

ADDENDUM NO. THREE (3) ILM TERMINAL IMPROVEMENTS CONTRACT 2

Date: January 22, 2019

RE: ILM Terminal Improvements Contract 2

From: The Wilson Group
PO Box 5510
Charlotte, NC 28299

To: All Plan Holders

This Addendum is hereby made a part of the contract documents and specifications of the above referenced project. All other requirements of the original specification shall remain in effect in their respective order. Acknowledge receipt of this Addendum by inserting its number and date in the Proposal form.

NOTE:

- 1. THIS ADDENDUM CHANGES THE BID TIME TO 2:00 P.M. (LOCAL TIME). THE BID DATE DOES NOT CHANGE.**

PROJECT MANUAL

1. In Section Invitation to Bid (Advertisement), in the first paragraph, **CHANGE** “11:00 a.m. (local time)” to “2:00 p.m. (local time)”. *Note: Bid opening time changed.*
2. In Section 00016 Invitation to Bid, **CHANGE** 1.2.2. to “2. Bid Time: 2:00 p.m., local time.”
Note: Bid opening time changed.
3. In Section 000110 Table of Contents, **INSERT** the following in Division 27: “271100 American Airlines Communications Specification (AD-03)” and “Critical IT Infrastructure Standards Document (United Airlines) (AD-03).”
4. **REPLACE** the following sections with sections provided in this Addendum:
 - a. Section BID FORM (AD-03). *Note: Unit prices nos. 3-6 added for concrete pavement demolition, new concrete pavement, new bituminous pavement, and borrow; added allowances.*
 - b. Section 012100 ALLOWANCES (AD-03). *Note: Added allowances for signage and contingency.*
 - c. Section 012200 UNIT PRICES (AD-03). *Note: Unit prices nos. 3-6 added for concrete pavement demolition, new concrete pavement, new bituminous pavement, and borrow.*
 - d. Section 012900 PAYMENT PROCEURES (AD-03). *Note: Added requirements for schedule of values preparation.*

- e. Section 015000 TEMPORARY FACILITIES AND CONTROLS (AD-03). *Note: Added supplemental conditions information regarding quality requirements for work during construction.*
 - f. Section 020660 WATER DISTRIBUTION (AD-03). *Note: Revised to reference final CFPUA documents effective as of January 1, 2019.*
 - g. Section 271100 Communication Equipment Room Fittings (AD-03). *Note: revisions highlighted.*
 - h. Section 271300 Communications Backbone Cabling (AD-03). *Note: revisions highlighted.*
 - i. Section 271500 Communications Horizontal Cabling (AD-03). *Note: revisions highlighted.*
5. **INSERT** the following sections with sections provided in this Addendum:
- a. Section 271100 AMERICAN AIRLINES (AA) COMMUNICATIONS SPECIFICATION, DATED DECEMBER 17, 2018 (AD-03). *Note: Added AA specific requirements.*
 - b. Section UNITED AIRLINES (UA) CRITICAL IT INFRASTRUCTURE DESIGN STANDARDS AND CONSTRUCTION PRACTICES DOCUMENT, DATED 8/22/14 (AD-03). *Note: Added UA specific requirements.*

DRAWINGS

1. **REPLACE** the following sheets with the sheets provided in this Addendum:
- a. G-000 DRAWING INDEX (AD-03). *Note: Updated sheet index.*
 - b. C-102 PROJECT SAFETY AND ACCESS PLAN 2 OF 4 (AD-03). *Note: Revised security provisions and added notes.*
 - c. C-104 PROJECT SAFETY AND ACCESS PLAN 4 OF 4 (AD-03). *Note: Revised security provisions and added notes.*
 - d. C-105 PROJECT SAFETY NOTES (AD-03). *Note: Revised security-related notes and escort table.*
 - e. C-106 PROJECT SAFETY PLAN DETAILS (AD-03). *Note: Added alternative barrier/fence detail.*
 - f. C-401 OVERALL PROPOSED UTILITY PLAN AND DETAILS (AD-03). *Note: Deleted duct bank from Terminal Building to Public Safety Office (PSO), updated CFPUA details.*
 - g. C-402 PROPOSED UTILITY PLAN AT EXPANSION (AD-03). *Note: Water main revisions.*
 - h. C-403 PROPOSED WATERLINE PROFILE (AD-03). *Note: Water main revisions, updated CFPUA details.*
 - i. C-602 MISCELLANEOUS DETAILS SHEET 1 OF 2 (AD-03). *Note: Revised drainage manhole detail, added drainage pipe trench detail.*
 - j. S-002 GENERAL NOTES AND ABBREVIATIONS (AD-03) *Note: Clarification that all exposed angles and lintels shall be primed and painted, not galvanized.*
 - k. S-120 FLOOR FRAMING PLAN (AD-03) *Note: Top of steel elevations notes.*
 - l. S-130 ROOF FRAMING PLAN (AD-03) *Note: General notes and top of steel elevations.*
 - m. S-302 FOUNDATION DETAILS (AD-03) *Note: Footing revisions at typical door entrance and typical wall footing.*
 - n. S-401 MASONRY DETAILS (AD-03) *Note: Masonry Wall Schedule*
 - o. S-512 STEEL FLOOR SECTIONS (AD-03) *Note: Detail 11 addresses added steel requirements for future canopies.*
 - p. A-165 ENLARGED TICKET LEVEL REFLECTED CEILING PLAN (AD-03) *Note: Removed the lay-in ceilings in each of the telecom (IT rooms).*

- q. A-201 ELEVATIONS (AD-03) *Note: Added locations for future canopies and charging stations (NIC Typical). Also added two additional lights to south face of addition to be included as part of this contract.*
- r. A-202 ELEVATIONS (AD-03) *Note: Added location for future canopy(s).*
- s. A-301 BUILDING SECTIONS (AD-03) *Note: Adjustment of wall section using 8" CMU vs. 12" CMU. per structural drawings.*
- t. A-303 BUILDING SECTIONS (AD-03) *Note: Adjustment of wall section using 8" CMU vs. 12" CMU. per structural drawings.*
- u. A-352 WALL SECTIONS (AD-03) *Note: Adjustment of wall section using 8" CMU vs. 12" CMU per structural drawings.*
- v. A-354 WALL SECTIONS (AD-03) *Note: Adjustment of wall section using 8" CMU vs. 12" CMU per structural drawings.*
- w. A-401 ENLARGED TICKET LEVEL FLOOR PLAN (AD-03) *Note: Added telecom locations, rated walls for UA- room # 196. Increased the size of AA room #180 and Delta room #188 to accommodate clearance for IT cabinet.*
- x. A-511 SECTION DETAILS (AD-03)
- y. A-601 DOOR SCHEDULE AND DETAILS (AD-03) *Note: Clarified two 1 HR door ratings and replaced Details 1 and 2.*
- z. A-701 ENLARGED TICKET LEVEL FINISH FLOOR PLAN- ZONE 5 (AD-03) *Note: Replaced VCT-1 with "SDT-1" in the respective airline IT/ Comm rooms.*
- aa. M-125 ENLARGED TICKET LEVEL FLOOR PLAN - DEMOLITION (AD-03). *Note: Additional HVAC ductwork to be removed as shown.*
- bb. M-126 ENLARGED TICKET LEVEL FLOOR PLAN (AD-03). *Note: Additional HVAC ductwork to be replaced as shown; revised supply airflows as shown; added ductless split system heat pump in Telecom 188 and outdoor section on roof above as shown.*
- cc. M-501 DETAILS (AD-03). *Note: Added ductless heat pump detail J/M-501.*
- dd. M-601 SCHEDULES (AD-03). *Note: Added ductless split system heat pump schedule.*
- ee. E-001 ELECTRICAL NOTES, LEGENDS & SCHEDULES (AD-03). *Note: Updated receptacle & outlet legend with additional receptacle types; updated data & telephone legend for AA, DL & UA outlet requirements; updated fire alarm legend to clarify that speaker wattages are to be as indicated on the plans.*
- ff. E-012 SECOND LEVEL DEMOLITION PLAN (AD-03). *Note: noted six existing PA/intercom speakers to remain; clarified that airline IT rack removals require coordination with the airlines, not relocation.*
- gg. E-101 PARTIAL FIRST LEVEL POWER PLAN (AD-03). *Clarified that a 200A feeder breaker is existing, located in existing Panel B, for new Panel 4BH feeder; added conduits for future charger power circuitry; upgraded duplex receptacles to quads for airline workstations; added quad receptacle for airline workstations.*
- hh. E-103 SECOND LEVEL POWER PLAN (AD-03). *Note: Added enlarged plan for room Telecom 188; revised receptacle configuration in room Telecom 188; added power for ductless heat pump and air handler for room Telecom 188; added receptacle at roof beside ductless heat pump.*
- ii. E-111 FIRST LEVEL LIGHTING PLAN (AD-03). *Note: Added two exterior light fixtures; added homerun circuitry for exterior lighting.*
- jj. E-112 SECOND LEVEL LIGHTING PLAN (AD-03). *Note: eliminated inadvertent switch symbols.*
- kk. E-121 FIRST LEVEL AUXILIARY SYSTEMS PLAN (AD-03). *Note: Added data & telephone outlet locations for airline workstations.*
- ll. E-122 SECOND LEVEL AUXILIARY SYSTEMS PLAN (AD-03). *Note: clarified AA,*

DL & UA outlet types; identified six PA/intercom speakers as existing; updated layouts of room Comm 180, Telecom 188, and IT 196.

mm. E-602 PANEL SCHEDULES (AD-03). *Note: updated panel schedule for ductless heat pump and air handler.*

nn. E-701 ELECTRICAL RISERS (AD-03). *Revised telephone/data systems riser diagram for updated AA, DL & UA requirements.*

2. **INSERT** the following sheets with the sheets provided in this Addendum:
 - a. C-603 MISCELLANEOUS DETAILS SHEET 2 OF 2 (AD-03). *Note: Added fence and gate details and notes.*
 - b. P-701 RISER DIAGRAMS-DEMOLITION (AD-03). *Note: New drawing added at the request of New Hanover County Inspections plan reviewer.*
 - c. P-702 RISER DIAGRAMS-RENOVATION (AD-03). *Note: New drawing added at the request of New Hanover County Inspections plan reviewer.*

QUESTIONS AND ANSWERS

1. **QUESTION:** Door schedule for the interior door frames are listed as Hollow Metal. Detail 1,2/A-601 shows wood door frames. Which are correct?
ANSWER: They are hollow metal. See modifications included with this Addendum.
2. **QUESTION:** E-701 Telephone/Data systems riser diagram. UA Storage 196 shows a 3" conduit with fabric innerduct being terminated in the existing main electrical room. Sheet E-123 Storage/IT 196 located on ticket level clearly reflects a conduit to be run for fiber optic cable to the gate along with the other airlines but the riser diagram shows a conduit going from Storage/IT 196 to the existing main electrical room. Where should this conduit be terminated?
ANSWER: The reference to the existing main electrical room is clarified to indicate Existing Main Electrical Room A5. It is indicated on drawing E-121. See revised E-701 included with this Addendum for revised requirements.
3. **QUESTION:** Can the bid time be changed to the afternoon?
ANSWER: Bid time has been changed to 2:00 p.m. (local time). There has been no change to bid date. See modifications made in this addendum.
4. **QUESTION:** Regarding E-112 Kiosks 160 & Check-in 161, please clarify the "\$" symbols. This symbol should represent a single pole switch but the locations seem random.
ANSWER: Symbols are erroneous. See modifications made in this addendum.
5. **QUESTION:** Please verify that the airport will reuse existing or the TSA will supply any new workstation tables? BHS contractor will not price any new tables?
ANSWER: Confirmed. The design intent is for the reuse of the existing TSA workstations/tables, which shall be relocated as illustrated in the bid documents by the TSA's Contractor.
6. **QUESTION:** In Section 2.6.A.1 pg. 72 states roller bed conveyors will be supplied by TSA, then in section H on pg. 38 is calls out for gravity roller bed conveyors to be supplied by BHS contractor, and on the drawing it shows both gravity conveyor and 4 gravity gates but says nothing about who is to supply these. Please verify that the TSA is supplying the gravity gates and conveyors.
ANSWER: The BHS Contractor will be responsible to provide all conveyance equipment,

including the specified non-powered gravity roller bed sections and associated lift-up gates.

