

GUIDELINES

HAS/PDC/Design Division
Houston, Texas

Project Title
Proj./CIP No.

(These Guidelines are basic minimum criteria to be met in preparing the final specifications for this section, which is the responsibility of the Designer/Contractor/Installation Team.)

SECTION 271300 BACKBONE AND RISER MEDIA INFRASTRUCTURE (REV. 02-23-2018 SJS)

PART 1 GENERAL

1.01 SUMMARY

- A. Provide a Structured Cabling System (SCS) for the purpose of supporting voice, data and video communications at various locations within the Houston Airport System. The Houston Airport System (HAS) has established Systimax as the standard for cabling infrastructure installations. *(Designer to provide a detailed summary of all work to be performed)*

1.02 SECTIONS INCLUDES

- A. This section includes specifications for the installation of backbone and riser media infrastructure.
- B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification sections, apply to the work of this section.
- C. Backbone and Riser Media Infrastructure includes but not limited to copper, fiber cable types, Ipatch panels, imVision controllers, connectors, testing requirements, accessories and associated hardware.

1.03 REFERENCES

- A. Related Sections: Use these Specifications for all related work not specifically covered in this specification:
 - 1. Section 270526: Telecommunication Grounding and Bonding
 - 2. Section 270528: Interior Communication Pathways
 - 3. Section 270543: Exterior Communication Pathways
 - 4. Section 270553: Identification and Labeling of Communication Infrastructure
 - 5. Section 271100: Communication Cabinets and Equipment Rooms
 - 6. Section 271500: Horizontal Media Infrastructure
 - 7. Section 272100: Data Communication Network Equipment
 - 8. Section 272200: PC, Laptop, Servers and Equipment
 - 9. Section 275113: Audio Communication System
 - 10. Section 281300: Access Control System
 - 11. Section 232313: Video Surveillance Control and Management System

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B. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.

C. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect two weeks prior to the date of the Bidding Documents unless the document is shown dated.

D. Conflicts.

1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
2. Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements.

E. References.

3. ANSI/TIA/EIA-568-D, Commercial Building Telecommunications Wiring Standards
4. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
5. ANSI/TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
6. International Standards Organization/International Electromechanical Commission (ISO/IEC) DIS11801, January 6, 1994
7. Underwriters Laboratories (UL®) Cable Certification and Follow Up Program
8. National Electrical Manufacturers Association (NEMA)
9. American Society for Testing Materials (ASTM)
10. National Electric Code (NEC®) Latest issue
11. National Electrical Safety Code (NESC) Latest issue
12. Institute of Electrical and Electronic Engineers (IEEE)
13. UL Testing Bulletin
14. American National Standards Institute (ANSI) X3T9.5 Requirements for UTP at 100 Mbps
15. SYSTIMAX Structured Cabling Systems, Performance Specifications, Latest Issue
16. SYSTIMAX Structured Cabling Systems, Components Guide, Latest Issue
17. Systimax Generic Specifications: Fiber Optic Outside Plant Cable, Latest Issue
18. BICSI Telecommunications Distribution Methods Manual (TDMM) Latest issue
19. Rural Utilities Service (RUS) Section 1755

F. All splicing methods, procedures and products shall comply with the following:

20. Rural Utilities Service (RUS) Section 1755
21. National Electrical Safety Code (NESC) Latest issue
22. National Electrical Code (NEC) Latest issue
23. Fiber closures: GR-771-Core

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24. Copper splice cases: Bellcore Testing Requirement PUB-55003 (Pressure Tight Splice Closure)
25. UL 1863 classified
26. Applicable local codes, statutes, ordinances, regulations, license requirements.

1.04 SUBMITTALS

- A. Qualifications: Demonstrate compliance with requirements of Paragraph 1.05A below.
- B. Manufacturers' data, including part numbers, cut sheets and detailed descriptions, for all proposed equipment. to include quantity of spare parts.
- C. Cable inventory data shall be submitted for all fiber, copper, and coaxial cabling and termination equipment. Reference Specification 270553 for the Inside and Outside plant spread sheets. Information shall be provided on a CD.
- D. Shop Drawings to be submitted and approved before implementation is started. Shop Drawings to be submitted in accordance with Specification 01340.
- E. Record Drawings: Furnish CAD drawings, following format in Section 01340, of completed work including cable numbers. Refer to Specification 270553 for labeling conventions. Contractor's on-site Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all shop drawings, coordination drawings and record drawings.
- F. Include spares list to be approved by HAS IT Project Manager for approval.
- G. Cable Testing Reports.
 1. Submit Testing Plan prior to beginning cable testing.
 2. Submit certified test reports of Contractor-performed tests in accordance with paragraph 3.04. of this document.
 3. Electronic versions of the original raw data files and PDF versions of the test reports shall be submitted together and clearly identified with cable identification, reviewed and stamped by the Contractor's on-site RCDD.
 4. Test reports shall be reviewed, approved and stamped by the Contractor's on-site RCDD.
- H. Product data for all termination and test equipment to be used by Contractor to perform work.
 1. Equipment shall be calibrated with traceability to National Institute of Standards and Technology (NIST) requirements.
 2. Contractor shall include copy of calibration and certification that equipment calibration meets NIST standards and has been calibrated at least once in the previous calendar year.
 3. Test equipment data shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.

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4. Refer to 3.04. in this document for test equipment requirements.

I. Submit Technology Implementation Plan in accordance with 1.07 below.

J. Submit Cable Pulling Plan, as follows:

1. Indicate the installed backbone conduit layout in schematic format, including junction boxes and distances between junction boxes.
2. Indicate contents of each conduit.
3. Indicate the cable pulling calculations, conduit fill ratios and actual cable runs and tensions.
4. Cable Pulling Plan shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submittal.
5. Installation of cabling shall not commence prior to approval of the pulling plan and calculations by the Architect/Engineer.

K. Submit installation plan indicating:

1. Equipment and personnel
2. Materials and staging area
3. Start and completion dates
4. Locations, including floor, room and building
5. Installation plan shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.

L. Cable Splicing Submittals

1. Submit fiber fusion splicing method and procedures.
2. Submit schedules of copper and fiber cables to be spliced.
3. Submit copper splicing method and procedures.
4. Submit certification documents for all splicing personnel.
5. Submit cut sheets, showing accurately scaled components, of fiber and copper splice closures, accessories, clamps, brackets, hangers, splice connectors, splice joint assemblies and fittings,
6. Submit manufacturer's data on fiber and copper splice closures including, but not limited to types, materials, finishes, and inside and outside dimensions (cross-sectional properties).

