

The background of the cover features a dark blue gradient with several glowing fiber optic cables. Some cables are a vibrant orange, while others are a bright blue. They are arranged in a complex, overlapping pattern that suggests connectivity and data flow.

**aetna**<sup>SM</sup>

STRUCTURED  
**CABLE**  
SPECIFICATION

# Aetna Structured Cable Specification

New Construction  
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AETNA STRUCTURED CABLE SPECIFICATION



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# PART I - GENERAL SPECIFICATIONS



## 1.1 SCOPE

- A. Aetna maintains three specific/separate structured cable specifications. The first is a Data Center Specification which governs the Middletown Data Center and Windsor Data Center locations only. The second is a New Construction Specification which details the latest revision of Aetna's nation wide cable standard for use at all new office constructions and large scale renovations. This includes all field offices as well as the Bluebell and Hartford Campus sites. The third specification is a Move, Add, Change (MAC) Specification which acknowledges the need to maintain Aetna's complete portfolio of existing properties built across several eras of cable standards as well as acquisitions.
- B. Of the three fore mentioned specifications, this document is the New Construction Specification.
- C. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling in support of new construction projects.
- D. This specification must not be used for small scale work that consists of only the addition, relocation, and removal of horizontal cable. Instead the abbreviated MAC cable specification shall be used. Additionally telecommunications cable scope within the Middletown and Windsor data centers must use the specific Aetna Data Center specification.
- E. The horizontal (workstation) cabling system shall consist of one (1) 4 pair Blue Unshielded Twisted Pair (UTP) Copper Cable to each work area outlet (CO-Set) unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Voice Data Communications Room (VDC) or Wire Closet (WC) located on the same floor, and routed to the appropriate rack serving that area and terminated as specified in this document. On an as needed basis (1) 4 pair White Unshielded Twisted Pair (UTP) Copper cable for analog voice service will be run as detailed on the project cable plan or schedule terminated as specified in this document.
- F. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications Contractor (TC) as detailed in this document.
- G. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, an RFI must be issued for clarification from Aetna VDC Engineer. The successful vendor shall meet or exceed all requirements for the cable system described in this document.



## 1.2 REGULATORY REFERENCES

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.
- B. All materials shall be UL or ETL Listed and shall be marked as such. If UL/ETL has no published standards for a particular item, then other national independent testing standards shall apply and such items



shall bear those labels. Where UL/ETL has an applicable system listing and label, the entire system shall be so labeled.

C. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 5e (or cat6 as applicable) component and channel compliant.

D. The cabling system described in this Aetna specification is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:

1. ANSI/TIA-568-C.0, Generic Communications Cabling for Customer Premises, Current Edition
2. ANSI/TIA-568-C.1, Commercial Building Communications Cabling Standard Part 1: General Requirements, Current Edition
3. ANSI/TIA-568-C.2, Balanced Twisted-Pair Communications Cabling and Components Standard, Current Edition
4. ANSI/TIA-568-C.3, Optical Fiber Cabling Components Standards, Current Edition
5. ANSI/TIA/EIA-569-B, Commercial Building Standard for Communications Pathways and Spaces, Current Edition
6. ANSI/TIA/EIA-606-A, Administration Standard for Communications Infrastructure of Commercial Buildings, Current Edition
7. ANSI/J-STD-607-B, Commercial Building Grounding and Bonding Requirements for Communications, Current Edition
8. TIA-758-A, Customer-Owned Outside Plant Communications Cabling Standard, Current Edition
9. TIA-758-A, Customer-Owned Outside Plant Telecommunications Cabling Standard, Current Edition
10. BICSI - TDMM, Building Industries Consulting Services International, Communications Distribution Methods Manual (TDMM) – Current Edition.
11. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) –Current Edition
12. FCC 47 CFR 68
13. NEMA 250
14. NEC 2005
15. NEC Articles 770 and 800
16. ADA, Americans with Disabilities Act

E. If this document, any of the documents listed above or any project issued documents and drawings are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of and uphold all local codes that may impact this project.





## 1.3 APPROVED CONTRACTOR

A. Aetna Information Services (AIS) requires that only qualified and experienced Telecommunications contractors perform design, project management, and installation services in the construction of structured cabling infrastructure. Pursuant to this, AIS wants to ensure that successful contractors have the manufacturer authorizations, capabilities, qualifications, financial stability, and experience to complete Telecommunications installations using common industry practices (i.e. BICSI TDMM, ANSI/TIA/EIA, NEMA, NFPA, etc) while meeting all AIS guidelines.

B. A contractor, by responding to a bid or work request, represents that their company possesses the manufacturer authorizations, qualifications, certifications, capabilities, test equipment, expertise, and personnel necessary to provide an efficient and successful installation of properly operating components, as specified.

C. All bidders must meet the requirement of having continuously performed Telecommunications installation work for a period of at least five (5) years. The Telecommunications Contractor (installer) must be an approved Legrand/Ortronics Certified Installer at the Enterprise Service Provider (CIP-ESP) tier and be a Berk-Tek Certified OASIS Integrator. No other certification levels or non-certified installers are recommended by Aetna because of the requirement for a NetClear warranty. The approved Telecommunication Contractor will adhere to all CIP protocols. Greater than 75% percent of the installation and termination crew inclusive of all subcontractors must be certified by Berk-Tek and Ortronics on proper installation and testing of copper and fiber structured cabling systems. A current copy of the telecommunications contractor's certificate and/or letter from Ortronics stating that the Installer Company's certification at the ESP and OASIS tier is current and in good standing must be submitted with the quote in order for such quote to be valid. The Telecommunications Contractor is responsible for workmanship and installation practices in accordance with the Ortronics ESP/CIP Program and Berk-Tek OASIS Program. The Telecommunications contractor must also register the project and submit test data for approval, per the requirements of the Ortronics/Berk-Tek certification program guidelines. Once approved, Ortronics/Berk-Tek will extend a NetClear 25-year Static, Dynamic and Applications Warranty to the end user.

The awarded telecommunications contractor vendor must conduct the installation or sub-contract a portion or all of the installation only to an Ortronics ESP installer based on geographic location or as approved by Aetna.

D. Prior to submitting bid, bidder is required to carefully consider the amount and character of the work to be done, as well as the difficulties involved in its proper execution. Bidder should include in their bid all costs deemed necessary to cover contingencies essential to successfully installing the specified system. Any cost not specifically itemized in the proposal shall not be incurred unless specifically agreed upon by all parties and documented in writing. No claims for compensation will be considered or allowed for extra work resulting from lack of knowledge of any existing conditions on the part of the bidder.

E. Aetna requires references from projects of a similar size and nature. Names of the officers of the company and resumes of those to be assigned to the project, including subcontractors, must be provided. Telecommunications contractor shall, at all times during performance of work, and until work is completed and accepted, have on the premises a competent supervisor satisfactory to Aetna or GEMS or JLL or AIS and with authority to act for the Telecommunications contractor regarding work schedules and any changes to the scope of work. The supervisor must be a BICSI certified Technician and a BICSI member in good standing.

F. As a requirement to bidding and performing awarded work, Telecommunications contractor shall have a currently registered and certified BICSI Registered Communication Distribution Designer (RCDD) on staff as a full-time employee. A copy of the RCDD certificate and BICSI member number must be provided with bidding documents.