7. **QUESTION:** Can the bid time be extended to 2 or 3 pm, we need this time for complete subtrade coverage and evaluating our bids.
ANSWER: Yes. Please see modifications made elsewhere in this addendum.
8. **QUESTION:** The structural drawing 9/S-521 show 8" exterior walls to roof. Architectural drawings 1/A-352 shows 12" wall after 10'-8". Can you confirm which detail to be used?
ANSWER: Changed to 8" block wall. See revisions made elsewhere in this Addendum.
9. **QUESTION:** Can the Baggage Handling System Price Schedule can this be sent in within 24 hrs after bid? This will be very difficult to get in at the bid time.
ANSWER: We already have it set up to be submitted post-bid. Supplementary Instructions to Bidders, Article 6.3.5 states "Apparent lowest bidder shall provide a completed Baggage Handling System (BHS) Price Schedule and Baggage Handling System (BHS) Unit Pricing Schedule no later than 2 business days following bid opening. BHS Price Schedule total shall match BHS Turn Key provided on Bid Form. An electronic version of BHS Price Schedule and Unit Pricing will be provided by Architect."
10. **QUESTION:** Please see comments from Penco lockers below, can you please send a note to the architect to clarify how much ADA are required for this project? This also will affect how many Digi Locks we'll need for ADA lockers will requires special pricing. Thank you!! Chris, how much ADA does this quote require? I see that the specs request Digi Locks for the ADA lockers, so I'll need a good number. Digi Locks will require and SPI.
ANSWER: Locker sizes and quantities are shown on A-251. Per North Carolina Building Code (NCBC) 5% of lockers are required to comply with accessibility requirements.
11. **QUESTION:** Can you provide details of new bollards, detail 14/A-115 notes see structural. I cannot find detail of bollards on structural drawings.
ANSWER: See detail 6/S-302.
12. **QUESTION:** Define the Construction Requirements for maintaining the path through the demolition zone for airline staff in phases 3-7
ANSWER: See modifications made elsewhere in this Addendum.
13. **QUESTION:** Define the Temporary Lighting Requirements for maintaining the path through the demolition zone for airline staff in phases 3-7
ANSWER: See modifications made elsewhere in this Addendum.
14. **QUESTION:** Define any Negative Pressure requirements for containing dust within interior construction areas.
ANSWER: See modifications made elsewhere in this Addendum.
15. **QUESTION:** Define the construction requirements for dust control in the interior general public areas (I.E. Ticketing Lobby)
ANSWER: See modifications made elsewhere in this Addendum.
16. **QUESTION:** Define the construction requirements for maintaining public access in general public areas.

ANSWER: See modifications made elsewhere in this Addendum.

17. **QUESTION:** DL-VCT-1 is labeled as a floor finish in multiple rooms and is noted in the finish schedule per pg. A-701. The finish legend for Delta Airlines pg. A-753 does not have any details for this finish. There is also no reference in the project manual for Vinyl Composition Tile (VCT). Please define the specifications for flooring type DL-VCT-1
ANSWER: DL-VCT-1 is shown on A-753. Use Section 096520 for product requirements.

18. **QUESTION:** An Interim Milestone for Building Completion and Occupation of new ATO Offices is listed in the project manual for 270 Calendar Days from NTP, do liquidated damages apply to this date?
ANSWER: No.

ATTACHMENTS

1. SECTION BID FORM (AD-03)
2. SECTION 012100 ALLOWANCES (AD-03)
3. SECTION 012200 UNIT PRICES (AD-03)
4. SECTION 012900 PAYMENT PROCEDURES (AD-03)
5. SECTION 015000 TEMPORARY FACILITIES AND CONTROLS (AD-03)
6. SECTION 020660 WATER DISTRIBUTION (AD-03)
7. SECTION 271100 AMERICAN AIRLINES COMMUNICATIONS SPECIFICATION (AD-03)
8. CRITICAL IT INFRASTRUCTURE STANDARDS DOCUMENT (UNITED AIRLINES) (AD-03)
9. SECTION 271100 COMMUNICATION EQUIPMENT ROOM FITTINGS (AD-03)
10. SECTION 271300 COMMUNICATIONS BACKBONE CABLING (AD-03)
11. SECTION 271500 COMMUNICATIONS HORIZONTAL CABLING (AD-03)
12. G-000-DI DRAWING INDEX (AD-03)
13. C-102 PROJECT SAFETY AND ACCESS PLAN 2 OF 4 (AD-03)
14. C-104 PROJECT SAFETY AND ACCESS PLAN 4 OF 4 (AD-03)
15. C-105 PROJECT SAFETY NOTES (AD-03)
16. C-106 PROJECT SAFETY PLAN DETAILS (AD-03)
17. C-401 OVERALL PROPOSED UTILITY PLAN AND DETAILS (AD-03)
18. C-402 PROPOSED UTILITY PLAN AT EXPANSION (AD-03)
19. C-403 PROPOSED WATERLINE PROFILE (AD-03)
20. C-602 MISCELLANEOUS DETAILS SHEET 1 OF 2 (AD-03)
21. C-603 MISCELLANEOUS DETAILS SHEET 2 OF 2 (AD-03)
22. S-002 GENERAL NOTES AND ABBREVIATIONS (AD-03)
23. S-120 FLOOR FRAMING PLAN (AD-03)
24. S-130 ROOF FRAMING PLAN (AD-03)
25. S-302 FOUNDATION DETAILS (AD-03)
26. S-401 MASONRY DETAILS (AD-03)
27. S-512 STEEL FLOOR SECTIONS (AD-03)
28. A-165 ENLARGED TICKET LEVEL REFLECTED CEILING PLAN-ZONE 5 (AD-03)
29. A-201 ELEVATIONS (AD-03)
30. A-202 ELEVATIONS (AD-03)
31. A-301 BUILDING SECTIONS (AD-03)
32. A-303 BUILDING SECTIONS (AD-03)
33. A-352 WALL SECTIONS (AD-03)

- 34. A-354 WALL SECTIONS (AD-03)
- 35. A-401 ENLARGED TICKET LEVEL FLOOR PLAN (AD-03)
- 36. A-511 SECTION DETAILS (AD-03)
- 37. A-601 DOOR SCHEDULE AND DETAILS (AD-03)
- 38. A-701 ENLARGED TICKET LEVEL FNISH FLOOR PLAN-ZONE 5 (AD-03)
- 39. P-701 RISER DIAGRAMS – DEMOLITION (AD-03)
- 40. P-702 RISER DIAGRAMS – RENOVATION (AD-03)
- 41. M-125 ENLARGED TICKET LEVEL FLOOR PLAN - DEMOLITION (AD-03)
- 42. M-126 ENLARGED TICKET LEVEL FLOOR PLAN (AD-03)
- 43. M-501 DETAILS (AD-03)
- 44. M-601 SCHEDULES (AD-03)
- 45. E-001 ELECTRICAL NOTES, LEGENDS & SCHEDULES (AD-03)
- 46. E-012 SECOND LEVEL DEMOLITION PLAN (AD-03)
- 47. E-101 PARTIAL FIRST LEVEL POWER PLAN (AD-03)
- 48. E-103 SECOND LEVEL POWER PLAN (AD-03)
- 49. E-111 FIRST LEVEL LIGHTING PLAN (AD-03)
- 50. E-112 SECOND LEVEL LIGHTING PLAN (AD-03)
- 51. E-121 FIRST LEVEL AUXILIARY SYSTEMS PLAN (AD-03)
- 52. E-122 SECOND LEVEL AUXILIARY SYSTEMS PLAN (AD-03)
- 53. E-602 PANEL SCHEDULES (AD-03)
- 54. E-701 ELECTRICAL RISERS (AD-03)

END OF ADDENDUM NO. THREE (3)

BID FORM

Project Name: ILM Terminal Improvements Contract 2
Project Location: Wilmington, North Carolina

1.1 BID INFORMATION

- A. Date: _____
- B. Bidder: _____
- C. Bidder's Contractor License Number: _____
- D. Owner: New Hanover County Airport Authority
- E. Architect: The Wilson Group
- F. Architect Project Number: 9202-000

1.2 CERTIFICATIONS AND BASE BID

- A. Base Bid, Single-Prime Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by The Wilson Group, LS3P and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled/indicated allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. _____
_____ Dollars (\$_____).

- B. Owner's Contingency: (10% of Base Bid = Contingency) Do Not Include Contingency in Base Bid.

1. _____
_____ Dollars (\$_____).

1.3 BID GUARANTEE

- A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____ Dollars (\$_____).

- B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 SUBCONTRACTORS

- A. The following companies shall execute subcontracts for the portions of the Work indicated:

	Name	License Number
1. Plumbing Work:	_____	_____
2. HVAC Work:	_____	_____
3. Electrical Work:	_____	_____
4. Baggage Handling:	_____	
5. Baggage Control System Subcontractor:	_____	

- B. The General Contractor shall act as Project Expediter.

1.5 ALLOWANCES

Allowance 1: BHS Spare Parts	\$100,000.00	Include allowance in Base Bid.
Allowance 2: Temporary Construction Signage	\$15,000.00	Include allowance in Base Bid.
Allowance 3: Owner's Contingency	10% of Base Bid	Do not include allowance in Base Bid.

1.6 UNIT PRICES

- A. Unit prices quoted and accepted shall apply throughout the life of the contract, except as specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the scope of the work in accordance with the contract documents.

Unit Price No. 1 - Unsuitable Soil - Engineered Fill:

- Description: Unsuitable soil removal and disposal and placement and compaction of new satisfactory fill.
- Cost per Cubic Yard: \$ _____

Unit Price No. 2 - Unsuitable Soil - No. 57 Stone:

- Description: Unsuitable soil removal and disposal and placement and compaction of No. 57 stone.
- Cost per Cubic Yard: \$ _____

Unit Price No. 3 - Concrete Pavement Demolition:

- Description: Cutting, demolition and off-site disposal of existing concrete pavement, plain or reinforced, 10-inch to 17.5-inch thick plus the existing 6-inch thick econcrete base.
- Cost per Square Yard: \$ _____

Unit Price No. 4 - New Concrete Pavement:

- Description: 6-inch ABC base, 8-inch to 10-inch thick concrete pavement, including all reinforcing, joint steel and joint sealant.
- Cost per Square Yard: \$ _____

Unit Price No. 5 - New Bituminous Pavement:

- Description: 6-inch ABC base and 4-inch NCDPT S9.5B surface.
- Cost per Square Yard: \$ _____

Unit Price No. 6 - Borrow:

1. Description: Supply, placement, moisture conditioning and compaction of borrow material meeting the requirements of Section 020153 Subparagraphs 152-2.1 and 152-2.4. The material shall be measured by the cubic yard, compacted in place.
2. Cost per Cubic Yard: \$ _____

1.7 ALTERNATES

- A. The undersigned proposes to perform alternatives for stated resulting additions to or deductions from the Base Bid. Additions and deductions shall include any modifications of work or additional work that undersigned may be required to perform by reason of the acceptance of any alternative. (Bidder shall write in the amounts for the alternates listed below.)