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements.

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Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

- C. Maintain temperature of between 64 degrees Fahrenheit and 75 degrees Fahrenheit and between 30 and 55 percent humidity in areas of active electronic system work.

1.06 QUALITY ASSURANCE

- A. Submit written proof that the following experience requirements are being met.
 - 1. Contractor Qualifications
 - a. The contractor shall be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
 - b. Must be supervised on-site by a BICSI RCDD. Must demonstrate knowledge and compliance with all BICSI, TIA/EIA, UL, and NEC methods, standards and codes.
 - c. All members of the installation team shall be certified by the manufacturer as having completed the necessary training to complete their part of the installation. Resumes of the entire team shall be provided along with documentation of completed training courses.
 - d. The contractor shall provide five references for projects of equivalent scope, type and complexity of work completed within the last five years.
 - e. The contractor who is installing the cabling infrastructure shall be a certified and currently registered Commscope/Systimax Premier Partner capable of issuing a numbered registration certificate for the entire cable system.
 - f. The contractor who is installing the cabling infrastructure shall have the following Systimax iPatch/imVision certifications:
 - SP/ND3321 - SYSTIMAX SCS Design & Engineering
 - SP/ND3351 - SYSTIMAX MasterClass
 - SP/ND3361 - SYSTIMAX SCS Installation and Maintenance
 - GL5555 - SYSTIMAX SCS Certified imVision Support Specialist
 - g. Cable splicing personnel shall have a minimum of five years splicing experience and shall have completed a minimum of five major splicing projects.
 - 2. Copper cable splicing personnel/technician requirements:
 - a. All copper splicing personnel/technicians shall have a minimum of 900 pair in one project splicing experience.
 - b. All copper splicing personnel/technicians shall have outside plant (OSP) and inside plant splicing experience.
 - c. All copper splicing personnel/technicians shall be familiar with and shall have installed Systimax splicing modules.
 - d. All copper splicing personnel/technicians shall have installed in-line and butt splicing configurations.

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- e. All copper splicing personnel/technicians shall have installed OSP, underground, direct buried, aerial, pedestal, and vault splice closures.
 3. Fiber splicing personnel/technicians requirements:
 - a. All fiber splicing personnel/technicians shall have a minimum of 144 fibers in one project splicing experience.
 - b. All fiber splicing personnel/technicians shall have OSP and inside plant splicing experience.
 - c. All fiber splicing personnel/technicians shall be familiar and have installed fusion, rotary and mechanical splicing modules.
 - d. All fiber splicing personnel/technicians shall be familiar and have installed mass fusion splice trays.
 - e. All fiber splicing personnel/technicians shall be familiar and have installed ribbon fusion and mass fusion splicing.
 - f. All fiber splicing personnel/technicians shall have installed in-line and butt splicing configurations.
 - g. All fiber splicing personnel/technicians shall have installed OSP, underground, direct buried, aerial, pedestal, and vault splice closures.
 4. Console installers shall be certified by console manufacturer and experienced in the installation of systems of similar complexity.
 5. Manufacturer's hardware experience: All components shall be produced by manufacturers who have been regularly engaged in the production of telecommunications cabling components of the types to be installed in this project for a period of five years.
- B. Materials and equipment: Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, and vibration conditions encountered at the installed location. The equipment shall meet the following requirements:
1. Interior controlled environment: 60 to 100 degrees F dry bulb and 20 to 90 percent relative humidity, non-condensing.
 2. Interior uncontrolled environment: 0 to 130 degrees F dry bulb and 10 to 95 percent relative humidity, non-condensing.
 3. Exterior environments: Minus 30 degrees to 130 degrees F dry bulb, and 10 to 100 percent relative humidity, condensing.
 4. Hazardous environment: All system components located in areas where fire or explosion hazards may exist because of flammable gas or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings, shall be rated and installed according to Chapter 5 of the NFPA 70 and as shown.
- C. Standard products:
1. Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of telecommunications cabling products and shall be the manufacturer's latest standard design in satisfactory use for at least one year prior to bid opening.

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2. Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

1.07 CONTRACTOR'S DUTIES

- A. Contractor's RCDD shall provide all calculations and analysis to support design and engineering decisions as specified in the Submittals section.
- B. Provide and pay for all labor, supervision, tools, equipment, test equipment, tests and services/programming to provide and install a complete inside and outside plant fiber and copper infrastructure system. Pay all required sales, gross receipts, and other taxes.
- C. Secure and pay for plan check fees, permits, fees, and licenses necessary for the execution of Work as applicable for the project.
- D. Give required notices.
- E. Comply with all codes, ordinances, regulations, and other legal requirements of public authorities that bear on performance of Work.

1.08 PROCUREMENT

- A. Procure equipment specified in this document as dictated by the timeline in Appendix A "Technology Implementation Schedule" in order to ensure that the technology is acquired in a timely fashion, but not outdated by the installation date.
- B. Submit a copy of Appendix A "Technology Implementation Schedule" as a part of the equipment submittals required elsewhere in this document. Complete the columns headed "Quantity", "Purchasing Lead Time", "Start Date or Dependent", and "Installation Duration".
- C. The "Procurement Lead Time" shall be expressed in days or weeks, and shall include time required for the contractor's personnel to order and receive the material. Substantiation may be required.
- D. "Start Date or Dependent" and "Installation Duration" should be an accurate estimate based upon known facts in the project. Substantiation may be required.
- E. The Contractor shall not purchase any materials requiring submittals until the owner approves the product submittal and the Technology Implementation Schedule for that material.
- F. The Contractor shall not purchase any materials requiring submittals until 6 months prior to installation date is established by the owner as the Purchasing Authorized Date. The

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Purchasing Authorized Date will be reflected in the “Purch Auth” column of Appendix A as a part of the Submittal Review process.

1.09 MAINTENANCE AND SUPPORT

- A. System Assurance: The System Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the ANSI/TIA/EIA 568B or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty-year period.
- B. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
- C. Support Availability: The Contractor shall commit to make available local support for the product and system during the Warranty period.

1.010 EXTENDED WARRANTY

- A. The Extended Product Warranty shall meet all manufactures specification to ensure against product defects, that all approved cabling components exceed the specifications of ANSI/TIA/EIA 568B and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of ANSI/TIA/EIA 568B and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss and bandwidth requirements of ANSI/TIA/EIA 568B and ISO/IEC IS 11801 for fiber links/channels, for a twenty year period. The warranty shall apply to all passive SCS components.
- B. The Extended Product Warranty and the System Assurance shall cover the replacement or repair of defective products and labor for the replacement or repair of such defective products.