G. Telecommunications contractor must provide at least one project manager or lead technician on site at all times during project whom is a BICSI certified Technician and a BICSI member in good standing. A copy of certificate and BICSI member number must be provided with bidding documents. Weekly inspections and approval of all work performed shall be conducted by an RCDD.

H. Telecommunication contractor must be skilled and proficient in both inside cable plant (copper and fiber optics) installation, as well as outside cable plant (copper and fiber optics) installation, termination, splicing, and testing. Telecommunications contractor must be certified by the manufacture of the structured cable system specified in this document. (See Aetna/Anixter approved parts list revision 31)

I. Upon request, with no additional fee, the Telecommunications contractor must provide a certificate of insurance (COI) meeting all requirements for additionally insured as required by the project management company, landlord, building owner, or building management company.

J. All bid responses and proposals are to be based on floor plans and drawings provided by the Aetna VDC Engineer. The bid response must reference the drawing number, drawing revision, and drawing date which was used as the basis of the bid.

K. Questions which arise during the preparation of the bid response shall be issued by the bidder in writing in the form of a Request for Action (RFA) to the party issuing the bid specification.

L. All exposed cables such as those running thru cable trays or exposed on within patch panel racks will be neatly routed with the highest attention to organization. All cables running through a cable tray will be grouped into groups of no more than 72 cables where every cable is run perfectly parallel to all other cables in the bundle. Cables shall not cross over the top of other cables and no cable stack will ever be hidden or absorbed within an exposed cable tray.



## 1.4 APPROVED PRODUCTS

A. Anixter publishes and maintains an Aetna approved parts listing which is required to be used for all Aetna projects. Current version of the parts list can be attained from Brian Saier at Anixter Phone 203-806-2234

B. CAT5e will be used at all leased properties, CAT6 will be used at all owned properties.

C. Approved 4-pair UTP Cable : Berk-Tek LANmark-350 or 1000 Enhanced Category 6/5e Cable (Plenum/Non-Plenum/Limited Combustible)

D. Approved Optical Fiber Cable manufacturer: Berk-Tek, Corning

E. Approved UTP connector product manufacturer: Ortronics

F. Approved Fiber Optic cabinet product manufacturer: Ortronics

G. Approved Fiber Optic connectors/splices/couplers: Ortronics

H. Approved Rack and Cabinet manufacturer: Ortronics

I. Approved Patch Panel manufacturer: Ortronics



- J. Approved UTP Patch Cord manufacture: BS Cable
  - K. Basket Tray (for installation inside of Plenum ceiling): Legrand/Cabofil
  - L. Grounding Bur Bars and grounding accessories: Panduit
  - M. Ladder tray (for installation below the ceiling within IT rooms): CPI
- 



## 1.5 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install a complete telecommunications wiring infrastructure.
  2. Furnish, install, and terminate all UTP and Optical Fiber cable.
  3. Furnish and install all wall plates, jacks, patch panels.
  4. Furnish and install all required cabinets and/or racks as required and as indicated.
  5. Furnish any other material required to form a complete system.
  6. Perform link or channel testing (100% of horizontal and/or backbone links/channels) and certification of all components.
  7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
  8. Adhere and comply with all requirements of Ortronics Certification and Berk-Tek OASIS programs.
  9. Provide owner training and documentation. (Testing documentation and As-built drawings)
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## 1.6 SUBMITTALS

A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:

1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
3. Submit appropriate cut sheets and samples for all products, hardware and cabling.





B. Work shall not proceed without the Owner's approval of the submitted items.

C. The telecommunications contractor shall receive approval from the Aetna VDC Engineer on all substitutions of material. No substituted materials shall be installed except by written approval from the Aetna.



## 1.7 QUALITY ASSURANCE

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.



## 1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery and receipt of products shall be at the site described in the Scope Section.

B. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.

C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.



## 1.9 DRAWINGS

A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.

C. The telecommunications contractor shall inspect cellways, pathways, conduits, ceiling spaces and/or raised floor spaces and ensure adequate space for needed cable fill.



D. Prior to submitting the bid, the telecommunications contractor shall call to the attention of the Aetna VDC Engineer any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

E. The drawing revision numbers and drawing dates used to develop a cabling proposal must be listed in the proposal along with the version number of the specification used.

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## PART 2 - PRODUCTS



### 2.1 EQUIVALENT PRODUCTS

A. Due to the nature and type of communications all products, including but not limited to faceplates, jacks, patch panels, racks, 110 blocks, and patch cords, for the purpose of this document, shall be manufactured by Ortronics. All copper and optical fiber cable products shall be manufactured by Berk-Tek or Corning. All grounding products shall be manufactured by Panduit. All cable tray (ladder style) and accessories shall be manufactured by CPI. There will be no substitutions allowed.



### 2.2 WORK AREA OUTLETS

A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.

B. The Telecommunications Outlet Assembly shall accommodate:

1. A minimum of one (1) modular jacks
2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary
3. A blank filler will be installed when extra ports are not used.
4. A circuit number on the identifier strip consistent with issued project cable plan.
5. Multiple jacks that are identified in close proximity on the drawings (but not separated by a physical barrier) may be combined in a single assembly. The telecommunications contractor shall be responsible for determining the optimum compliant configuration based on the products proposed.
6. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the Owner.
7. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using Ortronics label program or using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.



C. Faceplates: The faceplates shall:

1. be Ortronics TracJack for all systems furniture
2. be Ortronics On-Q keystone jack with Leviton DECORA frame insert for all wall plates
3. be UL listed and CSA certified.
4. be constructed of high impact, ABS plastic UL 94V-0 construction (except where noted otherwise).
5. shall be cloud white in color unless otherwise noted by architect and additionally approved by AIS cabling coordinator.
6. be compliant with the above requirements along with the following when incorporating optical fiber:
  - a) be a low profile assembly,
  - b) incorporate a mechanism for storage of cable and fiber slack needed for termination,
  - c) position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
  - d) incorporate a shroud that protects the optical couplings from impact damage.
7. be available as single-gang or dual-gang.
8. shall provide easy access for adds, moves, and changes by front removal of jack modules.
9. possess recessed designation windows to facilitate labeling and identification.
10. shall include a clear plastic cover to protect labels in the designation window.
11. have mounting screws located under recessed designation windows.
12. comply with ANSI/TIA/EIA-606-A work area labeling standard.
13. allow for the UTP modules to be inverted in place for termination purposes.
14. be manufactured by an ISO 9001 registered company.

D. Voice / Data Jacks

1. Voice/Data jacks shall be 8-position modular jacks and shall be Category 6 performance as defined by the references in this document including ANSI/TIA/EIA-568-B.2-1. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
2. The modular jack shall use dual reactance modular contact array.
3. The modular jack shall have low emission IDC contacts.
4. The modular jack shall use standard termination practice using 110 impact tool



5. The modular jack shall be backwards compatible to Category 3, 5, and 5e.
6. The modular jack shall be center tuned to category 6 test specifications.
7. The modular jack shall be one of the following for a NetClearGT2 Solution:

Part Number	Description
KP3450-WH	Category 5e T568A/B On-Q Jack for use in Leviton Decora Frames
KP3450-OR	Category 5e T568A/B On-Q Jack for use in Leviton Decora Frames
OR-TJ5E00-88	Category 5e T568A/B Trac-Jack for use in Systems Furniture
OR-TJ5E00-23	Category 5e T568A/B Trac-Jack for use in Systems Furniture

8. Dust covers shall not be used on end terminations.



## 2.3 110 COPPER TERMINATION BLOCK

The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.

