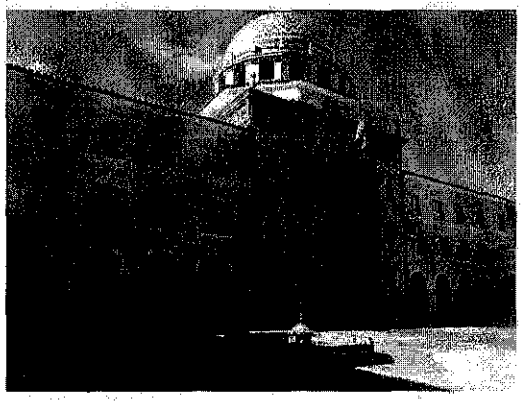
EXHIBIT "D" (56 pages)
SPECIFICATIONS-COMMUNICATIONS HORIZONTAL CABLING



PIMA COUNTY COMMUNICATIONS HORIZONTAL CABLING

Division 27 Specification

Section 27 05 26

Grounding and Bonding for Communications Systems

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2 SCOPE OF WORK

A. This section includes the minimum requirements for the equipment and cable installations in communications equipment rooms (Telecommunications Closets).

B. Included in this section are the minimum composition requirements and installation methods for the following:

1. Busbars
2. Bonding accessories

1.3 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufactures listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Material and work specified herein shall comply with the applicable requirements of:

1. ANSI/TIA/EIA – 568-C.0 *Commercial Building Telecommunications Cabling Standard.*

2. TIA – 569-C *Commercial Building Standard for Telecommunications Pathways and Space.*

3. ANSI/TIA/EIA – 606-B *Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.*

4. ANSI-J-STD – 607-B *Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.*

5. NFPA 70 – *National Electric Code. Current Edition*

6. BICSI – *Telecommunications Distribution Methods Manual. Current Edition*

1.4 SUBMITTALS

A. Provide product data for the following:

1. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

PART 2 – PRODUCTS

2.1 WALL-MOUNT BUSBARS

A. Telecommunications Main Grounding Busbar (TMGB)

1. Telecommunications Main Grounding Busbar (TMGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
2. The busbar shall be 4" (100 mm) high and 20" (510 mm) long and shall have 30 attachment points (two rows of 15 each) for two-hole grounding lugs.
3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 27 lugs with 5/8" (15.8 mm) hole centers and 3 lugs with 1" (25.4) mm) hole centers.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.
6. Design Make shall be:
Chatsworth Products, Inc. (CPI),
Telecommunications Main Grounding Busbar:
Part Number 40153-020, 20" x 4" (510 mm x 100 mm) Telecommunications Main Grounding Busbar, UL Listed.

B. Telecommunications Main Grounding Busbar (TMGB)

1. Telecommunications Main Grounding Busbar (TMGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
2. The busbar shall be 4" (100 mm) high and 12" (300 mm) long and shall have 18 attachment points (two rows of 9 each) for two-hole grounding lugs.
3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 15 lugs with 5/8" (15. 8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.
6. Design Make shall be:
Chatsworth Products, Inc. (CPI),
Telecommunications Main Grounding Busbar:
Part Number 40153-012, 12" x 4" (300 mm x 100 mm) Telecommunications Main Grounding Busbar, UL Listed.

C. Telecommunications Grounding Busbar (TGB)

1. Telecommunications Grounding Busbar (TGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
2. The busbar shall be 2" (50 mm) high and 12" (300 mm) long and shall have 9 attachment points (one row) for two-hole grounding lugs.
3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 6 lugs with 5/8" (15.8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.
6. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Telecommunications Grounding Busbar:
   Part Number 13622-012, 12" x 2" (300 mm x 50 mm) Telecommunications Grounding Busbar, UL Listed.

D. Telecommunications Grounding Busbar (TGB)

1. Telecommunications Grounding Busbar (TGB) shall be constructed of .25" (6.4 mm) thick solid copper bar.
2. The busbar shall be 2" (50 mm) high and 10" (250 mm) long and shall have 7 attachment points (one row) for two-hole grounding lugs.
3. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 4 lugs with 5/8" (15.8 mm) hole centers and 3 lugs with 1" (25.4 mm) hole centers.
4. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" (100 mm) standoff from the wall.
5. The busbar shall be UL Listed as grounding and bonding equipment.
6. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Telecommunications Grounding Busbar:
   Part Number 13622-010, 10" x 2" (250 mm x 50 mm) Telecommunications Grounding Busbar, UL Listed.

2.2 RACK-MOUNT BUSBAR

A. Horizontal Rack Busbar

1. Horizontal rack-mount busbar shall be constructed of 3/16" (4.7 mm) thick by 3/4" (19.1 mm) high hard-drawn electrolytic tough pitch 110 alloy copper bar.
2. Bar shall be 19" EIA or 23" rack mounting width (as specified below) for mounting on relay racks or in cabinets.
3. Bar shall have eight 6-32 tapped ground mounting holes on 1" (25.4 mm) intervals and four 0.281" (7.1 mm) holes for the attachment of two-hole grounding lugs.
4. Each bar shall include a copper splice bar of the same material (to transition between adjoining racks) and two each 12-24 x ¾" copper-plated steel screws and flat washers for attachment to the rack or cabinet.

5. Bar shall be UL Listed as grounding and bonding equipment.
6. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Horizontal Rack Busbar:
   Part Number 10610-019, Ground Bar for 19" Rack.
   Part Number 10610-023, Ground Bar for 23" Rack.

B. Vertical Rack Busbar

1. Vertical rack-mount busbar shall be constructed of 1/4" (6.4 mm) thick by 5/8" (15.8 mm) high hard-drawn electrolytic tough pitch 110 alloy copper bar.
2. Bar shall be 72" (1830 mm) or 36" (910 mm) high (as specified below) for mounting vertically on relay racks.
3. 72" (1830 mm) high bar shall have 13 threaded 1/4-20 attachment points for two-hole lugs with 5/8" (15.8 mm) hole centers and two pairs of threaded studs (one at top, one at bottom) for two-hole lugs with 1" (25.4 mm) hole centers.
4. 36" (910 mm) high bar shall have 8 threaded 1/4-20 attachment points for two-hole lugs with 5/8" (15.8 mm) hole centers and one pair of threaded studs for a two-hole lug with 1" (2.4 mm) hole centers.
5. Each bar shall include a #2 AWG two-hole compression lug for 1" (25.4 mm) hole centers, insulator blocks and mounting screws.
6. Bar shall be UL Listed as grounding and bonding equipment.
7. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Vertical Rack Busbar Kit:
   Part Number 40161-036, Vertical Rack Busbar, 36" (910 mm) H
   Part Number 40161-072, Vertical Rack Busbar, 72" (1830 mm) H

C. Vertical Rack Ground Bar

1. Vertical rack-mount ground bar shall be constructed of .05" (1.3 mm) thick by .68" (17 mm) wide tinned copper strip.
2. Bar shall be 78" (1997 mm) high for mounting vertically on relay racks and shall have holes punched on 5/8"-5/8"-1/2" alternating vertical centers to match the EIA-310-D Universal Hole Pattern for a 45 RMU rack.
3. Each bar shall include three #12-24 zinc-plated thread forming hex washer head installation screws, an abrasive pad and antioxidant joint compound.
4. Bar shall be UL Listed as grounding and bonding equipment.
5. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Vertical Rack Ground Bar Kit:
   Part Number 40172-001, Rack Ground Bar Kit, 45 RMU

2.3 BONDING ACCESSORIES

A. Two Mounting Hole Ground Terminal Block

1. Ground terminal block shall be made of electroplated tin aluminum extrusion.
2. Ground terminal block shall accept conductors ranging from #14 AWG through 2/0.
3. The conductors shall be held in place by two stainless steel set screws.

4. Ground terminal block shall have two 1/4" (6.4 mm) holes spaced on 5/8" (15.8 mm) centers to allow secure two-bolt attachment to the rack or cabinet.
5. Ground terminal block shall be UL Listed as a wire connector.
6. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Two Mounting Hole Ground Terminal Block:
   Part Number 40167-001, Two Mounting Hole Ground Terminal Block, 1 each

B. Compression Lugs

1. Compression lugs shall be manufactured from electroplated tinned copper.
2. Compression lugs shall have two holes spaced on 5/8" (15.8 mm) or 1" (25.4 mm) centers, as stated below, to allow secure two bolt connections to busbars.
3. Compression lugs shall be sized to fit a specific size conductor, sizes #6 to 4/0, as stated below.
4. Compression lugs shall be UL Listed as wire connectors.
5. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Compression Lugs:
   Part Number 40162-901, Compression Lug, #6 Awg, 5/8" (15.8 mm) hole spacing, 1 each.
   Part Number 40162-903, Compression Lug, #6 Awg, 1" (25.4 mm) hole spacing, 1 each.
   Part Number 40162-904, Compression Lug, #2 Awg, 5/8" (15.8 mm) hole spacing, 1 each.
   Part Number 40162-907, Compression Lug, #2 Awg, 1" (25.4 mm) hole spacing, 1 each.
   Part Number 40162-909, Compression Lug, 2/0 Awg, 1" (25. 4 mm) hole spacing, 1 each.
   Part Number 40162-911, Compression Lug, 4/0 Awg, 1" (25.4 mm) hole spacing, 1 each.
   Notes:
   Other sizes are available.

C. Antioxidant Joint Compound

1. Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.
2. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Antioxidant Joint Compound:
   Part Number 40168-101, Antioxidant Joint Compound, Copper-to-Copper Connections, .5 oz, 1 each.
   Part Number 40168-801, Antioxidant Joint Compound, Copper-to-Copper Connections, 8 oz, 1 each.
   Part Number 40166-101, Antioxidant Joint Compound, Aluminum-to-Aluminum or Aluminum-to-Copper Connections, .5 oz, 1 each.
   Part Number 40166-801, Antioxidant Joint Compound, Aluminum-to-Aluminum or Aluminum-to-Copper Connections, 8 oz, 1 each.
   Part Number 40168-150, Antioxidant Joint Compound, Copper-to-Copper Connections, .5 oz, 50 each.

Part Number 40168-812, Antioxidant Joint Compound, Copper-to-Copper Connections, 8 oz, 12 each.
Part Number 40166-150, Antioxidant Joint Compound, Aluminum-to-Aluminum or Aluminum-to-Copper Connections, .5 oz, 50 each.
Part Number 40166-812, Antioxidant Joint Compound, Aluminum-to-Aluminum or Aluminum-to-Copper Connections, 8 oz, 12 each.

D. C-Type, Compression Taps

1. Compression taps shall be manufactured from copper alloy.
2. Compression taps shall be C-shaped connectors that wrap around two conductors forming an irreversible splice around the conductors; installation requires a hydraulic crimping tool.
3. Compression taps shall be sized to fit specific size conductors, sizes #2 AWG to 4/0, as stated below.
4. Compression taps shall be UL Listed.
5. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Compression Taps:
   Part Number 40163-001, Compression Tap, #6 AWG Solid Run to #6 AWG Solid Tap, 1 each.
   Part Number 40163-007, Compression Tap, 2/0 Stranded Run to 2/0 Stranded Tap, 1 each.
   Notes:
   Other sizes are available.

E. Pedestal Clamp With Grounding Connector

1. Pedestal clamp shall be made from electroplated tinned copper or bronze. Installation hardware will be stainless steel.
2. Pedestal clamps shall be sized to fit a specific size conductor, size #6 and/or 2/0, as stated below.
3. Pedestal clamp installation hardware shall be sized to attach to round and/or square raised access floor pedestals that are 1-1/8" to 1-3/4" in diameter, as stated below.
4. Pedestal clamp shall provide straight (in-line) or cross (intersection) support for up to two conductors.
5. Pedestal clamp shall be UL Listed as grounding and bonding equipment.
6. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Pedestal Clamps:
   Part Number 40169-001, Pedestal Clamp, Cross Connector, for 1-1/8" Square Pedestals, with (2) #6 AWG conductors per side, 1 each.
   Part Number 40169-002, Pedestal Clamp, Cross Connector, for 1-1/8" to 1-3/4" Round Pedestals, with (1) #6 AWG and (1) 2/0 conductors per side, 1 each.

F. Pipe Clamp With Grounding Connector

1. Pipe clamp shall be made from electroplated tinned bronze. Installation hardware will be stainless steel.

2. Pipe clamp shall be sized to fit up to two conductors ranging in size from #6 to 250 MCM; conductors must be the same size.
3. Pipe clamp installation hardware shall be sized to attach to pipes, sizes 1" to 6" (.75" to 6.63" in diameter), as stated below.
4. Pipe clamp shall be UL Listed as grounding and bonding equipment.
5. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Pipe Clamps:
   Part Number 40170-002, Pipe Clamp, for 1" to 1-1/4" pipe, 1 each.
   Part Number 40170-003, Pipe Clamp, for 1-1/2" to 2" pipe, 1 each.
   Part Number 40170-004, Pipe Clamp, for 2-1/2" to 3" pipe, 1 each.
   Part Number 40170-005, Pipe Clamp, for 3-1/2" to 4" pipe, 1 each.
   Part Number 40170-006, Pipe Clamp, for 5" to 6" pipe, 1 each.

G. Equipment Ground Jumper Kit

1. Kit includes one 24"L insulated ground jumper with a straight two hole compression lug on one end and an L-shaped two hole compression lug on the other end, two plated installation screws, an abrasive pad and a .5 once tube of antioxidant joint compound.
2. Ground conductor is an insulated green/yellow stripe #6 AWG wire.
3. Lugs are made from electroplated tinned copper and have two mounting holes spaces .5" to .625" apart that accept 1/4" screws.
4. Jumper will be made with UL Listed components
5. Design Make shall be:
   Chatsworth Products, Inc. (CPI),
   Equipment Ground Jumper Kit:
   Part Number 40159-010, Equipment Ground Jumper Kit, 1 each.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Wall-Mount Busbars
1. Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions.
2. Conductor connections to the TMGB or TGB shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.
3. Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
4. The wall-mount busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

B. Rack-Mount Busbars and Ground Bars
1. When a rack or cabinet supports active equipment or any type of shielded cable or cable termination device requiring a ground connection, add a rack-mount horizontal or vertical busbar or ground bar to the rack or cabinet. The rack-mount busbar or ground bar provides multiple bonding points on the rack for rack and rack-mount equipment.

2. Attach rack-mount busbars and ground bars to racks or cabinets according to the manufacturer's installation instructions.
3. Bond the rack-mount busbar or ground bar to the room's TMGB or TGB with appropriately sized hardware and conductor.

C. Ground Terminal Block
1. Every rack and cabinet shall be bonded to the TMGB or TGB.
2. Minimum bonding connection to racks and cabinets shall be made with a rack-mount two-hole ground terminal block sized to fit the conductor and rack and installed according to manufacturer recommendations.
3. Remove paint between rack/cabinet and terminal block, clean surface and use antioxidant between the rack and the terminal block to help prevent corrosion at the bond.