1.011 DELIVERY AND STORAGE

- A. Equipment shall be delivered in original packages with labels intact and identification clearly marked.
- B. Equipment shall not be damaged in any way and shall comply with manufacturer’s operating specifications.
- C. All products shall be purchased not more than 6 months prior to installation.

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- D. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to system acceptance shall be replaced at no cost to the City.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to SYSTIMAX SCS and other manufacturers as referenced in this document. However, substitutions for Systemax products are not permitted.

2.02 GENERAL

- A. Provide all cabling, terminating hardware, adapters, and cross-connecting hardware necessary to interconnect all system equipment including equipment located in the Main Distribution Facility (MDF) and the Intermediate Distribution Facilities (IDFs).
- B. All Fiber terminations/connectors shall be pigtail fusion splice.

2.03 FIBER OPTIC CABLE GENERAL REQUIREMENTS

- A. SYSTIMAX SCS Teraspeed Singlemode or LazrSPEED 550 50 μ Multimode as required.
- B. Fiber optic cable shall be certified to meet all parts of EIA-455 and comply with the NEC.
 - 1. Cable installed in plenums or air-handling spaces shall meet UL 910 and shall be marked OFNP (optical fiber non-conductive plenum) in accordance with the NEC.
 - 2. Riser cable shall meet UL 1666 and be marked OFNR (optical fiber non-conductive riser) in accordance with the NEC.
- C. All fiber optic cable shall utilize the appropriate sheath for the particular application. This shall be in accordance with ANSI/EIA/TIA 568-B standards. Any cable placed in space used as an air return or in any way connected with air handling plenums or building ventilation shall be low-smoke, fire retarding cable, and shall comply with the National Electrical Code Articles 725, 760, and 800. No cabling shall be placed in plenums without written approval from HAS.
- D. Outside Plant Fiber Cables.
 - 1. Stranded loose tube dielectric or armored dry core fiber optic cable shall be utilized for underground conduit, direct buried or aerial applications.
- E. Building Fiber Cables.

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1. Non-plenum, riser rated cable consisting of multiple fibers, shall have a black, Polyvinyl Chloride (PVC) outer jacket. The cable shall be UL listed and meet the NEC requirements for OFNR.
 2. Plenum Fiber rated cable consisting of multiple fibers shall have a Plenum PVC outer jacket. Each group of fibers shall have a color-coded Low Smoke PVC buffer. Teraspeed shall be yellow and LazrSPEED 550 shall be Aqua. The cable and each subunit shall be UL listed and meet the NEC requirements for OFNP.
- F. Preparation for delivery: The fiber optic cable shall be shipped on reels in lengths as specified with a minimum overage of 10 percent.
1. The cable shall be wound on the reel so that unwinding can be done without kinking the cable.
 2. Two meters of cable at both ends of the cable shall be accessible for testing.
 3. Marking: Each reel shall have a permanent label attached showing length, cable identification number, cable size, cable type, attenuation, bandwidth, and date of manufacture. Labels shall be water resistant and the writing on the labels shall be indelible.
 4. Storage: The cable shall have a minimum storage temperature range of minus 40 C to plus 70 C.
- G. Unless otherwise specified, all fiber cables not installed in conduit shall be armored cable.

2.04 MULTIMODE FIBER OPTIC CABLE SPECIFICATIONS

- A. Manufacturer: SYSTIMAX SCS – LazrSPEED 550 Multimode 50 μ Cable.
1. Outdoor Cables: Systimax Multimode, Stranded Loose Tube Dielectric or Armored Dry core LazrSPEED 550 Outdoor Cable designed for underground conduit, direct buried or aerial applications consisting of multiple multimode 50/125 μ fibers.
 2. Building Cables: Multimode/non-plenum, Systimax LazrSPEED 550 Backbone/Riser Rated Cable, consisting of multiple multimode 50/125 μ fibers with a PVC outer jacket.
 3. Building Cables: Multimode/plenum, Systimax LazrSPEED 550 Backbone/plenum Rated Cable, consisting of multiple multimode 50/125 μ fibers and an Aqua, PVC outer jacket.

2.05 SINGLE MODE FIBER OPTIC CABLE SPECIFICATIONS

- A. Manufacturer: SYSTIMAX SCS – TeraSPEED Singlemode cable
1. Outdoor Cables: Systimax Singlemode, Stranded Loose Tube Dielectric or Armored Dry Core Outdoor Cable designed for underground conduit, direct buried or aerial applications.
 2. Building Cables: Singlemode/Non-plenum: TeraSPEED Backbone/Riser Rated Cable consisting of multiple singlemode fibers with a PVC outer jacket.

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- 3. Building Cables: Singlemode/plenum, Systemax TeraSPEED Backbone/plenum Rated Cable, consisting of multiple singlemode fibers and a yellow, PVC outer jacket.

2.06 FIBER HARDWARE TERMINATION STANDARDS - Real Time Infrastructure Management - Intelligent Fiber Patch Panel

- A. All Fiber to terminate on iPatch or ImVision Control panels. If a rack manager does not exist in the cabinet one must be added to manage the fiber infrastructure.
- B. Systemax Solution iPatch Intelligent Fiber Optic Patching System as follows:
 - 1. When install make sure cabinet rails are move back from front door.
 - 2. Make sure there is vertical and horizontal management for the fiber.

Product Number	Description
Fiber Shelves (19 inch rack-mountable) and accessories	
760193797	360-ip-G2-1U-LC-SD
760031856	RS-2AF-16SF
760105148	360 iPatch/imVision upgrade kit
760109470	12-LC-LS-AQ-Pigtails
760109488	12-LC-MM-BG-Pigtails
760109496	12-LC-SM-BL-Pigtails
Product Number	Description
760109504	12-LCA-SM-GR-Pigtails
760114975	24" Ribbon Cable
Copper Patch Panels - Cat 6	
760152355	360-iP-1100-E-GS3-1U-24 - 360 iPatch/imVision(enabled) 24 port panel
760152330	360-iP-1100-E-GS3-2U-48 - 360 iPatch/imVision(enabled) 48 port panel
760152561	360-IPR-1100-E-GS3-1U-24 - 360 iPatch/imVision(ready) 24 port panel
760152579	360-IPR-1100-E-GS3-2U-48 - 360 iPatch/imVision(ready) 48 port panel
Copper Patch Panels - Cat 6A	
760152363	360-iP-1100-E-GS6-1U-24 - 360 iPatch/imVision(enabled) 24 port panel
760152348	360-iP-1100-E-GS6-2U-48 - 360 iPatch/imVision(enabled) 48 port panel

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imVision Rack manager	
760161380	360-imV-CNTRLR - 360 imVision Panel Manager (1 per rack / cabinet)

2.07 FIBER PATCH CORDS

- A. Manufacturer: SYSTIMAX Solutions ONLY *(designer to specify the specific connector type for all equipment type for any give project. LC is HAS connector standard. Designer also to provide specific length need for install)*
- B. The fiber patch cord shall consist of buffered, graded index fiber with a 50 micron core and a 125 μ micron cladding for multimode with an Aqua Jacket and a stepped-index 8.3 micron core with a 125 μ micron cladding for single mode with a Yellow Jacket. The fiber cladding shall be covered by aramid yarn and a jacket of flame retardant PVC.