Alternate No. 1: Open Steel Grating Catwalks

Adjust Base Bid by Adding _____
_____ Dollars (\$ _____)

Alternate No. 2: Locksets by Best

Adjust Base Bid by Adding _____
_____ Dollars (\$ _____)

Alternate No. 3: Carpet Tile by Shaw

Adjust Base Bid by Adding _____
_____ Dollars (\$ _____)

Alternate No. 4: Direct Digital Control BAS by Honeywell

Adjust Base Bid by Adding _____
_____ Dollars (\$ _____)

Alternate No. 5: Closed-Circuit Television (CCTV) Surveillance System by Johnson Controls

Adjust Base Bid by Adding _____
_____ Dollars (\$ _____)

Alternate No. 6: Public Address System by MOOD Media

Adjust Base Bid by Adding _____
_____ Dollars (\$ _____)

Alternate No. 7: Access Control by Johnson Controls

Adjust Base Bid by Adding _____
_____ Dollars (\$ _____)

Alternate No. 8: Intelligent Fire Alarm Detection System and Integrated Digital Audio by Notifier

Adjust Base Bid by Adding _____
_____ Dollars (\$ _____)

1.8 HUB-M/WBE PARTICIPATION REQUIREMENTS

(Historically Underutilized Businesses - Minority/Women-Owned Business Enterprise)

Provide on the bid - Under GS 143-128 the undersigned bidder shall identify on its bid the minority businesses that it will use on the project and the total dollar value of the bid that will be performed by the minority businesses and list the good faith efforts made to solicit participation.

Note: Bidders must submit with their bid the *Report of Participating Subcontractors and Suppliers, Certification of Competitive Bids, M/WBE Subcontractor Contact Schedule, and Good Faith Efforts Affidavit.*

1.9 TIME OF COMPLETION

- A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within and not exceed the time limits set forth in the Contract Document.
- B. The undersigned Bidder acknowledges that 'Liquidated Damages' provisions shall be in effect for this project as stated in the Contract Document.

1.10 ACKNOWLEDGEMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:
 - 1. Addendum No. I, Dated _____.
 - 2. Addendum No. II, Dated _____.
 - 3. Addendum No. III, Dated _____.
 - 4. Addendum No. IV, Dated _____.
 - 5. Addendum No. V, Dated _____.

1.11 CONTRACTOR'S LICENSE

- A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the State of North Carolina, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.12 SUBMISSION OF BID

- A. Respectfully submitted this _____ day of _____, 20____.
- B. Submitted By: _____
(Name of Bidding Firm or Corporation)
- C. Authorized Signature: _____
(Handwritten Signature)
- D. Signed By: _____
(Type or Print Name)
- E. Title: _____
(Owner/Partner/President/Vice President)
- F. Witness/Attest: _____
(Handwritten Signature)
- G. Signed By: _____
(Type or Print Name)
- H. Title: _____
(Corporate Secretary or Assistant Secretary)
- I. Street Address: _____
- J. City, State, Zip: _____
- K. Phone: _____
- L. E-Mail: _____
- M. License No.: _____
- N. Federal ID No.: _____ (Affix Corporate Seal Here)

END OF BID FORM

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
 - 2. Include defined costs associated with allowances in base bid.
- B. Related Requirements:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices.

1.2 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.**
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.3 COORDINATION

- A. Coordinate allowance items with other portions of the Work.

1.4 QUANTITY ALLOWANCES

- A. Quantity Allowance: An estimated quantity or extent of a product, assembly, or portion of the Work that cannot be measured prior to construction, but is reasonably anticipated.
- B. All costs for performing the work described under the quantity allowance are included in the allowance. These costs include materials, delivery, installation, taxes, insurance, equipment rental, and similar costs, and Contractor's overhead and profit.
- C. When work is performed and actual quantity or extent is measured, the Contract Sum will be adjusted by Change Order based on Unit Cost indicated in the Agreement.

1.5 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials selected by Owner and Architect under allowance and shall include taxes, freight, and delivery to Project site.**
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Owner and Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.**

1.6 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.**
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.**
- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.**
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.**

1.7 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.
- C. Unused amounts of moneys that define the value of the allowances, included integrally in the work and materials allowances, shall be credited to the Owner by deduct change order prior to approval of Final Application for Payment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

- B. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.2 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Include **\$100,000.00** for BHS Spare Parts.
 - 1. Allowance to be included in BHS System Pricing Schedule.
- B. Allowance No. 2: Include \$15,000.00 for Temporary Construction Signage.**
- C. Allowance No. 3: Owner's Contingency Allowance: 10% of the Base Bid.**
 - 1. Do not include the sum in the Base Bid amount.**
 - 2. This allowance includes material cost receiving, handling, and installation and Contractor overhead and profit.**

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.2 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.
- B. Unsuitable Soil Removal and Replacement:
 - 1. The term "cubic yards" shall be defined as cubic yards of undisturbed material in-place. Under no conditions will the term "cubic yard" refer to "loose", "truck" or "disturbed" material.
 - 2. Soil removal, soil replacement, and other earthwork indicated on the Drawings shall be included in the Base Bid. Unit costs shall be used to calculate costs for unanticipated soil replacement in excess of the Scope of Work indicated on Drawings.
 - a. All soil replacement is unclassified.
 - 3. Replacement of unsuitable soil is defined as including:
 - a. Excavation of unsuitable material by mechanical means.
 - b. Disposal of unsuitable material off-site.
 - c. Supply of new satisfactory material acceptable to the Engineer from off site. Refer to Earthwork specifications for description of satisfactory backfill material.
 - d. Installation of new material including compaction as required by Division 02.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1:

1. Description: Unsuitable soil removal and disposal and placement and compaction of new satisfactory fill.
2. Unit of Measurement: Cubic Yard.

B. Unit Price No. 2:

1. Description: Unsuitable soil removal and disposal and placement and compaction of No. 57 stone.
2. Unit of Measurement: Cubic Yard.

C. Unit Price No. 3:

- 1. Description: Cutting, demolition and off-site disposal of existing concrete pavement, plain or reinforced, 10-inch to 17.5-inch thick plus the existing 6-inch thick econcrete base.**
- 2. Unit of Measurement: Square Yard.**

D. Unit Price No. 4:

- 1. Description: 6-inch ABC base, 8-inch to 10-inch thick concrete pavement, including all reinforcing, joint steel and joint sealant.**
- 2. Unit of Measurement: Square Yard.**

E. Unit Price No. 5:

- 1. Description: 6-inch ABC base and 4-inch NCDPT S9.5B surface.**
- 2. Unit of Measurement: Square Yard.**

F. Unit Price No. 6:

- 1. Description: Supply, placement, moisture conditioning and compaction of borrow material meeting the requirements of Section 020153 Subparagraphs 152-2.1 and 152-2.4. The material shall be measured by the cubic yard, compacted in place.**
- 2. Unit of Measurement: Cubic Yard.**

END OF SECTION 012200

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual Table of Contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703 with each item listing value of labor and material.
 - 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Description of the Work.
 - b. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 - 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements.
 - 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. **Airline Ticket Office (ATO) Offices: Provide separate line items in the schedule of values for ATO Office Upfits for each airline. Schedule of values for each upfit area to include architectural, fire protection, mechanical, plumbing and electrical work (including low-voltage systems) work.**
 - a. **American Airlines (AA): Rooms Corridor 170, Checkout 176, Training 177, CSM, 178, Comm 180, Break 174, Storage 173, Admin 171, and GM Office 172.**
 - b. **Delta Airlines (DL): Rooms Corridor 185, Storage 101, Shared Office 192, Breakroom 187, Training 186, Manager Office 190, Closeout, and Telecom 188.**
 - c. **United Airlines (UA): Rooms Hall 193, Breakroom 194, Office 195, IT 196.**
10. **Applied Fireproofing: Provide separate line item in the schedule of values for applied fireproofing in accordance with Section 078100.**
11. **Board Fireproofing: Provide separate line item in the schedule of values for rigid board fireproofing in accordance with Section 078200.**

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 1. Submit draft copy of Application for Payment prior to due date for review by Architect.
 2. Pay applications not submitted on time will not be paid until the following month.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders after all signatures are executed.
 4. Provide Sales and Use Tax Report with each Application for Payment.

- E. **Stored Materials:** Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. **Transmittal:** Submit five signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. **Waivers of Mechanic's Lien:** Owner reserves the right to require waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. **Waiver Forms:** Submit executed waivers of lien on forms acceptable to Owner.
- H. **Initial Application for Payment:** Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.
 13. Performance and payment bonds.
 14. Data needed to acquire Owner's insurance.

- I. Retainage Reduction: Until the Work is 50 percent complete, the Owner shall pay 95 percent of the amount due to the Contractor on account of progress payments. At the time the Work is 50 percent complete and thereafter, the Contractor shall submit, for Owner's and Architect's review and approval a written request for retainage reduction. Upon Owner's approval, with written consent of the surety, the Architect may certify remaining partial payments to be paid in full.
 - 1. The Contractor, as a condition precedent to retainage reduction, shall submit for review and approval by the Architect the required Operation and Maintenance Manuals.
- J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - 2. Prior to Substantial Completion of the work, the Contractor shall transmit the record set of Contract Documents to the Architect along with a typed list of each change or revision made during construction of the project. This list shall include change order numbers, authorization dates, and other information relevant to each change. Record Drawings must be received and approved prior to issuance of Final Payment.
- K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 - 1. Evidence of completion of Project closeout requirements.
 - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 - 3. Updated final statement, accounting for final changes to the Contract Sum.
 - 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 - 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 - 6. AIA Document G707, "Consent of Surety to Final Payment."
 - 7. Evidence that claims have been settled.
 - 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 - 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Electric Power Service from Existing System: Water and electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.

3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.
- B. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- E. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- F. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: Use of the permanent HVAC system for temporary use during construction is restricted by the condition listed below. If permanent HVAC system is used for temporary conditioning during construction, Contractor is responsible to protect return air from contamination by covering open end of duct with MERV 8 filter. Remove filter media at end of construction. Clean HVAC system as required in Section 017700 "Closeout Procedures."

- a. Owner must authorize use of permanent HVAC system for temporary use during construction.
- G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

2.2 TEMPORARY FACILITIES

- A. Field Office: Contractor has option to provide a field office or use space in the existing building. Space is available in the existing bag room for a plan table.
 - 1. Coordinate final location of field offices with Owner. Preferred site is adjacent to intersection of Airport Blvd and the loading dock access road, adjacent to west end of credit card lot.
- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 SITE USE PLAN

- A. Confine operations within the areas indicated and as shown on the site use plan and as permitted by law, ordinances, and permits. Site shall not be unreasonably encumbered with materials, products, or construction equipment.
- B. Contractor, in reviewing the use of the site, shall include access to proposed building for construction purposes, parking where possible for employees, temporary facilities including offices, storage, and workshop sheds or portable trailers, utility hookups, staging areas, storage materials and products, and unloading space.
- C. Show additional area needed in the use of the site beyond that which may be indicated on the Drawings. Where additional fencing is required, such fencing shall be included at no additional cost to the Owner.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

- B. Storm Sewers and Storm Drainage: If storm sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If storm sewers are not available or cannot be used, provide storm drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither storm sewers nor storm drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
1. Connect temporary storm sewers to municipal system as directed by authorities having jurisdiction.
 2. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog storm sewers or pollute waterways before discharge.
 3. Maintain temporary storm sewers and storm drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Final Acceptance, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets and wash facilities for use of construction personnel. Coordinate and comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Toilets: Install self-contained toilet units. Use of Owner's existing toilets will not be permitted.
 2. Disposable Supplies: Provide, and maintain adequate supply of, toilet tissue and similar disposable materials for use of construction personnel.
 3. Contractors shall provide drinking water for use of their personnel.
 4. Provide safety showers, eyewash fountains, and similar facilities where required by authorities having jurisdiction.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
1. ~~Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.~~ **Provide heating and cooling equipment as necessary to maintain a uniform indoor temperature of 68 to 72 degrees F.**
- F. Ventilation and Humidity Control: Provide temporary ventilation and humidity control required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. **Air-Quality Testing: For work is occurring in occupied areas of the Terminal, engage testing agency to perform the following:**
1. **Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in USGBC's "Green Building Design and Construction Reference Guide."**
 2. **Demonstrate that the contaminant maximum concentrations listed below are not exceeded:**
 - a. **Formaldehyde: 27 ppb.**
 - b. **Particulates (PM10): 50 mcg/cu. m.**

- c. **Total Volatile Organic Compounds (TVOC): 500 mcg/cu. m.**
 - d. **4-Phenylcyclohexene (4-PH): 6.5 mcg/cu. m.**
 - e. **Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.**
- 3. **For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.**
- 4. **Air-sample testing shall be conducted as follows:**
 - a. **All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside airflow rate for the occupied mode throughout the duration of the air testing.**
 - b. **Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.**
 - c. **Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.**
- H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- I. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
 - 1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 2. **Provide lighting fixtures capable of maintaining average illumination of 20 fc at desk height.**
- K. Electronic Communication Service: Provide wireless connectivity in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.
- L. Telephone Numbers: Provide a list of important telephone numbers. Include the following:
 - 1. Police and fire departments.
 - 2. Ambulance service.
 - 3. Contractor's home office.
 - 4. Contractor's emergency after-hours telephone number.
 - 5. Architect's office.
 - 6. Engineers' offices.
 - 7. Owner's office.
 - 8. Principal subcontractors' field and home offices.