D. Pedestal Clamp
1. At minimum, bond every sixth raised access floor pedestal with a minimum #6 AWG conductor to the TMGB or TGB using a pedestal clamp sized to fit the pedestal and the conductor and installed according to the manufacturer's recommendations.
2. If pedestal clamps are used to construct a signal reference grid, bond the signal reference grid to the TMGB or TGB and bond each rack and/or cabinet to the signal reference grid using a compression tap or similar non-reversible bonding component sized to fit both conductors.
3. Remove paint between the pedestal and pedestal clamp, clean surface and use antioxidant between the pedestal and the clamp to help prevent corrosion at the bond.
4. Remove insulation from conductors where wires attach to the pedestal clamp.

E. Pipe Clamp
1. Bond metal pipes located inside the data center computer room with a minimum #6 AWG conductor to the TMGB or TGB using a pipe clamp sized to fit the pipe and the conductor and installed according to the manufacturer's recommendations.
2. Remove paint between the pipe and pipe clamp, clean surface and use antioxidant between the pipe and the clamp to help prevent corrosion at the bond.
3. Remove insulation from conductors where wires attach to the pipe clamp.

F. Equipment Ground Jumper Kit
1. Bond equipment to a vertical rack-mount busbar or groundbar using ground jumper according to the manufacturer's recommendations.
2. Clean the surface and use antioxidant between the compression lugs on the jumper and the rack-mount busbar or groundbar to help prevent corrosion at the bond.

Section 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

Section 27 11 16

Communications Cabinets, Racks, Frames and Enclosures

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2 SCOPE OF WORK

A. This section includes the minimum requirements for the equipment and cable installations in telecommunications equipment rooms.

B. Included in this section are the minimum composition requirements and installation methods for the following:

Racks.

1.3 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Material and work specified herein shall comply with the applicable requirements of:

1. TIA – 569-B Commercial Building Standard for Telecommunications Pathways and Spaces, 2004

2. ANSI/TIA – 568-C Commercial Building Telecommunications Cabling Standard, 2009

3. ANSI/NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling

4. TIA – 606-A Administration Standard for Commercial Telecommunications Infrastructure, 2007

5. ANSI-J-STD – 607-A Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002

6. ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers, 2005

7. NFPA 70 – National Electric Code, 2008

1.4 SUBMITTALS

A. Provide product data for the following:

1. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

PART 2 – PRODUCTS

2.1 EQUIPMENT RACKS

A. Free Standing Relay Racks (Standard Rack)

1. Racks shall be manufactured from aluminum extrusion.

2. Each rack shall have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack shall assemble with nut and bolt hardware. The base angles shall be pre-punched for attachment to the floor.

3. Equipment mounting channels shall be 3" (76 mm) deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern, 1-3/4" (44.45 mm) rack-mount spaces (U), to provide 45U, 52U or 58U for equipment. Each mounting space (U) shall be marked and numbered on the mounting channel.

4. When assembled with top and bottom angles, equipment-mounting channels shall be spaced to allow attachment of 19" EIA rack-mount equipment. Equipment attachment points shall be threaded with 12-24 roll-formed threads. The rack shall include assembly and equipment-mounting hardware. Racks shall include 50 each combination pan head, pilot point mounting screws.

5. The assembled rack shall measure 7' (2.1 m)/84" (2133 mm) high, 8' (2.4 m)/96" (2438 mm) high or 9' (2.7 m)/108" (2743 mm) high; 20.3" (515.9 mm) wide and 15" (381.0 mm) deep. The sides (webs) of the equipment-mounting channels shall be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.

6. Assembly hardware shall electrically bond the top angles, side channels and base angles together when assembled, and there shall be a masked ground attachment point with 1/4-20 threaded studs spaced 5/8" apart on the inside of the side channel to attach a ground lug allowing easy attachment to the Telecommunications Ground.

7. The rack shall be rated for 1,000 lb (453.6 kg) of equipment.

8. The rack shall be UL and cUL Listed as a Communications Circuit Accessory, DUXR and DUXR7 category, file number 140851.

9. Finish shall be either clear grained aluminum or epoxy-polyester hybrid powder coat in the color as specified below.

10. Design Make shall be:
Chatsworth Products, Inc. (CPI),
Standard Rack

Part Number 55053-703, Standard Rack, 7'H (2.1 m) x 20.3"W (515.9 mm) x 15"D (381.0 mm), 45U x 19"EIA, Black, UL Listed.
Part Number 55053-E03, Standard Rack, 7'H (2.1 m) x 20.3"W (515.9 mm) x 15"D (381.0 mm), 45U x 19"EIA, Glacier White, UL Listed.

Part Number 40605-005, Equipment Mounting Screws, #12-24, 50 pack, Black.
Part Number 40604-003, Rack Installation Kit, Concrete Slab, Zinc.
Part Number 40607-001, Rack Installation kit, Wood Floor, Zinc

PART 3 – EXECUTION

3.1 INSTALLATION

A. Relay Racks

1. Assemble relay racks according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below. (Use CPI Part Number 40604-003 for concrete slab floors or 40607-001 wood floors. Raised floor support kits are also available.)
3. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
4. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.
5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack shall not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.
6. The equipment load will be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws. In seismic areas, secure equipment to shelves with additional bracing.

Section 27 11 23

Communications Cable Management and Ladder Rack

PART 1 – GENERAL

1.3 WORK INCLUDED

B. Provide all labor, materials, and equipment for the complete installation of work called for in the contract documents.

1.4 SCOPE OF WORK

B. This section includes the minimum requirements for the equipment and cable installations in telecommunications rooms.

B. Included in this section are the minimum composition requirements and installation methods for the following:

3. Ladder Rack.

1.3 QUALITY ASSURANCE

D. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner representative.

E. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.

F. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

G. Material and work specified herein shall comply with the applicable requirements of:

8. TIA – 569-B Commercial Building Standard for Telecommunications Pathways and Spaces, 2004

9. ANSI/TIA – 568-C Commercial Building Telecommunications Cabling Standard, 2009

10. ANSI/NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling

11. TIA – 606-A Administration Standard for Commercial Telecommunications Infrastructure, 2007

12. ANSI-J-STD – 607-A Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002

13. ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers, 2005

14. NFPA 70 – National Electric Code, 2008

15. NEMA – VE 1 – Metal Cable Tray Systems, 2009

16. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006

1.4 SUBMITTALS

B. Provide product data for the following:

1. Manufacturers data/cut sheets, product drawing/specifications and installation instructions for all products (submit with bid).

PART 2 – PRODUCTS

2.4 LADDER RACK, SUPPORTS, AND ACCESSORIES

A. Ladder Rack (Universal Cable Runway)

1. Ladder rack shall be manufactured from 3/8" (9.5 mm) wide by 1-1/2" (38 mm) high tubular steel with .065" (1.65 mm) wall thickness.

2. Ladder rack (side stringers) will be 9'-11½" (3.0 m) long. Cross members will be welded in between stringers on 12" (300 mm) intervals/centers beginning 5-3/4" (146 mm) from one end so that there are 10 cross members per ladder rack. There will be 10-1/2" (267 mm) of open space in between each cross member.

3. Ladder rack will be delivered individually boxed, and available in the width(s) specified below.

4. Ladder rack will be UL Classified for suitability as an equipment grounding conductor only (the installer must remove paint or use ground straps at splices and intersections)

5. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.

6. Design Make:
Chatsworth Products, Inc. (CPI),
Universal Cable Runway:

Part Number 10250-704, Universal Cable Runway, 4" (100 mm) Wide, Black.
Part Number 10250-706, Universal Cable Runway, 6" (150 mm) Wide, Black.
Part Number 10250-709, Universal Cable Runway, 9" (230 mm) Wide, Black.
Part Number 10250-712, Universal Cable Runway, 12" (300 mm) Wide, Black.
Part Number 10250-715, Universal Cable Runway, 15" (380 mm) Wide, Black.
Part Number 10250-718, Universal Cable Runway, 18" (460 mm) Wide, Black.
Part Number 10250-724, Universal Cable Runway, 24" (610 mm) Wide, Black.
Part Number 10250-731, Universal Cable Runway, 30" (760 mm) Wide, Black.
Part Number 10250-737, Universal Cable Runway, 36" (910 mm) Wide, Black

B. Horizontal-To-Vertical 90° Turns (Cable Runway Inside Radius Bend)

1. Horizontal-to-vertical 90° turns shall be manufactured from 3/8" (9.5 mm) wide by 1-1/2" (38 mm) high tubular steel with .065" (1.65 mm) wall thickness.

2. Stringers (sides) will be formed in a 90° arc with a 12-1/2" (317.5 mm) outside radius. Cross members will be welded in between stringers on approximate 23° increments so that there are 3 cross members per turn. The welded assembly will create a smooth 90° horizontal-to-vertical turn.

3. Horizontal-to-vertical 90° turns will be available in the width(s) specified below.

4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.

5. Design Make:
Chatsworth Products, Inc. (CPI),
Cable Runway Inside Radius Bend:

Part Number 10724-706, Inside Radius Bend, 6" (150 mm) Wide, Black.
Part Number 10724-709, Inside Radius Bend, 9" (230 mm) Wide, Black.
Part Number 10724-712, Inside Radius Bend, 12" (300 mm) Wide, Black.
Part Number 10724-715, Inside Radius Bend, 15" (380 mm) Wide, Black.
Part Number 10724-718, Inside Radius Bend, 18" (460 mm) Wide, Black.
Part Number 10724-720, Inside Radius Bend, 20" (510 mm) Wide, Black.
Part Number 10724-724, Inside Radius Bend, 24" (610 mm) Wide, Black.

C. Corner Brackets (Cable Runway Corner Bracket)

1. Corner brackets shall be manufactured from 3/8" (9.5 mm) wide by 1-1/2" (38 mm) high tubular steel with .065" (1.65 mm) wall thickness.

2. The inside stringers of the corner bracket will be formed at 90° with a small chamfer at the vertex. The outside stringer of the corner bracket will be formed in a 90° arc that is either 15" (380 mm) or 24" (610 mm) in radius. A single cross member will connect the chamfered portion of the inside stringer to the outside stringer. The welded assembly will create a smooth 90° turn within the L-shaped corner created by two intersecting ladder racks.

3. Corner brackets will be available in the size(s) specified below. Installation hardware will be included with the corner bracket. Corner bracket installation hardware does not include the junction splice kit required to form the L-shaped intersection between two ladder racks.

4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color specified below.

5. Design Make:
Chatsworth Products, Inc. (CPI),

Cable Runway Corner Bracket:

Part Number 11959-715, Corner Bracket, 15" (380 mm) Radius, Black.
Part Number 11959-724, Corner Bracket, 24" (610 mm) Radius, Black.

D. Ladder Rack Splices

1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.

2. Grounding kits will provide a method of bonding ladder rack sections and turns together that is independent of the pathway splices. The grounding kit should be constructed of UL Listed components. The preferred solution is a #6 AWG green insulated stranded copper conductor connected on both ends to ladder rack using two-hole compression lugs and stainless steel hardware.

3. An insulator bar kit will provide a means of electrically isolating individual ladder rack sections through an end-to-end splice separated with a non-conductive material. The preferred solution is a 3/8" (9.5 mm) wide by 1-1/2" (38 mm) high by 5-1/2" (140 mm) long insulator bar made of Delrin® (by DuPont, Delrin is a registered trademark of E.I. du Pont de Nemours and Company).

4. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.

5. Finish (of splice plates and hardware) shall be zinc plate in the color(s) specified below. Colors are applied as a chem. film over the zinc plate.

6. Design Make:
Chatsworth Products, Inc. (CPI),
Cable Runway Splices:

Part Number 11301-701, Butt-Splice Kit, Black.
Compression splice for end-to-end connections.

Part Number 11302-701, Junction-Splice Kit, Black.
Compression splice for T- or L-connections.

Part Number 12061-001, Grounding Kit, Zinc.
Bolted jumper that electrically bonds cable runway sections.

Part Number 10842-001, Insulator Bar Kit, White.
Compression splice for end-to-end connection that electrically isolates cable runway sections.

E. Ladder Rack Supports

1. Supports will be sized to match the width of the ladder rack that is supported. Some supports will work with multiple or all widths of ladder rack.

2. Each support will include a means of mechanically securing ladder rack to the support.

3. Supports will be manufactured from steel or aluminum.

4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below or zinc plate with a gold chem. finish specified gold. Included hardware shall be zinc plated with a gold chem. finish.

5. Design Make:
Chatsworth Products, Inc. (CPI),
Cable Runway Supports:

Part Number 11312-706, Triangular Support Bracket, For 4"-6" (100 mm – 150 mm) Wide Cable Runway (Ladder Rack), 100 lb (45.4 kg) Capacity, Aluminum, Black.
Part Number 11312-712, Triangular Support Bracket, For 6"-12" (150 mm – 300 mm) Wide Cable Runway (Ladder Rack), 100 lb (45.4 kg) Capacity, Aluminum, Black.
Part Number 11312-718, Triangular Support Bracket, For 12"-18" (300 mm – 460 mm) Wide Cable Runway (Ladder Rack), 100 lb (45.4 kg) Capacity, Aluminum, Black.
Wall support for side of cable runway. Installation requires (3) 5/16" or 8 mm lag bolts and (3) flat washers or concrete wall hardware (ordered separately).

Part Number 11746-712, Triangular Support Bracket, For 6" (150 mm) or 12" (300 mm) Wide Cable Runway (Ladder Rack), 400 lb (181.4 kg) Capacity, Steel, Black.
Part Number 11746-718, Triangular Support Bracket, For 18" (460 mm) Wide Cable Runway (Ladder Rack), 400 lb (181.4 kg) Capacity, Steel, Black.
Part Number 11746-724, Triangular Support Bracket, For 24" (610 mm) Wide Cable Runway (Ladder Rack), 400 lb (181.4 kg) Capacity, Steel, Black.
Wall support for side of cable runway. Installation requires (3) 5/16" or 8 mm lag bolts and (3) flat washers or concrete wall hardware (ordered separately).

Part Number 11421-704, Wall Angle Support Kit, For 4" (100 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 11421-706, Wall Angle Support Kit, For 6" (150 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 11421-709, Wall Angle Support Kit, For 9" (230 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 11421-712, Wall Angle Support Kit, For 12" (300 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 11421-715, Wall Angle Support Kit, For 15" (380 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 11421-718, Wall Angle Support Kit, For 18" (460 mm) Wide Cable Runway (Ladder Rack), Steel, Black.

Part Number 11421-720, Wall Angle Support Kit, For 20" (510 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 11421-724, Wall Angle Support Kit, For 24" (610 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Wall support for end of cable runway. Installation requires (2) 5/16" or 8 mm lag bolts and (2) flat washers or concrete wall hardware (ordered separately).