### A. 110 Block Kits shall

1. include both the wiring block in a 100 and 300 pair footprint and the connecting block C6110C4
2. be OR-30203518 (loaded with C4s) and OR-30200095 (loaded with C5s)
3. be manufactured using fire retardant molded plastic.
4. support termination of 22-24 AWG solid conductor
5. wiring block shall contain back openings for the feed through of cable
6. meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory
7. have color-coded tips on the wiring block and color coding on the connector blocks for installation identification.
8. shall use standard termination practice requiring a single conductor 110 impact tool
9. Termination hardware shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
10. be backwards compatible to category 3, 5 and 5e
11. be labeled in compliance with ANSI/TIA/EIA-606-A labeling specifications using permanent labels and Ortronics labeling program (or other labeling software/printer)



12. be manufactured by an ISO 9001 registered company.

B. 110 Cross-Connect System Backboard Channels Shall

1. be available in 50, 100, and 300 sizes.
2. allow the mounting of 110 100-pair blocks without legs.
3. include bottom trough and grounding bar.
4. be wall mountable.
5. be of cold roll steel construction.
6. be manufactured by an ISO 9001 registered company.

C. 110 Wall Mount Vertical Trough Shall

1. be available in single channel or dual channel configurations.
2. in dual channel configuration shall be used to provide separation for different wiring media.
3. be available in 100 and 300 pair sizes.
4. be wall mountable.
5. be used with wall mountable backboard channels. Acceptable configurations include a 50, 100, and a 300 pair.
6. be of cold roll steel construction.
7. be manufactured by an ISO 9001 registered company.



## 2.4 MODULAR PATCH PANELS

A. The Modular Patch Panels shall

1. meet category 5e/6 component compliance and be verified by a third-party nationally recognized independent testing laboratory
2. use low emission IDC contacts
3. use dual reactance technology to enhance the signal-to-noise ratio
4. require standard termination practices using a 110 impact tool
5. use a single piece IDC housing designed to accept larger Category 6 conductors
6. support both T568B and T568A wiring



7. include easy to follow wiring labels
8. include label fields
9. allow for the use of icons
10. include full length metal rear cable management
11. be available in standard or high density
12. be backward compatible to category 3, 5 and 5e
13. be center tuned to category 6 test specifications
14. The modular patch panel shall be one of the following for a NetClearGT2 Solution:

Part Number	Description
OR-PHA5E6U24	24 port Category 5e modular to 110 patch panel, T568A/B, Angled
OR-PHA5E6U48	48 port Category 5e modular to 110 patch panel, T568A/B, Angled
OR-PHA66U24	24 port Category 6 modular to 110 patch panel, T568A/B, Angled
OR-PHA66U48	48 port Category 6 modular to 110 patch panel, T568A/B, Angled



## 2.5 RACKS

All racks and wire management shall be Ortronics specific. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, 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. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.

### A. Free-Standing Rack

Free-standing rack shall:

1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
2. have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
3. have EIA hole pattern on front and rear.
4. be available with a 6.5" (165 mm) channel depth.
5. be available with hook and loop straps for securing bulk cables inside the vertical U channels.
6. assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.



7. be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
8. provide floor and ceiling access for cable management and distribution.
9. provide pre-drilled base for floor attachment of rack.
10. be available in standard color of black.
11. be manufactured by an ISO 9001 registered company.

**B. Wall Mounted Rack**

Wall mount rack shall:

1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-B.
2. have top cable trough to route patch and distribution cables between racks.
3. have EIA hole pattern on front and rear.
4. Rack height shall be specified as 7 ft / 2.13 m (44 rack units) or 4.0 ft/1.22 m (22 rack units).
5. be available with a 6.5" (165 mm) or 14" (356 mm) channel depth.
6. be available with hook and loop straps for securing cables inside the vertical U channels.
7. be available with vertical cable management rings for cord routing organization and strain relief.
8. be available with vertical U-channels to protect and conceal distribution cables.
9. provide floor and ceiling access for cable management and distribution.
10. have wall mount braces with locator posts for easy wall mounting.
11. have side access points that allow for access to manage/install distribution cables in the vertical channels.
12. be available in standard color of black.
13. be manufactured by an ISO 9001 registered company.



## 2.6 HORIZONTAL DISTRIBUTION CABLE

All horizontal data station cable and voice cable shall terminate on modular patch panels (copper or fiber), 110 cross-connecting blocks (copper), or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings.

**A. 100 OHM Category 5e or Category 6 UNSHIELDED TWISTED PAIR CABLE (UTP)**



1. Physical Characteristics:

- a) (For Plenum) Shall be plenum rated and meet applicable requirements of ANSI/ICEA S-80-576. All 4 pairs must be insulated with F.E.P. No 2x2 or 3x1 constructions will be allowed.
- b) (For limited combustible) For horizontal runs installed in raised floor or dropped ceiling environmental air spaces(as designated on Drawings) use UL verified “Limited Combustible FHC 25/50 CMP”.
- c) (For limited combustible) All 4 pairs must be insulated with 100 % DuPont Teflon.
- d) (For limited combustible) The outer jacket shall be SmokeGuard FP with Teflon.
- e) The diameter of the insulated conductor shall be .022 in. nominal.
- f) Shall consist of (4) 23 AWG twisted pairs.
- g) Shall be suitable for the environment in which they are to be installed.
- h) The color coding of pairs shall be:

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BL	W-O; O	W-G; G	W-BR; BR

- i) The overall diameter of the cable shall be 0.226 inches nominal.
- j) The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
- k) Cable shall withstand a bend radius of 1 inch at -20 degrees Celsius without jacket or insulation cracking.
- l) Cable shall be third party verified to meet ANSI/TIA/EIA-568-B.2-1.