C. Multimode Fiber Patch Cord

- 1. Multimode Fiber Patch Cord Part Numbers:

Product Number	Description
Multimode, 50μ Micron, Single, LC to LC, LC to SC and LC to STII	
MX1LC-LC-xxx	LC to LC (xxx length designator)
MX1LC-SC-xxx	LC to SC (xxx length designator)
MX1LC-EP-xxx	LC to STII (xxx length designator)
Multimode, 50μ Micron, Duplex, LC to LC, LC to SC and LC to STII	
MX2LC-LC-xxx	LC to LC (xxx length designator)
MX2LC-SC-xxx	LC to SC (xxx length designator)
MX2LC-EP-xxx	LC to STII (xxx length designator)

D. Singlemode Fiber Patch Cord

- 1. Single mode Fiber Patch Cord Part Numbers:

Singlemode, 8.3μ Micron, Single, LC to LC, LC to SC and LC to STII	
MS1LC-LC-xxx	LC to LC (xxx length designator)
MS1LC-SC-xxx	LC to SC (xxx length designator)
MS1LC-EP-xxx	LC to STII (xxx length designator)
Singlemode, 8.3μ Micron, Duplex, LC to LC, LC to SC and LC to STII	
MS2LC-LC-xxx	LC to LC (xxx length designator)
MS2LC-SC-xxx	LC to SC (xxx length designator)
MS2LC-EP-xxx	LC to STII (xxx length designator)

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- E. Patch Cord Quantity. Patch cord spares shall be provided to match fiber strand assignment as shown in the fiber cable schedules in the Drawings. Patch cords shall be various lengths to include but not limited to 3mm, 6mm, 10mm etc.

- F. LC type connectors are HAS standard for all patch panel installations.
 - 1. When there is a requirement to transmit MATV service over the fiber infrastructure APC type pigtailed must be used at. Design must specify APC type fiber jumpers as well. Patch cords shall be various lengths to include but not limited to 3mm, 6mm, 10mm etc.

- G. Fiber splicing and closures shall be Commscope/Systimax. The fiber splice module shall meet the following specifications:
 - 1. Fusion
 - 2. Joins single mode or multi-mode fibers
 - 3. Establishes a permanent fusion splice
 - 4. May be used in OSP and/or premises applications
 - 5. Accept 250 and 900 micron fibers
 - 6. Re-enterable, re-arrangeable and reusable
 - 7. Require no polishing
 - 8. Require no adhesives
 - 9. No loose parts
 - 10. Unlimited shelf life

2.08 BACKBONE COPPER CABLE – INSIDE PLANT

- A. Manufacturer: Systimax, unless otherwise noted.

- B. Non-plenum Backbone Cable – 24 AWG
 - 1. Multi-pair insulated with color-coded PVC copper cables shall be used as the vertical riser cables. The cable shall support voice, data, and building service applications. All 50-pair and larger cable shall be conformance tested to meet ANSI/TIA/EIA 568B for Category 3 cables. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation. No cable count larger than 100 pair accepted

- C. Non-plenum Backbone Cable – 22 AWG
 - 1. Manufacturer – Superior Essex or submitted and owner-approved equivalent
 - 2. 22 AWG 100-pair insulated with color-coded PVC copper cables shall be used only transition splices from OSP to inside cable. The ARAM cable shall be routed from the splice closure to the protector panel, as indicated in Drawings.

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D. Plenum Backbone Cable

1. The plenum cable shall consist of 24-AWG solid-copper conductors insulated with color-coded PVC. All 50-pair and larger cable shall be conformance tested to meet ANSI/TIA/EIA 568B for Category 3 cables. The cable shall be UL® and c (UL®) Listed for Fire Safety and ISO 9001 Certified. The plenum cable shall be available in 25, 50, and 100 pair.

- E. The backbone copper cable shall meet or exceed the electrical specifications provided by the manufacture

2.09 BACKBONE COPPER CABLE – OUTSIDE PLANT

- A. Manufacturer: Superior Essex or submitted and owner-approved equivalent

- B. Superior Essex or submitted and owner-approved equivalent ASP-filled 22 AWG multi-pair copper cables shall be utilized for underground conduit or direct buried applications. The cable shall support voice, low-speed data, and building service applications. The bending radius and pulling strength requirements of all outside plant cables shall be observed during handling and installation. No cable count larger than 200 pair accepted.

- C. Protectors (Outside Plant applications):

Product Number	Description	COM code
331901	Circa 1880NA1/NSC-200: 188-Type, 200-pair protector panel. Input on left side for front of cabinet.	N/A
331902	Circa 1880NA1/NSC-200: 188-Type, 200-pair protector panel. Input on right side for back of cabinet.	N/A
750031	Circa C4B1S: 5-pin solid-state protector module, black shell, 300 volt, sneak current protection and built-in test points.	N/A
4C3S-75	Solid-state protector unit for nonringing circuits (red)	105 581 086

D. Copper Cable Splice System

1. Copper Splice Systems are defined to include, but not limited to copper splice module, components, closure kits, supports and required accessories to provide a turnkey copper network system.
2. Copper cable to be spliced shall be 22 AWG OSP and 22 AWG inside cable as specified in the previous paragraphs.

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3. Splices shall be inline, from underground OSP cable (filled metallic) to indoor cable (air core metallic).
4. Copper Splice Kit
 - a. Manufacturer: Preformed Line Products or submitted and owner-approved equivalent.
 - b. All splice kit products must be Commscope/Systimax Solutions material.
5. Copper Splice Closure Requirements
 - a. Manufacturer: Preformed Line Products or submitted and owner-approved equivalent.
 - b. Provide an inline, re-enterable copper cable closure.
 - 1) Metallic stainless steel.
 - 2) Finish shall be non-corrosive in all intended environments (see Drawings).
 - c. Re-enterable without the need for special re-entry kit.

