ORDINANCE NO. ____

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF LOMA LINDA ADOPTING CHAPTER 15.54 OF TITLE 15 OF THE LOMA LINDA MUNICIPAL CODE PERTAINING TO THE LOMA LINDA CONNECTED COMMUNITY PROGRAM FOR ALL NEW DEVELOPMENT PROJECTS IN THE CITY AND ADDITIONS THAT EXCEED MORE THAN FIFTY (50) PERCENT OF THE ORIGINAL STRUCTURE AND WITHIN THE FIBER-OPTIC MASTER PLAN AREA.

WHEREAS, the City has identified a need to provide local residents and businesses with additional options to meet their telecommunication needs, and has prepared and included in the Loma Linda Connected Community Program a Design, Installation and Product Specification, attached hereto as Exhibit "A," that outlines the Program details, which will act as a living document allowing for adjustments, which have been approved by the City Council, to facilitate advancements and efficiencies in the technology and its implementation;

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF LOMA LINDA DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. Chapter 15.54 is hereby added to Title 15 of the Municipal Code to read as follows:

"15.54. Connected Community Program – Participation in Program.

In recognition of the need to provide local residents and businesses within the community with additional options to meet their telecommunications needs, as adopted by City Council resolution, all new development projects within the City, regardless of whether such new development falls within the fiber-optic master plan area, and additions that exceed more than fifty (50) percent of the original structure that fall within the fiber-optic master plan area, will be required to participate in, and will be bound by, the Connected Community Program and all conditions and requirements contained therein. Further, any conditions or requirements of the Connected Community Program may be required as a condition of approval of any such new development or addition exceeding fifty (50) percent of the original structure."

Section 2. Validity. If any section, subsection, sentence, clause or phrase of this Ordinance is for any reason held to be invalid, such holding or holdings shall not affect the validity of the remaining portions of this Ordinance. The City Council hereby declares that it would have passed this Ordinance and each

section, subsection, sentence, clause and phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases be declared invalid.

Section 3. Posting. Prior to the expiration of fifteen (15) days from its passage, the City Clerk shall cause this Ordinance to be posted pursuant to law in three (3) public places designated for such purpose by the City Council.

This Ordinance was introduced at the regular meeting of the City Council of the City of Loma Linda, California, held on the 28th day of September, 2004, and was adopted on the ___ day of _____, 2004, by the following vote to wit:

Ayes:

Noes:

Abstain:

Absent:

_____
Karen L. Gaio Hansberger, Mayor

Attest:

_____
Pamela Byrnes-O'Camb, City Clerk

Rev 4. 9/22/04

The City of Loma Linda Connected Community Program

and

Design, Installation and Product Specifications

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1. INTRODUCTION

Background

The City of Loma Linda is a diverse and unique community with strong ties to its religious, educational and healing arts roots. It is the home of the Loma Linda University, Loma Linda University Medical Center, Loma Linda University Children's Hospital, Loma Linda University Community Hospital, and Jerry L. Pettis Memorial VA Medical Center. Local residents tend to be fairly well educated and many have undergraduate degrees. A fair number of residents also have graduate and post-graduate degrees. In comparison to other cities in the East Valley, many of the local residents have home-based businesses and/or telecommute. Given the high percentage of professional people who live and work in the community and the concentration of medical institutions and medical research facilities, Loma Linda is a great match for the Connected Community concept. The Loma Linda Connected Community Program was developed to meet the existing and future needs of the community and its residents.

Purpose

The purpose of this document is to standardize requirements for residential telecommunications cabling in The City of Loma Linda. These requirements are based on the facilities that are necessary for existing and emerging telecommunications services. The cabling infrastructure specifications within these Specifications are intended to include support for voice, data, video, multimedia, home automation systems, environmental control, security, audio, television, sensors, alarms and intercom. These Specifications will be implemented for all new construction, additions exceeding 50 percent of the original structure and within Fiber-Optic Master Plan areas. The intent of this document is to establish the general Specifications for a premises structured cabling system, manufactured by Berk-Tek/Ortronics/Corning, which will meet the voice, video and data communication needs of the City of Loma Linda.

The system shall incorporate all features and facilities listed in these Specifications.

2. GENERAL INFORMATION

The City of Loma Linda will implement a new Berk-Tek/Ortronics/Corning, Category 6, copper-structured cabling system within each residence of any and all new residential developments. The City of Loma Linda will also implement a new Corning Fiber Optic FTTH OSP cabling infrastructure connecting each new residence in any and all new residential developments to a proposed Main Data Frame (MDF) located within the new development property.

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- All cabling and connectivity hardware listed within this document and attachments shall be purchased from Anixter, Inc., of Anaheim, California, (714) 799-0500, or an approved equal by the developer or contractor. This will guarantee compliance with all codes and industry standards. Alternate materials shall be submitted for approval. No substitutions of equipment or material providers will be accepted without City of Loma Linda written approval.

  - The City of Loma Linda has negotiated with Anixter, Inc., to provide the scope of work and estimated bill of material for each individual development at no cost to the developer.

  - Contractors should understand that the issuance of these Specifications do not create any obligation on the part of the City of Loma Linda to enter into any contract or undertake any financial obligations with respect to the system referred to herein.

  - Contractor acknowledges that the City of Loma Linda will rely on contractor's ability, expertise and knowledge of the system. Contractor shall be obligated to exercise the highest standard of care in performing its obligations. Contractor shall demonstrate to City of Loma Linda's satisfaction that it is of sound financial condition and is adequately bonded and insured.

  - If additions, deletions, modifications or clarifications to these Specifications become necessary, the changes to these Specifications will be noted in writing.

  - In the same manner as the infrastructure for water, sewer, storm drains, streetlights, and traffic signals, the fiber-optic cabling and conduit pathways will be owned and maintained by the City Loma Linda after the developer completes the installation.

3. APPLICABILITY

These Specifications apply to telecommunications-premises cabling systems and the related pathways and spaces for single and multi-tenant residential buildings.

These Specifications specify cabling systems intended to support a wide range of telecommunications applications in the residential environment.

These Specifications apply to the telecommunications cabling within or between structures. This includes the cabling within a living unit and the backbone cabling.

These Specifications are intended to be in conformance with Part 68 of the FCC Rules and Regulations, the National Electrical Code, and the National Electrical Safety Code.

Cabling shall comply with requirements in these Specifications, which meet or exceed all current local codes and regulations.

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These Specifications are in compliance with local code. The reader should also be aware of applicable codes that may impact the use of these Specifications.

4. *LIFE OF THESE SPECIFICATIONS*

These Specifications are a living document. The criteria contained in these Specifications are subject to revision and updating as warranted by advances in building construction techniques and telecommunications technology.

5. *NORMATIVE REFERENCES*

The following Standards contain provisions that, through reference in this text, constitute provisions of these Specifications. At the time of publication of these Specifications, the editions were valid. All Standards are subject to revision; parties to agreements based on these Specifications are encouraged to investigate the possibility of applying the most recent editions of Standards indicated. ANSI and TIA maintain registers of currently valid national Standards published by them. Copies of these standards can be obtained on-line at **http://www.tiaonline.org/, http://www.bicsi.org/ and http://www.ieee.org.**

- ANSI/EIA/TIA-455-A-1991, Standard Test Procedures for Fiber Optic Fibers, Cables and Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components.
- ANSI/ICEA S-83-596-1994. Fiber Optic Premises Distribution Cable
- ANSI/ICEA S-87-640-1992, Fiber Optic Outside Plant Communications Cable
- ANSI/ICEA S-89-648-1993, Telecommunications Aerial Service Wire
- ANSI/IEEE C2-2002, National Electrical Safety Code
- ANSI/NFPA 70-2002, National Electrical Code
- ANSI/TIA/EIA-492CAAA-1998, Detail Standard for Class IVa Dispersion Un-shifted Single-mode Optical Fibers
- ANSI/TIA/EIA-526-7-1998, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant-OFSTP-7
- ANSI/TIA/EIA-526-14-A-1998, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant OFSTP-14A
- ANSI/TIA/EIA-570-B-Draft 2-May/2003, Residential Telecommunications Infrastructure Standard

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- ANSI/TIA/EIA-568-B, Additional Transmission Performance Standard for 4-Pair 100 Ω Category 6 Cabling
- ANSI/TIA/EIA-569-A-1998, Commercial Building Standard for Telecommunications Pathways and Spaces
- ANSI/TIA/EIA-598-A-A995, Optical Fiber Cable Color Coding
- ANSI/TIA/EIA-604-3-1997, FOCIS 3 Fiber Optic Inter-connector Inter-mate Ability Standard
- ANSI/TIA/EIA-606-1993, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- ANSI/TIA/EIA-607-1994, Commercial Building Grounding and Bonding Requirements for Telecommunications
- ANSI/TIA/EIA-758, 1999 Customer-owned Outside Plant Telecommunications Cabling Standards
- IEC 60603-7, 1996, Detail Standard for Connectors, 8-Way, Including Fixed and Free Connectors with Common Mating Features Bellcore Generic Requirements and the Society of Cable Telecommunications Engineers, Inc., document which are not ANSI approved, are specified in this Standard.

  The following is a list of non-Standardized references.

- Bellcore GR-1503-CORE, March 1995, Bellcore Generic Requirements for Coaxial Connectors (Series 59, 6, 7 and 11)
- SCTE, IPS-SP-001, June 13, 1996, Flexible R.R. Coaxial Drop Cable
- SCTE, IPS-SP-100, January 14, 1997, Standard for Trunk, Feeder and Distribution Coax Cable
- SCTE, IPS-SP-401, October 10, 1997, "F" Port (Male Feed Thru) Physical Dimensions
- SCTE, IPS-SP-404, October 10, 1997, "F" Connector (Male Indoor) Installation and Performance

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6. *SYSTEM SUPPORT*

The System Shall:

- Cover its capacity and functionality with minimum components and be flexible and capable of including new facilities or technologies as they become required or available.

- As new technologies evolve, the need for a balanced and redundant cabling infrastructure to handle these high-data rates will become more crucial. All major structured cabling installations for the City of Loma Linda must be certified to the requirements of these Specifications and the cable and connecting hardware manufacturers' specifications contained herein.

7. *STRUCTURED CABLING SYSTEM*

The structured cabling system (SCS) shall consist of any or all of the following subsystems in accordance with ANSI/TIA/EIA and BICSI guidelines and shall consist of cable and connecting hardware manufactured by Berk-Tek/Ortronics/Corning. For direct assistance in interpreting telecommunications specifications, the services of a Registered Communications Distribution Designer certified by the Building Industry Consulting Service International (BICSI) is recommended.

8. *RESIDENTIAL CABLING SYSTEM REQUIREMENTS*

8.1 General

- The system established in these Specifications is based upon services that are expected to be supported within each residential unit and to assist in the selection of the cabling infrastructure.

- For home automation and security systems cabling requirements, refer to the manufacturer's recommendations.

- Each cabled location provides a structured cabling system that meets the specified requirements for advanced, and multimedia telecommunications services.

- This provides for both current and developing telecommunications services. As an example, this provides for telephone, satellite, community antenna television (CATV) and data services.

- It specifies twisted-pair cable and coaxial cable placed in a star topology.