M. Dust Control

1. Airport operations are continuous in all areas of work and dust control is required in all areas where dust is being generated. Contractor shall utilize Zip-Wall or similar dust protection system for each work area to minimize dust created through the work. Any dust accumulation must be removed at the end of each work shift so as to ensure a fully operational “final-clean” state within the concourse between 0430 and 2100 daily.
2. Cleaning personnel should be provided during/after dust-generating activities such as sanding, demolition, etc.
3. Tenant areas must be protected from dust including dust protection applied over tenant access doors whenever work is occurring in the vicinity.
4. Contractor must cover all ticket counter millwork, bag scales and baggage handling system (BHS) equipment in the vicinity of any work area with a protective covering before each work shift, removing the covering at the very end of the work shift, to minimize dust and debris falling on or settling on the millwork.
5. The Contractor's to provide 1-2 Abatement Technologies model PAS2400 portable air scrubber machines, to be used to remove dust and particles from the air in the ticket lobby. These machines should be moved to the work areas generating the most amount of dust during the work shift, and relocated as required as requested by the Owner during the Operational Day so they can continue to run and filter the air throughout the day. Contractor shall operate and maintain the for functionality and optimum performance throughout the project.
6. NOTE: The existing ceiling baffles, drywall ceilings and ductwork system have been in place since the late 1980's. The contractor should anticipate a great deal of dust to be present above the ceiling and make special provisions during the ceiling demolition phase to control dust and remove dust from the project throughout the work period.

N. Clean Up

1. Contractor shall, at all times, keep its work areas in a neat, clean, and safe condition. Upon completion of any portion of the Work, Contractor shall promptly remove all of its equipment, construction plant, temporary structures and surplus materials not to be used at or near the same location during later stages of Work. Upon completion of the Work and before final payment is made, Contractor shall at its expense, satisfactorily dispose of all plant, buildings, rubbish, unused materials, and other equipment and materials belonging to it or used in the performance of the Work, and Contractor shall leave the premises in a neat, clean, and safe condition. In the event of Contractor's failure to comply with the foregoing, the Owner may accomplish the same at Contractor's expense.
2. At the completion of the Work, Contractor shall provide a final cleaning of all interior glass surfaces and wipe down all aluminum window mullions.
3. In all Work areas Contractor shall maintain on staff sufficient personnel to provide cleaning of a “final clean” caliber at the end of EACH work shift, including removal of any and all work and personal trash, complete dust-down of all surfaces on which dust has accumulated during the work shift, vacuuming of all areas in the vicinity of work, wiping down holdroom seating wherever dust has accumulated, and any other work required to present a clean, operational building between 0430 – 2100 daily.

O. General Work Requirements and Constraints

1. All ticket counters, kiosks, equipment and adequate queueing spaces must be in place and operational at each gate 0430 – 2100 daily unless otherwise approved in writing by Owner.
2. The Contractor shall provide and make available daytime staff each workday after a night shift to come to the work area as needed to address issues that have come up as a result of the work. Examples of this include coming to the ticket lobby to mitigate tripping hazards caused by new floor conditions, removal of materials or FOD from the ramp, securing above-ceiling items that have come loose during the work shift, addressing issues with seating or cleanup in holdroom areas, clean-up, etc.
3. Access to all tenant spaces must be provided between 0430 – 2100.

4. Work is expected to progress continually and efficiently. General sequencing should proceed as noted in Exhibits and as described herein. Multiple crews are anticipated and expected as required in order to maintain schedule and operations.
5. Proper pre-planning is required in order to execute work efficiently and to provide the Owner with adequate information to properly notify all user groups such as tenants, airlines and the traveling public.
6. Other than tenant façade signage, wayfinding, or any other temporary signage that may be required to maintain operations and adequately direct public traffic during the work is to be included in the Signage Allowance.
7. All communication systems (WIFI, PA, FIDS, gate electronics) must remain fully operational during operational hours of 0430 – 2100.
8. Wherever a hole is cored for an electrical floor box, the hole must be filled safely by the end of the work shift. Any floor boxes not ready for usage must be clearly marked Out of Operation and covered with tape or other material to discourage attempted usage by the public.
9. Additionally, any airline provided stanchions and queuing signage or equipment that must be removed for the work shall be relocated in the same configuration to avoid the need for any adjustments by airline staff upon arrival for the day's operations.
10. For all items in the Contract Documents denoting requirements related to Operations during the time frame of 0430 – 2100, should Irregular Operations necessitate that Operational Hours must extend past the time frames identified, those requirements will apply during the extended Operational Hours.
11. Provide barriers to work in occupied areas during Contractor's work hours suitable to prevent the Public from entering work zones. Remove barriers prior to 0430 each morning.

P. Establishment of Project Working Points:

1. Contractor shall establish project working points to be used for measurements for all circulation corridor and centerline of column dimensions including terrazzo joints, centerline of column, column covers, soffits, etc.

Q. Notices Required to Owner

1. 30 day minimum notice to work in any area or in the vicinity of any tenant space, including submission of a completed Logistics permit.
2. 2-week look ahead including detailed listing and projected start and completion dates of any activities to occur within the next 2 weeks shall be provided weekly.
3. Electrical shutdown planning or generator startup planning to begin a minimum of 60 days in advance to allow adequate time for Owner to arrange staffing
4. Owner may desire for ILM staff to be present during generator startup activities- Contractor to schedule these activities a minimum of 30 days in advance.
5. Notice of HVAC cutover to be provided a minimum of 60 days in advance to allow adequate time for Owner to arrange staffing
6. Contractor should not communicate directly with airlines, concession or retail contacts, any other Tenant or Operator without prior permission from ILM project manager.
7. 5-day notice to Owner is required anytime entering tenant spaces on ticket level. ILM On Site representative and/or GC supervisory personnel must accompany the Contractor's workers whenever entering occupied tenant spaces on ramp level unless otherwise directed by the Owner.
8. Proper pre-planning is required in order to execute work efficiently and to provide the Owner with adequate information to properly notify all user groups such as tenants, airlines and the traveling public.
9. A fully completed Logistics permit must be submitted a minimum of 30 days prior to work occurring in any area, including details about the upcoming activity, exhibits clearly identifying the affected area, and any other pertinent information that can be shared with Owner contacts and other stakeholders.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
3. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

B. Traffic Controls: Coordinate and comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide temporary parking areas for construction personnel.

D. Dewatering Facilities and Drains: Coordinate and comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.

E. Project Signs: Provide Project sign as indicated. Unauthorized signs are not permitted.

1. Temporary Signs: Provide signs as required to inform public and individuals seeking entrance to Project. Provide temporary, directional signs for construction personnel and visitors.
2. Engage an experienced sign painter to apply graphics for Project identification signs.
3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood unless indicated otherwise, and in sizes and thicknesses indicated. Support on posts and framing of preservative-treated wood.
4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
5. Location of project identification sign as directed by Architect.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to normal business hours.

- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Coordinate and comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- G. Pest Control: Perform control operations lawfully, using environmentally safe materials.
- H. Barricades, Warning Signs, and Lights: Coordinate and comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
 - 1. Provide protective measures as required to provide free and safe passage of the public on adjoining sidewalks and streets.
- I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
 - 2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
 - 3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 - 4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.
- J. Temporary Partitions: Provide floor-to-ceiling dustproof non-combustible partitions to limit dust and dirt migration to completed areas. Protect air-handling equipment. Provide walk-off mats at each entrance through temporary partition.
- K. Protect air-handling equipment.

- L. Temporary Egress: Maintain temporary egress from existing occupied facilities as required by authorities having jurisdiction.
- M. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
 - 1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 - 2. Paint and maintain appearance of walkway for duration of the Work.
- N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
 - 1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
 - a. Field Offices: Class A stored-pressure water-type extinguishers.
 - b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
 - c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Prohibit smoking on Project site.
 - 3. Supervise welding operations and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 4. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting.
 - 5. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 6. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
 - 7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
 - 8. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.6 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 1. If authorized by Owner, use permanent HVAC system to control humidity.
- C. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - 1. Materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.

2. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
3. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 020660 – WATER DISTRIBUTION – CFPUA SPECIFICATIONS

PART 1 – GENERAL

- 660-1.1 Summary. Section Includes: Ductile iron water mains, fittings and appurtenances as detailed on the drawings and specified herein.
- 660-1.2 CFPUA Standard Drawings and Specifications. All materials and work included in the section shall conform to the requirements of the Cape Fear Public Utilities Authority (CFPUA) as prescribed in new CFPUA documents effective as of January 1, 2019. The final documents are available on the CFPUA website and include:
- Material Specification Manual
Technical Specification Manual
Standard Drawing Details
- 660-1.3 Requirements. All CFPUA requirements applicable to water distribution main construction for development projects shall apply to this work as a responsibility of and at the expense of the contractor (included in the lump sum bid pricing) including but not limited to administrative requirements (pre-construction meetings, submittals, construction records, close-out documentation, etc.), materials, thrust restraint (restrain all joints plus supplemental thrust blocks at 90 degree bends), earthwork, installation, pressure testing, disinfection and placing into service.
- 660-1.4 Work under this section will not be measured for payment. The work shall be included in the project lump sum pricing.