2.010 MULTI-PAIR CABLE TERMINATION HARDWARE

A. 110 Wiring Blocks

1. Manufacturer: SYSTIMAX
2. 110 blocks shall provide for the termination of horizontal, equipment, or tie cables. This high-density modular design shall be compatible with all voice and data circuits. The block shall be Underwriter's Laboratories (UL) listed.
3. Field-terminated, wall-mounted 110 Wiring Block part numbers are as follows:

Product Number	Description	COM code
110 Wiring Blocks With Legs (Small Installations)		
110AB2-100FT	4-pair	107 058 919
110AB2-300FT	4-pair	107 058 943
110 Wiring Block System With Back Panel (Larger Installations)		
110PB2-300FT	4-pair (Station)	107 058 810
110PB2-900FT	4-pair (Station)	107 058 869
110PB2-300FT	5-pair (Riser)	107 058 802
110PB2-900FT	5-pair (Riser)	107 058 851
188 Backboards w/distributing rings for 110 blocks		
188D3	300 pair	107 151 193
188C3	900 pair	107 151 185

4. Field-terminated, rack and cabinet mounted 110 Wiring Block part numbers are as follows:

Product Number	Description	COM code
110 Connector System Mounting Brackets		
110RD2-200-19	(2) 100-Pair Bracket	107 058 919
110 Wiring Block for Wiring Bracket		

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Product Number	Description	COM code
110DW2-100	110 100-Pair Wiring Blocks	107 059 909
110 Jumper Troughs		
110B3	110 Troughs	107 831 141

B. Electrical requirements of Copper Termination Equipment per manufactures specification.

C. Wire Managers for Copper Termination Equipment

1. Vertical Wire Manager – Wall-mounted 110 Patch Panel System Backboard
 - a. Manufacturer: Chatsworth or submitted and owner-approved equivalent
 - b. One on each side
 - c. Chatsworth part number(s) are as follows:

Product Number	Description	COM code
Single-Sided Narrow Vertical Cabling Section		
11730-7XX	Vertical Cabling Mgr (Black)	N/A

2. Horizontal Wire Managers –Wall-mounted 110 Patch Panel System Backboard
 - a. Manufacturer: Systimax
 - b. Above and below each hardware shelf.
 - c. Systimax part number(s) are as follows:

Product Number	Description	COM code
110 Jumper Troughs		
110B3	110 Troughs	107 831 141

3. Horizontal Wire Managers – Racks and cabinets
 - a. Manufacturer: Chatsworth or submitted and owner-approved equivalent
 - b. Above and below each equipment shelf
 - c. Not required with RJ45 patch panels
 - d. Chatsworth part number(s) are as follows:

Product Number	Description	COM code
Horizontal Wire Managers		
11753-719	19” Medium Wire Manager	

D. Hybrid RJ45 to 110 Patch Cords. *Designer to specify correct length for all patch cords)*

1. Manufacturer: Systimax 119P2PS
2. As required provide Category 5e, Hybrid Patch Cords for each assigned data/voice port on the patch panel. Cords shall RJ45 connector on one end and 110GS on the other end. Cords shall be provided in appropriate lengths to accommodate all tenant voice or specialty ports as shown in detailed drawings. All Category 5e cordage shall be round, and consist of 24-

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AWG copper, stranded conductors, tightly twisted into individual pair and shall meet or exceed the Category 5e specifications.

3. Hybrid patch cords shall conform to the TIA 568B wiring scheme.
4. Hybrid patch cords shall be provided for each installed port designated as “Tenant Voice or Specialty jack” in the drawings.
5. Hybrid patch cord single pair part numbers are as follows(last 3 digits designates length):
(Designer to specify correct length for all patch cords)

Length	Material ID
8FT	CPC8662-03F-008
10FT	CPC8662-03F-010

6. Hybrid patch cord 2 pair part numbers are as follows(last 3 digits designates length):
(Designer to specify correct length for all patch cords)

Length	Material ID
8FT	CPC3852-03F-008
10FT	CPC3852-03F-010

7. Hybrid patch cord 4 pair part numbers are as follows(last 3 digits designates length):
(Designer to specify correct length for all patch cords)

Length	Material ID
8FT	CPC3812-03F-008
10FT	CPC3812-03F-010

2.011 IDENTIFIERS, LABELS AND LABELING SYSTEM

- A. All Identification and Labeling shall follow Specification: 270553–Identification and Labeling of Communication Infrastructure. **Any deviation from the specification must be approved by HAS IT prior to installation.**

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify raceways, boxes, hand holes and maintenance holes are properly installed following Sections 270528, and 270543.
- B. All communication media must be installed in conduit or cable tray unless an alternate method has been approved by HAS/IT Infrastructure.
- C. Verify backboards are properly installed.
- D. Verify telecommunications grounding system is properly installed and tested following Section 270526.

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- E. Verify liquid-carrying pipes are not installed in or above any IDF/MDF that has active electronic equipment. Do not proceed with installation in affected areas until removed.

3.02 PREPARATION

- A. Environmental controlled communication rooms shall maintain temperature of between 64 degrees Fahrenheit and 78 degrees F and between 30 and 55 percent humidity in areas of active electronic system work.
- B. Cable Splicing: Exact cable routing, splice enclosure locations, distances, elevations, work space and purpose of splice will be governed by actual field conditions. Contractor shall perform field surveys prior to submitting layout drawings.
- C. Contractor's on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and record drawings.

3.03 INSTALLATION

- A. Install work following drawings, manufacturer's instructions and approved submittal data. The number of cables per run, outlet configuration and other pertinent data are included on the drawings.
- B. All installation shall be done in conformance with ANSI/TIA/EIA 568B standards, BICSI methods, Industry standards and SYSTIMAX SCS installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines shall require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.
- C. The SCS installation shall comply with all applicable national and local codes pertaining to low voltage cable system installations.
- D. The contractor shall adhere to the installation schedule of the general contractor and shall attend all construction meetings scheduled by the general contractor.
- E. Upon structural completion of the communications room(s) and prior to the installation of any communications equipment or supporting devices inside the room, the City Engineer shall consult the Communications Designer in order to:
 - 1. Perform construction administration activities to compare as-built configuration to the design.
 - 2. Observe all "not-to-design" compliance issues and issue corrective advisement of actions.