2. Transmission Characteristics:

- a) DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
- b) The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 nF .
- c) DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
- d) The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
- e) Structural return loss swept measurement for 100m or longer shall be meet or exceed the following:

Frequency (MHz)	1.0	4.0	10.0	20.0	31.25	62.5	100	250	350	500	550





Max. SRL(dB)	26.0	26.0	26.0	26.0	25.0	23.5	22.5	20.5	19.8	19.0	18.8
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f) The maximum insertion loss of any pair shall be less than the following:

Frequency (MHz)	1.0	4.0	10.0	20.0	31.25	62.5	100	250	350	500	550
Max. Attenuation (dB)	2.0	3.8	5.9	8.4	10.6	15.3	19.7	32.6	39.5	48.6	51.4

g) The NEXT coupling loss between pairs in a cable shall be greater than or equal to the following:

Frequency (MHz)	1.0	4.0	10.0	20.0	31.25	62.5	100	250	350	500	550
NEXT Loss Worst Pair (dB)	79.3	70.3	64.3	59.8	56.9	52.4	49.3	39.3	37.2	34.8	57.3

h) The PSNEXT loss @ 20 degrees Celsius + 3 degrees (68 degrees F + 5.5 degrees) between pairs in a cable for a length of 100m (328ft) shall be greater than or equal to the following:

Frequency (MHz)	1.0	4.0	10.0	20.0	31.25	62.5	100	250	350	500	550
PSNEXT Loss Worst Pair (dB)	77.3	68.3	62.3	57.8	54.9	50.4	47.3	41.3	39.2	36.8	36.2

i) The ELFEXT loss @ 20 degrees Celsius + 3 degrees (68 degrees F + 5.5 degrees) between pairs in a cable for a length of 100m (328ft) shall be greater than or equal to the following:

Frequency (MHz)	1.0	4.0	10.0	16	31.25	62.5	100	250	350	500	550
ELFEXT Loss Worst Pair (dB)	72.8	60.7	52.8	48.7	42.9	36.8	32.8	24.8	21.9	18.8	17.9

j) The PSELFEXT loss @ 20 degrees Celsius + 3 degrees (68 degrees F + 5.5 degrees) between pairs in a cable for a length of 100m (328ft) shall be greater than or equal to the following:

Frequency (MHz)	1.0	4.0	10.0	16.0	31.25	62.5	100	250	350	500	550
PS-ELFEXT Loss Worst Pair (dB)	69.8	57.7	49.8	45.7	39.9	33.8	29.8	21.89	18.9	15.8	14.9

k) The return loss @ 20 degrees Celsius + 3 degrees (68 degrees F + 5.5 degrees) between pairs in a cable for a length of 100m (328ft) shall meet or exceed the following

Frequency (MHz)	1.0	4.0	10.0	20.0	31.25	62.5	100	250	350	500	550
Min. RL (dB)	20.0	23.6	26.0	26.0	25.0	23.5	22.5	20.5	19.80	19.0	18.8



l) Minimum longitudinal and transverse conversion loss (LCL & TCL) @ 20 degrees Celsius + 3 degrees (68 degrees F + 5.5 degrees) shall meet or exceed the following

Frequency (MHz)	1.0	4.0	10.0	31.25	62.5	100	200	250	350	500	550
LCL & TCL (dB)	50.0	44.0	40.0	35.1	32.0	30.0	27.0	26.0	24.0	23.0	22.6

m) Minimum equal level transverse conversion loss (EL TCTL) @ 20 degrees Celsius + 3 degrees (68 degrees F + 5.5 degrees) for a length of 100m (328ft) shall meet or exceed the following

Frequency (MHz)	1.0	4.0	10.0	16.0	20.0	30.0
EL TCTL (dB)	35.0	23.0	15.0	10.9	9.0	5.5

n) The propagation delay of any pair at from 1 to 250 MHz @ 20 degrees Celsius + 3 degrees (68 degrees F + 5.5 degrees) for a length of 100m (328ft) shall meet or exceed the following

Frequency (MHz)	1.0	4.0	10.0	20.0	31.25	62.5	100	200	250 -550
Propagation Delay (ns)	570	552	545	542	540	539	538	537	536

3. Design Make:

a) Berk-Tek CAT5e LANmark-350 UTP (CMR Riser-PVC)

Color	Box	Reel
White	10032459	10032458
Blue	10032425	10032164

b) Berk-Tek CAT5e LANmark-350 UTP (CMP Plenum-PVC Alloy)

Color	Box	Reel
White	10032062	10032091
Blue	10032064	10032093

c) Berk-Tek CAT6 LANmark-1000 UTP (CMR Riser-PVC)



Color	Box	Reel
White	10032459	10032458
Blue	10032455	10032454

b) Berk-Tek CAT6 LANmark-1000 UTP (CMP Plenum-PVC Alloy)

Color	Box	Reel
White	10032092	10032091
Blue	10032094	10032093



## 2.7 BACKBONE CABLE

A. Indoor/Outdoor Optical Fiber Non-Conductive Plenum (OFNP) Loose Tube With Enhanced (Low Water Peak) Single-mode Optical Fibers

1. Each Single-mode Fiber shall be:

- a) Class IVa dispersion - unshifted single mode optical fibers with Low Water Peak complying with ANSI/EIA/TIA-492CAAB-2000.
- b) The zero dispersion wavelength shall be between 1300 nm and 1320 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.090 ps/km-nm<sup>2</sup>. Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-175-B.
- c) The nominal mode field diameter shall be 9.1 μm with a tolerance of ± 0.4 μm at 1310 nm when measured in accordance with ANSI/EIA/TIA 455 191 B.
- d) Transmission Characteristics:
- e) Maximum cabled attenuation dB/km @ 1310/1550 nm: 0.4/0.3
- f) The cabled cutoff wavelength shall be ≥ 1260 nm when measured in accordance with ANSI/EIA/TIA-455-80-C
- g) Distance vs. bandwidth using a Laser transmitter operating at a 1310 nm wavelength

2. Physical Characteristics:

- a) Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
- b) Shall be suitable for use in risers, plenums and horizontal applications.
- c) Shall have a dry water blocking system for cable core and buffer tubes.
- d) Shall be available with a fiber strand count range from 6 to 432.
- e) Shall have a 3.0 mm sub-unit diameter.



- f) Shall have and be marked with an OFNP and OFNP FT-6 Flame Rating.
- g) Shall comply with Telcordia GR-409
- h) Shall comply with ANSI/ICEA S-83-596, ANSI/ICEA S-87-640, and ANSI/ICEA S-104-696.
- i) Strength members shall be FGE/Aramid/yarn.
- j) Suitable for underground or above ground conduits.
- k) Loose Tube fibers shall be color coded in accordance with EIA/TIA-598 with an overall yellow jacket.
- l) Shall have a ripcord
- m) Suitable for operation between -40oC to +75o C
- n) Shall be UV resistant
- o) Shall be of an all dielectric design

3. Design Make:

- a) Berk-Tek Adventum optical fiber cable  
Part # 370-BKT8.3-TBA-24 (24-fiber, Single-Mode optical fiber)

H. Indoor/Outdoor Optical Fiber Non-Conductive Riser (OFNR) Loose Tube With Enhanced (Low Water Peak) Single-mode Optical Fibers

1. Each Single-mode Fiber shall be:

- a) Class IVa dispersion - unshifted single mode optical fibers with Low Water Peak complying with ANSI/EIA/TIA-492CAAB-2000.
- b) The zero dispersion wavelength shall be between 1300 nm and 1320 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.090 ps/km-nm<sup>2</sup>. Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-175-B.
- c) The nominal mode field diameter shall be 9.1 μm with a tolerance of ± 0.4 μm at 1310 nm when measured in accordance with ANSI/EIA/TIA 455 191 B.
- d) Transmission Characteristics:
- e) Maximum cabled attenuation dB/km @ 1310/1550 nm: 0.5/0.4
- f) The cabled cutoff wavelength shall be ≤ 1260 nm when measured in accordance with ANSI/EIA/TIA-455-80-C
- g) Distance vs. bandwidth using a Laser transmitter operating at a 1310 nm wavelength