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- Minimum horizontal cabling requirements consist of two (2) 4-pair UTP Berk-Tek Category 6 cables and (1) Berk-Tek 75-ohm coaxial horizontal cable from the Distribution Center Box (DCB) to each specified outlet location.

- Access service provider connectivity minimum requirements are one (1) Berk-Tek Category 6 cabling and one (1) Berk-Tek 75-ohm coaxial cable from the external service provider box through conductor provided to the DCB.

- Connectivity minimum requirements consist of one (1) Ortronics 3-port faceplate, two (2) Ortronics Category 6 connectors, and one (1) Berk-Tek 75-ohm coaxial connector at each specified outlet location.

- UTP cabling performance requirements are listed in Section 11 of this document.

- Patch Cord performance requirements are listed in Section 12 of this document.

- Connectivity performance requirements are listed in Section 13 of this document.

9. SINGLE RESIDENTIAL UNIT CABLING SYSTEM

The following is a sequential trace of the cabling system, from the DCB to the terminal equipment in a single residential unit. The system requirements in this section are applicable to all media types described above. Grounding and bonding shall be performed in accordance with applicable electrical codes.

9.1 DCB – Requirements: See Attached Diagram and Material List

9.1.1 General

- A DCB shall be provided within each residence. The DCB is a cross-connect facility used for the termination and connection of horizontal cables and equipment cords.

- The DCB is used for connection of access providers to the residence and to facilitate moves, additions and changes of premises cabling within the residence.

- The contractor must provide a 2" conduit pathway from the DCB to an industry standard NID, (NEMA-rated flush mount box with cover) to facilitate the entrance of access provider media to each residence, i.e., Telephone/CATV.

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- The contractor must connect all service provider boxes to the outside industry standard NID (NEMA-rated flush mount box) with a minimum 1" conduit.

- Space should be allocated adjacent to or within the DCB for the installation of a surge protection device for each conductive cable entering or leaving the building.

- Access to the building electrical ground shall be provided within the DCB and in accordance with applicable codes.

- The DCB may consist of a passive cross-connect facility, or an active cross-connect facility, or both. As an example, an active cross-connect facility may be embodied in a residential gateway.

9.1.2 Location Requirements for the Distribution Device

- The DCB shall be installed inside the tenant's space in a location that is accessible for cabling maintenance.

- The location should be centralized within the tenant space, where practicable, to minimize the length of outlet cables. Required: Space allocation in the master bedroom closet.

- The DCB shall not be mounted on any exterior wall or garage wall.

- The DCB and associated equipment shall be recessed between stud spaces.

9.1.3 Wall Space Allocation for a Distribution Device and Associated Equipment

- Space allocation for the DCB and associated equipment is to have a width of 14.5" with a minimum overall height of at least 32".

9.1.4 Electrical Power

- Electrical power will be required at the DCB.

- A dedicated 15 a, 120 v AC nominal, nonswitchable duplex electrical outlet shall be provided within the DCB and labeled "DCB Power" in the resident's breaker box.

- The location and height of the electrical outlet should be appropriate for the DCB and associated equipment being installed and shall be in

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compliance with applicable codes.

- Electrical power will also be required at the NID.
- A dedicated 15 a, 120 v AC nominal, nonswitchable duplex electrical outlet shall be provided within the NID and labeled "NID Power" in the resident's breaker box. To be used for optional Meter reader service.
- The location and height of the electrical outlet should be appropriate for the NID and associated equipment being installed and shall be in compliance with applicable codes.

9.2 Horizontal Cables

Horizontal cables provide the transmission path from the DCB to the telecommunications outlet/connector. A horizontal cable may be connected through a transition point or consolidation point (TIA/EIA TSB-75).

- The length of each horizontal cable shall not exceed 90 m (295 ft.). The 90 m (295 ft.) length allows an operational length of 100 m (328 ft.) including patch cords or equipment cords.

9.2.1 Recognized Cable Requirements: See Attached Material List.

Recognized horizontal cable includes:

- Berk-Tek 4-Pair UTP Category 6 (ANSI/TIA/EIA-568-B).
- Corning Single mode fiber (ANSI/TIA/EIA-492CAAA) (intended for outside plant and special case future applications).
- Series 6 coaxial (SCTE IPS-SP-001).

9.2.2 Cabling Topology For Outlet/Connectors

- Horizontal cabling shall be placed in a star topology.

9.2.3. Outlet Location Requirement: See Attached Material List.

- A minimum of one outlet location shall be cabled within each of the following rooms or similar living spaces as determined by the Community Development Director.

  Kitchen

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Bedroom
Den/Study
Desk/Tech Area
Living Room
Dining Room
Garage

- A minimum of two outlet locations shall be cabled within each of the following rooms.

  Family/great room; a minimum of one must be located in the media center area.
  Master bedroom on opposite walls.

- A sufficient number of telecommunications outlet locations should be planned to prevent the need for extension cords.

- Additional outlet locations should be provided so that no point along the floor line in any wall space is more than 7.6 m (25 ft.), measured horizontally from an outlet location in that space.

- Outlet mounting heights shall be in accordance with applicable codes.

9.2.4 Cable Pathways

- For new construction, a 2" conduit pathway shall be installed for future placement of satellite feeder cables between the DCB and the attic space.

- Horizontal pathways will expose the cable for any and all new construction. (Typically, exposed cabling is accomplished by placing the cables through holes in wall studs and ceiling joists before the walls and ceilings are sheathed). Proper care must be taken to route horizontal cabling a minimum of 1" from all in-wall electrical wiring. Direct contact must be avoided.

9.3 Telecommunications Outlet/Connector

The telecommunications outlet/connector shall be Ortronics Category 6 and compatible with the media provided at that location.

- Some networks or services require application-specific electrical components (e.g., splitters, amplifier, impedance matching devices) at the telecommunications outlet/connector.

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- These application-specific electrical components shall be placed external to the telecommunications outlet/connector.

9.4 Equipment Cords and Patch Cords

- Equipment cords extend from the telecommunications outlet location to the terminal/equipment connector. These cords are customer provided. Ortronics Category 6 Equipment Cords are recommended to maintain Category 6 performance.

- Patch cords or jumpers are used for interconnections or cross-connections at the DCB. Ortronics Category 6 Patch Cords are to be provided as part of these Specifications.

- For each channel, a total of 10 m (33 ft.) is allowed for equipment cords and patch cords.

9.5 Main Distribution Frame (MDF)

The MDF room is a centralized space for telecommunications equipment, computing equipment, video equipment that serves a designated housing development. The room shall house only equipment directly related to the telecommunications/computing/video systems and its environment support systems.

When selecting the MDF room site, avoid locations that are restricted by building components that limit expansion such as elevators, core, outside walls or other fixed building walls. Special attention for distance separation shall be given to electrical power supply transformers, motors and generators, radio, or radar transmitters, and induction sealing devices. It is desirable to locate the equipment room close to the main backbone pathway.

When designing the MDF room floor space, the room shall be designed to a minimum of 100 sq. ft. (10' X 10').

Installation of environmental control equipment, such as power distribution or conditioner, and UPS up to 100 kVA shall be permitted in the MDF room. UPS larger than 100 kVA should be located in a separate room. Equipment not related to the support of the MDF room (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed or pass through the MDF room.

Each MDF requires the installation of a FM-200 Fire Suppression System.

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HFC-227 (FM-200), chemically known as heptafluoropropane, is an alternative fire suppression system agent manufactured in the United States by Great Lakes Chemical (FM-200) and DuPont Corporation (HFC-227). It is a replacement for the ozone depleting Halon 1301 used extensively before 1994.

FM-200 (HFC-227) has no ozone depletion potential. Its ODP is zero. FM-200 has found by leading toxicologists to be safe for use when people are present. Just as with Halon 1301, people can be exposed to normal extinguishing concentrations without any fear of health problems.

The MDF room shall be connected to the City owned fiber optic backbone via (2) 4" conduit pathways. These 4" conduit pathways will be routed separately to accommodate redundant fiber optic cable path requirement. Additional provision can be found in TIA/EIA-569-A and the BICSI Telecommunications Distribution Design Manual.

Access shall be made available to the main telecommunications grounding system specified by ANSI/TIA/EIA-607.

- The MDF or main terminal space may be co-located with the entrance facility. It may also be used to house active equipment.
- The MDF or main terminal space may house the demarcation point for access providers and campus backbone cable.
- The associated pathways, protection devices, and any other equipment needed to provide a connection from the access providers' access lines, may also be located in the MDF or main terminal space.
- An MDF requires other support facilities such as power, heating, ventilation, and air conditioning (HVAC). For more information on Control Building/Equipment Rooms, see ANSI/TIA/EIA-569-A.

Listed below are additional provisions:

- A minimum of two walls should be covered with rigidly fixed (3/4 trade size) A-C plywood preferably void free, 8 ft. high, capable of supporting attached equipment. Plywood should be either fire rated or covered with two coats of fire retardant paint.
- Lighting shall be a minimum of 50 foot candles measured 3 ft. above the finished floor.
- False ceiling shall not be provided.
- The access door shall be a minimum of 36 in. wide and 80 in. high and

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shall be fitted with a lock.

- Floors, walls and ceiling shall be treated to eliminate dust. Finishes shall be light in color to enhance room lighting.

- Electrical: A minimum of four (4) dedicated 30A, 110V AC duplex electrical outlets, each on separate circuits, shall be provided for equipment power. Consideration should be given to identifying those outlets dedicated to telecommunications equipment. In addition, convenience duplex outlets shall be placed at 6 ft. intervals around the perimeter walls, at a height of 18 in. above the floor. If emergency power is available, consideration shall be given to automatic power backup.

- HVAC: A minimum of (2) 2-ton AC units shall be provided for each MDF Room. These units shall be powered on separate circuits to accommodate redundancy requirements.

- If an emergency power source is available in the building, it is desirable that at least one of the duplex outlets be so supplied.

- TIA/EIA-569-A contains fire-stopping, sprinkler requirements, miscellaneous pathways, telecommunications recommendations of separation from less than 480V power lines. Further information of entrance rooms can be found in TIA/EIA-569-A and the BICSI Telecommunications Distribution Methods Manuals.

- An independent telecommunications grounding system as specified by ANSI/TIA/EIA 607, shall be provided. Example Diagram 2:

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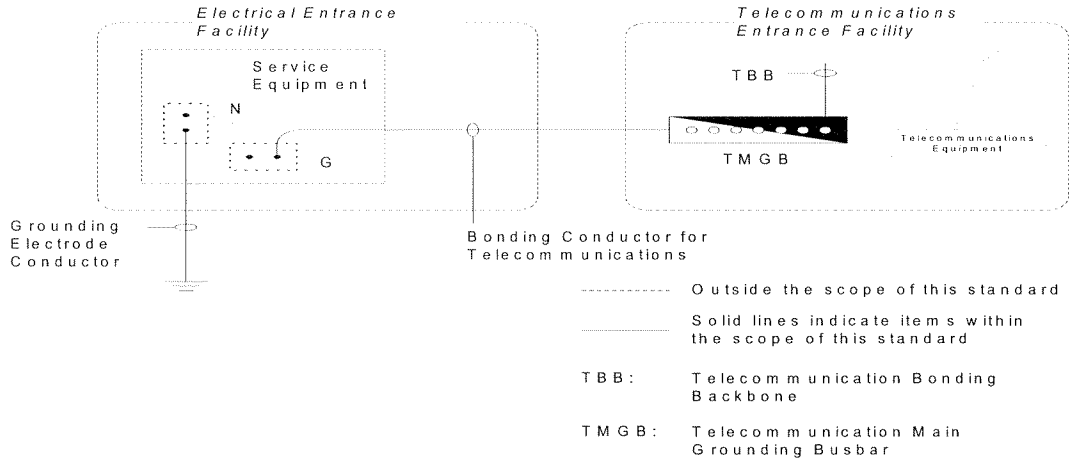
Diagram 2
Example TIA/EIA 607 Grounding

Bonding to the service equipment (power) ground

The bonding conductor for telecommunications shall bond the TMGB to the service equipment (power) ground. The figure below schematically depicts connectivity to the service equipment (power) ground.