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3. Upon completion of 1 and 2 above, the Communications Designer shall mark with masking tape the general layout of the equipment placement.
- F. Cable Splicing
1. Splicing optical fibers shall be accomplished with the fusion method only; mechanical splices are not allowed.
 2. Copper splicing shall be accomplished using Systimax modules.
 3. Copper splicing shall be done using the fold-back method.
 4. All closures and splice cases shall be installed according to the manufacturer's installation procedures.
 5. All closures and splice cases shall be "flash tested" to ensure they are properly sealed.
 6. All splicing work and splicing hardware shall comply with the following:
 - a. Cables shall be neatly routed and properly secured.
 - b. Minimum bending radius for fiber and copper cables shall not be exceeded.
 - c. Closures shall be properly mounted and secured.
 7. All closures, entry and exit cabling shall be labeled per specification 270553, easily visible from the finished floor.
- G. The contractor shall perform all required cross connections of the horizontal cable runs to the backbone cable system. The equipment connections to the data systems shall be performed by the vendors installing and/or maintaining those systems.
- H. The contractor is responsible for providing a CD with all the cable/patch panel information in the same format that will be accepted for download in HAS's iPatch database **1 month** prior any patching occurs.
- I. The contractor is responsible and must perform the following task associated with the iPatch system:
1. Connect iPatch Network Manger (or imVision Controller) to designated port on HAS network switch.
 2. Inter-connect iPatch Network Manager to rack managers if applicable.
 3. Confirm that all iPatch patch panels are on line.
 4. Configure network settings for iPatch Network Manage (or imVision Controller) with IP address, Mask and Gateway.
 5. Resolve patching conflicts associated with "Confirm" message on the iPatch Network Manager (or imVision Controller) Display.
 6. Resolve conflicts associated with "Alarms" on iPatch Network Manager or imVision Controller.
 7. Provide fiber cut sheet depicting fiber port to port or port to equipment connectivity.
 8. Provide an excel file compatible with imVision Import Wizard. The file will be used to build rooms, faceplates and jacks in iPatch database.

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9. Label all new devices including the iPatch Network Manager according to HAS labeling specs.
 10. Label all ports according to HAS labeling specs.
 11. Provide floor plans depicting rooms lay out and outlet locations.
 12. Confirm iPatch ports are pointing toward the proper end device(iPatch to equipment or iPatch to iPatch connection).
- J. The contractor shall provide service loops (slack) for cables terminating in the IDFs. A minimum of 10-foot service loop shall be provided above the access ceiling or cable trays unless specified otherwise. This allows for future changes or expansion without installing new cables.
- K. The installation contractor shall be responsible for coordination, testing and problem resolution with the system vendors.
- L. Label cable terminations on designation strips per specification 270553. Coordinate numbering with the City's automated cable management system..
- M. Labels for backbone/riser cables shall be placed in the following locations: on jack face plates, on cable inside back boxes, conduit pathway, junction boxes, access points, maintenance holes, and hand holes, on cable above the terminations in the IDF and MDF, on patch panels, and every 100 feet when not in conduit. Refer to specification 270553.
- N. City inspector or their designated representative shall randomly perform unannounced, on-site reviews during the installation. In addition, this person shall perform a final inspection and a complete review of the test results before the installation is accepted.
- O. Upon completion of the installation, Contractor shall prepare as-built documentation of the entire SCS. This documentation shall include:
1. As-Built Drawings
 - a. All drawings shall be provided on CD in a form compatible with AutoCAD Version 14. A complete set of project plans will be provided to the Contractor on disk. The Contractor shall modify the drawings by placing the cable information on a separate layer. All of the requested drawings shall be placed on these plans so that all cable routes are to scale and provide accurate information for use in the future when changes are made and the exact location of cables are required to avoid service interruptions.
 - b. A complete diagram of all terminations in the IDFs.
 - c. A complete diagram of all copper, fiber, and coax riser cable.
 - d. A complete diagram of all copper, fiber, and coax inter-building cable.
 - e. Floor plans showing exact cable routings with each outlet clearly marked with cable number.
 - f. A complete diagram of all cable tray, conduits and conduit sleeves.

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2. Documentation
 - a. All cable inventory data documentation shall be submitted in designated Microsoft Excel 2007 format, or ASCII, comma delimited files with fields in identical order so that data can be incorporated into existing databases.
 - b. Documentation on horizontal cable shall include cable number and length of cable.
 - c. Documentation on riser cable and inter-building cable shall include cable number, source and destination, type of cable, length of cable and number of pairs or fibers.
 - d. Complete cross connect documentation is required. This information will include detailed documentation of all four pairs of each horizontal cable and every pair of all copper riser and inter-building cable and every fiber of fiber optic cable.
3. As-built Drawings and Documentation shall be reviewed, approved and stamped by Contractor's on-site RCDD.

3.04 POST-INSTALLATION TESTING AND CERTIFICATION

A. Contractor Requirements

1. Contractor shall provide sufficient skilled labor to complete testing within a reasonable test period.
2. Contractor shall have a minimum of three years' experience installing and testing structured cabling systems. All installers assigned by the Contractor to the installation shall be certified by the factory to install and test the provided products.
3. Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.
4. Contractor is responsible for submitting acceptance documentation as defined in 3.04.D below. No cabling installation is considered complete until test results have been completed, submitted and approved as defined in 3.04.D below.
5. Contractor to insure that the database information for iPatch meets the HAS requirements.

B. Test Procedure

1. City Engineer reserves the right to be present during any or all testing. Notify City Engineer at least 48 hours prior to beginning test procedures.
2. Testing shall be of the Basic Link. However, Contractor shall warrant performance based on Channel performance and provide patch cords that meet channel performance.
3. All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the Owner.
4. Testing of all copper and fiber wiring shall be performed prior to system(s) cutover.
5. 100% of the installed cabling shall be tested. All tests shall pass acceptance criteria defined in 3.05 below.
6. Cable testing shall be performed by a fully charged tester, and the charging unit shall be disconnected during testing.

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7. Any pairs not meeting the requirements of the standard shall be brought into compliance by the contractor at no charge to the City. Complete end-to-end test results shall be submitted to the City.

C. Standards Compliance and Test Requirements

1. Copper Cabling shall meet the indicated performance specifications:
 - a. Category 3 Riser Cabling – ANSI/TIA/EIA 568B.2 Category 3 Backbone Cabling
2. Fiber Optic Cable shall meet the indicated performance specifications:
 - a. Per manufactures specifications and standards.
3. All test equipment used shall meet the performance specifications defined in 3.04.E. below.