Part Number 11309-001, Foot Kit, Steel, Gold.
Floor support for end of cable runway. (2) L-shaped bracket and (1) butt-splice kit. Installation requires (2) 3/8" or 10 mm lag bolts and (2) flat washers or concrete wall hardware (ordered separately).

Part Number 11241-712, Adjustable Floor Support Channel, For 12" (300 mm) Wide Cable Runway (Ladder Rack), 3" to 8" (80 mm to 200 mm) High, Steel, Black.
Part Number 11241-715, Adjustable Floor Support Channel, For 15" (380 mm) Wide Cable Runway (Ladder Rack), 3" to 8" (80 mm to 200 mm) High, Steel, Black.
Part Number 11241-718, Adjustable Floor Support Channel, For 18" (460 mm) Wide Cable Runway (Ladder Rack), 3" to 8" (80 mm to 200 mm) High, Steel, Black.
Floor support for the bottom of cable runway. 1 pair of channels (2 supports). Includes 5/8" threaded rod and floor installation hardware. Requires accessory anchor installation tool (P/N 06003-001) or substitut M16 threaded rod, (2) lock washers, (4) hex nuts and floor installation hardware (ordered separately).

Part Number 11310-001, Threaded Ceiling Kit, Includes 3/8" Diameter x 6' L Rod, Steel, Gold.
Part Number 11310-003, Threaded Ceiling Kit, Includes 5/8" Diameter x 6' L Rod, Steel, Gold.
Part Number 11310-093, Threaded Ceiling Kit, Includes M10 Diameter x 2 m L Rod, Steel, Gold.
Part Number 11310-094, Threaded Ceiling Kit, Includes M16 Diameter x 2 m L Rod, Steel, Gold.
Ceiling support for the side of cable runway. Kit includes (1) threaded rod, hardware and connectors for cable runway and a concrete ceiling. Use in pairs at each point of support. Ceiling installation hardware not included.

Part Number 12362-706, Center Support Kit, For 6" (150 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 12362-712, Center Support Kit, For 12" (300 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 12362-715, Center Support Kit, For 15" (380 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 12362-718, Center Support Kit, For 18" (460 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Part Number 12362-724, Center Support Kit, For 24" (610 mm) Wide Cable Runway (Ladder Rack), Steel, Black.
Center Support Kit is used with a single threaded rod to support cable runway from the bottom to the ceiling. One support is included per kit. Includes 5/8" Hex

Nuts and Washers. Requires 5/8" rod and ceiling installation hardware or M16 rod, (2) hex nuts, (1 lock washer and ceiling installation hardware (ordered separately).

Part Number 10595-704, Rack-To-Runway Mounting Plate, For 4" (100 mm) Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 10595-708, Rack-To-Runway Mounting Plate, For 5" to 8" (130 mm to 200 mm) Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 10595-712, Rack-To-Runway Mounting Plate, For 9" to 12" (230 mm to 300 mm) Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 10595-718, Rack-To-Runway Mounting Plate, For 15" to 18" (380 mm to 460 mm) Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12408-724, Rack-To-Runway Mounting Plate, For 20" (510 mm) and 24" (610 mm) Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Aluminum, Black.
Rack-To-Runway Mounting Plate attaches cable runway to the top of 2-post freestanding racks in parallel or perpendicular orientation. Includes J-bolt installation hardware for 1-1/2" (38 mm) High cable runway and rack top angles. CPI recommends use with Cable Runway Elevation Kit.

Part Number 12121-709, Rack-To-Runway Mounting Plate, For 5" to 9" (130 mm to 230 mm) Wide Cable Runway (Ladder Rack), For Standard Rack with 6" (150 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12121-712, Rack-To-Runway Mounting Plate, For 9" to 12" (230 mm to 300 mm) Wide Cable Runway (Ladder Rack), for Standard Rack with 6" (150 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12121-718, Rack-To-Runway Mounting Plate, For 15" to 18" (380 mm to 460 mm) Wide Cable Runway (Ladder Rack), for Standard Rack with 6" (150 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12409-724, Rack-To-Runway Mounting Plate, For 20" (510 mm) and 24" (610 mm) Wide Cable Runway (Ladder Rack), for Standard Rack with 6" (150 mm) Deep Equipment Mounting Channels, Aluminum, Black.
Rack-To-Runway Mounting Plate attaches cable runway to the top of 2-post freestanding racks in parallel or perpendicular orientation. Includes J-bolt installation hardware for 1-1/2" (38 mm) high cable runway and rack top angles. CPI recommends use with Cable Runway Elevation Kit.

Part Number 12730-704, Rack-To-Runway Mounting Plate with Bracket, For 4" (100 mm) Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12730-708, Rack-To-Runway Mounting Plate with Bracket, For 5" to 8" (130 mm to 200 mm) Wide Cable Runway (Ladder Rack), for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Steel, Black.

Part Number 12730-712, Rack-To-Runway Mounting Plate with Bracket, For 9" to 12" (230 mm to 300 mm) Wide, for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12730-718, Rack-To-Runway Mounting Plate with Bracket, For 15" to 18" (380 mm to 460 mm) Wide, for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 13730-724, Rack-To-Runway Mounting Plate with Bracket, For 20" (510 mm) and 24" (610 mm) Wide, for Standard and Universal Racks with 3" (80 mm) Deep Equipment Mounting Channels, Aluminum, Black.
Rack-To-Runway Mounting Plate with Bracket attaches cable runway to the top of 2-post freestanding racks in parallel or perpendicular orientation. Includes U-shaped rack bracket and installation hardware for 1-1/2" (38 mm) High Cable Runway and rack top angles. CPI recommends use with Cable Runway Elevation Kit.

Part Number 12731-709, Rack-To-Runway Mounting Plate with Bracket, For 5" to 9" (130 mm to 230 mm) Wide Cable Runway (Ladder Rack), for Standard Rack with 6" (150 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12731-712, Rack-To-Runway Mounting Plate with Bracket, For 9" to 12" (230 mm to 300 mm) Wide Cable Runway (Ladder Rack), for Standard Rack with 6" (150 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12731-718, Rack-To-Runway Mounting Plate with Bracket, For 15" to 18" (380 mm to 460 mm) Wide Cable Runway (Ladder Rack), for Standard Rack with 6" (150 mm) Deep Equipment Mounting Channels, Steel, Black.
Part Number 12731-724, Rack-To-Runway Mounting Plate with Bracket, For 20" (510 mm) and 24" (610 mm) Wide Cable Runway (Ladder Rack), for Standard Rack with 6" (150 mm) Deep Equipment Mounting Channels, Aluminum, Black.
Rack-To-Runway Mounting Plate with Bracket attaches cable runway to the top of 2-post freestanding racks in parallel or perpendicular orientation. Includes U-shaped rack bracket and installation hardware for 1-1/2" (38 mm) High Cable Runway and rack top angles. CPI recommends use with Cable Runway Elevation Kit.

Part Number 10506-102, Cable Runway Elevation Kit, 2" (50 mm), 2-1/2" (64 mm) or 3" (80 mm) High, for Racks, Steel, Gray.
Part Number 10506-202, Cable Runway Elevation Kit, 2" (50 mm), 2-1/2" (64 mm) or 3" (80 mm) High, for Racks, Steel, Computer White.
Part Number 10506-702, Cable Runway Elevation Kit, 2" (50 mm), 2-1/2" (64 mm) or 3" (80 mm) High, for Racks, Steel, Black.

Part Number 10506-106, Cable Runway Elevation Kit, 4" (100 mm), 5" (130 mm) or 6" (150 mm) High, for Racks, Steel, Gray.
Part Number 10506-206, Cable Runway Elevation Kit, 4" (100 mm), 5" (130 mm) or 6" (150 mm) High, for Racks, Steel, Computer White.
Part Number 10506-706, Cable Runway Elevation Kit, 4" (100 mm), 5" (130 mm) or 6" (150 mm) High, for Racks, Steel, Black.

Part Number 10506-112, Cable Runway Elevation Kit, 2" (50 mm), 2-1/2" (64 mm) or 3" (80 mm) High, for Cabinets, Steel, Gray.

Part Number 10506-212, Cable Runway Elevation Kit, 2" (50 mm), 2-1/2" (64 mm) or 3" (80 mm) High, for Cabinets, Steel, Computer White.
Part Number 10506-712, Cable Runway Elevation Kit, 2" (50 mm), 2-1/2" (64 mm) or 3" (80 mm) High, for Cabinets, Steel, Black.

Part Number 10506-116, Cable Runway Elevation Kit, 4" (100 mm), 5" (130 mm) or 6" (150 mm) High, for Cabinets, Steel, Gray.
Part Number 10506-216, Cable Runway Elevation Kit, 4" (100 mm), 5" (130 mm) or 6" (150 mm) High, for Cabinets, Steel, Computer White.
Part Number 10506-716, Cable Runway Elevation Kit, 4" (100 mm), 5" (130 mm) or 6" (150 mm) High, for Cabinets, Steel, Black.
Cable Runway Elevation Kit are L-shaped supports that elevate cable runway 2" (50 mm), 2-1/2" (64 mm), 3" (80 mm) or 4" (100 mm), 5" (130 mm), 6" (150 mm) above the rack or cabinet. May also be used to support cable runway vertically against a wall with a standoff from the wall. Kits for racks must be used with a Rack-To-Runway Mounting Plate. Includes installation hardware for Rack-to-Runway Mounting Plates and Cabinets. Order installation hardware for wall separately.

Part Number 31470-712, Cable Runway Standoff Kit, 12" (300 mm) High, Steel, Black.
Support a second tier of cable runway 12" (300 mm) above the first tier of cable runway with Cable Runway Standoff Kit. Includes one pair of supports and installation hardware.

Part Number 10608-001, Vertical Wall Brackets, 1 pair, Steel, Gold.
Attach cable runway to the wall or floor with no standoff. 1/4" or M6 installation hardware not included.

Part Number 10684-701, Tall Pipe Stand, 2" (50 mm) Diameter x 79" (2010 mm) High, Black. Use for 7' (2.1 m) high supports.
Part Number 10684-702, Tall Pipe Stand, 2" (50 mm) Diameter x 85" (2160 mm) High, Black. Use for 7'-6" (2.3 m) high supports.
Part Number 10684-703, Tall Pipe Stand, 2" (50 mm) Diameter x 91" (2310 mm) High, Black. Use for 8' (2.4 m) high supports.
Part Number 10684-704, Tall Pipe Stand, 2" (50 mm) Diameter x 103" (2620 mm) High, Black. Use for 9' (2.7 m) high supports.
Pipe stands include 1/4" concrete floor installation hardware. Use with cable runway center support kit and 5/8-11 threaded rod.

Part Number 11235-701, Adjustable Floor Support Stands, 5" to 6" (130 mm to 150 mm) High, 1 pair, Black.
Part Number 11236-701, Adjustable Floor Support Stands, 6" to 8" (150 mm to 200 mm) High, 1 pair, Black.
Part Number 11237-701, Adjustable Floor Support Stands, 8" to 10" (200 mm to 300 mm) High, 1 pair, Black.
Adjustable floor support stands include framing bar clamps, threaded rod and hardware. Floor installation hardware is not included. Order 1/4" floor installation hardware separately.

F. Ladder Rack Accessories

1. Cable straps used for attaching cable bundles to the ladder rack cross members must be reusable with a hook and loop-style closure, at least 3/4" (19 mm) wide, and sized for cable bundles that are 2" (50 mm), 3" (80 mm) or 4" (100 mm) in diameter.

2. Cable retaining posts used to keep cable from falling off of the side of the ladder rack shall be manufactured from 1" (25 mm) by 1/2" (12.7 mm) tubular steel with .065" (1.65 mm) wall thickness. Cable retaining posts will be 8" (200 mm) high and will attach to the side stringer of the ladder rack with included hardware. The top of the cable retaining posts will be fitted with a rubberized end cap to protect cables.

3. End caps used to cover the ends of ladder rack will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8" (9.5 mm) wide by 1-1/2" (38 mm) high side stingers and will be sold in pairs.

4. End closing kits used to cover the end of ladder rack will be manufactured from 3/8" (9.5 mm) wide by 1-1/2" (38 mm) high tubular steel with .065" (1.65 mm) wall thickness. Kits will consist of a bar cut to match the width of the ladder rack and the hardware required to attach the bar to the end of a length of ladder rack.

5. Radius drops used to create a radius to form cables over as the cables exit or enter the ladder rack will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3" (75 mm). Radius drops will attach to either the side stringer or the cross member of the ladder rack using a clevis pin. Radius drops will include 1-1/2" (38 mm) high cable spools that attach to the top of the radius drop to guide cables.

6. Movable cross members used to support cross member radius drops in between welded cross members on ladder rack will be manufactured from 3/8" (9.5 mm) by 1-1/2" (38 mm) aluminum bar. Movable cross members will attach to ladder rack at the side stringers with included hardware so that the location of the movable cross member can be adjusted. Moveable cross member will support a cross member radius drop.

7. Cable spools used to separate ladder rack into multiple cable pathways will be made from a black flame retardant ABS. Cable spools will attach to the cross members with a clip that allows the width of the ladder rack to be divided into any proportion. The spools will be 3.94" (100 mm) tall, with a 1.94" (49 mm) diameter top cap, and a body that tapers from .88" (22 mm) diameter at the top to .62" (16 mm) diameter at the bottom.

8. Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack will be made from 1/8" (3 mm) by 1" (25 mm) steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack. The bracket will hang below the ladder rack a minimum of 4" (100 mm). The bracket support surface will be 4" (100 mm) long. The bracket will be zinc plated with a gold chem. finish.

9. Touch-up paint used on ladder rack and ladder rack system components will be color-matched to the finish on the ladder rack or component. A spray on and brush on option will be available.

10. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below. Hardware will be zinc plated with a gold chem. finish.

11. Design Make:
Chatsworth Products, Inc. (CPI),
Cable Runway Accessories:

Part Number 02006-203, Saf-T-Grip Reusable Cable Management Straps, Open Loop Series, 3/4" (19 mm) Wide by 6" (150 mm) Long for 2" (50 mm) Diameter Cable Bundles, Package of 25, Royal Blue.
Part Number 02009-203, Saf-T-Grip Reusable Cable Management Straps, Open Loop Series, 3/4" (19 mm) Wide by 9" (230 mm) Long for 3" (80 mm) Diameter Cable Bundles, Package of 25, Royal Blue.
Part Number 02012-203, Saf-T-Grip Reusable Cable Management Straps, Open Loop Series, 3/4" (19 mm) Wide by 12" (300 mm) Long for 4" (100 mm) Diameter Cable Bundles, Package of 25, Royal Blue.