Schematic of connectivity to the service equipment (power) ground

Recognized Backbone Cables in accordance with the City of Loma Linda Connected Community Program and ANSI/TIA/EIA 568-B are noted below.

- Single-mode optical fiber

All intra-building, (within the building) fiber optic backbone cables shall meet the appropriate NEC flame and smoke specifications. These include NEC Article 800 for copper cables and Article 770 for fiber optics. All cables shall meet or exceed the electrical specifications of ANSI/TIA/EIA 568-B. In addition, Corning Cabling Systems, an ISO 9000 series manufacturer, is the manufacture of choice for all fiber optic cable and connectivity.

Installers should anticipate intra-building backbone fiber supporting voice/data/video applications shall be singlemode fiber, unless otherwise specified by The City of Loma Linda.

Inter-building backbone fiber supporting data applications will also be singlemode fiber, as specified by The City of Loma Linda. Fiber counts will also be specified by The City of Loma

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Linda, though it is suggested backbone cable should allow for a minimum 25% growth.

Optical Fiber Backbone Cable Specifications:

Transmission Parameters (outdoor single-mode):
Attenuation: 0.5dB/km at 1310 nm
.0.5dB/km at 1550 nm
Operating Temperature Range: -40 degrees F to 158 degrees F

All fiber optic cable installed for The City of Loma Linda shall conform to the Corning Cabling Systems manufacturer warranty requirements.

The type of connectors used for all fiber optic cabling shall be "SC" (UPC) uniform polish connector at each residence and "SC" (APC) angle polish connector at each MDF, as determined by the City of Loma Linda for any new installation and shall conform to requirements of Corning cabling Systems.

All splicing of backbone fiber optic cables shall be "Fusion" type.

Backbone Distance in accordance with TIA/EIA 568-B.1 are as follows:

- Single-mode Fiber Applications: 9,840 ft.

While it is recognized that the capabilities of single-mode fiber may allow for backbone link distances of up to 37 miles, this distance is generally considered to extend outside the scope of TIA/EIA 568-B.1.

9.6 Interbuilding Telecommunications Backbone Pathways

- Interbuilding telecommunications backbone pathways provide a means of interconnecting separate buildings and consist of underground, buried, aerial, and tunnel pathways.
- The City of Loma Linda Community Development Department must approve all routing of interbuilding telecommunications backbone pathways during the planning process.
- Minimum conduit sizing for outside plant conduit from the MDF to each splice node vault shall be 2 inches.

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- An industry standard splice node vault shall be provided for each eight (8) homes. All vaults shall be sized to accommodate fiber optic splice enclosures.

- The splice node vault shall be a Carson Industries, M-series G2436-18 (medium duty) with a static vertical load rating of Tier 5 – (Design Load 5,200lbf); (Test Load 11,282lbf) or equal.

- Minimum splice node vault size shall be 24"x36"x36".

- Minimum conduit sizing for an individual residence pathway shall be 1" from the splice node vault to the industry standard NEMA-rated flush mount box at each residence.

- Each splice node vault is to serve a maximum of (8) eight residences.

- The developer shall be responsible for providing two (2), 4" conduits from the MDF to the closest City-owned fiber-optic backbone connection point. This is to be determined at the plan check phase.

- The developer shall be responsible for providing two (2), 1" and one 1.5" inner duct in each 4" conduit. This is to be determined at the plan check phase.

- The developer must provide industry standard pull strings in each conduit pathway.

- For more information on interbuilding telecommunications backbone pathways, see ANSI/TIA/EIA-758.

9.7 Interbuilding Fiber-Optic Backbone

- A minimum of one continuous strand, single-mode fiber-optic cable shall be provided from the MDF, through the splice node vault to each individual residence.

- Each of the above required, strands of single-mode fiber-optic cable shall have "SC" type (UPC) connectors installed at each residence and "SC" type (APC) connectors installed at the MDFs. The connector shall be the SC-type.

- As an additional requirement, A minimum of one additional continuous strand, single-mode fiber-optic cable shall be provided from the splice

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node vault to each individual residence to allow connectivity access to service providers.

- These additional strands of single-mode fiber-optic cable shall have a "SC" type (UPC) connector installed at the residence only. The other ends are to be coiled and left un-terminated in the splice node vault.

- At each individual residence a fiber storage spool shall be provided and utilized within the DCB.

- At the MDF a minimum of one (1) 19" x 7' industry standard rack shall be provided and installed. It shall be mounted and braced as per applicable standards and local codes.

- At the MDF all individual single-mode fiber-optic strands shall be terminated with "SC" type (APC) connectors and shall be routed and connected to a Corning rack mount fiber shelf, with the capacity of the shelf to be determined by count of the fiber strands.

- Maximum fiber-optic cable outside diameter shall not exceed 1" in each 2" conduit and ½" in each 1" conduit.

- All single mode fiber-optic strands must be tested, certified and labeled in accordance with industry standards after installation and termination.

- The developer shall be responsible to provide all material and labor to accommodate all necessary fiber-optic splice hardware.

10. MULTITENANT INFRASTRUCTURE

10.1 General

The following is a sequential trace of the cabling system for the multi-tenant/campus infrastructure from the new Control Building MDF to the DCB located in each individual residence in a campus environment.

- The Control Building will be located on the development property at a TBD position.

- The DCB will be located in the individual residence or tenant space.

- Access to shared-use space shall be controlled by the building owner or agent.

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- Where the total length of cabling from the demarcation point to the furthest outlet exceeds 150 m (492 ft.), the access provider shall be notified at the design stage to accommodate transmission requirements.

- Grounding and bonding shall be performed in accordance with applicable electrical codes. For multi tenant buildings, ANSI/TIA/EIA-607 provides additional bonding and grounding information.

10.2 Main Distribution Frame (MDF)

The MDF room is a centralized space for telecommunications equipment, computing equipment, video equipment that serves a designated housing development. The room shall house only equipment directly related to the telecommunications/computing/video systems and its environment support systems.

When selecting the MDF room site, avoid locations that are restricted by building components that limit expansion such as elevators, core, outside walls or other fixed building walls. Special attention for distance separation shall be given to electrical power supply transformers, motors and generators, radio, or radar transmitters, and induction sealing devices. It is desirable to locate the equipment room close to the main backbone pathway.

When designing the MDF room floor space, the room shall be designed to a minimum of 100 sq. ft. (10' X 10').

Installation of environmental control equipment, such as power distribution or conditioner, and UPS up to 100 kVA shall be permitted in the MDF room. UPS larger than 100 kVA should be located in a separate room. Equipment not related to the support of the MDF room (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed or pass through the MDF room.

Each MDF requires the installation of a FM-200 Fire Suppression System.

HFC-227 (FM-200), chemically known as heptafluoropropane, is an alternative fire suppression system agent manufactured in the United States by Great Lakes Chemical (FM-200) and DuPont Corporation (HFC-227). It is a replacement for the ozone depleting Halon 1301 used extensively before 1994.

FM-200 (HFC-227) has no ozone depletion potential. Its ODP is zero. FM-200 has found by leading toxicologists to be safe for use when people are present. Just as with Halon 1301, people can be exposed to normal extinguishing concentrations without any fear of health problems.

The MDF room shall be connected to the City owned fiber optic backbone via (2) 4" conduit pathways. These 4" conduit pathways will be routed separately to accommodate redundant fiber optic cable path requirement. Additional provision can be found in TIA/EIA-569-A and the BICSI Telecommunications Distribution Design Manual.

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Access shall be made available to the main telecommunications grounding system specified by ANSI/TIA/EIA-607.

- The MDF or main terminal space may be co-located with the entrance facility. It may also be used to house active equipment.
- The MDF or main terminal space may house the demarcation point for access providers and campus backbone cable.
- The associated pathways, protection devices, and any other equipment needed to provide a connection from the access providers' access lines, may also be located in the MDF or main terminal space.
- An MDF requires other support facilities such as power, heating, ventilation, and air conditioning (HVAC). For more information on Control Building/Equipment Rooms, see ANSI/TIA/EIA-569-A.

Listed below are additional provisions:

- A minimum of two walls should be covered with rigidly fixed (3/4 trade size) A-C plywood preferably void free, 8 ft. high, capable of supporting attached equipment. Plywood should be either fire rated or covered with two coats of fire retardant paint.
- Lighting shall be a minimum of 50 foot candles measured 3 ft. above the finished floor.
- False ceiling shall not be provided.
- The access door shall be a minimum of 36 in. wide and 80 in. high and shall be fitted with a lock.
- Floors, walls and ceiling shall be treated to eliminate dust. Finishes shall be light in color to enhance room lighting.
- Electrical: A minimum of four (4) dedicated 30A, 110V AC duplex electrical outlets, each on separate circuits, shall be provided for equipment power. Consideration should be given to identifying those outlets dedicated to telecommunications equipment. In addition, convenience duplex outlets shall be placed at 6 ft. intervals around the perimeter walls, at a height of 6 in. above the floor. If emergency power is available, consideration shall be given to automatic power backup.

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- HVAC: A minimum of (2) 2-ton AC units shall be provided for each MDF Room. These units shall be powered on separate circuits to accommodate redundancy requirements.

- If an emergency power source is available in the building, it is desirable that at least one of the duplex outlets be so supplied.

- Access shall be made available to the independent telecommunications grounding system specified by ANSI/TIA/EIA 607.

- TIA/EIA-569-A contains fire-stopping, sprinkler requirements, miscellaneous pathways, telecommunications recommendations of separation from less than 480V power lines. Further information of entrance rooms can be found in TIA/EIA-569-A and the BICSI Telecommunications Distribution Methods Manuals.

Recognized Backbone Cables in accordance with the City of Loma Linda Connected Community Program and ANSI/TIA/EIA 568-B are noted below.

- Single-mode optical fiber

All intra-building, (within the building) fiber optic backbone cables shall meet the appropriate NEC flame and smoke specifications. These include NEC Article 800 for copper cables and Article 770 for fiber optics. All cables shall meet or exceed the electrical specifications of ANSI/TIA/EIA 568-B. In addition, Corning Cabling Systems, an ISO 9000 series manufacturer, is the manufacture of choice for all fiber optic cable and connectivity.

Installers should anticipate intra-building backbone fiber supporting voice/data/video applications shall be singlemode fiber, unless otherwise specified by The City of Loma Linda.

Inter-building backbone fiber supporting data applications will also be singlemode fiber, as specified by The City of Loma Linda. Fiber counts will also be specified by The City of Loma Linda, though it is suggested backbone cable should allow for a minimum 25% growth.