END OF SECTION 020660



Communication System Specification

Consolidated

December 17, 2018

Project Specifications for the procurement, installation and testing of Horizontal and Backbone cabling systems and associated telecommunication room fittings

SECTION 27 00 00
Premise Cabling Specification

PART 1 – GENERAL

1.1 SUMMARY

- A. This specification outlines the requirements for a complete Structured Communications Cabling System.
- B. This section includes the minimum requirements for all labor, materials, equipment and services necessary and required to complete and test the cabling system.
- C. It is the responsibility of the contractor to incorporate the applicable portions of this document as needed to meet specific project requirements. All sections may not apply.
- D. Horizontal Data and Voice Distribution Systems
 - 1. The horizontal data distribution system shall provide for the interconnection of individual Work Area Outlets to their respective Telecommunications Room or Equipment Room.
 - 2. Horizontal Distribution Systems shall consist of Category 6 cable for Data and Voice systems.
 - 3. Floor plans or scope of work definition shall provide for quantity and location information.
- E. Backbone Copper Distribution System (Voice)
 - 1. Voice Backbone distribution system shall provide for the interconnection of Equipment Rooms, Telecommunications Rooms, and Zone Cabinets within or between Facilities.
 - 2. Voice Backbone Systems shall consist of "Multi-Pair" Category 3 cabling with terminations at either end via wall mounted 110 style termination blocks.
- F. Backbone Fiber Distribution System
 - 1. Fiber Optic Backbone distribution system shall provide for the interconnection of Equipment Rooms, Telecommunications Rooms, and Zone Cabinets within or between Facilities.
 - 2. The Fiber Optic Backbone telecommunications distribution system shall utilize single and/or multi-mode fiber optic cables as directed on drawings or Scope of Work Definitions
- G. Telecommunication Room Fittings

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. AA American Airlines
 - 2. AA ITS American Airlines Information Technology Services

3. ANSI American National Standards Institute
4. AWG American Wire Gauge
5. BICSI Building Industry Consulting Services International
6. CAT Category Classification of Cable
7. CMR Communications Riser Cable
8. DTE Data Terminal Equipment
9. EIA Electronics Industries Association
10. ER (Telecommunications) Equipment Room
11. FO Fiber Optic
12. IDC Insulation Displacement Connector
13. IC Intermediate Cross-Connect
14. IEEE Institute of Electrical and Electronics Engineers
15. ISO International Standards Organization
16. LAN Local Area Network
17. MC Main Cross Connect
18. MER (Telecommunications) Main Equipment Room
19. TMGB Telecommunications Main Grounding Bus Bar
20. NEC National Electric Code
21. NEMA National Electric Manufacturers Association
22. NEXT Near End Crosstalk
23. OAR Owners Authorized Representative
24. OFNR Optical Fiber Nonconductive Riser
25. OTDR Optical Time Domain Reflectometer
26. PBX Private Branch Exchange
27. RL Return Loss
28. SRL Structural Return Loss
29. TR Telecommunications Room
30. TD Telecommunications Demark
31. TDR Time Domain Reflectometer
32. TGB Telecommunications Grounding Busbar
33. TIA Telecommunications Industry Association
34. TR Telecommunications Room
35. TSB Technical Services Bulletin
36. UL Underwriters Laboratories
37. UTP Unshielded Twisted Pair
38. WAO Work Area Outlet
39. WS Work Station
40. ZC Zone Cabinet

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- B. Strictly adhere to all BICSI, EIA and TIA recommended installation practices when installing the products specified in this section.
- C. Contractor's Qualifications:
 - 1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
 - 2. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 - 3. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- D. Material and Work specified herein shall comply with the applicable requirements of:
 - 1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 - 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial building Telecommunications Cabling, 2006
 - 3. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, 2009
 - 4. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, 2009
 - 5. ANSI/TIA/EIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces, 2004
 - 6. ANSI/TIA/EIA-606-A – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993-2002
 - 7. ANSI-J-STD-607-A – Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, 2002
 - 8. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers, 2005
 - 9. NFPA 70 – National Electric Code, 2008
 - 10. BICSI – Telecommunications Distribution Methods Manual, 12th Edition, 2009
 - 11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
 - 12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
 - 13. American Airlines Facilities Design Guidelines

14. Applicable codes and directives of authorities having jurisdiction
- E. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- 1.4 CONFLICTS
- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.
- 1.5 PERMITS
- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.
- 1.6 SCHEDULING
- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- 1.7 REQUIREMENTS
- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.
- 1.8 SUBMITTALS

- A. Produce Shop Drawings for ALL horizontal and backbone cabling, to include but not limited to, proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as any horizontal cables that may exceed 295' in length (including service loops).
- B. Provide all submittal requirements under this section as a single package.
- C. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Manufacturer's certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer's equipment.
 - 3. Manufacturer's installation specifications for UTP cabling and optical fiber, indicating minimum bend radius and maximum pull tension.
 - 4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per ANSI/EIA/TIA-606 and AA Standards.
 - 5. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 - 1. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
 - 2. As-built cable schedules with recorded cable routing and lengths of each designated run.
 - 3. As built documentation of all cabling systems
 - 4. As built documentation of IDF/TR modifications and associated cabinet elevations.
 - 5. Laminated as-built drawing sheet of TR service area representing each level, all WAO with designation at a scale of not less than 1/8", mounted on the wall of each TR and soft copy (PDF) provided to OAR.
- B. Warranty and Maintenance:
 - 1. 24 hour contact information for warranty repairs
 - 2. Inventory of supplemental spare parts list

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.

- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

- A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01, or for a period of 1 year from date of final completion, whichever is longer. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. Provide Panduit Certification PlusSM System Warranty at the completion of the project.
- C. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 ACCEPTABLE DISTRIBUTORS

- A. Contractor shall procure all parts through an approved Panduit Distributor.
- B. American Airlines negotiated pricing may be available to the contractor through Anixter distribution supplier. Contact Anixter Global Accounts Manager – Phred Balcom; 214-803-6987 to verify current pricing.

2.3 ACCEPTABLE VENDORS AND MATERIALS

- A. Subject to compliance with requirements, install products from the following manufacturers, except where noted:
 - 1. Cable, Copper
 - a. Panduit Corp.
 - b. General Cable Corp.
 - c. Owner Approved Equivalent
 - 2. Termination Components
 - a. Panduit Corp.
 - 3. Fiber Optic Components
 - a. Corning
 - b. Owner Approved Equivalent
 - 4. Backbone Multi-pair Copper Cabling
 - a. Superior Essex
 - b. Owner Approved Equivalent
 - 5. Racks
 - a. Chatsworth Products
- B. Part numbers are provided for convenience purposes only; the contractor is responsible for complete material list and quantities. Colors shall be approved by Owner.

2.4 CATEGORY 6 PRODUCTS

- A. UTP Cable (Voice/Data)
 - 1. Provide Category 6 cabling for all voice and data work area outlet locations.
 - 2. Cable shall far exceed ANSI/TIA/EIA-568-B.2-1 and ISO/IEC 11801 Class E standards.
 - 3. The conductors shall be 23 AWG with FEP (CMP) or polyolefin (CMR) insulation.
 - 4. The copper conductors shall be twisted in pairs and shall be covered by a low smoke, flame retardant (CMP) jacket or a flame retardant (CMR) jacket.
 - 5. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
 - 6. The jacket color for horizontal shall be blue.
 - 7. Approved products:
 - a. Panduit, TX6000; Part - PUP6C04BU-UY
 - b. Owner approved equivalent

B. UTP Jack Modules

1. Provide Category 6 jack modules to terminate both ends of each horizontal cable.
2. Module shall exceed requirements of ANSI/TIA-568-C.2 Category 6, IEEE 802.3an-2006, and ISO 11801 Class E channel standards and exceed requirements of ANSI/TIA-568-C.2 Category 6 and IEC 61156-5 Category 6 component standards.
3. Module shall meet requirements of IEEE 802.af and IEEE 802.3at for Power over Ethernet (PoE) applications.
4. Module shall be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
5. Modules at American Airlines work area outlet locations shall include jacks of all each of the following colors:
 - a. Blue
 - b. Gray
 - c. White
 - d. Modules at wireless access point shall be "yellow" in color.
 - e. Modules at IP camera locations shall be "red" in color.
 - f. Other miscellaneous American Airlines outlets shall be "green" in color.
 - g. Modules in American Airlines MER/TR patch panels shall match the color of jack at the faceplate.
6. Approved products:
 - a. Panduit CJ688TGWH Mini-Com® TX6™ PLUS UTP Jack Module, White
 - b. Panduit CJ688TGBU Mini-Com® TX6™ PLUS UTP Jack Module, Blue
 - c. Panduit CJ688TGIG Mini-Com® TX6™ PLUS UTP Jack Module, International Gray
 - d. Panduit CJ688TGRD Mini-Com® TX6™ PLUS UTP Jack Module, Red
 - e. Panduit CJ688TGGR Mini-Com® TX6™ PLUS UTP Jack Module, Green
 - f. Panduit CJ688TGYL Mini-Com® TX6™ PLUS UTP Jack Module, Yellow

C. Category 6 Patch Cords for IT Spaces (CR/TR/IT Rooms and Work Area Outlets)

1. Provide Category 6 small diameter patch cords for voice and data ports within these locations as required and detailed on the construction drawings.

2. Patch cord shall exceed ANSI/TIA-568-C.2 Category 6 and ISO 11801 Class E standards.
 3. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications in bundle sizes of no more than 40 patch cords.
 4. Each patch cord shall be 100% performance tested and wired T568B.
 5. Patch cord plugs shall meet all applicable ANSI/TIA/EIA-968-A requirements and exceeds IEC 60603-7 specifications.
 6. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
 7. Include a quantity necessary to patch every available patch panel port:
 8. Coordinate patch cord colors with the OARs.
 9. Approved Products
 - a. Panduit Category 6 Small Diameter Copper Patch Cord. Coordinate length with specific site conditions.
 - b. Owner approved equivalent
- D. RJ-45 to 110 Patch Cords
1. Provide RJ-45 to 110 patch cords for patching voice circuits in TR locations.
 2. Patch cord shall be constructed of 1- or 2-pair, 24 AWG UTP stranded cable as required by the project.
 3. Patch cord to be factory assembled with 1-, or 2-pair 110 connector on one end and an RJ-45 plug on the other
 4. Approved Products
 - a. Panduit
 - b. Owner Approved equivalent

2.5 WORK AREA OUTLET PRODUCTS

- A. Wall Mount Faceplates
1. Provide wall mount faceplates for voice and data work area outlets.
 2. Faceplate shall accept four (4) or six (6) Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
 3. Include label/label covers for easy port identification.
 4. Raised rail design for aesthetic appeal.
 5. Faceplate shall be white in color.
 6. Approved products :
 - a. Panduit CFPE4WHY Mini-Com® Executive Series Faceplate, 4-Port, White.

- b. Panduit CFPE6WHY Mini-Com® Executive Series Faceplate, 6-Port, White.
 - c. Owner approved equivalent.
- B. Wall phone Plates
 - 1. Provide faceplates for wall phone locations.
 - 2. Faceplate shall be of stainless steel construction.
 - 3. Faceplate shall include mounting studs on plate which are positioned to mount standard wall mount telephones with keystone adaptation flush to wall surface.
 - 4. Include a Category 6 TX PLUS keystone jack module.
 - 5. Approved products:
 - 6. Panduit KWP6PY Keystone Phone Plate, Cat 6 TX Plus
 - 7. Owner Approved Equivalent
- C. Stainless Steel Faceplates
 - 1. Provide stainless steel faceplates in mechanical, electrical or unfinished spaces.
 - 2. Approved Products
 - 3. Panduit CFPL4SY Mini-Com® Stainless Steel Faceplate, 4-Port.
 - 4. Owner Approved Equivalent
- D. Surface Mount Outlet Box
 - 1. Provide surface mount outlet boxes for work area outlet locations where outlets cannot be recessed.
 - 2. Shall accept Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
 - 3. Mount easily with supplied mounting screws, adhesive tape or optional magnet.
 - 4. Cable entry from side and rear knockouts and from opening in center of base.
 - 5. Outlet box shall be white in color.
 - 6. Approved products:
 - a. Panduit CBX1WH-A Surface Mount Box, 1 Port
 - b. Panduit CBX2WH-AY Surface Mount Box, 2 Port
 - c. Panduit CBX4WH-AY Surface Mount Box, 4 Port
 - d. Owner approved equivalent
- E. Furniture Faceplate:
 - 1. Provide faceplates for work area outlet locations inside of modular furniture.

2. Shall accept Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
3. Coordinate the exact faceplate assembly with the furniture manufacturer.
4. Faceplate shall be black in color.
5. Approved products:
 - a. Panduit CFFP*4BL Furniture Faceplate, 4 Port
 - b. Owner approved equivalent.