Part Number 05006-203, Saf-T-Grip Reusable Cable Management Straps, End Grommet & Buckle Series, 3/4" (19 mm) Wide by 6" (150 mm) Long for 2" (50 mm) Diameter Cable Bundles, Package of 25, Royal Blue.
Part Number 05009-203, Saf-T-Grip Reusable Cable Management Straps, End Grommet & Buckle Series, 3/4" (19 mm) Wide by 9" (230 mm) Long for 3" (80 mm) Diameter Cable Bundles, Package of 25, Royal Blue.
Part Number 05012-203, Saf-T-Grip Reusable Cable Management Straps, End Grommet & Buckle Series, 3/4" (19 mm) Wide by 12" (300 mm) Long for 4" (100 mm) Diameter Cable Bundles, Package of 25, Royal Blue.

Part Number 10596-108, Cable Retaining Post, 8" (200 mm) High, Gray.
Part Number 10596-208, Cable Retaining Post, 8" (200 mm) High, Computer White.
Part Number 10596-708, Cable Retaining Post, 8" (200 mm) High, Black.

Part Number 10642-001, Cable Runway Protective End Caps, 1 Pair, Black.

Part Number 11700-704, End Closing Kit, For 4" (100 mm) Wide Cable Runway (Ladder Rack), Black.
Part Number 11700-706, End Closing Kit, For 6" (150 mm) Wide Cable Runway (Ladder Rack), Black.
Part Number 11700-709, End Closing Kit, For 9" (230 mm) Wide Cable Runway (Ladder Rack), Black.
Part Number 11700-712, End Closing Kit, For 12" (300 mm) Wide Cable Runway (Ladder Rack), Black.
Part Number 11700-715, End Closing Kit, For 15" (380 mm) Wide Cable Runway (Ladder Rack), Black.

Part Number 11700-718, End Closing Kit, For 18" (460 mm) Wide Cable Runway (Ladder Rack), Black.
Part Number 11700-720, End Closing Kit, For 20" (510 mm) Wide Cable Runway (Ladder Rack), Black.
Part Number 11700-724, End Closing Kit, For 24" (610 mm) Wide Cable Runway (Ladder Rack), Black.
End Closing Kit includes installation hardware - a Gold Junction Splice Kit.

Part Number 12100-706, Cross Member Radius Drop, 5" (130 mm) Wide, Black. . Fits 6" (150 mm) Wide Cable Runway (Ladder Rack).
Part Number 12100-709, Cross Member Radius Drop, 8" (200 mm) Wide, Black. Fits 9" (230 mm) Wide Cable Runway (Ladder Rack).
Part Number 12100-712, Cross Member Radius Drop, 11" (280 mm) Wide, Black. Fits 12" (300 mm) Wide Cable Runway (Ladder Rack).
Part Number 12100-718, Cross Member Radius Drop, 17" (430 mm) Wide, Black. Fits 18" (460 mm) Wide Cable Runway (Ladder Rack).

Part Number 12101-701, Side Stringer Radius Drop, Universal Cable Runway, Black.

Part Number 12115-709, Movable Cross Member, For 9" (230 mm) Wide Cable Runway and 5" (130 mm) Wide Radius Drop, Black.
Part Number 12115-712, Movable Cross Member, For 12" (300 mm) Wide Cable Runway and 8" (200 mm) Wide Radius Drop, Black.
Part Number 12115-718, Movable Cross Member, For 18" (460 mm) Wide Cable Runway and 11" (280 mm) Wide Radius Drop, Black.

Part Number 13392-711, Cable Runway Dividers, Package of 5, Black.
Part Number 13392-712, Cable Runway Dividers, Package of 25, Black.

Part Number 11268-001, L-Bracket, 4" (100 mm) High x 4" (100 mm) Long, Gold over Zinc.

Part Number 25400-700, Touch-Up Paint in Spray Can, Black.
Paint in spray cans cannot be shipped by air.

Part Number 25401-700, Touch-Up Paint in 1oz. Bottle, Black.

G. Miscellaneous Hardware

1. Design Make:
Chatsworth Products, Inc. (CPI),
Miscellaneous Hardware:

Part Number 11440-001, Threaded Drop Rod, 3/8-16 UNC-2A rod, 6' Long, Gold.
Part Number 11440-002, Threaded Drop Rod, 5/8-11 UNC-2A rod, 6' Long, Gold.
Part Number 11440-003, Threaded Drop Rod, 3/8-16 UNC-2A rod, 12' Long, Gold.

Part Number 11440-004, Threaded Drop Rod, 5/8-11 UNC-2A rod, 12' Long, Gold.
Part Number 11440-005, Threaded Drop Rod, 5/8-11 UNC-2A rod, 8' Long, Gold.
Part Number 11440-006, Threaded Drop Rod, 5/8-11 UNC-2A rod, 4' Long, Gold.
Part Number 11440-007, Threaded Drop Rod, 5/8-11 UNC-2A rod, 6" Long, Gold.
Part Number 11440-008, Threaded Drop Rod, 5/8-11 UNC-2A rod, 8" Long, Gold.
Part Number 11440-009, Threaded Drop Rod, 5/8-11 UNC-2A rod, 5.5" Long, Gold.
Part Number 11440-012, Threaded Drop Rod, 5/8-11 UNC-2A rod, 1' Long, Gold.
Part Number 11440-024, Threaded Drop Rod, 5/8-11 UNC-2A rod, 2' Long, Gold.
Part Number 11440-036, Threaded Drop Rod, 5/8-11 UNC-2A rod, 3' Long, Gold.
Part Number 11440-091, Threaded Drop Rod, M10 x 1.5 Rod, 1 m Long, Gold
Part Number 11440-092, Threaded Drop Rod, M16 x 2 Rod, 2 m Long, Gold
Part Number 11440-093, Threaded Drop Rod, M10 x 1.5 Rod, 2 m Long, Gold
Part Number 11440-094, Threaded Drop Rod, M16 x 2 Rod, 2 m Long, Gold
Part Number 11440-095, Threaded Drop Rod, M10 x 1.5 Rod, 3 m Long, Gold
Part Number 11440-096, Threaded Drop Rod, M16 x 2 Rod, 3 m Long, Gold

Part Number 10697-001, Threaded Rod Coupling Kit, for 3/8-16 UNC-2A rods, Gold.
Part Number 10697-002, Threaded Rod Coupling Kit, for 5/8-11 UNC-2A rods, Gold.

Part Number 11085-001, Threaded Rod Cover, 10' (3 m) Long, Plastic, Gray.

Part Number 10557-001, Threaded Rod I-Beam Clamp, for 3/8-16 UNC-2A rod, Gold.
Part Number 10557-003, Threaded Rod I-Beam Clamp, for 5/8-11 UNC-2A rod, Gold.

Part Number 11408-001, Cable Runway Support Bracket, for 3/8" or M10 drop rod and 1-1/2" (38 mm) High Cable Runway, Gold.
Part Number 11408-003, Cable Runway Support Bracket, for 5/8" or M16 drop rod and 1-1/2" (38 mm) High Cable Runway, Gold.

Part Number 11406-001, Ceiling Support Bracket, for 3/8" or M10 drop rod, Gold.
Part Number 11406-002, Ceiling Support Bracket, for 5/8" or M16 drop rod, Gold.

Part Number 10607-002, Cable Runway Slotted Support Bracket, for 3/8" or M10 drop rod and 1-1/2" (38 mm) High Cable Runway, Gold.
Part Number 10607-001, Cable Runway Slotted Support Bracket, for 5/8" or M16 drop rod and 1-1/2" (38 mm) High Cable Runway, Gold.

Part Number 10873-001, Slip-On Cable Runway Support Bracket, for 5/8" drop rod, Gold.

Part Number 03003-001, Slip-On Lock Nut, for 3/8-16 UNC-2A rod, Zinc plated.
Part Number 03003-002, Slip-On Lock Nut, for 5/8-11 UNC-2A rod, Zinc plated.

Part Number 20142-071, Hex Nut, 1/4-20, Gold.
Part Number 20142-081, Hex Nut, 5/16-18, Gold.
Part Number 20142-091, Hex Nut, 3/8-16, Gold.
Part Number 03001-001, Hex Nut, 1/2-13, Gold.
Part Number 20142-111, Hex Nut, 5/8-11, Gold.

Part Number 04003-002, Split Lock Washer, 1/4, Gold.
Part Number 20141-080, Split Lock Washer, 5/16, Gold.
Part Number 20142-090, Split Lock Washer, 3/8, Gold.
Part Number 20141-100, Split Lock Washer, 1/2, Gold.
Part Number 04003-001, Split Lock Washer, 5/8, Gold.

Part Number 04002-002, Washer, Type A Plain, 3/8, Gold.
Part Number 04002-001, Washer, Type A Plain, 5/8, Gold.

Part Number 02007-004, Hex Lag Screw, 1/4-10 x 2" Long, Gold
Part Number 02006-001, Hex Lag Screw, 1/2-6 x 2" Long, Gold.
Part Number 20098-832, Hex Lag Screw, 3/8-7 x 2" Long, Gold
Part Number 02006-002, Hex Lag Screw, 5/8-5 x 2" Long, Gold

Part Number 20067-001, Anchor, 3/8-16 x Expansion Shield, Zinc.
Part Number 06001-004, Anchor, 5/8-11 Multi-set, Zinc.
Part Number 06003-001, Anchor Setting Tool, for P/N 06001-004.

PART 3 – EXECUTION

3.1 INSTALLATION

B. Ladder Rack

1. Provide all components of the ladder rack system (ladder rack, turns, splices, supports, and accessories) from a single manufacturer.

2. Ladder rack shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.

3. Ladder rack shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

4. Ladder rack splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.

5. Ladder rack shall be supported every 5' (1.5 m) or less in accordance with TIA-569-B. Ladder rack shall be supported within 2' (0.6 m) of every splice and within 2' (0.6 m) on both/all sides of every intersection. Support ladder rack within 2' (0.6 m) on both sides of every change in elevation. Support ladder rack every 2' (0.6 m) when attached vertically to a wall.

6. Heavy-duty splices are recommended for 18" (460 mm) wide or wider ladder rack. Heavy-duty splices are required for any splice formed in the vertical orientation including changes in elevation formed using vertical-to-horizontal 90° turns or horizontal-to-vertical 90° turns. Use heavy-duty splices to secure all overhead turns to the overhead horizontal pathway(s).

7. When the pathway is overhead, ladder rack shall be installed with a minimum clearance of 12" (300 mm) above the ladder rack. Leave a minimum of 12" (300 mm) in between ladder rack and ceiling/building truss structure. Leave a minimum of 3" (75 mm) in between ladder rack and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack shall be installed with a minimum clearance of 12" (300 mm) in between each tier of ladder rack. When located above an acoustical drop ceiling, leave a minimum of 3" (75 mm) clearance between the top of the drop ceiling tiles and the bottom of the ladder rack.

8. When installed under a raised floor, ladder rack shall be installed with a minimum 3" (75 mm) clearance between the top of the ladder rack and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" (75 mm) clearance between ladder racks wherever ladder racks cross.

9. Within each telecommunications room, ladder rack should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack and turns shall be bonded across each splice with a bonding kit or with splices per the manufacturer's installation instructions. Ladder rack shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack where bonding/ground lugs or splices contact the ladder rack so that the lug or spice will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack and ground lug or splice. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack sections and turns and through the bond to the TGB.

10. The quantity of cables within the ladder rack will not exceed a whole number value equal to 50% of the interior area of the ladder rack divided by the cross-sectional area of the cable. The interior area of ladder rack will be considered to be the width of the ladder rack multiplied by a height of 2" (50 mm), unless cable retaining posts are added to the ladder rack. The interior area of ladder rack equipped with cable retaining posts will be considered to be the width of the ladder rack multiplied by a height of 6" (150 mm). Actual cable fill for ladder rack that is not equipped with cable retaining posts will not exceed 2" (50 mm) in

height. Actual cable fill for ladder rack equipped with cable retaining posts will not exceed 6" (150 mm) in height.

11. The combined weight of cables within the ladder rack will not exceed the stated load capacity of the ladder rack as stated in the manufacturer's product specifications or load/design tables.

12. Cables (cable bundles) will be secured to the cross members of ladder rack with 3/4" (19 mm) wide reusable straps. Straps are not required when ladder rack is equipped with cable retaining posts.

13. Add 8" (200 mm) high cable retaining posts to the open sides of ladder rack when cable fill exceeds 2" (50 mm) in height or when cable bundles cannot be secured directly to the ladder rack cross members with a strap. Cable fill within any ladder rack should not exceed 6" (150 mm) in height.

14. When a single ladder rack supports different types of cable media, the cable media will be separated within the pathway by cable spools that attach to the cross members on the ladder rack. Treat each type of cable media and divided area of the ladder rack separately when determining cable fill limits.

15. Use a radius drop to guide cables wherever cable exits overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field. If necessary, provide a moveable cross member also to attach and align the radius drop in between the welded cross members of a ladder rack.

16. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.

17. Use auxiliary support brackets that attach to the side stringer of the ladder rack to support interconnect cabling (patch cords, equipment cords, jumper cords) that is routed between racks using the ladder rack. Auxiliary support brackets can be used to support other conductors that should be physically separated from cables within the ladder rack as defined by local code or the authority having jurisdiction (AHJ).

18. Whenever possible, maintain a 2' (0.6 m) separation between ladder rack used for communications cables and pathways for other utilities or building services.

19. The installer will provide touch-up paint color-matched to the finish on the ladder rack and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Horizontal (distribution) communications wiring and connecting hardware from Telecommunications Room (TR) to Telecommunication Outlets (TO).

1.2 RELATED REQUIREMENTS

A. Section 27 05 26 – Grounding and Bonding for Communications Systems.

B. Section 27 05 28 – Pathways for Communications Systems.

C. Section 27 10 00 – Structured Cabling.

D. Section 27 11 00 – Communications Equipment Room Fittings.

E. Section 27 13 00 – Communications Backbone Cabling.

F. Section 27 16 00 – Communications Connecting Cords, Devices, and Adapters.

1.3 REFERENCE STANDARDS

A. ANSI TIA-492.CAAB – Detail Specification for Class Iva Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak. Current Edition

B. ANSI/TIA 526 – OFSTP-19 Optical Signal-to-Noise Ratio Measurement Procedures for Dense Wavelength-Division Multiplexed Systems.

C. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises.

D. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.

E. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards

F. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard

G. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.

H. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.

I. ANSI/JSTD-607-B – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.

J. NFPA 70 – National Electrical Code (NEC).

K. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM)

1.4 PRE-INSTALLATION MEETINGS

A. Convene pre-installation meeting 2 weeks before start of installation of communications horizontal cabling.

B. Require attendance of parties directly affecting work of this section, including Contractor, Architect, installer, and manufacturer's representative.

C. Review materials, installation, field quality control, labeling, protection, and coordination with other work.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data sheets, including installation instructions verifying that materials comply with specified requirements and are suitable for intended application.