Optical Fiber Backbone Cable Specifications:

Transmission Parameters (outdoor single-mode):
Attenuation: 0.5dB/km at 1310 nm
.0.5dB/km at 1550 nm
Operating Temperature Range: -40 degrees F to 158 degrees F

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All fiber optic cable installed for The City of Loma Linda shall conform to the Corning Cabling Systems manufacturer warranty requirements.

The type of connectors used for all fiber optic cabling shall be "SC" (UPC uniform polish connectors at each residence and "SC" (APC) angle polish connector at each MDF, as determined by the City of Loma Linda for any new installation and shall conform to requirements of Corning cabling Systems.

All splicing of backbone fiber optic cables shall be "Fusion" type.

Backbone Distance in accordance with TIA/EIA 568-B.1 are as follows:

- Single-mode Fiber Applications: 9,840 ft.

While it is recognized that the capabilities of single-mode fiber may allow for backbone link distances of up to 37 miles, this distance is generally considered to extend outside the scope of TIA/EIA 568-B.1.

10.3 Equipment Room

- In multi tenant dwellings an equipment room may house the entrance facility, the main terminal space, and a floor-serving terminal.
- An equipment room typically houses more equipment than a floor-serving terminal and it has different space requirements.
- An equipment room requires other support facilities such as power, heating, ventilation and air conditioning (HVAC). For more information on equipment rooms, see ANSI/TIA/EIA-569-A.
- For proper sizing of an equipment room, refer to the ANSI/EIA/ITA-569-A.

10.4 Floor-Serving Terminal

- The floor-serving terminal is the space where backbone and horizontal cables terminate.

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- A floor-serving terminal should be located on each floor or every third floor, thus serving the floor it is on and the floors above and below.

- The floor-serving terminal should be in a common area and easily accessible. The minimum size of the space shall be in accordance with Table 4.

- The floor-serving terminal may be required to be expanded in size to accommodate additional hardware.

Table 4 – Minimum Space For Floor-Serving Terminal

- Minimum space for first five (5) tenant units

    - 370 mm (14.5") wide
    - 610 mm (24") high
    - 775 mm (30.5") wide
    - 610 mm (24") high

- Minimum additional space per tenant unit

    - 32270 sq. mm
    - (50 sq. in.)
    - 64540 sq. mm
    - (100 sq. in.)

- If active equipment is placed within the floor-serving terminal, a dedicated unswitched 15 a, 120 v AC nominal outlets shall be provided within 1.5 m (5 ft.) of the floor-serving terminal.

- The height of the electrical outlet should be appropriate for the floor-serving terminal being installed and shall be in compliance with codes.

10.5 Backbone Pathways

10.5.1 General

- Within buildings consideration should be given to establishing spare pathway capacity (i.e., conduit w/pull-string) for future media additions or modifications that would be difficult or impossible to cable.

10.5.2. Intrabuilding Backbone/Horizontal Pathways

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- Intrabuilding pathways typically employ conduits, sleeves, slots or cable trays (w/pull-string) as a means for placing backbone cable.

- A minimum of one (1) #4 trade size conduit or sleeve (w/pull-string) shall be provided for each backbone pathway where backbone cable extends from the main Equipment Room to a floor-serving terminal space.

- A minimum of one (1) 1" conduit (w/pull-string) shall be provided for each residence from the main Equipment Room or the associated floor-serving terminal to the industry standard NEMA-rated flush mount box at each individual residence.

- Where cable bundles with an equivalent diameter of 25 mm (1") or less extend through each apartment closet, a minimum of one (1) (1 ½) trade size conduit or sleeve shall be provided for the backbone pathways.

- For more information on intrabuilding pathways, see ANSI/TIA/EIA-569-A.

10.5.3 Interbuilding Telecommunications Backbone Pathways

- Interbuilding telecommunications backbone pathways provide a means of interconnecting separate buildings and consist of underground, buried, aerial and tunnel pathways.

- Minimum conduit sizing for all outside plant conduit shall be 2".

- An industry standard splice node vault shall be provided for each multti-tenant building. All vaults shall be sized to accommodate fiber optic splice enclosures.

- The splice node vault shall be a Carson Industries, M-series G2436-18 (medium duty) with a static vertical load rating of Tier 5 – (Design Load 5,200lbf); (Test Load 11,282lbf) or equal.

- Minimum splice node vault size shall be 24"x36"x36".

- Minimum conduit sizing for each individual multi-tenant/commercial building shall be 2" from the splice node vault to the main Equipment Room.

- The developer shall be responsible for providing two (2), 4" conduits from the MDF to the closest City-owned fiber-optic backbone connection point. This is to be determined at the plan check phase.

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- The developer shall be responsible for providing two (2), 1" and one 1.5" inner duct in each 4" conduit. This is to be determined at the plan-check phase.

- The developer must provide industry standard pull strings in each conduit pathway.

- For more information on interbuilding telecommunications backbone pathways, see ANSI/TIA/EIA-758.

10.6 Backbone Cabling

10.6.1 Recognized Cables

Recognized backbone cables include:

- Corning Single mode fiber (ANSI/TIA/EIA-492CAAA).

- Berk-Tek Hard-line coaxial (SCTE IPS-SP-100).

- Berk-Tek Series 6 coaxial (SCTE IPS-SP-001).

10.6.2 Topology

- A star topology should be implemented for optical fiber backbone cabling.

- Coaxial backbone cable may be implemented using a star topology.

10.6.3 Interbuilding Cabling Protection

- When buildings are connected with interbuilding cabling, the applicable fusing and voltage protection codes shall be followed.

10.6.4 Interbuilding Fiber-Optic Backbone

- A minimum of one continuous strand, single-mode fiber-optic cable shall be provided from the MDF, through the splice node vault to each individual residence.

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- Each of the above required, strands of single-mode fiber-optic cable shall have "SC" type (UPC) connectors installed at each residence and "SC" type (APC) connectors installed at each MDF. The connector shall be the SC-type.

- As an additional requirement, A minimum of one additional continuous strand, single-mode fiber-optic cable shall be provided from the splice node vault to each individual residence to allow connectivity access to service providers.

- These additional strands of single-mode fiber-optic cable shall have a "SC" type (UPC) connector installed at the residence only. The other ends are to be coiled and left un-terminated in the splice node vault.

- At each individual residence a fiber storage spool shall be provided and utilized within the DCB.

- At the MDF a minimum of one (1) 19" x 7' industry standard rack shall be provided and installed. It shall be mounted and braced as per applicable standards and local codes.

- At the MDF all individual single-mode fiber-optic strands shall be terminated with "SC" type (APC) connectors and shall be routed and connected to a Corning rack mount fiber shelf, with the capacity of the shelf to be determined by count of the fiber strands.

- Maximum fiber-optic cable outside diameter shall not exceed 1" in each 2" conduit and ½" in each 1" conduit.

- All single-mode fiber-optic strands must be tested, certified and labeled in accordance with industry standards after installation and termination.

- The developer shall be responsible for providing all material and labor to accommodate all necessary fiber-optic splice hardware.

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11. COMMERCIAL/CAMPUS INFRASTRUCTURE

11.1 General

The following is a sequential trace of the cabling system for the commercial/campus infrastructure from the new Control Building MDF to the main Equipment Room located in each individual commercial building in a campus environment.

- The Control Building MDF will be located on the development property at a TBD position.
- The main Equipment Room will be located in each building or each tenant space.
- Access to shared-use space shall be controlled by the building owner or agent.
- Grounding and bonding shall be performed in accordance with applicable electrical codes. For multi tenant buildings, ANSI/TIA/EIA-607 provides additional bonding and grounding information.

11.2 Main Distribution Frame (MDF)

The MDF room is a centralized space for telecommunications equipment, computing equipment, video equipment that serves a designated housing development. The room shall house only equipment directly related to the telecommunications/computing/video systems and its environment support systems.

When selecting the MDF room site, avoid locations that are restricted by building components that limit expansion such as elevators, core, outside walls or other fixed building walls. Special attention for distance separation shall be given to electrical power supply transformers, motors and generators, radio, or radar transmitters, and induction sealing devices. It is desirable to locate the equipment room close to the main backbone pathway.

When designing the MDF room floor space, the room shall be designed to a minimum of 100 sq. ft. (10' X 10').

Installation of environmental control equipment, such as power distribution or conditioner, and UPS up to 100 kVA shall be permitted in the MDF room. UPS larger than 100 kVA should be located in a separate room. Equipment not related to the support of the MDF room (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed or pass through the MDF room.

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Each MDF requires the installation of a FM-200 Fire Suppression System.

HFC-227 (FM-200), chemically known as heptafluoropropane, is an alternative fire suppression system agent manufactured in the United States by Great Lakes Chemical (FM-200) and DuPont Corporation (HFC-227). It is a replacement for the ozone depleting Halon 1301 used extensively before 1994.

FM-200 (HFC-227) has no ozone depletion potential. Its ODP is zero. FM-200 has found by leading toxicologists to be safe for use when people are present. Just as with Halon 1301, people can be exposed to normal extinguishing concentrations without any fear of health problems.

The MDF room shall be connected to the City owned fiber optic backbone via (2) 4" conduit pathways. These 4" conduit pathways will be routed separately to accommodate redundant fiber optic cable path requirement. Additional provision can be found in TIA/EIA-569-A and the BICSI Telecommunications Distribution Design Manual.

Access shall be made available to the main telecommunications grounding system specified by ANSI/TIA/EIA-607.

- The MDF or main terminal space may be co-located with the entrance facility. It may also be used to house active equipment.
- The MDF or main terminal space may house the demarcation point for access providers and campus backbone cable.
- The associated pathways, protection devices, and any other equipment needed to provide a connection from the access providers' access lines, may also be located in the MDF or main terminal space.
- An MDF requires other support facilities such as power, heating, ventilation, and air conditioning (HVAC). For more information on Control Building/Equipment Rooms, see ANSI/TIA/EIA-569-A.

Listed below are additional provisions:

- A minimum of two walls should be covered with rigidly fixed (3/4 trade size) A-C plywood preferably void free, 8 ft. high, capable of supporting attached equipment. Plywood should be either fire rated or covered with two coats of fire retardant paint.
- Lighting shall be a minimum of 50 foot candles measured 3 ft. above the finished floor.

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- False ceiling shall not be provided.

- The access door shall be a minimum of 36 in. wide and 80 in. high and shall be fitted with a lock.

- Floors, walls and ceiling shall be treated to eliminate dust. Finishes shall be light in color to enhance room lighting.

- Electrical: A minimum of four (4) dedicated 30A, 110V AC duplex electrical outlets, each on separate circuits, shall be provided for equipment power. Consideration should be given to identifying those outlets dedicated to telecommunications equipment. In addition, convenience duplex outlets shall be placed at 6 ft. intervals around the perimeter walls, at a height of 6 in. above the floor. If emergency power is available, consideration shall be given to automatic power backup.

- HVAC: A minimum of (2) 2-ton AC units shall be provided for each MDF Room. These units shall be powered on separate circuits to accommodate redundancy requirements.

- If an emergency power source is available in the building, it is desirable that at least one of the duplex outlets be so supplied.

- Access shall be made available to the independent telecommunications grounding system specified by ANSI/TIA/EIA 607.