F. Blank Modules

1. Populate any unused faceplate module openings with blank modules.
2. Blank module color shall match the faceplate color.
3. Populate any unused patch panel module openings with blank modules.
4. Blank module color shall match the patch panel color.
5. Approved products:
 - a. Panduit CMBWH-X Mini-Com® Blank Module, White
 - b. Panduit CMBBL-X Mini-Com® Blank Module, Black
 - c. Owner approved equivalent.

G. Patch Panels

1. Provide modular patch panels in MER/TR locations for all horizontal cabling.
2. Patch panel shall accept Mini-Com® Modules, which snap in and out for easy moves, adds, and changes.
3. Can be clearly identified with the PanTher™ LS8E or Cougar™ LS9 Hand-Held Thermal Transfer Printers.
4. Provide a separate 24-port patch panel in American Airlines TR locations to terminate wireless access point, IP camera drops and miscellaneous data applications as needed.
5. Approved products:
 - a. Panduit UICMPP24BLY Patch Panel, 24 Port, Ultimate ID, Black
 - b. Panduit UICMPP48BLY Patch Panel, 48 Port, Ultimate ID, Black
 - c. Owner approved equivalent.

2.6 UTP PRODUCTS

A. UTP Cable

1. Provide multi-pair Category 3 cabling for all copper backbone connectivity.
2. Conductors shall be 24 AWG solid annealed copper.
3. Pairs shall be formed into 25-pair binder groups.
4. The jacket shall be constructed of flame retardant PVC.

5. Comply with ICEA S-90-661 for mechanical properties.
 6. Comply with ANSI/TIA-568-C.1 & ANSI/TIA-568-C.2 for performance specifications.
 7. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
 8. Approved Products
 - a. General Cable Category 3 Plenum
 - b. General Cable Category 3 Non-Plenum
 - c. Superior Essex Category 3 CMR/CMP
 - d. Owner approved equivalent.
- B. UTP Cable Terminating Hardware
1. Terminate each end of copper backbone cables with rack mount 110 style field termination kits.
 2. Hardware to exceed the TIA/EIA-568-B.2 Category 3 standard.
 3. Hardware to be field terminable.
 4. Include required quantity of bases and connecting blocks, label holders and labels.
 5. Kit shall include jumper troughs.
 6. Connecting blocks shall be of the 5-pair variety
 7. Acceptable products:
 - a. Panduit P110B1005R4WJY 110 Punchdown Kit with Bases, 5 Pair Connector Blocks, Jumper Troughs
 - b. Owner approved equivalent.

2.7 FIBER OPTIC PRODUCTS

- A. Multimode Fiber
1. Provide multimode fiber optic backbone cabling, as indicated in the drawing set.
 2. Optical fibers shall be 50/125-micron and OM2 compliant.
 3. Maximum attenuation coefficient shall be:
 - a. 3.0 dB/km at 850 nm
 - 1.0 dB/km at 1300 nm
 4. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
 5. Jacket to be orange in color.
 6. Refer to the drawing set for exact fiber counts.
 7. Approved products
 - a. Intra-building

- 1) **Corning #0XXC81-3X131-24** (50/125-micron, riser), Strand count ≤ 24
- 2) **Corning #0XXC88-3X131-29** (50/125-micron, plenum), Strand count ≤ 24
- 3) **Corning #0XXC81-3X131-A1** (50/125-micron, riser, Armored-Metal Clad), Strand count ≤ 24
- 4) **Corning #0XXC88-3X131-A3** (50/125-micron, plenum, Armored-Metal Clad)
- 5) **Corning #0XXC88-T3131-A3** (50/125-micron, plenum, Armored-Metal Clad)

B. Singlemode Fiber

1. Provide singlemode fiber optic backbone cabling, as indicated in the drawing set.
2. Optical fibers shall be minimum OS1 compliant.
3. Maximum attenuation coefficient shall be:
 - a. 0.65 dB/km at 1310 nm
 - b. 0.65 dB/km at 1383 nm
 - c. 0.65 dB/km at 1550 nm.
4. Provide plenum-rated cable for all plenum environments and riser-rated cable for all non-plenum environments.
5. Jacket to be yellow in color.
6. Jacket to be imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches
7. Refer to drawings for exact fiber counts
8. Approved products
 - a. Intra-building
 - 1) **Corning #0XXE81-3X131-24** (8.3/125 -micron, riser)
 - 2) **Corning #0XXE88-3X131-29** (8.3/125 -micron, plenum)
 - 3) **Corning #0XXE81-3X131-A1** (8.3/125 -micron, riser, Armored-Metal Clad)
 - 4) **Corning #0XXE88-3X131-A3** (8.3/125 -micron, plenum, Armored-Metal Clad)
 - 5) **Corning # XXX-E8F-31131 – A1** Freedm Indoor/Outdoor (8.3/125, riser, Armored Metal Clad)
 - 6) **Corning # XXX-E8P-31131 – A3** Freedm Indoor/Outdoor (8.3/125, plenum, Armored Metal Clad)
 - b. Inter-building
 - 1) **Corning # XXX-E8F-31131 – A1** Freedm Indoor/Outdoor (8.3/125-micron, riser, Armored Metal Clad)

- 2) **Corning # XXX-E8P-31131 – A3** Freedm Indoor/Outdoor (8.3/125-micron, plenum, Armored Metal Clad)
- 3) **Corning # XXX-E8F-31131 – 29** Freedm Indoor/Outdoor (8.3/125-micron, riser)
- 4) **Corning # XXX-E8P-31131 – 293** Freedm Indoor/Outdoor (8.3/125-micron, plenum)
- 5) **Corning # XXXEWF-T4131D20** Freedm Indoor/Outdoor (8.3/125 – micron, riser)
- 6) **Corning #XXX-EWP-T4131D20** Freedm Indoor/Outdoor (8.3/125-micron, plenum)

C. Innerduct

1. Provide innerduct in all conduits carrying fiber optic and copper backbone cabling.
2. Innerduct to be constructed of flexible fabric ducts sewn together into groups.
3. The tensile strength of the innerduct shall exceed 2500 lbs.
4. The melting point for the innerduct shall be no less than 480° F.
5. Innerduct shall be unaffected by mud, silt or debris after placement of cable.
6. Each duct shall contain a color-coded pull tape.
7. Each group of ducts shall come with a unique color code.
8. Acceptable Products:
 - a. Maxcell Innerduct
 - 1) MXC4003 Standard 4" 3-Cell Fabric Innerduct
 - 2) MXC3003 Standard 3" 3-Cell Fabric Innerduct
 - 3) MXC2003 Standard 2" 3-Cell Fabric Innerduct
 - 4) Owner approved equivalent

D. Fiber Optic Connectors

1. Provide field terminated LC, SC, or FC connectors for each fiber and per contract drawings.
2. Quick-connect, simplex or duplex, type LC, SC or FC connectors per contract drawings.
3. Connector to comply with FOCIS specifications of TIA-604-3A.
4. Insertion loss not more than 0.75 dB.
5. Acceptable Products:
 - a. 95-050-41 (50 micron Multi-mode SC connector)
 - b. 95-400-03 BP (Clip for SC connectors to provide duplex connection)

- c. 95-200-41, 42 (Single-mode SC connector).
 - d. 95-210-10-BPXY (Single-mode FC APC polished connector, reference project design for specific applications).
 - e. Owner approved equivalent
- E. Fiber Enclosures
 - 1. Provide rack mount modular fiber enclosures.
 - 2. Enclosures shall accept splice modules and fiber adapter modules.
 - 3. Populate unused fiber adapter panel openings with blank filler plates.
 - 4. Refer to the drawing set to determine exact size and configuration.
 - 5. Acceptable Products:
 - a. Corning CCH-0XU Rack Mount Fiber Enclosure
 - b. Owner approved equivalent
- F. Fiber Adapter Panel
 - 1. Provide SC duplex fiber adapter panels for fiber enclosures.
 - 2. Modules shall be SC duplex for either 6 or 12 fibers.
 - 3. Modules shall be designed to install in rack mount fiber enclosures.
 - 4. Provide a quantity to accommodate every fiber within each enclosure.
 - 5. Acceptable Products:
 - a. Corning CCH-CP12-E7 Multimode Fiber Adapter Panel, 6 duplex SC
 - b. Corning CCH-CP12-59 Singlemode Fiber Adapter Panel, 6 duplex SC
 - c. Corning CCH-CP06-59 Singlemode Fiber Adapter Panel, 3 duplex UPC SC
 - d. Corning CCH-CP06-D9 Singlemode Fiber Adapter Panel, 3 duplex APC SC
 - e. Owner approved equivalent
- G. Fiber Optic Patch Cords
 - 1. Provide factory-made, duplex fiber jumpers.
 - 2. Multimode jumpers shall be constructed of laser optimized 50/125µm (OM2) fiber.
 - 3. Singlemode jumpers shall be constructed of 9/125µm (OS1 minimum) fiber.
 - 4. Provide a variety of lengths (1M, 2M and 3M), as needed, based on the rack elevations in the drawing set.
 - 5. Refer to the fiber usage schedules to determine patch cord quantities for each closet. Provide an additional 20% for spares.

6. Acceptable Products:

- a. Corning 5757-02-B5120-***-M SC to SC Fiber Jumper, Duplex, 10 GbE Multimode
- b. Corning 7272-02-R5120-***-M SC to SC Fiber Jumper, Duplex, Singlemode
- c. Corning 5705-02-B5120-***-M SC to LC Fiber Jumper, Duplex, 10 GbE Multimode
- d. Corning 7204-02-R5120-***-M SC to LC Fiber Jumper, Duplex, Singlemode
- e. Corning 0505-02-B5120-***-M LC to LC Fiber Jumper, Duplex, 10 GbE Multimode
- f. Corning 0404-02-R5120-***-M LC to LC Fiber Jumper, Duplex, Singlemode
- g. Corning 4458-02-G8120-***-M SC APC to SC Fiber Jumper, Duplex, Singlemode
- h. Corning 0244-02-G8120-***-M SC APC to LC Fiber Jumper, Duplex, Singlemode
- i. Corning 4444-02-G5120-***-M SC APC to SC APC Fiber Jumper, Duplex, Singlemode
- j. Owner Approved Equivalent

2.8 MISCELLANEOUS PRODUCTS

A. Cable Ties

1. Provide “hook & loop” cable ties for bundling cables.
2. The material shall consist of nylon loops with polypropylene hooks.
3. Use plenum-rated ties in plenum spaces.
4. Approved products:
 - a. Panduit TTS-20R0 Hook & Loop Roll, Low Profile, 20'L, .75"W, Black
 - b. Panduit HLSP*S-X0 Hook & Loop Cable Tie, Plenum
 - c. Owner approved equivalent.