2. Physical Characteristics:

- a) Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
- b) Shall be suitable for use in risers and horizontal applications.
- c) Shall have a dry water blocking system for cable core and buffer tubes.
- d) Shall be available with a fiber strand count range from 6 to 432.
- e) Shall have a 3.0 mm sub-unit diameter.
- f) Shall have and be marked with an OFNR and OFNR FT-6 Flame Rating.
- g) Shall comply with Telcordia GR-409 and GR20
- h) Shall comply with ANSI/ICEA S-83-596, ANSI/ICEA S-87-640, and ANSI/ICEA S-104-696.
- i) Strength members shall be FGE/Aramid/yarn.
- j) Suitable for underground or above ground conduits.
- k) Loose Tube fibers shall be color coded in accordance with EIA/TIA-598 with an overall black jacket
- l) Shall have a ripcord .
- m) Suitable for operation between -40oC to +75o C
- n) Shall be UV resistant
- o) Shall be of an all dielectric design

3. Design Make:

- a) Berk-Tek Adventum optical fiber cable  
Part # LTR012AB0403 (12-fiber, Single-Mode optical fiber)  
Part # LTR0X024AB0403 (24-fiber, Single-Mode optical fiber)  
Part # LTR12B036AB0403 (36-fiber, Single-Mode optical fiber)

L. Optical Fiber Non-Conductive Plenum (OFNP) Tight Buffered With Enhanced (Low Water Peak) Single-mode Optical Fibers

1. Each Single-mode Fiber shall be:

- a) Class IVa dispersion - unshifted single mode optical fibers with Low Water Peak complying with ANSI/EIA/TIA-492CAAB-2000.
- b) The zero dispersion wavelength shall be between 1300 nm and 1320 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.090 ps/km-nm<sup>2</sup>. Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-175-B.



- c) The nominal mode field diameter shall be 9.1  $\mu\text{m}$  with a tolerance of  $\pm 0.4 \mu\text{m}$  at 1310 nm when measured in accordance with ANSI/EIA/TIA 455 191 B.
- d) Transmission Characteristics:
- e) Maximum cabled attenuation dB/km @ 1310/1550 nm: 0.7/0.7
- f) The cabled cutoff wavelength shall be  $\leq 1260$  nm when measured in accordance with ANSI/EIA/TIA-455-80-C
- g) Distance vs. bandwidth using a Laser transmitter operating at a 1310 nm wavelength

2. Physical Characteristics:

- a) Shall be suitable for use in indoor applications.
- b) Shall be suitable for use in risers, plenums and horizontal applications.
- c) Shall be available with a fiber strand count range from 6 to 144.
- d) Bundled cable constructions shall have a sub-unit core size of 5.2mm for 12 fibers.
- e) Shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating.
- f) Shall comply with Telcordia GR-409.
- g) Shall comply with the requirements of ICEA S-83-596.
- h) Strength members shall be dielectric and may be either FGE/aramid/yarn.
- i) Buffered fibers shall be color coded in accordance with EIA/TIA-598 with an overall yellow jacket.
- j) Shall have a ripcord .
- k) Suitable for operation between  $-20^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$
- l) Shall be of an all dielectric design

3. Design Make:

- a) Berk-Tek Premise Distribution optical fiber cable  
Part # PDP012AB0707 (12-fiber, Single-Mode optical fiber)  
Part # PDP024AB0707 (24-fiber, Single-Mode optical fiber)  
Part # PDP12B036AB0707 (36-fiber, Single-Mode optical fiber)





## 2.8 FIBER OPTIC CONNECTORS

### A. Field-Installable Fiber Optic Connectors

1. Each Fiber Connector shall:
  - a. Be available in singlemode and multimode versions
  - b. Be available as pre-polished or anaerobic epoxy style
  - c. Designed for installation on 900 micron buffered fiber
  - d. Be stable over an operating range of –40C to +75 degrees C.
2. The field-installable fiber optic connector must be a fusion spliced pigtail:

Description	Style	Fiber	Part Number
PigTails	SC	9/125	1520027





## 2.9 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 copper bonding conductor between the protector ground lug and the TC ground point. Approved manufacturer of protection units is Porta Systems.

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## 2.10 PATCH CORDS

Aetna will provide patch cords assembled by BSCable. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B for patch cord testing. TC must coordinate the exact quantity and length of cords with Aetna VDC Room Engineer and Aetna Network Engineer.

A. Copper (UTP) patch cords shall:

1. be an Ortronics OR-MC6xx-06, OR-MC6xx-05, OR-MC6xx-09 category 6 Clarity patch cord with Paralign 2 Plug Design.
2. use 8 position connector with impedance matched contacts and designed using dual reactance.
3. be constructed of 100 ohm, 4 pair, 24 AWG, stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 standard.
4. meet TIA category 6 component specifications in ANSI/TIA/EIA-568-B.2-1
  - 100% factory tested to meet category 6 performance and
  - ETL or any other nationally recognized 3rd party verification
5. be center tuned to category 6 performance specifications by using paired bi-level contact array
6. be capable of universal T568A or T568B wiring schemes.
7. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
8. have a performance marking indelibly labeled on the jacket (by the manufacturer).
9. have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
10. have "snagless" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief
11. be available in three standard colors
12. be available in 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, and 30, foot standard lengths
13. be backwards compatible to Category 3, 5 and 5e
14. be manufactured by an ISO 9001 registered company.







## 2.11 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 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. Telecommunications Grounding Busbar (TGB) shall be a tinned solid copper bar, 2" high by 10" long by 1/4" thick, manufactured with holes evenly spaced horizontally and vertically throughout in accordance with ANSI/TIA/EIA-607-A pattern. The TGB will be equipped with isolated mountings, which provide a 2" standoff from the wall. Panduit part number GB2B0312TPI-1.
- C. 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.
- D. 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 stranded copper bonding conductor and compression connectors.
- E. All bonding conductors (excepting Equipment Bonding Conductors) installed as part of the telecommunications earthing and bonding system shall be terminated to appropriately sized two-hole compression rings and/or lugs. The routing of all conductors must be in lines as straight as possible (horizontal and vertical); all changes in direction must have a minimum bend radius equal to four times the outer diameter of the conductor, as not to cause undue deformation of the conductor(s).
- F. All lugs must be two hole style and must be correctly installed with two appropriately sized nuts, bolts, and compression washers. All lugs must be PANDUIT part numbers LCC6-14AW-L (for #6 wire) or LCC1/0-38DW-X (for #1/0 wire).
- G. Within the datacenter, the TGB shall be bonded to the TBB or building steel by means of an appropriate "C" type tap, using a minimum #1/0 AWG tap conductor and the electrical service earth at the nearest panel board by a tradesperson licensed by the Authority Having Jurisdiction
- H. All wires used for telecommunications grounding purposes shall be identified with a green insulation. No non-insulated conductors shall be permitted. Green Phase tape is NOT an acceptable alternative to green insulation. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.
- I. It shall be the responsibility of the electrical contractor (EC) to furnish and install the respective TGB in each VDC Room or Wire Closet. The electrical contractor shall coordinate the exact location with the telecommunications contractor based on the project drawings.
- J. The telecommunications contractor shall be responsible to bond all racks individually to the TGB as well as the cable tray.



K. The electrical contractor shall be responsible to bond the ESD (anti-static) flooring system to the TGB in accordance with details provided in the drawing package.