- TIA/EIA-569-A contains fire-stopping, sprinkler requirements, miscellaneous pathways, telecommunications recommendations of separation from less than 480V power lines. Further information of entrance rooms can be found in TIA/EIA-569-A and the BICSI Telecommunications Distribution Methods Manuals.

Recognized Backbone Cables in accordance with the City of Loma Linda Connected Community Program and ANSI/TIA/EIA 568-B are noted below.

- Single-mode optical fiber

All intra-building, (within the building) fiber optic backbone cables shall meet the appropriate NEC flame and smoke specifications. These include NEC Article 800 for copper cables and Article 770 for fiber optics. All cables shall meet or exceed the electrical specifications of ANSI/TIA/EIA 568-B. In addition, Corning Cabling Systems, an ISO 9000 series manufacturer,

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is the manufacture of choice for all fiber optic cable and connectivity.

Installers should anticipate intra-building backbone fiber supporting voice/data/video applications shall be singlemode fiber, unless otherwise specified by The City of Loma Linda.

Inter-building backbone fiber supporting data applications will also be singlemode fiber, as specified by The City of Loma Linda. Fiber counts will also be specified by The City of Loma Linda, though it is suggested backbone cable should allow for a minimum 25% growth.

Optical Fiber Backbone Cable Specifications:

Transmission Parameters (outdoor single-mode):
Attenuation: 0.5dB/km at 1310 nm
.0.5dB/km at 1550 nm
Operating Temperature Range: -40 degrees F to 158 degrees F

All fiber optic cable installed for The City of Loma Linda shall conform to the Corning Cabling Systems manufacturer warranty requirements.

The type of connectors used for all fiber optic cabling shall be "SC" (UPC) uniform polish connector at each residence and "SC" (APC) angle polish connector at each MDF, as determined by the City of Loma Linda for any new installation and shall conform to requirements of Corning cabling Systems.

All splicing of backbone fiber optic cables shall be "Fusion" type.

Backbone Distance in accordance with TIA/EIA 568-B.1 are as follows:

- Single-mode Fiber Applications: 9,840 ft.

While it is recognized that the capabilities of single-mode fiber may allow for backbone link distances of up to 37 miles, this distance is generally considered to extend outside the scope of TIA/EIA 568-B.1.

11.3 Entrance Facility considerations

- The building entrance facility consists of the telecommunications service entrance to the building, including the entrance point through the building wall, and continuing to the entrance room or space. The entrance facility may contain the backbone pathways that link to the main Equipment room

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and to other buildings in campus situations.

- The City of Loma Linda and all carriers and telecommunications providers involved in providing service to the building shall be contacted to establish their requirements and explore alternatives for delivering service.

- An alternate entrance facility should be provided where security, continuity of service, or other special needs exist.

- The location of other utilities, such as electrical, water, gas, and sewer, shall be considered in the selection of the telecommunications entrance facility.

- In single or multi tenant buildings, an equipment room may house the entrance facility.

- For recommendations on all commercial building communication entrance facility infrastructure design requirements such as, proper sizing of an entrance facility, intra-building pathway design and building entrance conduit design, etc., refer to the ANSI/EIA/ITA-569-A.

11.4 Equipment Room

- In single or multi tenant buildings, an equipment room may house the entrance facility, the MDF, and a floor-serving terminal.

- An equipment room typically houses more equipment than a floor-serving terminal and it has different space requirements.

- An equipment room requires other support facilities such as power, heating, ventilation and air conditioning (HVAC). For more information on equipment rooms, see ANSI/TIA/EIA-569-A.

- Each Equipment Room requires the installation of a FM-200 Fire Suppression System.

- HFC-227 (FM-200), chemically known as heptafluoropropane, is an alternative fire suppression system agent manufactured in the United States by Great Lakes Chemical (FM-200) and DuPont Corporation (HFC-227). It is a replacement for the ozone depleting Halon 1301 used extensively before 1994.

- FM-200 (HFC-227) has no ozone depletion potential. Its ODP is zero.

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- FM-200 has found by leading toxicologists to be safe for use when people are present. Just as with Halon 1301, people can be exposed to normal extinguishing concentrations without any fear of health problems.

- For recommendations on all commercial building communication infrastructure design requirements such as; proper sizing of an equipment room, floor loading, intra-building pathway design, building entrance conduit design, telecom closet design, etc., refer to the ANSI/EIA/ITA-569-A.

11.5 Backbone Pathways

11.5.1 General

- Within buildings consideration should be given to establishing spare pathway capacity (i.e., conduit w/pull-string) for future media additions or modifications that would be difficult or impossible to cable.

11.5.2. Intrabuilding Backbone/Horizontal Pathways

- For recommendations on all commercial building communication infrastructure intra-building pathway and horizontal pathway design, refer to the ANSI/EIA/ITA-569-A.

11.5.3 Interbuilding Telecommunications Backbone Pathways

- Interbuilding telecommunications backbone pathways provide a means of interconnecting separate buildings and consist of underground, buried, aerial and tunnel pathways.

- An industry standard splice node vault shall be provided for each commercial building. All vaults shall be sized to accommodate fiber optic splice enclosures.

- The splice node vault shall be a Carson Industries, M-series G2436-18 (medium duty) with a static vertical load rating of Tier 5 – (Design Load 5,200lbf); (Test Load 11,282lbf) or equal.

- Minimum splice node vault size shall be 24"x36"x36".

- The developer shall be responsible for providing two (2), 4" conduits from

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the MDF to the closest City-owned fiber-optic backbone connection point. This is to be determined at the plan check phase.

- The developer shall be responsible for providing two (2), 1" and one 1.5" inner duct in each 4" conduit. This is to be determined at the plan-check phase.
- The developer shall be responsible for providing a minimum of one (1), 4" conduit from the MDF to the associated splice node vault at each commercial building.
- The developer shall be responsible for providing two (2), 1" and one 1.5" inner duct in each 4" conduit. This is to be determined at the plan-check phase.
- The developer shall be responsible for providing a minimum of one (1), 2" conduit from the splice node vault to the associated commercial building entrance facility. This is to be determined at the plan check phase.
- The developer must provide industry standard pull strings in each conduit pathway.
- For more information on interbuilding telecommunications backbone pathways, see ANSI/TIA/EIA-758.

11.6 Backbone Cabling

11.6.1 Recognized Cables

Recognized backbone cables include:

- Corning Single mode fiber (ANSI/TIA/EIA-492CAAA).
- Berk-Tek Hard-line coaxial (SCTE IPS-SP-100).
- Berk-Tek Series 6 coaxial (SCTE IPS-SP-001).

11.6.2 Topology

- A star topology should be implemented for optical fiber backbone cabling.
- Coaxial backbone cable may be implemented using a star topology.

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11.6.3 Interbuilding Cabling Protection

- When buildings are connected with interbuilding cabling, the applicable fusing and voltage protection codes shall be followed.

11.6.4 Interbuilding Fiber-Optic Backbone

- A minimum of one continuous strand, single-mode fiber-optic cable shall be provided from the MDF, through the splice node vault to each individual residence.

- Each of the above required, strands of single-mode fiber-optic cable shall have "SC" type (UPC) connectors at each residence and "SC" type (APC) connectors installed at each MDF. The connector shall be the SC-type.

- As an additional requirement, A minimum of one additional continuous strand, single-mode fiber-optic cable shall be provided from the splice node vault to each individual residence to allow connectivity access to service providers.

- These additional strands of single-mode fiber-optic cable shall have a "SC" type (UPC) connector installed at the residence only. The other ends are to be coiled and left un-terminated in the splice node vault.

- At each individual residence a fiber storage spool shall be provided and utilized within the DCB.

- At the MDF a minimum of one (1) 19" x 7' industry standard rack shall be provided and installed. It shall be mounted and braced as per applicable standards and local codes.

- At the MDF all individual single-mode fiber-optic strands shall be terminated with "SC" type (APC) connectors and shall be routed and connected to a Corning rack mount fiber shelf, with the capacity of the shelf to be determined by count of the fiber strands.

- Maximum fiber-optic cable outside diameter shall not exceed 1" in each 2" conduit and 1/2 " in each 1" conduit.

- All single-mode fiber-optic strands must be tested, certified and labeled in accordance with industry standards after installation and termination.

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- The developer shall be responsible for providing all material and labor to accommodate all necessary fiber-optic splice hardware.

12. APPROVED CATEGORY 6 CABLE PERFORMANCE

Scope

This specification applies to solid 4-pair, unshielded twisted-pair (UTP) communication cables and stranded patch cordage manufactured by Berk-Tek, NEC types CM, CMG, CMR, CMP, MP, MPG, MPR, and MPP, and, where applicable, CSA FT-4 and FT-6 Zero Halogen constructions are also included.

Normative References

Reference Documents

The latest edition of referenced standards (from the latest available draft in the case of proposed standards) shall be the controlling documents. Where the standards appear to conflict with one another, the one with the most stringent requirements shall be applicable.

CSA
UL 444
ANSI/TIA/EIA-568-A
ISO/IEC 11801
CENELEC EN50173: 1995
ANSI/ICEA S-90-661
NEC, NFPA70
NEMA WC-63/66

Applicable Testing Standards

Testing shall be in accordance with the following standards:

ASTMD 4566-94, Standard Test Methods for Electrical Performance Properties of Insulation and Jackets for Telecommunications Wire and Cable, 1994
ANSI/TIA/EIA-568-A, Commercial Building Telecommunications /Standard, 1995
ANSI/TIA/EIA-568-A-1, Propagation Delay and Delay Skew Specifications for 100 Ω 4-pair cables, 1997
ANSI/TIA/EIA-568-A-2, Corrections and Additions to TIA/EIA-568-A, 1998
ANSI/TIA/EIA-568-A-5, Transmission Performance Specifications for 4-pair 100 Ω Category 5e Cabling, 1999

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This document provides required test values at specific discrete frequencies. The tabulated values are intended for reference only. All Levels products are swept-tested through a prescribed frequency range. The Anixter Levels purchase specification requires 100% compliance throughout the specified range of frequencies tested. By convention, all values of electrical characteristics, while predominantly negative numbers (representing losses), are expressed as absolute values (positive numbers).

General Requirements

Applicable Cables

Levels of performance apply to 4-pair. unshielded twisted pair cables. A shielded version, if allowed, shall comply with the performance requirements of the applicable Level.

Minimum Performance Requirements

All cables shall meet the minimum performance requirements of the latest applicable standards defined above.

Minimum Levels Requirements

The cable for each purchasing Level shall meet the performance requirements of all lower Levels.

Virgin Materials

Only virgin materials shall be used in the construction of Levels cables.

Plenum-Rated Cables

Plenum-rated cables shall use 100% FEP for the insulation, except where it is proven that the cable constructed with alternate materials meets or exceeds the electrical performance of FEP.

Quality Assurance

The manufacturer of Level cables shall be ISO 9000 registered. Initial Qualification and Certification of the manufacturer is required. An ongoing program of random sample compliance testing of all Levels products must be maintained.

Labeling of UTP Cable and Patch Cordage

The following information will be repetitively printed every 12-24 inches on the cable jacket: Manufacturer's name, brand, gauge, pair count, NEC type (CSA in Canada), part number, other standards compliance rating, and footage marker.

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Packaging of UTP Cable

Standard packaging is 1,000 feet, one continuous length on a reel, in a reelless box or on a reel in a box. All cables shall be shipped on 42" x 48" pallets, and shall not be stacked higher than 48". All pallets shall contain the same color cable with the same footage marked with the appropriate part number.