C. Installer's Project References: Submit installer's list of successfully completed communications horizontal cabling projects, including project name and location, name of architect, and type and quantity of communications horizontal cabling installed.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer regularly engaged, for past 5 years, in manufacture of communications horizontal cabling of similar type to that specified.

B. Installer's Qualifications:
   1. Approved Leviton Optimized Installer or Berk-Tek Oasis Optimized Integrator Optimized before, during, and through completion of the system installation. Supporting documentation will be required as part of the submittal.

   2. Responsible for workmanship and installation practices in accordance with Leviton Optimized Installer Program and Berk-Tek Oasis Program.

   3. Communications Contractors shall have an office and maintain normal operations within 25 miles of downtown Tucson in order to reduce the carbon emission footprint.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer's instructions.
   2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
   3. Store materials in clean, dry area indoors.
   4. Protect materials during storage, handling, and installation to prevent damage.

1.8 WARRANTY

A. The horizontal communications cabling system installed shall be eligible for coverage by a Limited Lifetime Warranty to the end user.
   1. Horizontal channels shall be completed with Leviton Network Solutions factory-terminated copper and/or fiber optic patch cords in order to be eligible for the applicable Berk-Tek or Leviton Warranty with channel performance guarantees.
   2. Approved product shall be listed on the most recent version of the applicable Berk-Tek Leviton Technologies data sheets for each Berk-Tek Leviton Technologies solution.

B. Optimized Installer/Optimized Integrator shall provide labor, materials, and documentation in accordance with Berk-Tek and Leviton Network Solutions requirements necessary to ensure that the Owner will be furnished with a Limited Lifetime Warranty.

C. The installed structured cabling system shall provide a warranty guaranteeing installed channel performance above the ANSI/TIA 568-C requirements for Cat 6, and/or Cat 6A Atlas-X1 XTP cabling systems or ISO 11801 requirements for Cass D, Class E, and/or Class E_a.
   1. Standards-compliant channel or permanent link performance tests shall be performed in the field with a Berk-Tek Leviton Technologies approved certification tester in the appropriate channel or permanent link test configuration. See 1.8 A.1 above for channel requirements.

D. Necessary documentation for warranty registration shall be provided to the manufacturer by the installer (within 10 days) following 100 percent testing of cables.
   1. Submit test results to Leviton Network Solutions or to Berk-Tek, in the certification tester's original software files.
   2. Installer shall ensure that the warranty registration is properly submitted, with all required documentation within 10 days of project completion.
   3. Optimized Contractor/Optimized Integrator must adhere to the terms and conditions of the respective manufacturer's warranty programs.

E. Installer shall ensure that the Owner receives the manufacturer issued project warranty certificate within 60 calendar days of warranty registration.

F. Installer must recycle and use every measure to reduce waste on Pima County projects.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Leviton Network Solutions, 2222 222nd Street SE, Bothell, Washington 98021. Phone 425-486-2222. Fax 425-485-3373. Website www.leviton.com.

Berk-Tek, A Nexans Company, 132 White Oak Road, New Holland, PA 17557 Phone: 717-354-6200. Fax 717-354-7944. Website www.berktek.com.

2.2 SYSTEM DESCRIPTION

A. Horizontal Distribution Subsystem: Intra-building twisted-pair and fiber optic communications cabling connecting Telecommunication Rooms (TRs) to Telecommunication Outlets (TOs) located at individual work areas.

B. Horizontal Cabling: Combination of the following types of cables from TR to TO:
   1. Category 6A Shielded Atlas-X1 CS6700 (100-Ohm, 4-pair, Foiled unshielded twisted pair) cables from TRs to TOs, all ports unless otherwise specified. – All new installations (Greenfield).

C. Communications Horizontal Cabling System: Includes cables, jacks, patch panels, connecting blocks, patch cords, fiber connectors, fiber adapter plates, fiber enclosures, jumpers, and necessary support systems, such as cable managers and faceplates.

D. Cables: Route through conduit, cable trays, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile, and through plenum air-handling spaces above ceiling tile.

E. Furnish and install all materials necessary for a complete and working communications horizontal cabling system.

2.3 STATION CABLING

A. Category 6A Shielded Twisted Pair with innovative crosstalk prevention technology: **CS6700 Cat 6A Shielded System.**

   1. 100 ohm, Category 6A, 23 AWG, 4-pair shielded twisted pair, LANmark10G FTP, CMR rated.
      Color: Blue
      Part Number: 10143424
      Cable: Third-party verified by ETL.
      Berk-Tek LANmark-10G FTP CMP

      a. All category cabling manufacturers must be able to provide documentation from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications, not simply at or above the standard.

2. Channel margin guarantees for a **CS6700 Cat 6A Shielded System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-connector channel).

a.	Insertion Loss	3 %
b.	NEXT	4 dB
c.	PSNEXT	6 dB
d.	ACR-F (ELFEXT)	8 dB
e.	PSACR-F (PSELFEXT)	8 dB
f.	Return Loss	3 dB
g.	ACR-N	7 dB
h.	PSACR-N	8 dB
i.	PSANEXT	16 dB
j.	PSAACR-F	16 dB

B. Single-Mode Optical Fiber Cable. **OS2 Fiber Optic System:**

1. Each Single-mode Fiber shall be:
   a) Dispersion - unshifted single mode optical fibers with Low Water Peak complying with ITU-T G.652.D and with improved bending loss complying with ITU-T G.657.A1.
   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^2. 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 9.2 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 for loose tube fibers shall be 0.4/0.3 dB/km @ 1310/1550 nm.
   f) Maximum cabled attenuation for tight buffer fibers shall be 0.7/0.7 dB/km @ 1310/1550 nm.
   g) The cabled cutoff wavelength shall be ≤1260 nm when measured in accordance with ANSI/EIA/TIA-455-80-C.

2. Physical Characteristics:
   a) Shall be suitable for use in indoors or in indoor/outdoor applications.
   b) Appropriately flame rated optical cable shall be suitable for use in risers, plenums and horizontal applications.
   c) Plenum rated optical cables shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating. Riser rated optical cables shall have and be marked with an UL-OFNR and OFN FT4 Flame Rating
   d) Shall comply with the requirements of ICEA S-83-596 (Premises), ICEA S-104-696 (I/O), or ANSI/ICEA S-87-640 (Outside Plant, OSP).
   e) Suitable for underground or aboveground conduits.
   f) Optical cables and fibers shall be color coded in accordance with EIA/TIA-598-C.
   g) Shall have a ripcord for overall jacket.

3. Design Make:

   a) **Berk-Tek Riser optical fiber cable with OS2 (Low Water Peak) Bend-insensitive Singlemode fiber**

LTRxxxAB0403, (006 to 012 Bend-insensitive optical fibers, I/O Loose Tube)
LTR12BxxxAB0403, (012 to 432 Bend-insensitive optical fibers, I/O Loose Tube)
PDRxxxAB0707 (006 to 024 Bend-insensitive optical fibers, Indoor Tight Buffer)
PDR12BxxxAB0707, (036 to 144 Bend-insensitive optical fibers, Indoor Tight Buffer)

2.4 MODULAR JACKS AND FIBER ADAPTERS FOR WORKSTATION OUTLETS

A. Augmented Category 6 Shielded Modular Jacks: **CS6700 Cat 6A Shielded System.**

1. 8-position modular jack, Category 6A, IDC terminals, T568A/B wiring scheme.
2. The modular connector shall exceed all component performance requirements in the ANSI/TIA-568-C.2 standard for Augmented Category 6 from 1 MHz to 500 MHz to support the IEEE 802.3an standard for 10GBASE-T network performance
3. The Modular Connector shall be terminated without the need for any punch down tool or other specialized or proprietary termination tool.
4. The Connector Module shall feature a termination wire manager that holds individual conductors in place during termination. The wire manager shall incorporate a 360-degree bonding mechanism for cable shielding, as well as a capture feature for the shielded cable drain wire.
5. The Shielded Category 6A Modular Connector termination method shall be consistent with the termination method available for shielded modules from the same manufacturer. The same termination method shall also be consistent with Category 6A UTP modules from the same manufacturer.
6. The Modular Connector shall be reusable and support multiple termination and re-termination cycles and be facilitated by simple termination release levers.
7. The modular connector shall be independently tested and verified by Intertek (ETL) to exceed Category 6A component performance.
8. The eight-position connector module shall utilize a method of tine tensioning that prevents six-position modular plug insertion from damaging either the cord or the module.
9. The connector body shall be made of die-cast zinc and all plastic components shall be made of high-impact, fire-retardant plastic rated UL 94V-0.
10. The connector shall also be in compliance will all National Electrical Codes; compliant with ANSI/TIA-1096-A (formerly FCC Part 68); cULus Listed; and independently tested for component compliance.
11. In addition to Category 6A component compliance, the connector shall have the ability to support high megabit and shared sheath applications.
12. Connector wiring shall be universal and will accommodate both T568A and T568B pair/pin assignments.
13. The connector shall incorporate a triple-stage compensation design with integrated flexible circuit design that enhances link and channel performance.
14. The modular connector shall fit a range of telecommunications faceplates, outlets, and field-configurable patch panels.
15. The modular connector shall be available in 13 TIA 606-A compatible colors.
16. Connector Module shall be supplied with interchangeable icons (voice, data, A/V, and blank, color coded to match the connector face) for easy identification and tracking of data, voice, or other functions.
17. Additional bulk Icons for the connector shall be available in 13 colors to facilitate a broad range of connector marking/identification options.
18. Connector Modules shall be available with an internal shutter to protect against dust and debris
19. Connector Module shall have a maximum depth of 1.31"

20. Each connector shall be identified on its face as CAT 6A.
21. Basis for design: Leviton Atlas-X1 Shielded Cat 6A Connector. Category 6A Plenum Rated (UL Standard 2043).
22. Color: Blue & Orange (13 colors available).
23. Part Numbers: Standard version: 6ASJK-RL6 (blue).
Standard version: 6ASJK-RO6 (orange).
Additional Icons: ICONS-IC* (72 two-sided Icons)
* = color option

B. Single Mode Fiber Modular Adapters for workstation outlets: Use for **OS2 Fiber Optic System.**

1. QuickPort Duplex LC Adapter, blue adapter for OS1/OS2 Single Mode fiber, zirconia ceramic sleeve.
   a. Color of plastic housing: ivory
   b. Part Number: Leviton 41085-SLI (ivory).
2. QuickPort Simplex SC Adapter, for OS1/OS2 Single Mode fiber, zirconia ceramic sleeve.
   a. Color of plastic housing: ivory
   b. Part Number: Leviton 41085-SIC (ivory).

2.5 WORK AREA OUTLETS

A. Flush-Mounted Plastic Faceplates:
1. 1-port single-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-1IS (ivory).
2. 2-port single-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-2IS (ivory).
3. 3-port single-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-3IS (ivory).
4. 4-port single-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-4IS (ivory).
5. 6-port single-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-6IS (ivory).
6. 4-port dual-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-4IP (ivory).
7. 6-port dual-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-6IP (ivory).
8. 8-port dual-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-8IP (ivory).
9. 12-port dual-gang plastic wallplate with ID windows.
   a. Colors: ivory
   b. Part Number: Leviton 42080-12I (ivory).

10. Faceplate Colors: Coordinate with Architect to match finish. Part numbers shown are for standard color of white. Also available in Light Almond, Ivory, Grey, and Black.

B. Flush-Mounted Stainless Steel Faceplates:
   1. 1-port QuickPort faceplate with mounting lugs for wall phone, stainless steel, mounts onto single-gang wall box.
      a. Part Number: Leviton 4108W-0SP (flush plate) or 4108W-1SP (jack area recessed).
   2. 1-port QuickPort single-gang stainless steel wallplate, with ID windows
      a. Part Number: Leviton 43080-1L1.
   3. 2-port QuickPort single-gang stainless steel wallplate, with ID windows
      a. Part Number: Leviton 43080-1L2.
   4. 3-port QuickPort single-gang stainless steel wallplate, with ID windows
      a. Part Number: Leviton 43080-1L3.
   5. 4-port QuickPort single-gang stainless steel wallplate, with ID windows
      a. Part Number: Leviton 43080-1L4.
   6. 6-port QuickPort single-gang stainless steel wallplate, with ID windows
      a. Part Number: Leviton 43080-1L6.
   7. 2-port QuickPort dual-gang stainless steel wallplate, with ID windows
      a. Part Number: Leviton 43080-2L2.
   8. 6-port QuickPort dual-gang stainless steel wallplate, with ID windows
      a. Part Number: Leviton 43080-2L6.
   9. 8-port QuickPort dual-gang stainless steel wallplate, with ID windows
      a. Part Number: Leviton 43080-2L8.

C. Surface-Mounted Outlet Boxes (Plenum Rated) for WAP Installations:
   1. 1-port QuickPort surface-mount box, plastic, with ID window.
      a. Color: ivory
      b. Part Number: Leviton 41089-1IP (ivory).
   2. 2-port QuickPort surface-mount box, plastic, with ID window.
      a. Color: ivory
      b. Part Number: Leviton 41089-2IP (ivory).
   3. 2-port QuickPort surface-mount box, plastic, with ID window, extra-deep for shielded connectors, Cat 6A, other larger bend-radius cable applications.
      a. Color: ivory
      b. Part Number: Leviton 4S089-2IP (ivory)

D. Surface-Mounted Outlet Boxes (Plenum Rated):
   1. 1-port QuickPort surface-mount box, plastic, with ID window.
      a. Color: white
      b. Part Number: Leviton 41089-1WP (white).
   2. 2-port QuickPort surface-mount box, plastic, with ID window.
      a. Color: white
      b. Part Number: Leviton 41089-2WP (white).
   3. 4-port QuickPort surface-mount box, plastic, with ID window.
      a. Color: white
      b. Part Number: Leviton 41089-4WP (white).
   4. 6-port QuickPort surface-mount box, plastic, with ID window.
      a. Color: white
      b. Part Number: Leviton 41089-6WP (white).
   5. 12-port QuickPort surface-mount box, plastic, with ID window.
      a. Color: white

b. Part Number: Leviton 41089-12W (white)

6. 2-port QuickPort surface-mount box, plastic, with ID window, extra-deep for shielded connectors, Cat 6A, other larger bend-radius cable applications.
   a. Color: white
   b. Part Number: Leviton 4S089-2WP (white)
7. 4-port QuickPort surface-mount box, plastic, with ID window, extra-deep for shielded connectors, Cat 6A, other larger bend-radius cable applications.
   a. Color: white
   b. Part Number: Leviton 4S089-4WP (white)
8. Surface Box Colors: part numbers shown are for white. Also available: Ivory, Grey, and Black.
   a. Coordinate with Architect to match finish.
   b. (Compliant with NEC 300-22 (b)

E. Modular Furniture Faceplates:
1. 2-port furniture wallplate fits 1.38-inch by 2.63-inch furniture knockout, with ID window.
   a. Colors: ivory
   b. Part Number: Leviton 49910-SI2 (ivory).
2. 4-port furniture wallplate fits 1.38-inch by 2.63-inch furniture knockout, with ID window.
   a. Colors: ivory
   b. Part Number: Leviton 49910-SI4 (ivory).
3. 4-port furniture wallplate fits 1.38-inch by 2.63-inch furniture knockout, with ID window. Extra-deep version with additional room for cable bend radius.
   a. Colors: ivory
   b. Part Number: Leviton 49910-EI4 (ivory).
4. 2-port furniture wallplate fits 1.88-inch by 2.98-inch Hermann-Miller furniture knockout, with ID window.
   a. Colors: ivory
   b. Part Number: Leviton 49910-HI2 (ivory).
5. 4-port furniture wallplate fits 1.88-inch by 2.98-inch Hermann-Miller furniture knockout, with ID window.
   a. Colors: ivory
   b. Part Number: Leviton 49910-HI4 (ivory).
6. Furniture Faceplate Colors: Part numbers shown are for white. Also available: Ivory, grey, and black. Coordinate with Architect to match finish.