D. Cable Test Documentation

1. Test reports shall be submitted in hardcopy and electronic format and certified by the contractor's RCDD to be a complete and accurate record of cabling installed. Hand-written test reports are not acceptable.
2. Hardcopy reports are to be submitted in labeled three-ring binders with an attached affidavit verifying passing execution of all tests. For large installations (greater than 300 pair copper and/or greater than 72 strand fiber), electronic reports with hardcopy summaries are preferred. Hardcopy summary reports shall contain the following information on each row of the report: circuit ID, test specification used, cable length, date of test, and pass/fail result.
3. Electronic reports shall be submitted on CD in PDF format. . Electronic reports shall be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate shall reference traceable circuit numbers that match the electronic record.
4. Hardcopy and electronic reports for each cable route shall be submitted together in one submittal. The submittal description shall include the type of test performed, type of cable, and cable ID (including originating and terminating room numbers) of cable tested. Partial or unclear documentation will be returned without reviewing.
5. Test reports shall include the following information for each cabling element tested:
 - a. Wiremap results that indicate that 100% of the cabling has been tested for shorts, opens, miswires, splits, polarity reversals, transpositions, presence of AC voltage and end-to-end connectivity.
 - b. For Category 3 cabling: Attenuation and NEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 to 16 MHz. Information shall be provided for all pairs or pair combinations and in both directions. Any individual test that fails the relevant performance specification shall be marked as a FAIL.

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- c. Length (in meters), propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
 - d. Cable manufacturer, cable model number/type, and NVP
 - e. Tester manufacturer, model, serial number, hardware version, and software version
 - f. Circuit ID number and project name
 - g. Auto test specification used
 - h. Overall pass/fail indication
 - i. Date of test
6. Test reports shall be submitted within seven business days of testing.
- E. Test Equipment
1. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years' experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.
 - a. Category 6 – Level III tester or owner-approved equivalent.
 - b. Category 3 copper backbone/riser – 3M Dynatel 965 DSP Subscriber Loop Analyzer with Far End Device or submitted and owner-approved equivalent.
 - c. Fiber Optic – Calibrated and certified OTDR, and optical power meter or submitted and owner-approved equivalent.
 2. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.
 3. Test adapter cables shall be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.
 4. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.
 5. Test equipment shall be capable of certifying Category 6 links.
 6. Test equipment shall have a dynamic range of at least 100 dB to minimize measurement uncertainty.
 7. Test equipment shall be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
 8. Test equipment shall include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
 9. Test equipment shall be capable of running individual NEXT, return loss, etc measurements in addition to auto tests. Individual tests increase productivity when diagnosing faults.
 10. Test equipment shall include a library of cable types, sorted by major manufacturer.
 11. Test equipment shall store at least 1000 Category 6 auto tests in internal memory.
 12. Test equipment shall be able to internally group auto tests and cables in project folders for good records management.
 13. Test equipment shall include DSP technology for support of advanced measurements.

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14. Test equipment shall make swept frequency measurements in compliance with TIA standards.
15. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.
16. The Category 3 copper backbone/riser test equipment shall be capable of making frequency sweeps at an impedance of 135 Ohms at the following frequencies (kHz): 20, 30, 50, 69, 90, 110, 138, 276, 400, 600, 800, 1000, and 1100. A far-end device shall be used for all frequencies measurements. The loss at 138kHz shall not exceed -46 dB. The test set shall have the ability to store 100 tests and be able to upload to a PC.
17. The Category 3 copper backbone/riser test equipment shall be able to measure resistance between the following conductors: tip to ring, tip to ground, ring to ground. All measurements shall be greater than 9999 M ohms.

F. Optical Fiber Cable Testing w/ Optical Time Domain Reflectometer (OTDR) and Optical Power Loss Meter

1. Test all lightguide cable prior to the installation of the cable. Assume liability for the replacement of the cable should it be found defective at a later date.
2. All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of a bi-directional end-to-end OTDR trace performed per TIA/EIA 455-61 and end-to-end in one direction for Optical Power loss meter measurement. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
3. Any link not meeting the requirements of the standard shall be brought into compliance by the contractor, at no charge to the City.
4. End point locations.
5. Test direction.
6. Reference power measurement (when not using a power meter with a Relative Power Measurement Mode).
7. Measured attenuation of the link segment.
8. Acceptable link attenuation.
9. Acceptable Attenuation Values shall comply with Systimax latest version of "Fiber Attenuation Calculation" spread sheet.

3.05 ACCEPTANCE

- A. Once all work has been completed, test documentation has been submitted and approved, and City Engineer is satisfied that all work is in accordance with contract documents, the City Engineer will notify Contractor in writing of formal acceptance of the system.
- B. Acceptance Requirements

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1. Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified under 3.04. "Standards Compliance & Test Requirements" above.
2. City reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent of the cable plant to confirm documented results. Random re-testing, if performed, shall be at the expense of the City, using standard labor rates. Any failing cabling shall be re-tested and restored to a passing condition at no cost to the City. In the event more than two percent of the cable plant fails during re-test, the entire cable plant shall be re-tested and restored to a passing condition at no additional cost to the Owner.
3. City Engineer may agree to allow certain cabling runs to exceed standardized performance criteria (e.g. length). In this event, such runs shall be explicitly identified and excluded from requirements to pass standardized tests.
4. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described in 3.04.
5. See Appendix A & B

3.06 DEMOLITION

- A. The contractor shall be responsible for maintaining all communications service to areas of the building scheduled to remain in service during the period of renovation.
- B. Notify HAS Information Technology (IT) department 30 days prior to the start of demolition work taking place in existing communications rooms. Coordinate removal of equipment and cabling within existing communications rooms with HAS IT.
- C. Where removal is indicated in Drawings, remove communications cable from termination point back to originating communications room, MDF or tenant communications room. Coordinate removal at terminating blocks and panels with HAS IT. Coordinate removal of cross-connects and patch cables with HAS IT.
- D. Ensure systems and circuits are no longer active before removing and prior to the demolition of existing communications rooms. If active circuits exist at time of scheduled demolition, coordinate with City Engineer to reroute or deactivate circuit(s).
- E. Demolition and removal of cabling shall not impact the operation of active systems.
- F. Unless otherwise noted, discard all removed cable, patch cables and cross-connects. Except where re-routing of cable is specified in Drawings or by Designer, do not reuse cable.
- G. Remove all loose unterminated cabling to source found above ceiling, under floor or in wall.

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- H. All Demo shall include ALL Abandoned cables shall be removed in accordance with NEC 800.25

3.07 CLEANING

- A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been completed unless designated for storage.

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APPENDIX A

MDF/IDF Check List

This list is intended as a minimum checklist. CM should ensure that the contractor's schedule has built in these components and the necessary buffer period – and associated access restrictions to the communications equipment rooms -- for HAS IT and tenant IT to prepare.