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## 2.12 FIRESTOP

A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped using Wiremold's FlameStopper FS Series.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

D. Where permissible by EC, GC, and AHJ, Aetna recommends the use of HILTI fire plugs CFS-PL Series.

E. It is the responsibility of the EC to fire stop around the exterior of all electrical and low voltage conduits. It is the responsibility of the TC to plug all low voltage sleeves and conduits after the low voltage cable has been installed.

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# PART 3 - EXECUTION



## 3.1 WORK AREA OUTLETS

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

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

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).



D. Bend radius of the twisted-pair horizontal cable shall not be less than 4 times the outside diameter of the cable.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).



## 3.2 HORIZONTAL DISTRIBUTION CABLE

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.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-B maximum fill for the particular raceway type or 40%.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

E. 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.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

H. Horizontal distribution cables shall be bundled in groups of no more than 72 cables. Cable bundle quantities in excess of 72 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

I. 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.

J. 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.

K. 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.

L. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. 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.



### 3.3 HORIZONTAL CROSS CONNECT

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. 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.

E. The cable jacket shall be maintained as close as possible to the termination point.

F. 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.



### 3.4 OPTICAL FIBER TERMINATION HARDWARE

A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

B. 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.

C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

E. A maximum of 12 strands of fiber shall be spliced in each tray

F. All spare strands shall be installed into spare splice trays.



### 3.5 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 are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.
- E. 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.
- F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- G. 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.
- H. 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.
- I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.



## 3.6 COPPER TERMINATION HARDWARE

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practice.
- B. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- D. 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.
- E. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.
- F. 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.





## 3.7 RACKS

- A. Racks shall be securely attached to the concrete floor using a minimum 5/8" hardware or as required by local codes.
- B. 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 front of the row of racks and from the wall at each end of the row.
- C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.11 of this document.
- D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- E. Wall mounted termination block fields shall be installed with the highest edge of the mounting frame at 60" AFF and with the lowest edge no lower than 18" from the finished floor.



## 3.8 FIRESTOP SYSTEM

- A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.



## 3.9 GROUNDING SYSTEM

- 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 ANSI/TIA/EIA-607-A standard, and shall be installed in accordance with best industry practice.
- B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.





## 3.10 IDENTIFICATION AND LABELING

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.

B. All label printing will be machine generated by Ortronics labeling program using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

C. Approved label templates for patch panels and 110 blocks are located at <http://vdc.aetna.com>



## 3.11 TESTING AND ACCEPTANCE

### A. General

1. 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-B; marginal passes (\*PASS) are not acceptable. 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.

2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Ortronics Certification Program Information Manual 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.

### B. Copper Channel Testing

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.

2. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance. The basic tests required are:

- Wire Map
- Length
- Attenuation



- NEXT (Near end crosstalk)
- Return Loss
- ELFEXT Loss
- Propagation Delay
- Delay skew
- PSNEXT (Power sum near-end crosstalk loss)
- PSELFEXT (Power sum equal level far-end crosstalk loss)

3. 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.

4. 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-B 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.

5. Category 6 Performance

Shall meet the channel requirements outlined below for a 100-meter, 4-connector channel.

Frequency (MHz)	Maximum Insertion Loss (dB)	Minimum NEXT (dB)	Minimum PSNEXT (dB)	Minimum ELFEXT (dB)	Minimum PSELFEXT (dB)	Minimum Return Loss (dB)
1.0	2.1	70.0	67.0	68.3	65.3	22.0
4.0	4.0	68.0	65.5	56.2	53.2	22.0
10.0	6.3	61.6	59.0	48.3	45.3	22.0
20.0	9.0	56.6	54.0	42.2	39.2	22.0
31.25	11.3	53.4	50.7	38.4	35.4	20.1
62.5	16.4	48.4	45.6	32.3	29.3	17.1
100.0	21.2	44.9	42.1	28.3	25.3	15.1
155.0	26.6	41.7	38.8	24.4	21.4	13.1
200.0	31.5	39.8	36.9	22.2	19.2	12.1
250.0	36.0	38.1	35.2	20.3	17.3	11.0

C. Fiber Testing

1. Testing procedures shall be in accordance with the following:
  - a. ANSI/TIA/EIA-568-B
  - b. ANSI/TIA/EIA-568-B.1





- c. ANSI/TIA/EIA-526-7, Method A.1
- d. ANSI/TIA/EIA-526-14A, Method B
- e. TSB-140 Tier 1 fiber testing is required. Tier 2 Fiber Testing is recommended

## 2. Preparation

- a. Properly clean all connectors, adapters, and jumpers prior to testing.
- b. Insure that the testing jumpers are of the same fiber core diameter and connector type as the fibers to be tested.
- c. The power meter shall be properly calibrated prior to testing. Contractor to provide written confirmation of the calibration, with the power meter serial number, to the Owner, if requested. If this documentation is not available upon request, the Contractor shall re-test all optical fiber cables after documented calibration of the power meter is accomplished.

## 3. Test Equipment

- a. Optical power meter and source (Certification tester Fluke or Agilent preferred). Suitable OTDR with launch cable for Tier 2 testing. OTDR Launch Cable length recommendation is 75 meters for MMF and 300 meters for SMF systems.

## 4. Testing

- a. All Multimode fibers shall be tested to the requirements of ANSI/EIA/TIA-568-B, TIA-525-14A (Method A.1) and TSB-140. Optical fibers shall be tested at both 850 nm and 1300 nm wavelengths for end-to-end insertion loss and Bi-Directional (MTR to TR-1, TR-1 to MTR)
- b. All Single-mode fibers shall be tested to the requirements of ANSI/EIA/TIA-568-B, TIA-526-7 (or Method A.1) and TSB-140. Optical fibers shall be tested at both 1310 nm and 1550 nm wavelengths for end-to-end insertion loss and Bi-Directional (MTR to TR-1, TR-1 to MTR)
- c. Insure that the power meter and light source are set to the same wavelength prior to testing each fiber.
- d. Connect an appropriate test jumper to the light source and power meter.
- e. Power on both the power source and light meter, allowing them to stabilize.
- f. Record the reference power reading in dB. If the jumper is removed from the light source for any reason, the reference power reading must be re-established.
- g. Insert a second appropriate jumper, using an appropriate adapter, between the first jumper and the power meter. Record the power reading in dB.
- h. Reference TSB-140 for additional recommendations and testing guidelines.
- i. Provide written documentation of all test results to owner. Provide electronic copy of test results, in original tester format, to manufacturer when registering project for warranty on-line.





## 3.12 SYSTEM DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the subsections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

## 3.13 TEST RESULTS

A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-B including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.

C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form (CD-ROM).

D. Test documentation shall also be provided to the manufacturer within three weeks after the completion of the project. Test results shall be uploaded when registering the project for warranty using the manufacturer's on-line system. Test results shall be in the tester's original format from an approved tester listed on manufacturer's website. All test results must show a PASS; marginal passes (\*PASS) are not accepted.

E. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.



## 3.14 AS-BUILT DRAWINGS



A. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans electronically by posting them at <http://ot.aetna.com>. It is the responsibility of the telecommunications contractor to use a reprographics service to produce full sized hard copies for the job site. A FULL set (containing all sheets listed on the cover page) must be present on the job site dedicated to the telecommunications contractor foreman.