F. Mounting Frames for QuickPort Jacks and Connectors
1. 1-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41641-00I (ivory).
2. 2-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41642-00I (ivory).
3. 3-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41643-00I (ivory).
4. 4-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41644-00I (ivory).
5. 6-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white

b. Part Number: Leviton 41646-00I (ivory)

6. 2-port QuickPort Duplex 106-style frame. Fits in Duplex electrical-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41087-2IP (ivory).
7. Decora-style wallplates for above mounting frames
   a. Single-gang, nylon: Leviton part number 80401-0NI (ivory)
   b. Dual-gang, nylon: Leviton part number 80409-0NI (ivory)
8. 4-port QuickPort Duplex 106-style frame. Fits in Duplex electrical-style wallplate
   a. Colors: ivory
   b. Part Number: Leviton 41087-QIP (ivory).
9. Duplex electrical-style wallplates for above mounting frames
   a. Single-gang, nylon: Leviton part number 80703-00I (ivory)
   b. Dual-gang, nylon: Leviton part number 80716-00I (ivory)

G. Mounting Frame colors: Part numbers shown are for white. Also available: Light almond, ivory, grey, black (and brown for the Decora-style frames). Coordinate with Architect to match finish.

H. In-Ceiling Brackets - Mounting QuickPort Jacks, Connectors, 1 & 2 Port Surface Mounted Box, Slack Loops.
   1. QuickPort In-Ceiling 2 Port Bracket, includes clip for drop wire/rod
      a. Colors: Metal
      b. Part Number: Levlton 49223-CBC.
   2. QuickPort In-Ceiling 2 Port Bracket, no clip .
      a. Colors: Metal
      b. Part Number: Leviton 49923-CB0.

I. Multimedia Outlet System (MOS):
   1. Single-gang Multimedia Outlet System wallplate, plastic, with ID windows. Holds a wide variety of copper, fiber, and/or audio-video inserts.
      a. Color: ivory
      b. Part Number: Leviton 41290-SMI (ivory).
   2. Dual-gang Multimedia Outlet System wallplate, plastic, with ID windows. Holds a wide variety of copper, fiber, and/or audio-video inserts.
      a. Color: ivory
      b. Part Number: Leviton 41290-DMI (ivory).
   3. Multimedia Outlet System wallplates, Stainless Steel, with ID windows. Holds a wide variety of copper, fiber, and/or audio-video inserts.
      a. Color: Stainless Steel
      b. Part Numbers: Single-gang Leviton 41290-SMS (Stainless).
         Dual-gang Levlton 41290-DMS (Stainless).
         Three-gang Leviton 41290-TMS (Stainless).
   4. Fiber storage/spacer ring, plastic. Fits Dual-gang Multimedia Outlet System wallplate.
      a. Color: ivory
      b. Part Number: Leviton 41290-DRI (ivory).
   5. 6-port Multimedia Outlet System surface-mount box, plastic, with ID window. Holds a wide variety of copper, fiber, and/or audio-video inserts.
      a. Color: white
      b. Part Number: Leviton 41290-SMI (ivory).
   6. Multimedia Outlet System (MOS) colors: Part numbers shown are for ivory. Coordinate with Architect to match finish.

7. Multimedia Outlet System (MOS) Inserts: For a complete list of MOS Inserts available please visit www.leviton.com/mos

2.6 PATCH PANELS

A. Atlas-X1 Shielded Patch Panels: **CS6700 Cat 6A Shielded System.**

1. 24-port, 1RU, flat metal, shielded Atlas-X1 patch panel
   a. Part Number: Leviton 4S255-S24.
2. 48-port, 2RU, flat metal, shielded Atlas-X1 patch panel
   a. Part Number: Leviton 4S255-S48.
3. 24-port, 1RU, angled metal, shielded Atlas-X1 patch panel
   a. Part Number: Leviton 4S256-S24.
4. 48-port, 2RU, angled metal, shielded Atlas-X1 patch panel
   a. Part Number: Leviton 4S256-S48.
5. 48-port, 1RU, flat metal, shielded Atlas-X1 patch panel
   a. Part Number: Leviton 4S255-D48.
6. 48-port, 1RU, angled metal, shielded Atlas-X1 patch panel
   a. Part Number: Leviton 4S256-D48.

   (Only as specified by Pima County IT)

2.7 FIBER OPTIC TERMINATION ENCLOSURES and SPLICE TRAYS. Use for OS2 Fiber Optic Systems

A. Opt-X 1000i Fiber Optic Enclosures: High-end features, all metal enclosure, rack mountable, holds various fiber adapter plates, splice trays, or MTP modules, based on connector choice and density requirements.
   1. 1RU Opt-X 1000i rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 72 fiber strands (LC), 3 fiber adapter plates and 3 splice trays, or 3 MTP modules
      b. Part Number: Leviton 5R1UM-S03.
   2. 2RU Opt-X 1000i rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 144 fiber strands (LC), 6 fiber adapter plates and 6 splice trays, or 6 MTP modules
      b. Part Number: Leviton 5R2UM-S06.
   3. 3RU Opt-X 1000i rack-mount Fiber Optic Enclosure, empty.
      a. Capacity: 216 fiber strands (LC), 9 fiber adapter plates and 9 splice trays, or 9 MTP modules
      b. Part Number: Leviton 5R3UM-F09.
   4. 4RU Opt-X 1000i rack-mount Fiber Optic Enclosure, empty.
      a. Capacity: 288 fiber strands (LC),12 fiber adapter plates and 12 splice trays, or 12 MTP modules
      b. Part Number: Leviton 5R4UM-F12.

B. Opt-X Ultra HD Fiber Optic Enclosures
   1. 1RU Opt-X Ultra HD rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 96 fiber strands (LC), 4 Opt-X HD fiber adapter plates or 4 Opt-X HD MTP cassette modules
      b. Part Number: Leviton 5R1UH-S08

2. 2RU Opt-X Ultra HD rack-mount Fiber Optic Enclosure, empty, with sliding tray.
   a. Capacity: 192 fiber strands (LC), 8 Opt-X HD fiber adapter plates or 8 Opt-X HD MTP cassette modules
   b. Part Number: Leviton 5R1UH-S16

C. Opt-X Ultra Fiber Optic Enclosures: High-end appearance, metal and composite, rack mountable, holds various fiber adapter plates, splice trays, or MTP modules, based on connector choice and density requirements.
   1. 1RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 72 fiber strands (LC), 3 fiber adapter plates and 3 splice trays, or 3 MTP modules
      b. Part Number: Leviton 5R1UH-S03.
   2. 2RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 144 fiber strands (LC), 6 fiber adapter plates and 6 splice trays, or 6 MTP modules
      b. Part Number: Leviton 5R2UH-S06.
   3. 4RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 288 fiber strands (LC),12 fiber adapter plates and 12 splice trays, or 12 MTP modules
      b. Part Number: Leviton 5R4UH-S12.

D. Splice Trays
   1. 12-fiber Mini Splice Tray, 3.74" x 5.59"
      a. Part Number: Leviton T5PLS-12F
   2. 24-fiber High-density Splice Tray, 4.5" x 7.63"
      a. Part Number: Leviton T5PLS-24F

E. Splice Cassettes
   1. Use for **OS2 Fiber Optic System**
      a. Opt-X 12-Fiber LC OS2 Splice Module
         1) Part Number: Leviton SPLCS-12L
      b. Opt-X 12-Fiber LC/APC OS2 Splice Module
         1) Part Number: Leviton SPLCS-12V
      c. Opt-X 12-Fiber SC OS2 Splice Module
         1) Part Number: Leviton SPSCS-12L
      d. Opt-X 12-Fiber SC/APC OS2 Splice Module
         1) Part Number: Leviton SPSCS-12V
      e. Opt-X 24-Fiber LC OS2 Splice Module
         1) Part Number: Leviton SPLCS-24L
      f. Opt-X 24-Fiber LC/APC OS2 Splice Module
         1) Part Number: Leviton SPLCS-24V

2.8 FIBER OPTIC ADAPTER PLATES

A. Single Mode Adapter Plates, for **OS2 Fiber Optic System**.
   1. 6-LC duplex (12-fiber) singlemode OS1/OS2, blue adapter plate, zirconia-ceramic sleeves.
      a. Part Number: Leviton 5F100-2LL.
   2. 6-LC quad (24-fiber) singlemode OS1/OS2, blue adapter plate, zirconia-ceramic sleeves.
      a. Part Number: Leviton 5F100-4LL.

3. 6-SC duplex (12-fiber) singlemode OS1/OS2, blue adapter plate, zirconia-ceramic sleeves.
   a. Part Number: Leviton 5F100-2LC.

B. Opt-X HD Fiber Adapter Plates (for Opt-X 1000i HD Fiber Enclosures) Use for **OS2 Fiber Optic Systems**, as specified.
   1. OS2, Quad LC (Blue), 12 fibers, Zirconia Ceramic Sleeve
      a. Part Number: Leviton 5FUHD-6LL
   2. OS2, Duplex SC (Blue), 6 fibers, Zirconia Ceramic Sleeve
      a. Part Number: Leviton 5FUHD-6LC
   3. Opt-X HD Blank Adapter Plate (Black)
      a. Part Number: Leviton 5FUHD-BLK

2.9 MTP FIBER OPTIC CASSETTE MODULES (Data Center)

A. Opt-X Unity 40/100 MTP Cassette Modules for 50µm LOMM fiber, OM3 and OM4. Use for **OM3 Fiber Optic System.**
   1. Use configurator for optioning Opt-X Unity 40/100 MTP Cassettes
      a. www.leviton.com/configurator

B. www.leviton.com/configuratorOpt-X HD MTP Cassettes for Opt-X Ultra HD and Opt-X 1000i HD Fiber Enclosures
   1. Use configurator for optioning Opt-X HD MTP Cassettes
      a. www.leviton.com/configurator (verify all configurations with Technical Support Team)

2.10 FIBER OPTIC CONNECTORS

A. OS2 Single Mode Fiber Optic Connectors (blue): Use for **OS2 Fiber Optic System**
   1. FastCam LC Connector
      a. Part Number: Leviton 49991-SLC
   2. FastCam SC Connector
      a. Part Number: Leviton 49991-SSC

2.11 PATCH CORDS/JUMPERS

A. Atlas-X1 Category 6A Modular Patch Cords: **CS6700 Cat 6A Shielded Premium+ UTP System.**
   1. Slim-Line style, Category 6A, shielded cord (use same cord for shielded or unshielded systems) 4-pair, stranded wire construction.
      b. Color: 9 colors available.
      c. Part Numbers:
         1) Leviton 6AS10-03L (3 feet, Blue).
         2) Leviton 6AS1-03O (3 feet, Orange).
         3) Leviton 6AS10-05L (5 feet, Blue).
         4) Leviton 6AS10-05O (5 feet, Orange).
         5) Leviton 6AS10-07L (7 feet, Blue).
         6) Leviton 6AS10-07O (7 feet, Orange).
         7) Leviton 6AS10-10L (10 feet, Blue).

8) Leviton 6AS10-10O (10 feet, Orange).
9) Leviton 6AS10-15L (15 feet, Blue).
10) Leviton 6AS10-15O (15 feet, Orange).
11) Leviton 6AS10-20L (20 feet, Blue).
12) Leviton 6AS10-20O (20 feet, Orange).

B. Single Mode Fiber Optic Jumpers:

1. OS2, yellow. Factory-terminated, double-ended, 2-strand singlemode cordage, UPC polish. Use for **OS2 Fiber Optic System**
   a. Duplex LC-Duplex LC:
      1) Leviton UPDLC-S01 (1 meter)
      2) Leviton UPDLC-S02 (2 meter)
      3) Leviton UPDLC-S03 (3 meter)
      4) Leviton UPDLC-S05 (5 meter)
      5) Leviton UPDLC-S10 (10 meter)

   b. Duplex SC-Duplex SC:
      1) Leviton UPDSC-S01 (1 meter)
      2) Leviton UPDSC-S02 (2 meter)
      3) Leviton UPDSC-S03 (3 meter)
      4) Leviton UPDSC-S05 (5 meter)
      5) Leviton UPDSC-S10 (10 meter)

   c. Duplex SC-Duplex LC:
      1) Leviton UPDCL-S01 (1 meter)
      2) Leviton UPDCL-S02 (2 meter)
      3) Leviton UPDCL-S03 (3 meter)
      4) Leviton UPDCL-S05 (5 meter)
      5) Leviton UPDCL-S10 (10 meter)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive communications horizontal cabling.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION – GENERAL

A. Install communications horizontal cabling in accordance with manufacturer's instructions, ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, ANSI/TIA-569-C, BICSI TDMM, and NFPA 70.

B. Field Terminated Copper and Fiber Optic Patch Cords and Jumpers: Not allowed.

C. Copper Patch Cords and Fiber Jumpers: Manufactured by Leviton Network Solutions.

D. Install cables after building interior has been physically protected from weather and mechanical work likely to damage cabling has been completed.

E. Ensure cable pathways are completely and thoroughly cleaned before installing cabling.

F. Inspect installed conduit, wireway, cable trays, and innerduct.

G. Clean additional enclosed raceway and innerduct systems furnished.

H. Provide protection for exposed cables where subject to damage.

I. Abrasion Protection:
   1. Provide abrasion protection for cable or wire bundles which pass through holes or across edges of sheet metal.
   2. Use protective bushings to protect cables.

J. Cable Ties and Other Cable Management Clamps:
   1. No more than hand tightened.
   2. Fit snugly, but not compress, crimp, or otherwise change physical characteristics of cable jacket or distort placement of twisted-pair components.
   3. Replace cables exhibiting stresses due to over tightening of cable management devices.
   4. Use plenum-rated cable ties in plenum spaces.
   5. Velcro wraps are preferred over cable ties for all cable bundles. Plenum-rated Velcro wraps are available from Leviton.