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1. All communication rooms that will service the area to be opened must be completed. That means a final walkthrough of these areas has been completed. It is not necessary that the entire project achieve substantial completion, but IT cannot install equipment and begin work until the following minimum criteria is met:

- a. Space is built out and clean – free from dust/residues.
- b. Electrical w/UPS as required.
- c. All racks/cabinets installed and mounted. Padlocks eyes have been installed.
- d. Grounding bus bar installed and properly tied to main grounding bus bar in MDF
- e. HVAC functioning properly and is adequately filtering dust. Humidity is controlled.
- f. Door access control is installed (card reader) -or- an approved temporary provision. Simple key access is not permissible.
- g. Lighting is installed and operational.
- h. Cable trays/ladder racks installed and ready to use.
- i. Permanent or temporary signage identifying permanent room number.

2. All cabling necessary to operate the areas to be opened is completed.

- a. Backbone cabling (copper and fiber) from the applicable communication room(s) is installed, tested, labeled, and approved by the inspector and communications design consultant.
- b. Horizontal cabling for all areas to be occupied is installed, tested, labeled, and approved by the inspector and communications design consultant.
- c. Copper cross connects and/or fiber jumpers have been installed per the owner/tenant requirements.
- d. Cable records and redline drawings for installed cables are submitted and approved PRIOR to putting any active circuits on the new cables. Cable records reflect all installed cables ****and**** any cross connects or jumper assignments installed by the contractor.
- e. All iPatch Panels are programmed and operational.
- f. All jumpers and patch cords specified by the contract are transmitted to the owner for use.
- g. NOTE: cable labels and permanent room numbers need to match. CM needs to be sure to get design team, airport, IT, and CM / contractor reps together to review permanent room numbers prior to contractor installing cable labels.

3. Move-in buffer period needs to be minimum **6 weeks** for HAS-IT to install/extend services within the area to be occupied prior to occupation of the facility or spaces. Additional time may be necessary if Tenant IT organization is involved, or if contractor has other systems that must be configured/tested which require HAS-IT resources (i.e. cabling or data network connections). This is frequently the case for PA System, television, radio, Fire Alarm, pay telephone, EFSO, access control & CCTV, etc.

4. Once HAS-IT accepts a communications equipment room and begins to install/configure equipment in preparation for hosting live applications, this room becomes a restricted area with access to be controlled by HAS-IT. Contractors must be substantially complete with systems inside the communications equipment room so that access is generally not required. Minor punch list and scheduled testing with escort can be arranged, but access will be very limited.

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5. Other IT-related systems that must be operational, tested, and accepted or approved temporary provisions.
 - a. PA System
 - b. MATV and/or CNN TV (where applicable)
 - c. Fire Alarm
 - d. MUFIDS
 - e. Pay Telephones (where applicable)
 - f. EFSO (where applicable)
 - g. Access Control & CCTV (note: must be PROGRAMMED, and approved acceptance test walk through by HAS)
 - h. Crash phone (where applicable)
 - i. Radio system enhancements (where applicable)
 - j. Data Network switch installed and configured.

GUIDELINES

HAS/PDC/Design Division
Houston, Texas

Project Title
Proj./CIP No.

(These Guidelines are basic minimum criteria to be met in preparing the final specifications for this section, which is the responsibility of the Designer/Contractor/Installation Team.)

APPENDIX B

GUIDELINES

HAS/PDC/Design Division
Houston, Texas

Project Title
Proj./CIP No.

(NOTE TO DESIGNER/SPECIFIER: These Guidelines are basic minimum criteria to be met in preparing the final specifications for this section, which is the responsibility of the Designer.)

	IDF Number:	Date:		
	Grounding & Bonding:	YES	NO	COMMENTS
	TGB properly installed			
	Proper grounding conductor installed (6AWG min.)			
	Cable trays properly bonded			
	Equipment Racks & Cabinets properly bonded			
	Conduit properly bonded			
	Cabling properly bonded			
	Splice Cases properly bonded			
	Horizontal Cabling:	YES	NO	COMMENTS
	Routing			
	Cables properly supported			
	Pull tensions properly recorded			
	Sheath damage			
	Bend radius observed			
	Pair twist meets spec			
	Proper termination scheme			
	Cable/jack part number meets spec			
	Plenum vs. PVC			
	Properly dressed in tray			
	Properly dressed in cable management			
	Cables bundled properly			
	Appropriate clearances observed (power)			
	Minimum about of cable exposed at termination			
	Backbone Cabling:	YES	NO	COMMENTS
	Fiber strain relief properly applied			
	Routing			
	Cables properly supported			
	Pull tensions properly recorded			
	Sheath damage			
	Bend radius observed			
	Properly dressed in tray			
	Fiber installed in inner duct			

BACKBONE AND RISER MEDIA INFRASTRUCTURE

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REV. 02-23-2018

GUIDELINES

HAS/PDC/Design Division
Houston, Texas

Project Title
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(NOTE TO DESIGNER/SPECIFIER: These Guidelines are basic minimum criteria to be met in preparing the final specifications for this section, which is the responsibility of the Designer.)

	Properly dressed in termination shelf			
	Any splice cases properly supported			
Room Layout:		YES	NO	COMMENTS
	Room laid out according to project drawings			
	Proper clearances maintained			
	Is the room clean & neat in appearance			
	Liquid carrying pipes within the room			
Pathways:		YES	NO	COMMENTS
	Conduit properly routed & supported			
	Cable Tray properly routed & supported			
	Inner Duct used to route fiber and properly supported			
Labeling:		YES	NO	COMMENTS
	Grounding conductor			
	End-to-End labeling			
	Pair Count on Splice Case			
	Horizontal Cabling			
	Fiber Optic Cabling			
Other:		YES	NO	COMMENTS
	Appropriate fire stop material in place			
	Cabling test results submitted with proper information			
	Climate controlled environment (Temp. & Humidity)			
	Is the room access controlled			
Copper Cabling:				
	Total Pairs (Riser)			
	Pair Counts			
	Termination Type (66, 110, Protectors..)			
	Termination Location			
Fiber Optic Cabling:				
Multimode:				
	Total Strands			
	Termination Type (LC, SC)			
	Termination Location			

BACKBONE AND RISER MEDIA INFRASTRUCTURE

271300 - 32

REV. 02-23-2018

GUIDELINES

HAS/PDC/Design Division
Houston, Texas

Project Title
Proj./CIP No.

(NOTE TO DESIGNER/SPECIFIER: These Guidelines are basic minimum criteria to be met in preparing the final specifications for this section, which is the responsibility of the Designer.)

	Single Mode	
	Total Strands	
	Termination Type (LC, SC)	
	Termination Location	