2.9 EQUIPMENT RACKS

A. Communication Room Relay Racks

1. Chatsworth Products # 55053-703. 19" X 84" Standard Relay Rack. Provide with the following rack components for complete assembly.
 - a. Chatsworth Products # 11231-719 (double sided vented shelf)
 - b. Chatsworth Products # 12816-704 (flush mount plug strip with Nema L5-15p, and surge protection). *Note: Where required, CPI #12816-703 may be used if “twist-lock receptacle is not available”.*
 - c. Chatsworth Products # 12665-712 (keyboard shelf) –

B. Communications Room Equipment Cabinets

1. Acceptable products:

- a. Chatsworth Products, Inc. (CPI), F-Series TeraFrame™ Network Cabinet:
 - 1) FF2B-113C-C21, F-Series TeraFrame Network Cabinet, 27.6" wide x 36.3" deep x 83.5" high cabinet, 19" EIA x 45 RMU, Square-Punched Equipment Mounting Rails, Top Panel, One Solid Side Panels, Single Perforated Metal Front Door, Double Perforated Metal Rear Door, Two-Point Cam Latches, Keyed Locks, Black.
- b. Chatsworth Products # 12335-719 (Fixed four point shelf)
- c. (2) Chatsworth Products # 12816-704 (flush mount plug strip with Nema L5-15p, and surge protection)
- d. Chatsworth Products # 12639-001 Cage Nut & Screw – (25 count)

C. Zone Distribution/Wall Mounted Racks & Cabinets.

1. Wall Mount Racks –

- a. Where specified provide with Chatsworth Products #12816-704 (flush mount plug strip with Nema L5-15p).
- b. Chatsworth Products # 11791-718 (38.5" H X 19" W X 18" D) wall mounted swing rack.
- c. Chatsworth Products # 11807-725 (49" H X 19" W X 18" D) wall mounted swing rack

2. Wall Mount Cabinets

- a. Chatsworth Products # 11900-736 (36" H X 24" D) wall mounted swing cabinet
- b. Chatsworth Products # 11900-748 (48" X 24" D) wall mounted swing cabinet

Provide and installed with the following accessories:

- 1) CPI # 12787-536/548 front and rear mounting rails
- 2) CPI #12816-704 (flush mount plug strip with Nema L5-15p)
- 3) CPI #12804-701 Fan Kit
- 4) CPI #12805-701 Filter Kit
- 5) CPI #12806-06 Replacement Filters
- 6) CPI # 40605-005 #12024 Screw Package

2.10 POWER OVER ETHERNET INJECTORS (POE MIDSPAN)

A. PoE Midspan Injector (PoE +)

1. Provide multiport PoE midspan injectors in American Airlines MER/TR locations where wireless access point and IP camera drops exist.
2. Injector shall fully comply with the IEEE 802.3at PoE+ standard and provide a minimum of 36 Watts of power through each port.
3. Shall be capable of supporting 10/100/1000Base-TX Ethernet over TIA/EIA-568 Category 5/5e/6 cabling.
4. Approved products:
 - a. PowerDsine PD-9000G/ACDC/M
 - b. Owner approved equivalent.

B. PoE Midspan Injector (High PoE)

1. Provide multiport PoE midspan injectors in American Airlines MER/TR locations where wireless access point and IP camera drops exist.
2. Injector shall fully comply with the IEEE 802.3at PoE+ standard and provide a minimum of 60 Watts of power through each port.
3. Shall be capable of supporting 10/100/1000Base-TX Ethernet over TIA/EIA-568 Category 5/5e/6 cabling.
4. Approved products:
 - a. PowerDsine PD-9500G/ACDC/M
 - b. Owner approved equivalent.

2.11 HORIZONTAL AND VERTICAL WIRE MANAGEMENT

A. Horizontal Wire Managers

1. Place horizontal cable managers above and below each patch panel and each piece of connected equipment on/in each rack/frame. The horizontal cable manager will guide patch/equipment cords between the vertical cable manager and individual network port connections.
2. The horizontal cable manager shall attach to the front or rear of the rack/frame with screws and shall be sized to fit in standard EIA-310-D or EIA-310-E Universal rack-mount spacing (1-3/4" high U).
3. The horizontal cable manager shall be sized to match cabling requirements. Provide a minimum of 1U of horizontal cable management for every 2U of connectivity. Cables must be able to access the cable manager so that no ports are blocked by the cables.
4. A single horizontal cable manager may be used to support multiple patch panels (above and below) as long as it is sized to match cable fill requirements. Cables must be able to access the cable manager so that no ports are blocked by the cables.

5. The horizontal cable manager shall be a single-sided C-shaped trough with a cover. 2U and 3U high cable managers shall have three edge-protected oval openings at the rear to facilitate front-to-rear cabling through the horizontal manager. The front of the cable manager shall have T-shaped cable guides along the top and bottom surfaces of the cable manager. Evenly spaced cable openings in between the T-shaped cable guides shall allow cables to enter/exit the cable manager from/into the rack-mount space. The cover shall be removable, hinged to open up or down and shall snap on to secure the cover in the closed position.
 6. The horizontal cable manager shall be delivered individually boxed, and available in the width(s) and height(s) as specified below and in the contract documents.
 7. The horizontal cable manager shall be manufactured from steel, aluminum and plastic.
 8. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. Edge-protectors, T-shaped cable guides and latch hardware is black.
 9. Acceptable products:
 - a. Chatsworth Products, Inc. (CPI), Velocity™ Horizontal Cable Management:
 - 1) Part Number 35441-702, Evolution Single-Sided Horizontal Cable Manager, 2U x 19"EIA x 8.2" Deep (208 mm), Black.
 - b. Owner Approved Equivalent
- B. Strain Relief Bars
1. Install one strain relief bar behind each 24 ports of each patch panel.
 2. Acceptable products:
 - a. Leviton 49005-DMB
 - b. Owner Approved Equivalent
- C. Vertical Wire Managers
1. Every rack/frame shall have a minimum of one vertical cable manager. The vertical cable manager shall create a space for storing and organizing cables along the side of the rack/frame. The cable manager shall maintain separation between patch/equipment/jumper cords and premise cables.
 2. The vertical cable manager shall match the height of the rack(s)/frame(s).
 3. The vertical cable manager shall bolt to the side of racks/frames with included hardware.
 4. The cable manager shall be sized to match cabling requirements. Maximum cable fill shall be calculated by dividing 50% of the usable area within the cable manager by the area of a single cable.
 5. The vertical cable manager shall be a single-sided C-shaped trough with a front door and individual cable rings on the rear side. The single-sided

trough and cable rings shall provide independent front and rear cable pathways. The front sides of the cable manager shall have T-shaped cable guides separated by openings that align with each U space on the rack. The back of the manager shall have individual rings with plastic spin-open latches. The rings will provide attachment points for cable management accessories inside the cable management trough. Openings between the rings will allow easy cable pass-through.

6. The door shall be removable, hinged to open from the right or left side, with a two-point latch and a single knob on the right and left side to secure the door in the closed position. The front door shall have a two-tone finish: black with a vertical aluminum panel at the center. The rear door on double-sided cable managers shall be flat with a black finish.
7. The T-shaped cable guides shall be made from a composite plastic material (not metal) and shall have rounded edges to protect cables. Openings between the T-shaped guides will be evenly spaced. When the cable manager is attached to a rack/frame, each cable opening shall align with a rack-mount space (U) on the rack/frame. Each opening shall pass a minimum of 24 each .25" OD patch cords.
8. The cable manager shall be delivered individually boxed, and available in several widths as specified below and in the contract documents.
9. Optional internal cable management accessories will include cable management spools that attach to the panels/mid-sections to provide slack management for patch cords; a cable lashing bar kit to provide tie points for cable bundles at the rear/mid of the manager; and a fiber segregation kit that creates a separate pathway inside the manager to separate fiber from other cables.
10. Acceptable products:
 - a. Chatsworth Products, Inc. (CPI), Velocity™ Cable Management:
 - 1) Part Number 35571-703, Evolution g3 Combination Vertical Cable Manager, 7' High x 6" Wide x 20.2" Deep (2.1 m x 150 mm x 513 mm), Black.
 - 2) Part Number 15008-001, Cable Distribution Spools, Pack of 4, Black.
 - 3) Part Number 35473-703, Cable Lashing Bar Kit, for Evolution Vertical Cable Managers, Zinc-Plate (Silver-Colored).
 - b. Owner Approved Equivalent.

D. Provide strain relief bars behind each patch panel.

1. Strain relief shall be 7" deep.
2. Acceptable products:
 - a. Panduit SRB19D7BL Deep Strain Relief Bar
 - b. Owner approved equivalent.

2.12 LADDER RACK, SUPPORTS, AND ACCESSORIES

- A. Ladder Rack (Cable Runway)
1. Ladder rack shall be manufactured from 3/8" wide by 1-1/2" high tubular steel.
 2. Ladder rack (side stringers) will be 9'-11½" long. Cross members will be welded in between stringers on maximum 12" centers beginning 5-3/4" from one end so that there are a minimum 10 cross members per ladder rack. There will be a maximum 10-1/2" of open space in between each cross member.
 3. Provide with Turns, Corner Brackets, Vertical Stringers, Splices, Ladder Rack Supports and Accessories.
 4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
 5. Refer to the drawing set to determine the width.
 6. Acceptable products: ("xx" denotes nominal width)
 - a. Chatsworth 10250-7xx
 - b. Cooper B-Line SB17TxxBFB
 - c. Owner Approved Equivalent

PART 3 – EXECUTION

3.1 INSTALLATION

A. GENERAL

1. Cables shall be pulled in accordance with the manufacturers recommended practices and in compliance with the NEC and the BICSI Telecommunications Distribution Methods Manual. Planning and care shall be taken to prevent abuse and damage during the handling or installation phase. Specified minimum cable bend radius shall be met without deviation.
2. Pull cables simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant where necessary. Compound used must not deteriorate conductor or insulation. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.
3. Protect cable from tension, compression, torsion, bending, squeezing and vibration. Do not pull cables improperly or exceed the Manufacturer's tensile rating. This value shall be not more than thirty-two (32) lb. force (provide breakable link for all cable pulling). There shall be no coils of excess cable left in the ceilings, cable trays, or raised floor areas unless specified otherwise. A trailer pull string shall be left in all conduits before and after cables have been installed. The cabling within the wiring closets/cabinets shall be routed and dressed neatly to their termination points such that no excess cable is present. As cables are pulled into the cabinet, bundle them in groups with Velcro type straps according to their terminating row position. Strap exposed cables for strain relief at the termination in the communications rooms.

4. All strapping and lashing of cable within the TR(s) shall be made with "Velcro" type straps for easy access to cable bundles to facilitate future "adds and changes". No plastic tie-wraps will be allowed for support of cable.
5. All floor and wall penetrations shall be fire-stopped in accordance with local codes and restrictions.
6. New cabling will be installed in cable tray, conduit, and/or J-hooks throughout entirety of cable path.

B. HORIZONTAL CABLE

1. Install voice and data cable locations and configurations as depicted on drawings.
2. Test all cable prior to installation. Upon failure to perform testing, the installer shall accept the cable as good and assume all liability for the replacement of the cable should it be found defective at a later date.
3. All conformance standards must be certified for multipair and individual cable runs.
4. Jacketing and insulation must satisfy the Underwriter's Laboratories (UL) listed fire rated cable insulation requirements in plenum areas.
5. Any pulling compound or lubricant used in cable installation must not deteriorate the conductor or the insulation. Provide 3M type WLC or an approved equal.
6. Copper cable runs shall not exceed 295 feet. All runs shall be continuous. No splicing is allowed.
7. The Contractor shall install copper cable with a minimum bend radius of six times the diameter of the cable.
8. Install 10-feet of spare copper cable (service loop) in each closet prior to termination. Provide Velcro type tie wrap for cable support and organization.
9. Install minimum 12-inches of spare copper cable in ceiling plenum prior to dropping down wall to outlet. Support slack to structure with J-Hook and Velcro ties. If there is no plenum, loop shall be located in box prior to termination. Provide box of sufficient size to accommodate spare cable, termination equipment if applicable and maintain bending radius.
10. Install 10-feet of spare copper cable (service loop) at each above ceiling outlet prior to termination. Provide Velcro type tie wrap for cable support and organization.
11. All horizontal cable shall be rated for plenum use.
12. The maximum pulling tension for 4-pair 23 AWG horizontal UTP cables shall not exceed 32 lbf. The Contractor shall provide a tension meter during the pulling of all cables. If the meter shows that the tension has exceeded 32 lbf, the Contractor shall discard the cable and pull new cable.