B. The Contractors shall annotate the base drawings with red pen and submit to Tecton architects for whom will perform all CAD updates.

C. Final cable plans must be posted in each respective VDCRoom or wire closet.



### 3.15 CONDUIT FILL CAPACITY / ROUTING

A. The following table provides guidelines used by ANSI / TIA / EIA – 569 for cable fill capacity for conduits ranging from ½-inch trade size to 4-inch trade size that have no more than two 90 degree bends (180 degrees total) and are no longer than 100 feet. The number of cables that can be installed is actually limited by the allowed maximum pulling tensions of the cables.

B. Flexible conduit is not recommended for use in buildings because it tends to creep, shift and damage cable sheaths. Use only in situations where it is the only practical alternative and increase the conduit size by one trade size.

Conduit ID inches	Conduit Trade Size	Cable Outside Diameter (inches)									
		0.13	0.18	0.22	0.24	0.29	0.31	0.37	0.53	0.62	0.70
0.63	1/2	1	1	0	0	0	0	0	0	0	0
0.83	3/4	6	5	4	3	2	2	1	0	0	0
1.06	1	8	8	7	6	3	3	2	1	0	0
1.37	1-1/4	16	14	12	10	6	4	3	1	1	1
1.61	1-1/2	20	18	16	15	7	6	4	2	1	1
2.08	2	30	26	22	20	14	12	7	4	3	2
2.48	2-1/2	45	40	36	30	17	14	12	6	3	3
3.07	3	70	60	50	40	20	20	17	7	6	6
3.58	3-1/2							12	12	7	6
4.05	4							30	14	12	7

C. Conduit serving low voltage telecommunications cable shall not exceed 90 degrees of bend or 100 feet between accessible pull boxes.

D. Where a 90 bend is required in the conduit run, the bend shall be provided by use of an appropriately sized junction box instead of bent pipe.

E. Caution must be made to ensure that the cable can be pulled thru the conduit path within allowable maximum pull tolerances.





## 3.16 CABLE DEMO / REMOVAL

Both fiber and copper telecommunications cable from active patch panels shall never be tagged for future re-use. All such cable must be removed from the source. All cable terminated on the a patch panel must at all times be terminated to a work area outlet, be tested and in good operating condition and it's location noted on accurate as-build drawing posted on the wall of the room containing the patch panel rack.

New requirements were added to the National Electrical Code in 2002 for removal of abandoned cables:

- 645.5 (D) (6) Information technology equipment rooms
- 760.3 (A) Fire alarm systems
- 770.3 and 770.54 (B) Fiber optics
- 800.52 (B) Communications circuits
- 820.3 (A) and 820.53 (B) (1) CATV and radio distribution systems

# PART 4 - WARRANTY AND SERVICES



## 4.1 WARRANTY

- A. The NetClear Warranty combines a 25-year extended product warranty with a 25-year applications assurance warranty. Berk-Tek and Ortronics (Manufacturer) provides the warranty directly to the end-user.
- B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.
- C. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-B.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE T, and 155 Mb/s ATM.
- D. The contractor shall provide a warranty on the physical installation.



## 4.2 CONTINUING MAINTENANCE

- A. The contractor shall furnish an hourly rate with the proposal submittal, which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall be performed by an Ortronics CIP Contractor /



Berk-Tek OASIS Integrator and shall be added to the NetClearGT2 warranty when registered with Ortronics or Berk-Tek.

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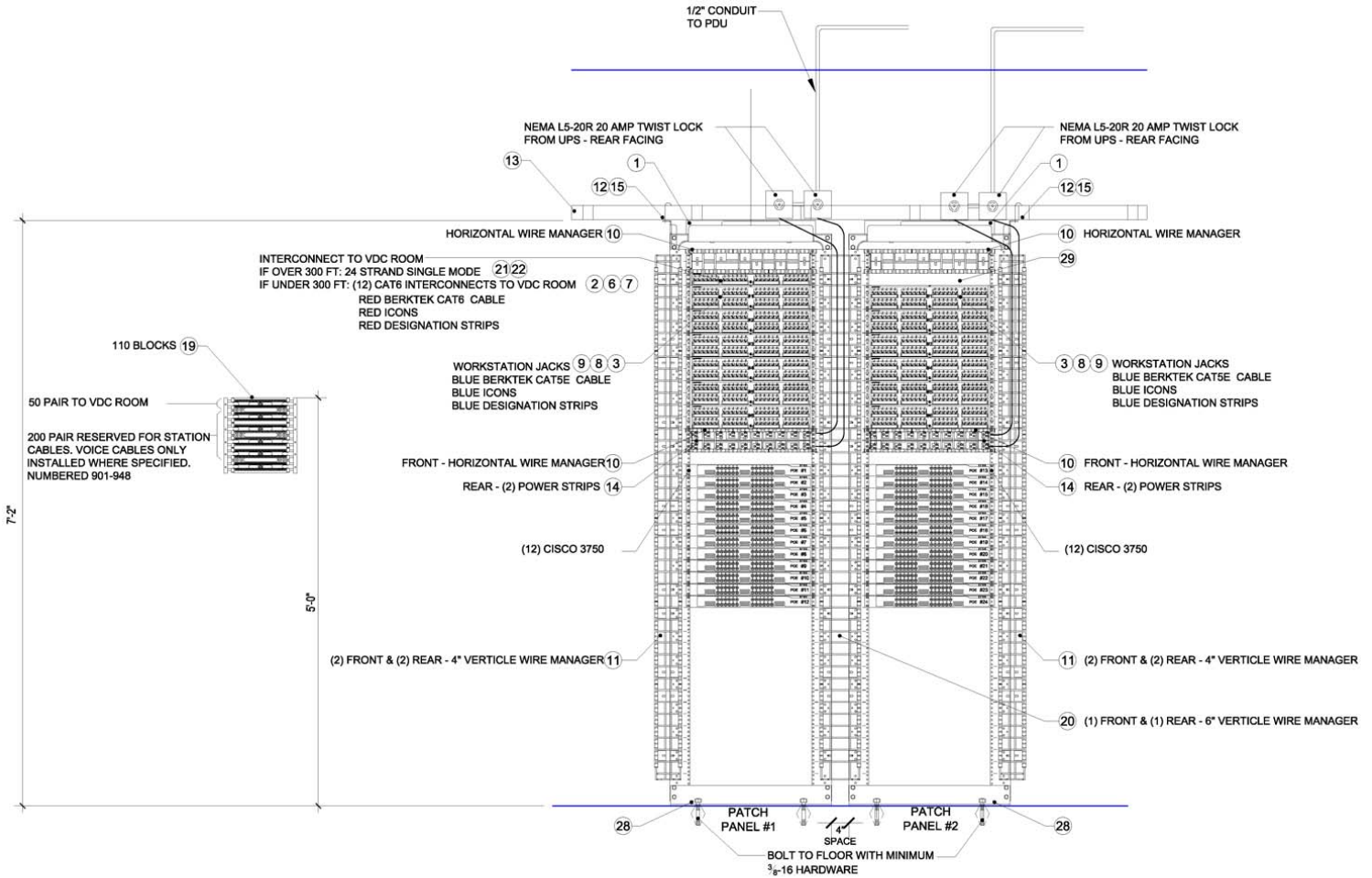
## 4.3 FINAL ACCEPTANCE & SYSTEM CERTIFICATION

A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from Ortronics or Berk Tek, registering the installation.