Measurement Precautions

Transmission measurements shall be performed on 100 m (328 ft.) cable samples cut from the reel or package. Impedance matching balun terminations shall be used in conjunction with an RF vector network analyzer to acquire all data. When preparing the cable samples for measurement, no more than 38 mm (1.5") of jacket shall be removed on either end of the sample. The twist rate shall be maintained as much as possible into the balun test terminals. When a load termination is required, a precision metal film or chip 100 $\Omega \pm 1\%$ resistor shall be used to terminate each cable pair.

Category 6 Cable

Reference Documents

In addition to the requirements listed above and below, Category 6 cables shall meet the requirements of:

ANSI/TIA/EIA-568-A-5 Category 5e
ANSI/TIA/EIA-568-B Category 6
ISO/IEC 11801 Categories 5 & 6

Performance Requirements

Category 6 Cable – Highest Test Frequency

400 MHz minimum (all parameters).

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Category 6 Cable – Input Impedance

Input impedance shall be measured per ASTM 4566-94, 43.2 Method 2, Option 2. Category 6 input impedance should be swept out to 400 MHz and meet the following:

FREQUENCY (MHz)	UPPER IMPUT IMPEDANCE LIMIT (Ohms)	LOWER INPUT IMPEDANCE LIMIT (Ohms)
1	122	82
10	111	90
20	111	90
400	124	81

The above limits describe the boundaries of an envelope within which the swept curve must fit.

Category 6 Cable – Minimum Pair-to-Pair NEXT and ELFEXT

Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Pair-to-Pair Equal Level Far End Crosstalk (ELFEXT) shall not be less than the minimum numbers shown in the table.

FREQUENCY (MHz)	PAIR-TO-PAIR NEXT LOSS (dB)	PAIR-TO-PAIR ELFEXT LOSS (dB)
1	75.3	68.8
10	60.3	48.8
20	55.8	42.7
31.25	52.9	38.9
100	45.3	28.8
150	42.7	25.2
200	40.8	22.7
250	39.3	20.8
300	38.2	19.2
350	37.2	17.9
400	36.3	16.7

Category 6 Cable – Minimum Power Sum NEXT and ELFEXT

Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Equal Level Far End Crosstalk (PSELFEXT) shall not be less than the minimum numbers shown in the following table.

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FREQUENCY (MHz)	POWER SUM NEXT LOSS (dB)	POWER SUM ELFEXT LOSS (dB)
1	73.3	65.8
10	58.3	45.8
20	53.8	39.7
31.25	50.9	35.9
100	43.3	25.8
150	40.7	22.2
200	48.8	19.7
250	37.3	17.8
300	36.2	16.2
350	35.2	14.9
400	34.3	13.7

Power Category 6 Cable – Maximum Attenuation, Minimum Pair-to-Pair ACR and Power Sum ACR

Attenuation shall not be greater than the maximum numbers shown in the following table when measured at an ambient temperature of 20° C (68°F). Pair-to-Pair Attenuation to Crosstalk Ratio (ACR) shall not be less than the minimum numbers shown in the following table. Power Sum Attenuation to Crosstalk Ratio shall not be less than the minimum numbers shown in the following table.

FREQUENCY (MHz)	ATTENUATION (dB)	PAIR-TO-PAIR ACR (dB)	POWER SUM ACR (dB)
1	2.0	73.3	71.3
10	6.0	54.3	52.3
20	8.5	47.3	45.3
31.25	10.7	42.2	40.2
100	19.9	25.4	23.4
150	24.9	17.8	15.8
200	29.2	11.6	19.6
250	33.0	6.3	4.3
300	36.6	1.5	-0.5
350	40.0	-2.9	-4.9
400	43.2	-6.9	-8.9

MC. *Attenuation for Category 6 stranded patch cordage is allowed to be up to 10% greater.*

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Category 6 Cable – Minimum ACR Frequencies @ 0.0 dB and 10 dB

10 dB @ 228 MHz (100 meter Pair-Pair NEXT)
0 dB @ 344 MHz (100 meter Pair-Pair NEXT)
10 dB @ 208 MHz (100 meter Power Sum NEXT)
0 dB @ 319 MHz (100 meter Power Sum NEXT)

Category 6 Cable – Minimum Return Loss (at 100 meters)

26.0 dB @ 10 MHz
25.0 dB @ 31.25 MHz
23.5 dB @ 62.50 MHz
22.5 dB @ 100 MHz

Category 6 Cable – Longitudinal Conversion Loss (LCL)

(Reserved for future use when the proper test procedure is developed by ASTM).

Category 6 Cable – Maximum Skew

25 ns at 100 meters

Category 6 Cable – Maximum Attenuation

43.2 dB @ 400 MHz

13. APPROVED PATCH CORDS

Scope

This section applies to 100 ohm stranded 4-pair, UTP patch cordage in various lengths terminated with eight conductor modular RJ45- or IDC-type plugs, manufactured by Ortronics, Inc.

Normative References

Reference Documents

The latest edition of referenced standards (from the latest available draft in the case of proposed standards) shall be the controlling document. Where the standards appear to conflict with one another, the one with the most stringent requirements shall be applicable.

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CSA
UL 1863
ANSI/TIA/EIA-568-A
ISO/IEC 11801
ISO/IEC 60603-7

Applicable Testing Standards

Testing shall be conducted in accordance with the following standards:
ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Standard, 1995
ANSI/TIA/EIA-568-A-4, Production Modular NEXT Loss Test Method and Requirements for Unshielded Twisted Pair Cabling, 1999
ATS Anixter Test Specification ATS 01.01 for Non-Destructive Testing of Assembled Patch Cords

This document provides required test values at specific discrete frequencies. The tabulated values are intended for reference only. All Levels products are swept-tested through a prescribed frequency range. The Anixter Levels purchase specification requires 100% compliance throughout the specified range of frequencies tested. By convention, all values of electrical characteristics, while predominantly negative numbers (representing losses), are expressed as absolute values (positive numbers).

General Requirements

Applicable Hardware

Levels of performance apply to patch cords used with 100 ohm 4-pair, Unshielded UTP cabling systems. A shielded version, if offered, shall comply with the performance requirement of the applicable Level.

Quality Assurance

The manufacturer of Level hardware shall be ISO 9000 registered. Initial Qualification and Certification of the manufacturer is required. An ongoing program of random sample compliance testing of all Levels products must be maintained.

Labeling of Patch Cords

The following information will be repetitively printed every 12-24 inches on the cable jacket: Manufacturer's name, brand, gauge, pair count, NEC type (CSA in Canada), part number, and other standards compliance ratings.

Measurement Precautions

Transmission testing shall be conducted on representative samples of the manufacturer's

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shortest, median, and longest length cords received directly from Anixter's product in inventory. The following tables provide reference numbers at specific discrete frequencies for 3-ft., 10-ft. and 25-ft. patch cords. The selected range of patch cord lengths is intended to provide baseline numbers for evaluating patch cord NEXT at varying lengths.

Category 6 Patch Cords

Performance Requirements

Category 6 Patch Cord – Highest Test Frequency

Swept to 250 MHz minimum.

Category 6 Patch Cord – Minimum Pair-to-Pair NEXT

Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table.

FREQUENCY (MHz)	**PAIR-TO PAIR NEXT LOSS** 3 ft. cord Limit (dB)	**PAIR-TO-PAIR NEXT LOSS** 10 ft. cord Limit (dB)	**PAIR-TO-PAIR NEXT LOSS 25 ft. cord Limit (dB)**
1	65.0	65.0	65.0
10	60.0	59.9	59.7
20	54.0	54.0	53.9
31.25	50.2	50.2	50.2
100	40.3	40.4	40.8
150	36.8	37.1	37.6
250	32.5	32.9	33.7

Category 6 Patch Cord – Minimum Return Loss

Return Loss shall not be less than the minimum numbers shown in the following table.

FREQUENCY (MHz)	**RETURN LOSS** (dB)
1 to 20	25
31.25	23
62.5	20
100	18
250	14

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14. APPROVED CONNECTING HARDWARE PERFORMANCE

Scope

This section applies to 100 ohm UTP connecting hardware. Manufactured by Ortronics.

Normative References

Reference Documents

All connecting hardware shall meet, at a minimum, all the requirements, including the electrical and mechanical performance requirements of:
CSA
UL 1863
ANSI/TIA/EIA-568-A
ISO/IEC 11801
CENELEC EN50173: 1995
NEC, NFPA70

Applicable Testing Standards

Testing shall be conducted in accordance with the following standards:
ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Standard, 1995
ANSI/TIA/EIA-568-A-5, Transmission Performance Specifications for 4-pair 100 Ω Category 5e Cabling, 1999
ISO/IEC 11801

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General Requirements

Applicable Hardware

Levels of performance apply to connecting hardware used with 100 ohm 4-pair, UTP Levels-type cables. A shielded version, if offered, shall comply with the performance requirement of the applicable Level.

Quality Assurance

The manufacturer of Level hardware shall be ISO 9000 registered. Initial Qualification and Certification of the manufacturer is required. An ongoing program of random sample compliance testing of all Levels products must be maintained.

Measurement Precautions

Transmission testing shall be conducted on representative samples received directly from Anixter's product inventory. The normative annexes, C, D, E and F of the ANSI/TIA/EIA-568-A-5 shall be adhered to when quantifying connecting hardware.

Category 6 Connecting Hard

Performance Requirements

Category 6 Hardware – Highest Test Frequency

Swept to 250 MHz minimums.

Category 6 Hardware – Minimum Pair-to-Pair NEXT, Power Sum NEXT and Maximum Attenuation

Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Attenuation shall not be more than the maximum numbers shown in the following table.

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FREQUENCY (MHz)	PAIR-TO PAIR NEXT LOSS (dB)	POWER SUM NEXT LOSS (dB)	ATTENUATION N (dB)
1	94.0	90.0	0.02
10	74.0	70.0	0.06
20	68.0	64.0	0.09
31.25	64.1	60.1	0.11
100	54.0	50.0	0.20
150	50.5	46.5	0.24
200	48.0	44.0	0.28
250	46.0	42.0	0.32

Category 6 Hardware – Minimum Return Loss

Return Loss shall not be less than the minimum numbers shown in the following table.

FREQUENCY (MHz)	RETURN LOSS (dB)
1 to 25	35.0
31.25	34.1
62.5	28.1
100	24.0
150	20.5
200	18.0
250	16.0

15. CHANNEL PERFORMANCE

Scope

This section further defines the complete end-to-end channel requirements for the Levels Channel 7 solution manufactured by Berk-Tek, Inc. Channel compliance is only applicable following successful compliance to individual component Levels in these Specification. This section specifies the minimum requirements that cables, connecting hardware and assembled patch cords must meet when combined into a full cabling system, in order to reach compliance with the Anixter Levels Channel Program.

