.

Work area connecting hardware shall be Panduit Mini-Com Network Cabling System Executive Series and Mini-Com Snap-in Connector Modules or approved equivalent. Typical outlet will use four position faceplate, others will use six-position (include blanks as needed).

1 Module single gang faceplate, Off White:

Panduit Part Number: CFPE1IWY

2 Module single gang faceplate, Off White:

Panduit Part Number: CFPE2IWY

2 Module single gang sloped faceplate, Off White:

Panduit Part Number: CFPSL2IWY

4 Module single gang faceplate, Off White:

Panduit Part Number: CFPE4IWY

6 Module single gang faceplate, Off White:

Panduit Part Number: CFPE6IWY

Single gang faceplate frame accepts up to two 1/2-size module inserts or three 1/3-size module inserts, Off White:

Panduit Part Number: CBEIWY

Mini Com modular furniture faceplate, accepts four Mini-Com Modules, Off White:

Panduit Part Number: CFFPL4IW

Mini Com modular furniture faceplate, accepts four Mini-Com Modules, Black:

Panduit Part Number: CFFPL4BL

2 Module Space Mini-Com Surface Mount Box:

Panduit Part Number: CBXJ2IW-A

4 Module Space Mini-Com Surface Mount Box:

Panduit Part Number: CBX4IW-AY

6 Module Space Mini-Com Surface Mount Box:

Panduit Part Number: CBXF6IW-AY

12 Module Space Mini-Com Surface Mount Box:

Panduit Part Number: CBXF12IW-AY

Category 6, RJ45, 8-position, 8-wire, UTP Mini-Com® universal jack module, Off White (voice):

Panduit Part Number: CJ688TGIW

Category 6, RJ45, 8-position, 8-wire, UTP Mini-Com® universal jack module, International Gray (data)

Panduit Part Number: CJ688TGIG

Category 6A, RJ45, 10 Gb/s, 8-position, 8-wire, UTP Mini-Com® universal jack module, Off White (voice):

Panduit Part Number: CJ6X88TGIW

Category 6A, RJ45, 10 Gb/s, 8-position, 8-wire UTP Mini-Com® universal module, International Gray. (data)

RUTGERS, THE STATE UNIVERSITY OF NJ

27 10 00 Structured Cabling

Panduit Part Number: CJ6X88TGIG

Where indicated for individual projects, alternate colors must be provided.

27.20.00 Data Communications

27.21.00 Data Communication Network Equipment

27.21.33 Data Communications Wireless Access Points

General Requirements

Residence halls: 4-6 beds per AP. Assumption is no more than 40 devices per AP.

Lecture halls and classrooms: 25-30 seats per AP. Assumption is no more than 60 devices per AP.

General access/Administrative Spaces: Roughly, 20ft radius per cell - with cell overlap APs spaced about 25-30 feet apart.

27.40.00 Audio-Video Communications

27.41.16 Integrated Audio-Video Systems and Equipment
(See Telepresence Wall Plates document)