# Typical Aetna Wire Closet



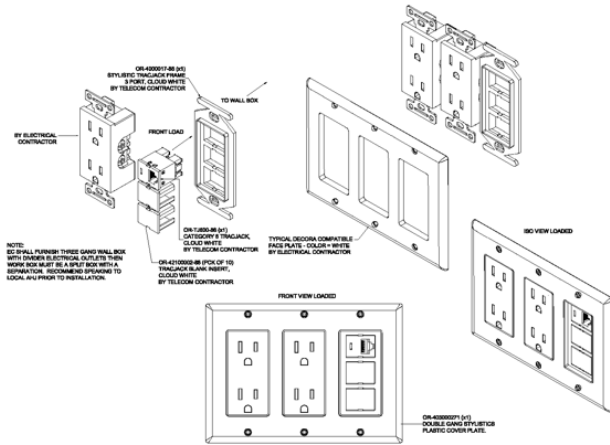
PATCH PANEL & CABLE TRAY BILL OF MATERIALS - SMALL WIRE CLOSET-1					
KEY	QUANTITY	PART#	SUPPLIER	DESCRIPTION	NOTES
1	1	OR-MM8708	ORTRONICS	MIGHTYMOE RACK	
2	1	OR-PHASE6U24	ORTRONICS	24 PORT ANGLED PATCH PANEL	USED FOR VDC JACKS AND WLAN
3	6	OR-PHASE6U48	ORTRONICS	48 PORT ANGLED PATCH PANEL	USED FOR STATION
4	0	OR-70400408-24	ORTRONICS	YELLOW DESIGNATION STRIPS	USED FOR VDC JACKS
5	0	OR-40324200	ORTRONICS	YELLOW DATA ICONS	USED FOR VDC JACKS
6	1	OR-70400408-22	ORTRONICS	RED DESIGNATION STRIPS	USED FOR WLAN JACKS
7	1	OR-40322200	ORTRONICS	RED DATA ICONS	USED FOR WLAN JACKS
8	2	OR-70400408-26	ORTRONICS	BLUE DESIGNATION STRIPS	USED FOR WORKSTATION JACKS
9	4	OR-40326200	ORTRONICS	BLUE DATA ICONS	USED FOR WORKSTATION JACKS
10	2	OR-MM8-HM2RU	ORTRONICS	HORIZONTAL WIRE MANAGERS	
11	4	OR-MM8VMS704	ORTRONICS	4" VERTICLE WIRE MANAGERS	2 ON FRONT AND 2 ON REAR
12	4	OR-60402238	ORTRONICS	RUNWAY SUPPORT BRACKET	ATTACHES CABLE TRAY TO MIGHTYMOE RACK WITH J-HOOK
13	4	10295-712	APC	12" BLACK CABLE TRAY (10' LENGTHS)	
14	2	AP9564	APC	POWER STRIP	MOUNTED ON REAR OF RACK BEHIND WIRE MANAGER
15	4	11431-001	CPI	J-HOOK FOR CABLE RUNWAY SUPPORT BRACKET	
16	2	11301-001	CPI	CABLE TRAY SPLICE	
17	2	11421-712	CPI	CABLE TRAY WALL BRACKET	
18	2	11302-001	CPI	CABLE TRAY T	
19	2	OR-110ABC300	ORTRONICS	300 PAIR 110 BLOCK WITH INSERTS	
20	0	OR-MM8VMS70	ORTRONICS	6" VERTICLE WIRE MANAGERS	1 ON FRONT AND 1 ON REAR
21	1	OR-FC1U-P	ORTRONICS	FIBER PANEL	
22	3	OR-DFP-SC08AC	ORTRONICS	FIBER INSERTS	
23	0	OR-PMPSE1289	ORTRONICS	T1 PANEL - 12 PORT	SEE T1 PANEL DRAWING FOR DETAILS
24	4	PH3851GJ8	HUBBELL	CAT5E VOIP WALL PLATE	
25	4	12127-001	CPI	2" DRIBING	
26	4	G4X2BL6	PANDUIT	BLACK VERTICLE 4"x2" PANDUIT WIRE DUCT	
27	1	40184-001	CPI	CABLE TRAY GROUNDING JUMPER	
28	1	OR-MM8BDC06	ORTRONICS	MIGHTY MOE DUST COVER	

\* TELECOM CABLE CONTRACTOR TO VERIFY AND ORDER CORRECT QUANTITY.

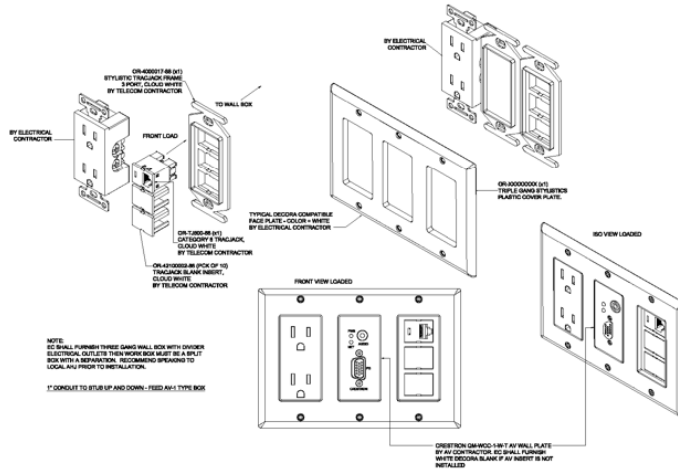




# Typical Aetna Communications Outlet



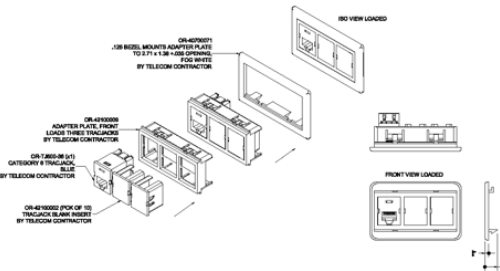
1 TYPE A - COMBO POWER/DATA WALL BOX - THREE GANG - (2) POWER + TEL/DATA  
N.T.S.



2 TYPE B - "AV-1 BOX" : THREE GANG - POWER + AV + TEL/DATA  
N.T.S.



RACO 885 - MASONRY BOX - GANGABLE  
3-1/2" DEEP, 1/2" & 3/4" KNOCKOUTS  
WITH THE RACO 876 BARRIERS  
FLEXIBILITY OF CONSTRUCTING A BOX TO  
HOLD ONE TO EIGHT DEVICES - 3-1/2" DEEP  
BOXES ARE USED IN 8" OR 6" BLOCK WALLS



GENERAL NOTE:  
IF EXACT DIMENSIONS ARE NOT  
PROVIDED CONTRACTOR  
SHOULD ISSUE AN RFI.

3 GANGABLE MOUNTING BOX  
N.T.S.

4 FURNITURE DATA JACK COVER PLATE  
N.T.S.