Normative Reference

Reference Documents

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The latest edition of referenced standards (from the latest available draft in the case of proposed standards) shall be the controlling document. Where the standards appear to conflict with one another, the one with the most stringent requirements shall be applicable.
ANSI/ICEA S-90-661
CSA
UL 444
ANSI/TIA/EIA-568-A
ISO/IEC 11801
CENELEC EN50173: 1995
NEC, NFPA70
NEMA WC-63/66

In addition to the requirements shown above, Category 6 cables shall previously meet the requirements of:
ANSI/TIA/EIA-568-A-5 Category 5e
ANSI/TIA/EIA-568-A Category 5
ISO/IEC 11801 Categories 5 & 6

All connecting hardware and patch cords shall previously meet, at a minimum, all the requirements, including the electrical and mechanical performance requirements of:
CSA
UL 1863
ANSI/TIA/EIA-568-A
ISO/IEC 11801
ISO/IEC 60603-7
CENELEC EN50173: 1995
NEC, NFPA70

Applicable Testing Standards

Testing of individual components and channels shall be conducted in accordance with the following standards:
ASTM D 4566-94, Standard Test Methods for Electrical Performance Properties of Insulation and Jackets for Telecommunications Wire and Cable, 1994
ANSI/TIA/EIA-568-A, Commercial Building Telecommunications Standard, 1995
ANSI/TIA/EIA-568-A-1, Propagation Delay and Delay Skew Specifications for 100 Ω 4-pair cable, 1997
ANSI/TIA/EIA-568-A-2, Corrections and Additions to TIA/EIA-568-A, 1998
ANSI/TIA/EIA-568-A-4, Production Modular NEXT Loss Test Method and Requirements for Unshielded Twisted Pair Cabling, 1999
ANSI/TIA/EIA-568-A-5, Transmission Performance Specifications for 4-pair 100 Ω Category 5e Cabling, 1999
ANSI/TIA/EIA-TSB 67, Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems, 1999
ATS Anixter Test Specification ATS 01.01 for Non-Destructive Testing of Assembled Patch

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Cords
ISO/IEC 11801

This document provides required test values at specific discrete frequencies. The tabulated values are intended for reference only. All Levels products are swept-tested through a prescribed frequency range. The Anixter Levels purchase specification requires 100% compliance throughout the specified range of frequencies tested. By convention, all values of electrical characteristics, while predominantly negative numbers (representing losses), are expressed as absolute values (positive numbers).

Requirements

Applicable Channels

Levels of performance apply to 4-pair, UTP cables, assembled patch cords and connecting hardware used with 100 ohm 4-pair, UTP Levels-type cable. A shielded version, if allowed, shall comply with the performance requirements of the applicable Level. The Anixter channel will consist of an equipment patch cord, information outlet, horizontal cabling (90 m) with a transition point near the information outlet (I/O), two telecom closet connection points and patch cords for a total of four (4) connection points, as shown below.

Quality Assurance

The manufacturers of Levels cable and hardware shall be ISO 9000 registered. Initial Qualification and Certification of the manufacturer is required. Anixter also maintains an ongoing program of random sample compliance testing of all Levels products.

Category 6 Channel

Category 6 Channel – Performance Requirements

Category 6 Channel – Highest Test Frequency

250 MHz minimum (all parameters).

Category 6 Channel – Minimum Pair-to-Pair NEXT and ELFEXT

Pair-to-Pair Near End Crosstalk (NEXT) shall not be less than the minimum numbers shown in the following table. Pair-to-Pair Equal Level Far End Crosstalk (ELFEXT) shall not be less than the minimum following table.

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FREQUENCY (MHz)	PAIR-TO-PAIR NEXT LOSS (dB)	PAIR-TO-PAIR ELFEXT LOSS (dB)
1	73.5	63.9
10	57.3	43.8
20	52.3	37.8
31.25	49.1	33.9
100	40.5	23.8
150	37.5	20.3
200	35.3	17.8
250	33.7	15.8

Category 6 Channel – Minimum Power Sum NEXT and ELFEXT

Power Sum Near End Crosstalk (PSNEXT) shall not be less than the minimum numbers shown in the following table. Power Sum Equal Level Far End Crosstalk (PSELFEXT) shall not be less than the minimum numbers shown in the following table.

FREQUENCY (MHz)	POWER SUM NEXT LOSS (dB)	POWER SUM ELFEXT LOSS (dB)
1	71.15	60.8
10	54.7	40.8
20	49.6	34.8
31.25	46.3	30.9
100	37.6	20.8
150	34.5	17.3
200	32.3	14.8
250	30.6	12.9

Category 6 Channel – Maximum Attenuation, Minimum Pair-to-Pair ACR and Power Sum ACR

Attenuation shall not be greater than the maximum numbers shown in the following table when measured at an ambient temperature of 20°C (68°F). Pair-to-Pair Attenuation to Crosstalk Ratio (ACR) shall not be less than the minimum numbers shown in the following table. Power Sum Attenuation to Crosstalk Ratio shall not be less than the minimum numbers shown in the following table.

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FREQUENCY (MHz)	ATTENUATION (dB)	PAIR-TO-PAIR ACR (dB)	POWER SUM ACR (dB)
1	2.1	71.4	68.9
10	6.3	51.0	48.4
20	9.0	43.4	40.6
31.25	11.3	37.8	35.0
100	20.6	19.9	16.7
150	26.1	11.4	8.5
200	30.6	4.8	1.8
250	34.6	-1.0	-4.0

Category 6 Channel – Minimum Return Loss

Return Loss shall not be less than the minimum numbers shown in the following table.

FREQUENCY (MHz)	RETURN LOSS (dB)
1 to 25	19.0
25	18.0
31.25	17.1
62.5	14.1
100	12.0
150	10.2
200	9.0
250	8.0

16. INSTALLATION REQUIREMENTS

In order for UTP cabling infrastructure to deliver high-speed performance, it is manufactured to very tight specifications. Consequently, to maintain the UTP cabling system performance, proper installation practices must be followed. Listed below are some requirements that shall be followed:

- Never crush the cable (by over-cinching with cable ties or by using a staple gun). Use of Velcro cable ties in the closets is required.
- Do not kink, knot or snag the cable while pulling; this will cause damage under the jacket and may alter cable performance.
- Do not exceed the recommended pulling tension.

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- Do not exceed the minimum bend of 4 x outside diameter (OD) for 4-pair, UTP cable, 10 x OD for multipair (more than 4-pair), UTP cable, 1.18 in for two- (2) fiber cable, and 10 x OD for multifiber cable.

- Per ANSI/TIA/EIA-568-B and BICSI, never untwist the pairs of cable beyond the absolute minimum required for termination.

- The cable jacket on UTP cable shall only be stripped back the minimum required to terminate to connecting hardware.

- Cable management panels shall be used when terminating cable.

- Use the same performance criteria for both cable and connecting hardware through the entire horizontal run.

- Maximum cable lengths shall not be exceeded.

- Properly rated patch cables will be provided and tested. Silver satin line cord is not acceptable.

- All fiber optic cables shall be set in inner-duct with the appropriate flame and smoke rating.

- All horizontal runs, moves, additions and changes must be documented. Use of a software package is recommended. Link and channel test results must be provided.

- Connecting hardware for optical fiber installed at the following locations: main cross-connect, intermediate cross-connect, horizontal cross-connect, horizontal transition point, telecommunications outlet, shall not surpass minimum bend radius and shall be capable of storing 1 m (3.28 ft.) of additional fiber.

- SC-type connectors for fiber are recommended by ANSI/TIA/EIA-568-B.3 (beige for multi mode and blue for single mode). Users that have installed ST-type fiber connectors may remain with them for both existing and future additions.

- The use of different colored icons for jacks (e.g., one for data, and one for voice) and different colored jacketed cables (which aid in cable identification and administration) are required.

- A single shared sheath at the outlet is not acceptable.

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- Only one pin-out throughout the total installation (T568A or T568B) is allowed

- Sizing of the house backbone cable (voice) will allow for a minimum of 2-pair per station, allowing for 30-40% growth and rounding off to the next largest pair count cable (e.g., 250 pairs needed, which includes growth, move to a 300 pair cable). Never specify smaller than six (6) fibers in the backbone. Again, this is driven by the topology being implemented and should always allow for future growth.

- Reinstalling cable that has been pulled out of modular furniture is not allowed.

- A 40% fill ratio for all conduit runs is recommended (see Diagram 1)

Diagram 1
Sizing of Horizontal Pathways

Cable Diameter

The following table lists typical ranges of cable diameter for recognized Horizontal cabling media. These values are provided for planning purposes only. It is strongly recommended that the distribution designer check the actual diameter of the cable being used before determining pathway size requirements.

Typical ranges of cable diameter:

Horizontal Cable Type…	Typical range of Overall Diameter…
Four-pair 100-ohm UTP	0.36 cm to 0.61 cm (0.14 in. to 0.25 in.)
62.5/125um Optical Fiber Cable	0.28 cm to 0.46 cm (0.11 in. to 0.18 in.)

Number of cables

The following table provides guide-lines used by ANSI/TIA/EIA-569-A on cable capacity for conduits ranging from trade size ½ to trade size 4.

Diagram 1

Conduit Capacity

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Trade Size	Cable Outside Diameter Cm (in.)									
	0.33 (0.13)	0.46 (0.18)	0.56 (0.22)	0.61 (0.24)	0.74 (0.29)	0.79 (0.31)	0.94 (0.37)	1.35 (0.53)	1.58 (0.62)	1.78 (0.70)
½	1	1	0	0	0	0	0	0	0	0
¾	6	5	4	3	2	2	1	0	0	0
1	8	8	7	6	3	3	2	1	0	0
11/4	16	14	12	10	6	4	3	1	1	1
11/2	20	18	16	15	7	6	4	2	1	1
2	30	26	22	20	14	12	7	4	3	2
21/2	45	40	36	30	17	14	12	6	3	3
3	70	60	50	40	20	20	17	7	6	6
31/2	-	-	-	-	-	-	22	12	7	6
4	-	-	-	-	-	-	30	14	12	7

17. LABELING AND ADMINISTRATION

The purpose of clear and permanent labeling is to initially facilitate the services installer, but, more importantly, to provide the resident with clear, easy identification of the location of each cable termination within the DCB.

Clear identification labels in permanent ink shall be attached approximately 6" from the cable termination.

Each label is to identify the "Room". The identifier must be consistent with the builder's Plan Set call-out for that room.

Or

Each label is to utilize a number sequence. If this method is utilized, the numbers must be attached as referenced above. Further, a full, specific and correct "Key Sheet" must be included and permanently affixed to the inside of the DCB.

- A labeling plan and administration plan must be submitted and approved before any cable or fiber is deployed.
- Each cable shall be labeled.
- Each RJ45 Jack will include the appropriate color-coded icon symbol (i.e., telephone or computer).
- Each RJ45 Jack on the patch panel will include the appropriate color-

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coded icon symbol (i.e., telephone or computer).

- Each identifier shall be unique.
- Components shall be marked where they are administrated (label at all punch down points, panels, blocks, outlets, etc.).
- Example:

Home #	Outlet #	B/B Fiber #	Rack & P/P Location #
001	01A1	012	A012

hall be

- All dedicated telecommunications grounding bus bars shall be labeled.

18. BONDING AND GROUNDING

Grounding

Grounding shall meet the requirements of the NEC; and, additionally, grounding bonding shall conform with ANSI/TIA/EIA-607. For example see Diagram 2.