K. Where possible, route cables in overhead cable trays and inside wire management systems attached to equipment cabinets and racks.
   1. Use Velcro, plastic ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.
   2. Cable Trays: Do not exceed 50 percent fill.

L. Pull Cord:
   1. Nylon, 1/8-inch minimum.
   2. Co-install with cables installed in conduit.

M. Cable Raceways: Do not fill greater than ANSI/TIA-569-B maximum fill for particular raceway type.

N. Support horizontal cables at a maximum of 48-inch (1.2 to 1.5-m) irregular intervals, if J-hook or trapeze system is used to support cable bundles.

O. Do not allow cables to rest on acoustic ceiling grids, plumbing pipes, or electrical conduits.

P. Bundle horizontal distribution cables in groups of no more than amount of cables designed for by cable support manufacturer, based on cable OD and weight.

Q. Fire-Sprinkler System:
   1. Install cables above fire-sprinkler system.
   2. Do not attach cables to fire-sprinkler system or ancillary equipment or hardware.
   3. Install cable system and support hardware so that it does not obscure valves, fire alarm conduit, boxes, or other control devices.

R. Do not attach cables to ceiling grid or lighting fixture wires.

S. Install appropriate carriers to support cabling, where support for horizontal cables are required.

T. Replace before final acceptance, cables damaged or exceeding recommended installation parameters during installation.

3.3 INSTALLATION – FOILDED UNSHIELDED TWISTED-PAIR CABLES

A. Install unshielded twisted-pair cables in accordance with manufacturer's instructions.

B. Install cables in continuous lengths from origin to destination, without splices, except for transition points or consolidation points.

C. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in enclosure intended and suitable for the purpose.

D. Cable Minimum Bend Radius and Maximum Pulling Tension:
   1. Do not exceed bend radius for UTP = 4 X Cable OD, FTP = 4 X Cable OD.
   2. Install unshielded twisted-pair cables so that there are no bends smaller than 4 times cable outside diameter at any point in the run and at the termination field.
   3. Pulling Tension on 4-Pair UTP Cables: Do not exceed 25 ft.lb. for 4-pair UTP cable.

E. Separation from Power Lines: Provide following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
   1. Open or Nonmetal Communications Pathways:
      a. Electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3 kVA: 12 inches.
      b. Electrical equipment and unshielded power lines carrying more than 5 kVA: 36 inches.
      c. Large electrical motors or transformers: 48 inches.

   2. Grounded Metal Conduit Communications Pathways:
      a. Electrical equipment and unshielded power lines carrying up to 2 kVA: 2-1/2 inches.
      b. Electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA: 6 inches.
      c. Electrical equipment and unshielded power lines carrying more than 5 kVA: 12 inches.
      d. Power lines enclosed in grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA: 3 inches.
      e. Power lines enclosed in grounded metal conduit (or equivalent shielding) carrying more than 5 kVA: 6 inches.

3.4 INSTALLATION – UNSHIELDED TWISTED-PAIR TERMINATION

A. Coil cables to house cable coil without exceeding manufacturer's bend radius.
   1. In hollow wall installations where box eliminators are used, store excess wire in wall.
   2. Store no more than 12 inches of FTP and 36 inches of fiber slack.
   3. Loosely coil excess slack and store in ceiling above each drop location, when there is not enough space present in outlet box to store slack cables.

B. Dress and terminate cables in accordance with ANSI/TIA-568-C.0, ANSI/TIA- C.1, BICSI TDMM, and manufacturer's instructions.

C. Terminate 4-pair cables on jack and patch panels using T568-B or T568-A wiring scheme.

D. Pair Untwist at Termination: Do not exceed 12 mm (1/2 inch).

E. Bend Radius of Horizontal Cables:
   1. Not less than 4 times OD of FTP cables.

F. Maintain cable jacket to within 25 mm (1 inch) of termination point.

G. Neatly bundle cables and dress to their respective panels or blocks.
   1. Feed each panel or block by individual bundle separated and dressed back to point of cable entrance into rack or frame.

3.5 INSTALLATION – OPTICAL FIBER CABLES

A. Place fiber optic cables to maintain minimum cable bend radius limits specified by manufacturer or 15 times cable diameter, whichever is larger.

B. Use care when handling fiber optic cables.
   1. Carefully monitor pulling tension so as not to exceed limits specified by manufacturer.

C. Do not splice horizontal fiber optic cables.

3.6 FIELD QUALITY CONTROL

A. Cables and Termination Hardware: Test 100 percent for defects in installation and verify cabling system performance under installed conditions in accordance with ANSI/TIA-568-C.0.
   1. Verify all pairs of each installed cable before system acceptance.
   2. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.

B. Test all cables in accordance with this specification section, ANSI/TIA-568-C.2, and ANSI/TIA-568-C.3 standards, and Berk-Tek and Leviton Network Solutions instructions
   1. If any of these are in conflict, bring discrepancies to the attention of the Architect for clarification and resolution.

C. Cables, Jacks, Connecting Blocks, and Patch Panels:
   1. Verify all pairs of each installed cable before system acceptance.

2. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.

D. Testing Unshielded Twisted-Pair Cables: (**NOTE: Permanent Link Test results are recommended, and are the expected norm** – unless patch cords that will remain installed at the work area and cross-connect are also being tested, in which case Channel Test results would be expected and accepted).
   1. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens, and performance as specified.
      a. Additional testing is required to verify Category performance.
      b. Test horizontal cabling using approved certification tester for Category 6A performance compliance in accordance with ANSI/TIA-568-C.2. (NOTE: Appropriate Fluke certification testers shall be used).
      c. Category 6A shall conform to ANSI/TIA-568-C.2 for augmented Category 6 to 500 MHz.
   2. Follow ANSI/TIA-568-C.2.
   3. Basic Tests Required:
      a. Wire map.
      b. Length (feet).
      c. Insertion loss (dB), formerly attenuation.
      d. NEXT (Near end crosstalk) (dB).
      e. Return loss (dB).
      f. ELFEXT (dB).
      g. Propagation delay (ns).
      h. Delay skew (ns).
      i. PSNEXT (Power sum near-end crosstalk loss) (dB).
      j. PSELFEXT (Power sum equal level far-end crosstalk loss) (dB).
   4. Test Category 6A by auto test to 500 MHz.
      a. Alien Crosstalk (AXT) testing and AXT test results are NOT required by Leviton or Berk-Tek for warranty of a Category 6A system. (Note: AXT testing may be required by the customer, in which case these tests WOULD have to be performed).
   5. Provide test results in approved certification testers original software format on CD, with the following minimum information per cable:
      a. Circuit ID.
      b. Information from specified basic tests required.
      c. Test Result: "Pass" or "Fail".
      d. Date and time of test.
      e. Project name.
      f. NVP.
      g. Software version.
   6. An occasional asterisk-Pass (*Pass) will be accepted by Leviton or Berk-Tek at the manufacturer's discretion, but rework of these links should be done in an attempt to achieve clean "Pass" results prior to submission of test results.
   7. To receive Manufacturer's Warranty for the project, submit software copy of test results, in original tester software format, to the Owner and to the Manufacturer (either Berk-Tek or Leviton).
   8. Submit fully functional version of tester software for use by the Owner in reviewing test results.

9. Report in writing to the Owner immediately, along with copy of test results, failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs).

E. Optical Fiber:
   1. Testing procedures shall be in accordance with the following:
      a. ANSI/TIA-568-C.3.
      b. ANSI/TIA-526-7, Method B.
      c. Proposed TSB-140 Tier One Fiber Certification, C.
      d. Encircled Flux testing per the TSB-4979 and TIA-526-14-B standard.
   2. Test Equipment: Certification tester (Note: Fluke testers shall be used).
   3. Testing:
      a. Test optical fibers at both 1310 nm and 1550 nm wavelengths for singlemode, end-to-end insertion loss, Telecommunications Room (TR) to Telecommunications Outlet (TO), Telecommunications Outlet (TO) to Telecommunications Room (TR).
      b. Maximum insertion loss for horizontal fiber optic cables without consolidation point: 2.0 dB.
      c. Test horizontal fiber runs TR to TO, TO to TR, at wavelength of operation to desktop applications.
   4. Submit software copy of test results, in original tester software format, to the Owner and to the Manufacturer (either Berk-Tek or Leviton).

3.7 LABELING

A. All labeling is to be in accordance with ANSI/TIA-606-B and manufacturer's instructions.

B. Label horizontal cables using machine-printed label at each end of cable at approximately 12 inches from termination point and again at approximately 48 inches from termination point.
   1. Handwritten Labels: Not acceptable.

C. Label patch panel ports and TO ports with cable identifier.

D. Labels: Denote TO ID and unique cable number for that TO, i.e. A-001-A for cable number 1, A-001-B for cable number 2, and so forth.
   1. Owner may provide specific labeling requirements. Coordinate with the Owner.

E. Note labeling information on as-built drawings.

3.8 PROTECTION

A. Protect installed communications horizontal cabling from damage during construction.

SECTION 27xxx

NON-CONTINUOUS CABLE SUPPORTS FOR HIGH-SPEED TRANSMISSION CABLES (CATEGORY 6e AND HIGHER, AND OPTICAL FIBER CABLES) – HIGH PERFORMANCE J-HOOKS

PART 1 – HIGH PERFORMANCE NON-CONTINUOUS CABLE SUPPORT (HPNCCS) SYSTEMS

1.1 HPNCCS

1. HPNCCS shall be available in diameter sizes of 25 mm (1 in), 33 mm (1 5/16"), 50 mm (2 in), 75 mm (3 in) and 100 mm (4 in)
2. HPNCCS shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
3. HPNCCS shall have flared edges to prevent damage while installing cables.
4. HPNCSS shall meet the bend radius support requirements of supporting 4 times outer diameter (O.D.) per TIA-C.5.3.2.1; all edges shall support a bend radius of 1 ½" or more.
5. HPNCCS shall support bend radius requirements on the "neck" to allow for pathways around corners
6. HPNCCS shall have a cable retainer wire form to provide containment of cables within the hanger. The cable retainer shall be removable and reusable.
7. HPNCCS shall have an electro-galvanized, G60, or powder coated finish and shall be rated for indoor use in non-corrosive environments.
8. Acceptable ERICO products: CADDY® CAT16HP, CADDY CAT21HP, CADDY CAT32HP, CADDY CAT48HP, CADDY CAT64HP. Colored HPNCCS have the two-letter color code added to the product number (e.g., CADDY CAT32HPRD). The color code is: RD (red), BU (blue), BA (black), WH (white), YL (yellow), GR (green) and OR (orange).

cULus is a registered trademark of Underwriters Laboratories, Inc.
TIA is a registered service mark of the Telecommunications Industry Association.

END OF SECTION

Graphic Diagrams:

The following section will show examples to follow for existing installations. All new work shall be a Berk-Tek Leviton Technologies product solution and be backed by a Lifetime Warranty. A preconstruction meeting with Chris Garcia will be required prior to start of construction to cover any installation best practices and/or changes. Please see figures 1-5 below.

Figure 1:

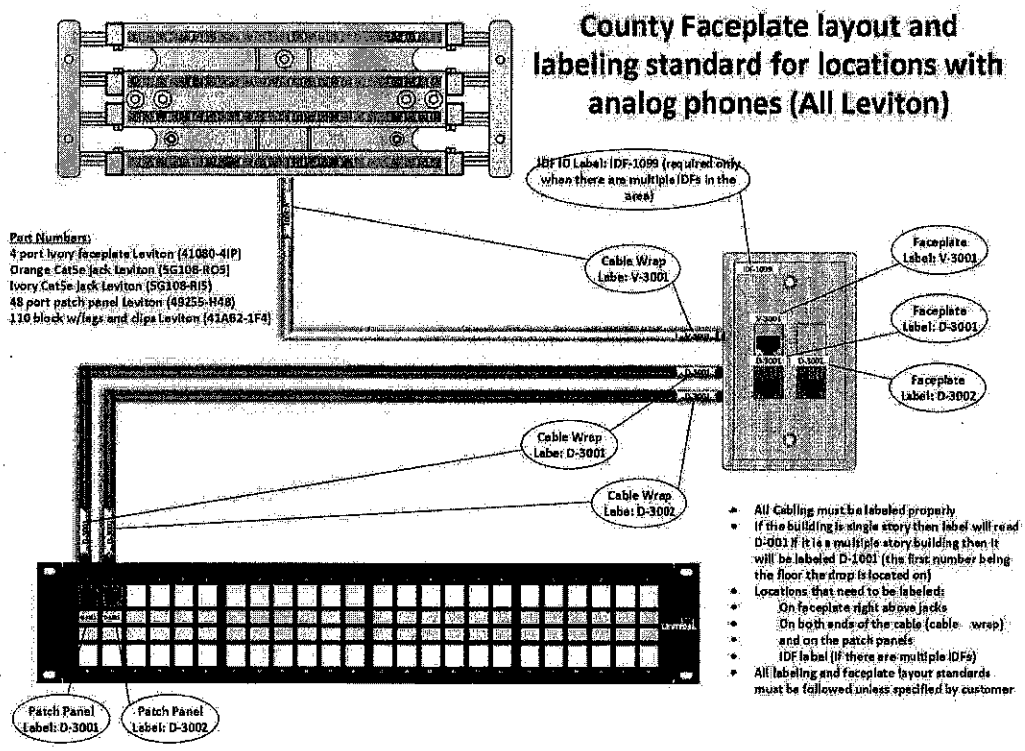

County Faceplate layout and labeling standard for locations with analog phones (All Leviton)
IDF ID Label: IDF-1099 (required only when there are multiple IDFs in the area)
Part Numbers:
4 port ivory faceplate Leviton (41080-4IP)
Orange Cat5e jack Leviton (5G108-ROS)
Ivory Cat5e jack Leviton (5G108-RIS)
48 port patch panel Leviton (49255-H48)
110 block w/legs and clips Leviton (41A62-1F4)
Cable Wrap Labe: V-3001
Faceplate Label: V-3001
Faceplate Label: D-3001
Faceplate Label: D-3002
Cable Wrap Labe: D-3001
Cable Wrap Labe: D-3002
All Cabling must be labeled properly
If the building is single story then label will read D-001 if it is a multiple story building then it will be labeled D-1001 (the first number being the floor the drop is located on)
Locations that need to be labeled:
On faceplate right above jacks
On both ends of the cable (cable wrap)
and on the patch panels
IDF label (if there are multiple IDFs)
All labeling and faceplate layout standards must be followed unless specified by customer
Patch Panel Label: D-3001
Patch Panel Label: D-3002

Figure 2:

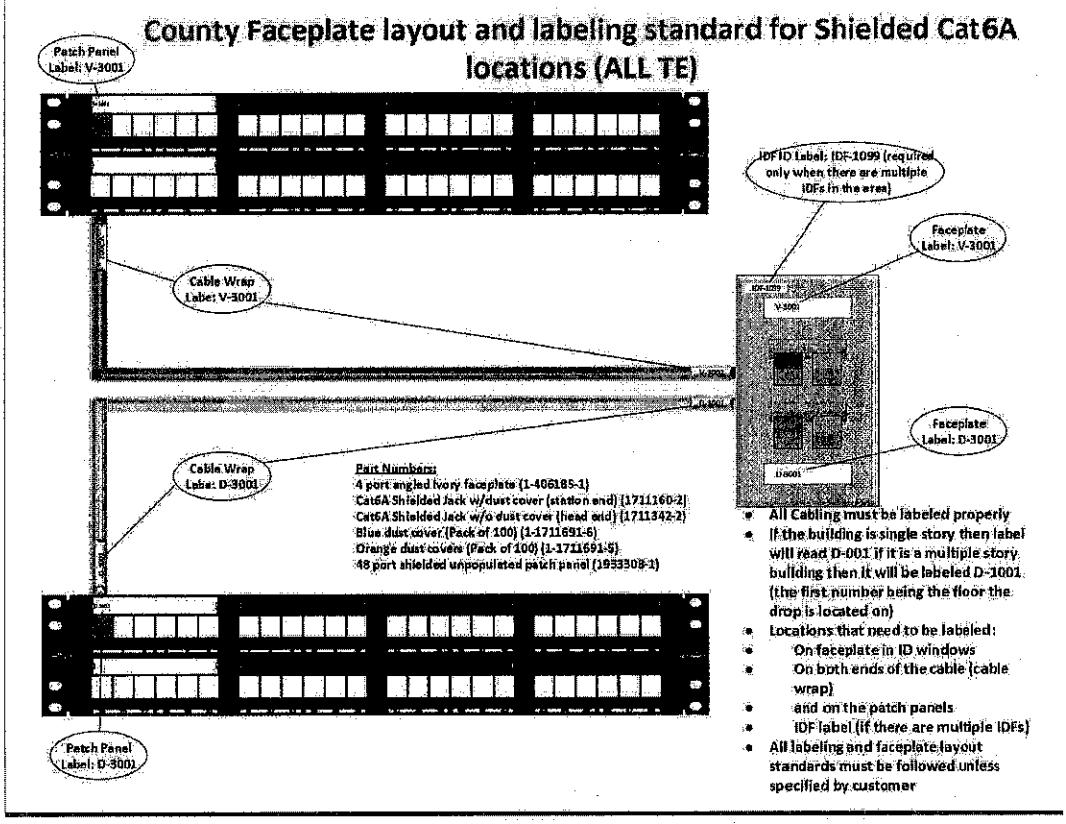

County Faceplate layout and labeling standard for Shielded Cat6A locations (ALL TE)
Patch Panel Label: V-3001
IDF ID Label: IDF-1099 (required only when there are multiple IDFs in the area)
Faceplate Label: V-3001
Cable Wrap Label: V-3001
Cable Wrap Label: D-3001
Faceplate Label: D-3001
Part Numbers:
4 port angled ivory faceplate (1-406185-1)
Cat6A Shielded Jack w/dust cover (station end) (1711160-2)
Cat6A Shielded Jack w/o dust cover (head end) (1711342-2)
Blue dust cover (Pack of 100) (1-1711691-6)
Orange dust covers (Pack of 100) (1-1711691-5)
48 port shielded unpopulated patch panel (1933308-1)
Patch Panel Label: D-3001
All Cabling must be labeled properly
If the building is single story then label will read D-001 if it is a multiple story building then it will be labeled D-1001 (the first number being the floor the drop is located on)
Locations that need to be labeled:
On faceplate in ID windows
On both ends of the cable (cable wrap)
and on the patch panels
IDF label (if there are multiple IDFs)
All labeling and faceplate layout standards must be followed unless specified by customer

Figure 3:

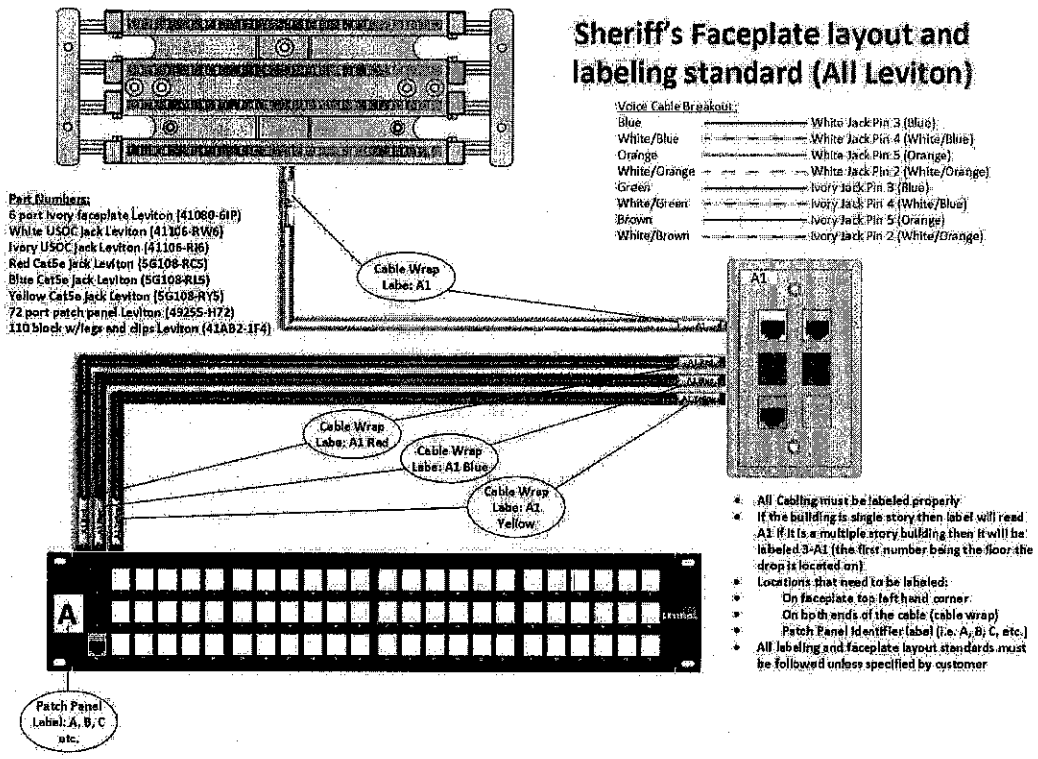

Sheriff's Faceplate layout and labeling standard (All Leviton)
Voice Cable Breakout:
Blue — White Jack Pin 3 (Blue)
White/Blue — White Jack Pin 4 (White/Blue)
Orange — White Jack Pin 5 (Orange)
White/Orange — White Jack Pin 2 (White/Orange)
Green — Ivory Jack Pin 3 (Blue)
White/Green — Ivory Jack Pin 4 (White/Blue)
Brown — Ivory Jack Pin 5 (Orange)
White/Brown — Ivory Jack Pin 2 (White/Orange)
Part Numbers:
6 port Ivory faceplate Leviton (41080-6IP)
White USOC Jack Leviton (41106-RW6)
Ivory USOC Jack Leviton (41106-RI6)
Red Cat5e Jack Leviton (5G108-RC5)
Blue Cat5e Jack Leviton (5G108-RL5)
Yellow Cat5e Jack Leviton (5G108-RY5)
72 port patch panel Leviton (4925S-H72)
110 block w/legs and clips Leviton (41AB2-1F4)
Cable Wrap Labe: A1
A1
Cable Wrap Labe: A1 Red
Cable Wrap Labe: A1 Blue
Cable Wrap Labe: A1 Yellow
A
Patch Panel Label: A, B, C etc.
All Cabling must be labeled properly
If the building is single story then label will read A1 if it is a multiple story building then it will be labeled 3-A1 (the first number being the floor the drop is located on)
Locations that need to be labeled:
On faceplate top left hand corner
On both ends of the cable (cable wrap)
Patch Panel identifier label (i.e. A, B, C, etc.)
All labeling and faceplate layout standards must be followed unless specified by customer

Figure 4:

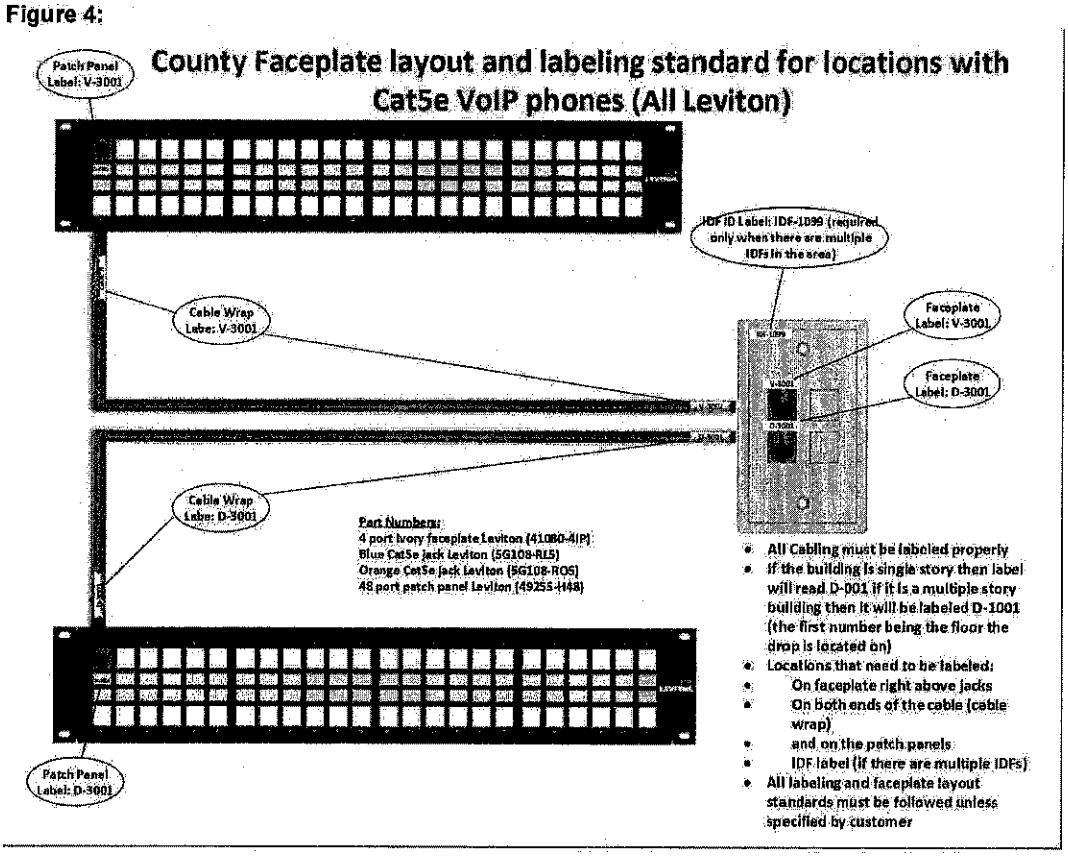
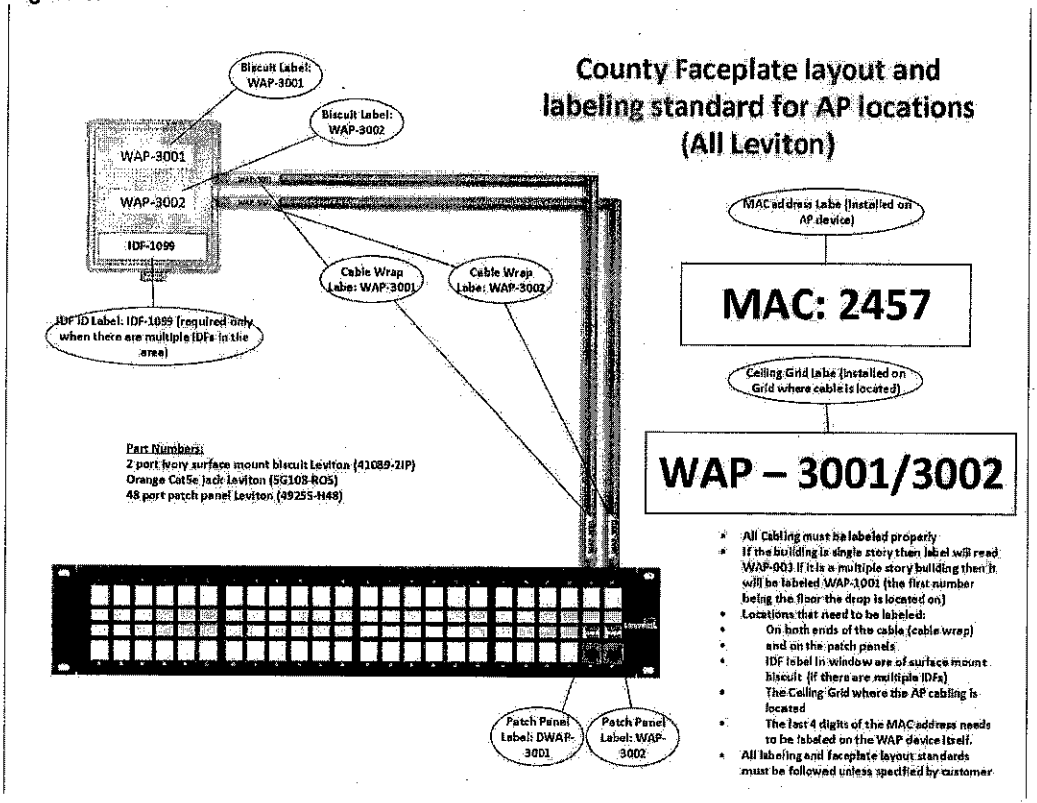

County Faceplate layout and labeling standard for locations with Cat5e VoIP phones (All Leviton)
Patch Panel Label: V-3001
IDF ID Label: IDF-1099 (required only when there are multiple IDFs in the area)
Cable Wrap Labe: V-3001
Faceplate Label: V-3001
Faceplate Label: D-3001
Cable Wrap Labe: D-3001
Part Numbers:
4 port ivory faceplate Leviton (41080-4IP)
Blue Cat5e jack Leviton (5G108-RL5)
Orange Cat5e jack Leviton (5G108-ROS)
48 port patch panel Leviton (49255-H48)
Patch Panel Label: D-3001
All Cabling must be labeled properly
If the building is single story then label will read D-001 if it is a multiple story building then it will be labeled D-1001 (the first number being the floor the drop is located on)
Locations that need to be labeled:
On faceplate right above jacks
On both ends of the cable (cable wrap)
and on the patch panels
IDF label (if there are multiple IDFs)
All labeling and faceplate layout standards must be followed unless specified by customer

Figure 5:



END EXHIBIT "D" - SPECIFICATIONS-COMMUNICATIONS HORIZONTAL CABLING