Diagram 2
Example ANSI/TIA/EIA-607 Grounding

Bonding to the service equipment (power) ground

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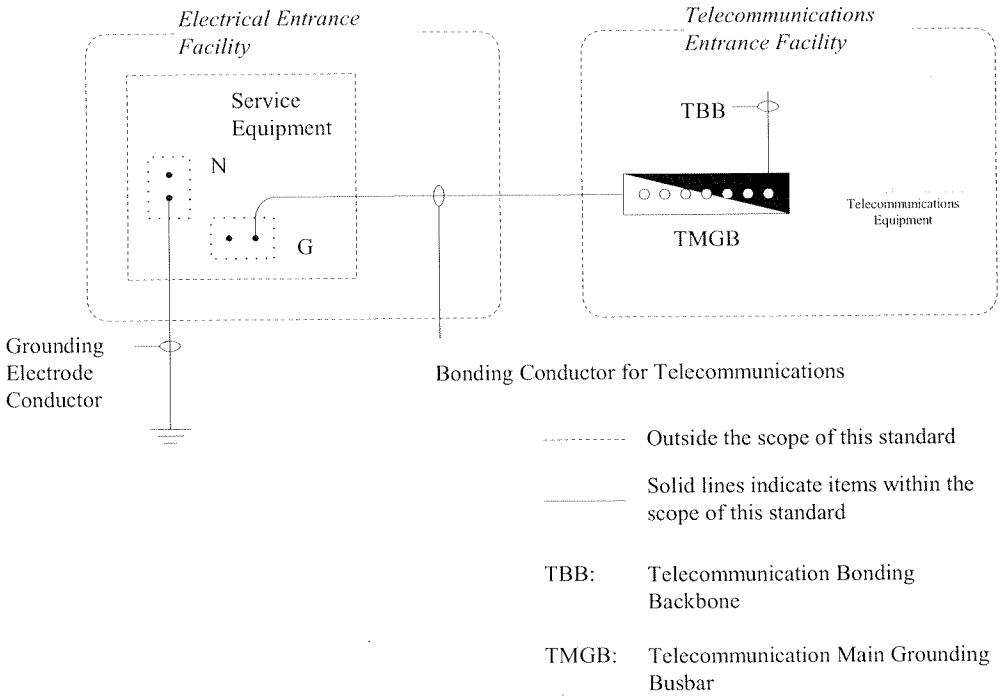
The bonding conductor for telecommunications shall bond the TMGB to the service equipment (power) ground. The figure below schematically depicts connectivity to the service equipment (power) ground.



Schematic of connectivity to the service equipment (power) ground

19. TESTING, CERTIFICATION & WARRANTY

Testing of all installed "Basic Links" shall be performed using a Level (e) hand-held tester and performed to the latest revision of ANSI/TIA/EIA-568-B documents. All reports shall be recorded and presented to the end-user before acceptance. This also includes all fiber runs that have been installed. Fiber will be tested for both wavelengths of multimode and single-mode fiber by power meter and light source.

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Testing

Testing of cabling shall be performed prior to system cut-over '100 percent of the UTP horizontal and riser pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. UTP voice, data and building control device horizontal wiring pairs shall be tested to the latest version of the ANSI/TIA/EIA-568-B documents, from the information outlet, to the TC, to the information outlet. In addition, all assigned circuits shall be tested from the information outlet/building control device to the MDF.

Workmanship

Components of the premises distribution system shall be installed in a neat, orderly manner consistent with the best telephone and data installation practices. Wiring color codes shall be strictly observed and termination shall be uniform throughout. Identification marking and systems shall be uniform, permanent and readable and in accordance with ANSI/TIA/EIA-606 Specifications. ANSI/TIA/EIA-568-B.1 wiring codes as shown on the drawings shall specify all twisted pair wiring.

Inspection

The City of Loma Linda Project Manager and Installation Project Managers shall perform on-going inspections during construction. All work shall be performed in a high quality, craftsman-like manner, and the overall appearance shall be neat, clean and orderly. The following points will be examined:

- Is the design documentation complete? Are all cables properly labeled from end-to-end?
- Have all terminated cables been properly tested in accordance with the Specifications for the required performance Level as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and/or DC voltage?
- Is the cable type suitable for its pathway? Are the cables bundled in parallel?
- Have the pathway manufacturer's guidelines been followed? Are all cable penetrations installed properly and fire-stopped according to the code?
- Have the contractors avoided excessive cable bending?
- Have potential EMI and RFI sources been considered?
- Is cable fill correct?

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- Are hanging supports within 1.5 meters (5 ft.)?
- Does hanging cable exhibit some sag?
- Are telecommunications closet terminations compatible with applications equipment?
- Have Patch Panel instructions been followed?

  a) Jacket removal point
  b) Termination positions
  c) All pair terminations tight with minimal pair distortions
  d) Twists maintained up to the Index Strip

- Have Modular Panel instructions been followed?

  a) Cable dressing first
  b) Jackets remain up to the Connecting Block
  c) All pair terminations tight and undistorted
  d) Twists maintained up to the Connecting Block

- Are the correct outlet connectors used and turned right side up?
- Are identification markings uniform, permanent and readable?

Warranty

A product Warranty and System Assurance Warranty for this structured cabling system shall be provided. Upon successful completion of the installation and subsequent testing by the installer and the City of Loma Linda, a Warranty certificate registering the installation by Berk-Tek and Ortronics shall be provided to the City of Loma Linda.

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20. SCOPE OF WORK

A scope of work shall be created and supplied by Anixter, Inc., for each individual development.

21. BILLS OF MATERIAL (See Attached Material List)

An estimated Bills of Material shall be created and supplied by Anixter, Inc., for each individual development.

22. BUILDING/PLAN-CHECK

Plans shall be submitted showing compliance with design standards as outlined in Resolution No. 2312. Plans shall show location of:

- All Distribution Center Boxes
- All jack locations
- Materials to be used in compliance with Resolution No. 2312

23. PUBLIC WORKS/PLAN CHECK

Any and all work in the public right-of-way (R.O.W.) or proposed public R.O.W. requires a Public Works permit. A Public Works permit will be issued based upon a plan, approved by the City, showing all work proposed in the R.O.W.

24 CONTRACTOR QUALIFICATIONS

- The selected Contractor shall be a recognized Anixter "Levels" Partner Contractor, certified by the manufacturer: **Berk-Tek/Ortronics.**

- The selected contractor shall be a recognized Anixter "Levels" Partner Contractor, certified in fiber placing, fiber splicing and fiber testing by Corning Cabling Systems.

- The Contractor must be fully capable and have a minimum of five (5) years of experience in the design and installation of the telecommunications distribution system proposed.

- The Contractor must be fully capable of offering a minimum five (5) year Labor and workmanship warranty of the installation of the telecommunications distribution system proposed.

- To ensure the system has continued support, the **City of Loma Linda** will contract only with Contractors having a successful history of sales,

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installation, service, and support. During the evaluation process the City of Loma Linda may, with full cooperation of the Contractors, visit the contractors' places of business, observe operation and inspect records.

- A minimum of 50% of the staff assigned to installation of the proposed system by the contractor must be certified by the associated manufacturer.

- All staff assigned to this project by the Contractor must wear shirts with the Contractor's logo at all times.

- **The City of Loma Linda** may, with full cooperation of the Contractors, visit client installations to observe equipment operations and consult with references. Specified visits and discussions shall be arranged through the Contractors, with Contractor personnel present during these discussions.

- The Contractor must provide a minimum of two (2) reference accounts at which similar work, both in size and scope, have been completed by the Contractor within the last two (2) years and one (1) reference account of similar size and scope that is currently in progress.

25. APPROVED CONTRACTORS

The following Contractors are approved to bid all Berk-Tek/Ortronics, "Residential Development Copper" work associated with the Loma Linda Connected Community Program:

- John Griffin Construction, Inc
  Mr. Mike Houska – (909) 278-2377

- Enterprise Electric
  Mr. Dan DeWitt - (909) 296-1530

- Pacific Coast Cabling
  Mr. Tim McManus - (818) 407-1911

- CCCI West
  Mr. Jeff Stanley – (714) 606-2915
  A
- SST
  Mr. Craig Curran – (949) 367-9375

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The following Contractors are approved to bid all Corning Cabling Systems, "Residential Development Fiber Optic" work associated with the Loma Linda Connected Community Program:

- John Griffin Construction, Inc
  Mr. Mike Houska – (909) 278-2377

- Enterprise Electric
  Mr. Dan DeWitt - (909) 296-1530

- CCCI West
  Mr. Jeff Stanley – (714) 606-2915

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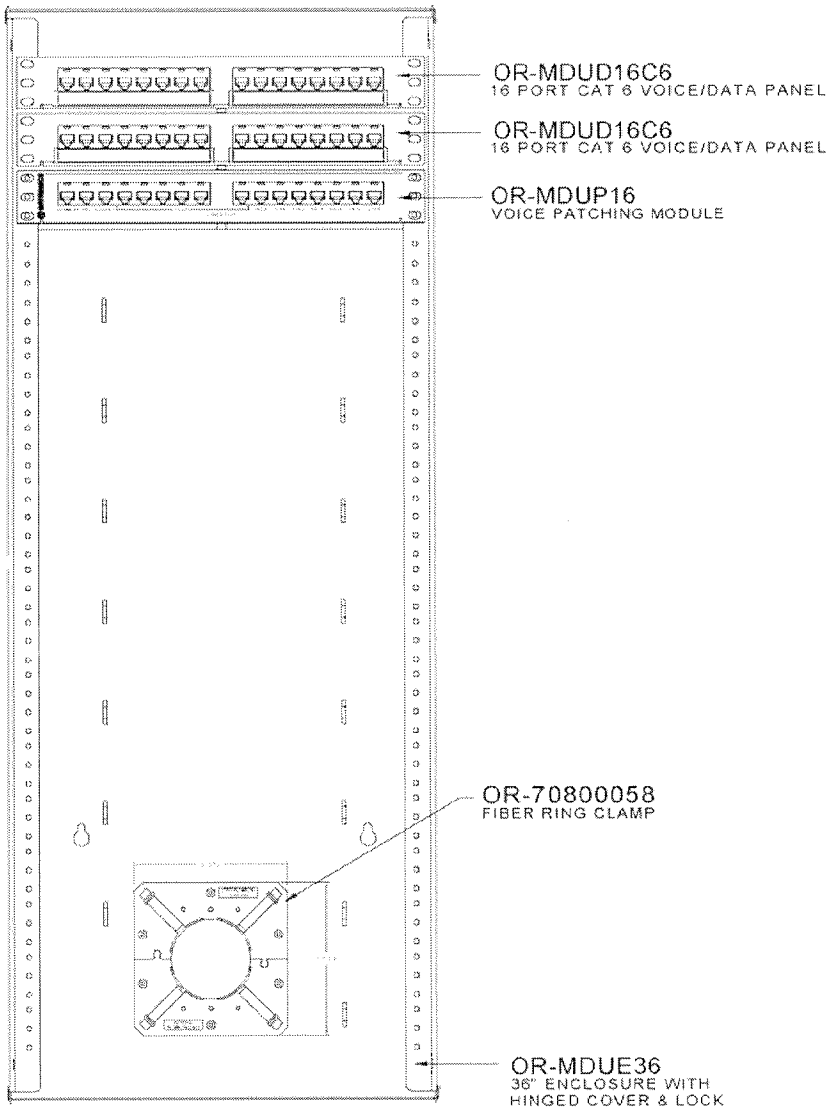
DISTRIBUTION CENTER BOX (DCB)



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