C. WORKSTATION TERMINATION

1. At the workstation termination point, cables shall be routed and dressed to provide a service loop in case re-termination is necessary. Leave 12 inches of slack at the junction box. Provide strapping of voice and data cable to provide strain relief of cable in relation to outlet termination.
2. Each horizontal workstation cable shall terminate on a "Mini-Com" modular jack connector and attached to the outlet faceplate. All unused faceplate ports will have a blank insert.
3. The Contractor shall adhere to the latest termination procedures as specified by manufacturer's instructions.
4. Follow TIA/EIA 568-A termination procedures.

D. PATCH SYSTEM

1. Each horizontal data cable will terminate on a "Mini-Com" modular jack, inserted into the patch panel module. Horizontal termination of individual data cables within the communications room shall be the same as aforementioned termination procedures for the workstation cables.
2. Terminate miscellaneous cables (antennas, cameras, etc.) on a separate patch panel.
3. Non-Miscellaneous cables (cables that do not support cameras and antennas) shall be terminated adjacent to each other in groups of three according to their work area outlet position. Provide blanks within the patch panel for work area outlets that consist of only 1 or 2 cables to maintain consistent grouping (i.e. 8 work area outlets shall occupy 1 row of the patch panel).
4. Mount the distribution panels starting at the upper most position of the racks/rails beginning with contractor provided fiber patch panels. Allow for sufficient space between the distribution panels to allow for horizontal wire managers and cross connect component installation. Provide a detail of your elevation plan to the OWNER or Owner's Representative before proceeding.
5. Patch cords shall be installed in a manner as to limit the bundling of patch cords to no more than 40 patch cords.

E. 110- BLOCK SYSTEM

1. Mount 110-block panel kits starting that the upper most position of the rack/rails below the contractor provided wire managers. Provide a detail of your elevation plan to the OWNER or Owner's Representative before proceeding.
2. All cable shall be routed through slots in the base. Each pair of each cable shall be inserted into position in the wire strip slots while maintaining the proper color sequence and punched-down. Secure the connecting block over the wired base.
3. Terminate cross-connect wires to the top of the connecting blocks, maintaining the proper color sequence.

F. LABELING

1. Provide labeling in accordance with American Airlines Labeling Standard

2. ROOM IDENTIFICATION

a. Each Telecommunications Room will have both an Architectural Room number as well as a “logical” room number. Architectural Room number is assigned and installed by others, “logical” room number will be assigned and performed within this section of specification:

b. Label Telecommunications/Equipment Room door with unique identifying code located on door below Architectural Room Number.(TR or ER)

c. Characters shall be 1-inch minimum.

d. Each Room will be labeled sequentially and by floor number (as applicable):

e. Example; AA TR-x-XX (AA TR-1.02, or AA TR02)

Where:

x = Floor Number as Applicable

XX = Sequential number

3. EQUIPMENT RACK IDENTIFICATION

a. Label each Equipment rack with a unique alpha numeric character indicating Rack Type and sequential rack number

b. Position Labels at top of Rack

c. Characters shall be 1” minimum

d. Example: X## (R01)

Where:

X= Floor Number as Applicable

XX = Sequential number

4. PATCH PANELS AND RACK MOUNTED TERMINATION BLOCKS

a. Each Patch Panel or Rack Mounted Termination block shall be labeled with a sequential number. Beginning 01 at the upper most block within the rack and working down.

Example: 01

5. PATCH PANEL PORT LABELING

a. Patch panel ports are numbered from left to right, top to bottom starting with '01' to '24', then for a 48 port patch panel '25'-'48'.

b. The top line of the data port label shall indicate the Destination Faceplate

c. The second line (port label) shall be labeled by Port# (001 thru 999)

Example:

Line 1: TR03-017

Line 2:TR103-024

6. TELECOMMUNICATIONS OUTLET IDENTIFICATION (WAO)

- a. Label each Telecommunications Outlet connector with a unique identifying code
 - 1) Position labels in recessed label holders on faceplate and cover with plastic covers.
- b. Telecommunications Outlet Faceplate labeling code shall be as follows:
 - 1) TR/ER – Faceplate number where:
 - a) TR/ER is identifier for room where cable terminates in horizontal cross-connect
 - 2) Faceplate number starts with '001 to 999'
 - 3) Example: TR03-017

7. HORIZONTAL CABLING

- a. All horizontal cables shall be labeled at Telecommunications outlet and horizontal cross-connect with self-laminating labels via Panduit labeler and software.
- b. Cables shall be labeled at each end with information indicating termination point of both ends of cable as follows:
 - 1) TR/ER, Face Plate #, Patch Panel #, Port #
 - a) Example: TR01-085-03-104
- c. Cables shall be labeled on a visible part of the cable within three to six (3-6) inches of termination point for ease of identification after termination.
- d. Labels at the telecommunications outlet shall be visible by removing the faceplate.
- e. Outlets shall be numbered sequentially within the TR zone beginning clockwise from plan west (left) across the space and maintaining sequence within rooms.

8. BACKBONE CABLING

- a. All backbone cabling shall be labeled at each end with self-laminating labels via Panduit labeling system.
- b. Cables shall be labeled on a visible part of the cable within twelve (12) inches of termination point for ease of identification after termination
- c. Cabling shall be labeled at each end with information indicating the building identifier, owner, room, cable number and "F" indicating fiber or "CU" indicating copper:

- 1) "SM" shall be used before the F to indicate the use of single-mode fiber.
 - 2) "MM" shall be used after the F to indicate the use of multi-mode fiber.
 - 3) Fiber shall be labeled on the front of the fiber enclosure.
 - a) SMF for single-mode fiber.
 - b) MMF for multi-mode fiber.
- d. Cables shall be labeled at each end with information indicating termination point of both ends of the cable as follows:
- 1) Owner/Bldg/Cable Type - TR/ER -Cabinet Rack– Patch Panel
 - a) Example: AA-Term A-SMF TR01-R03-06/ ER01-R02-03

G. RELAY RACKS

1. Assemble relay racks according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
2. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor.
3. Attach Ladder rack to the top of the rack or directly to the wall to deliver cables from the rack to the horizontal cable Ladder or to the wall

H. CABINETS

1. Provide all components of the cabinet system (cabinet, mounting rails, shelves, cable managers, power strips, environmental sensors, and thermal management accessories) from a single manufacturer.
2. Install and adjust to position all accessories including vertical cable managers, vertical power strips, equipment-mounting rails, airflow baffles using the manufacturer's installation instructions prior to baying and/or placing the cabinet for attachment to the building. Shelves, horizontal cable managers and filler panels, if used, may be installed after the cabinet is placed.
3. Attach overhead ladder rack or cable tray to the ceiling, independent of the cabinet
4. Cabinets shall be securely bonded to the Telecommunications Grounding Busbar (TGB).

I. WALL MOUNT CABINETS

1. Provide all components of the cabinet system (cabinet, mounting rails, cable managers, power strips, and accessories) from a single manufacturer.

2. Attach the cabinet to the wall so that the front door and cabinet body can be fully opened. Follow the manufacturer's installation instructions when securing the cabinet to the wall and backboard. When not attached to the wall, the floor, shelf or tabletop surface on which the cabinet is placed must be able to hold the combined weight of the cabinet and the equipment within the cabinet. The cabinet should not be attached to sheet rock (gypsum wall board). The cabinet must be attached directly into studs through a 3/4" (19 mm) plywood backboard. The cabinet may be attached to a masonry wall when the installer provides hardware. Use included hardware or the appropriate hardware as defined by local code or the authority having jurisdiction. The top of the cabinet when installed should not exceed 84" (2133.6 mm) above the finished floor.
3. Provide a telecommunications ground for equipment within the cabinet.

J. LADDER RACK

1. Provide all components of the ladder rack system (ladder rack, turns, splices, supports, and accessories) from a single manufacturer.
2. Within each telecommunications room, ladder rack should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents.
3. Ladder rack shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.
4. Ladder rack shall be secured to the structural ceiling, building truss system, wall, and the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

3.2 TESTING

A. Cable Testing

1. Cabling installation is not considered complete until test results have been completed, submitted and approved.
2. Provide 72 hours notice to the OAR prior to testing.
3. Test results saved within the field-test instrument shall be transferred into a Windows™ based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered and printed directly to .PDF (Adobe Acrobat)
4. Horizontal Cable Testing:
 - a. Contractor shall utilize personnel trained in the operation of the following Level II rated test equipment:
 - 1) Agilent WireScope Pro Series
 - 2) Fluke DTX-1800 Series
 - 3) Ideal LanTEK II

- 4) Or approved equal
 - b. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable link performance. The Contractor shall verify all conductors of each cable useable prior to system acceptance.
 - c. Perform end to end link testing of all cabling and connections with specified equipment and certify as meeting the criteria as defined in Category 6 UTP cabling systems within the most current publication of TIA/EIA 568-B.
5. Copper Backbone Cable Testing
- a. Testing of all copper wiring shall be performed prior to system cutover. 100% of riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage.
 - b. Category 3 riser cables shall be tested for conformance to TIA 568C.
 - c. Copper backbone shall exceed ANSI/TIA-568-C.2 Backbone Cabling requirements and meet the manufacturer's specifications for the installed product.
6. Fiber Backbone Cable Testing
- a. Testing documentation shall be submitted in accordance with TIA/EIA 526-14-A "Optical Power Loss Measurement in Installed Multimode Fiber Cable Plant" and TIA/EIA 526-7 "Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant". At minimum, the following information shall be documented during testing.
 - b. Optical fiber shall exceed ANSI/TIA-568-C.3 Optical Fiber Cabling Components Standard requirements and meet the manufacturer's specifications for the installed product.
 - c. Optical Fiber Testing with OTDR
 - 1) The Contractor shall test all optical fiber cable prior to installation. The Contractor shall assume all 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 system. Bidirectional end-to-end OTDR testing shall be performed in accordance with TIA 455-78-B. The system loss measurement shall be provided at 850 and 1310 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.
 - 3) Fiber links shall have a maximum loss of (allowable cable loss per km) (km of fiber in the link) + (.4dB)(number of mated connectors) = maximum allowable loss.

- 4) Documentation shall be provided in both hard copy and CD format to the OAR.
- d. Optical Fiber Testing with Power Meter
 - 1) Multimode Horizontal Link Segments should be tested in both directions at 850-nm and 1300-nm wavelengths.
 - 2) Multimode backbone and composite link segments should be tested in both directions at both 850-nm and 1300-nm wavelengths.
 - 3) Singlemode horizontal link segments shall be tested in both directions at 1300-nm and 1550-nm wavelengths.
 - 4) Singlemode backbone and composite link segments should be tested in both direction at both 1310-nm and 1550-nm wavelengths.

B. CLEANING

1. Upon completion of the installation, make all components free of any oil, grease, dust and debris.
2. Work areas will be cleaned at the end of each work day and a final cleanup will occur at project completion.

C. DOCUMENTATION

1. Electronic submittal, via CD ROM, of required cable test results, As-Built drawings, and warranty information will be submitted to the Owner or Owner's representative at least ten (10) working days before Certificate of Occupancy is awarded. CAD files will be submitted in Autocad (.dwg) format. When proprietary software is needed to view cable test results, the contractor will provide a licensed copy to owner for review.

D. ACCEPTANCE

1. Review test results and conduct a final inspection and punch list walk-thru with Owner and/or OAR, to inspect installation and obtain concurrence. Concurrence does not waive the responsibility of the Contractor to correct deficiencies.

- END OF SECTION -

UNITED AIRLINES

UNITED



Critical IT Infrastructure

Information Technology Systems

Design Standards & Construction Practices

for

Structured Connectivity Systems

Security & Access Control Systems

Audio Visual Systems

Paging Systems

Revision 1.0 08/22/14

**Developed and Maintained
by
IT Critical Infrastructure Group
(Layer Zero)**

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PART 1. GENERAL INFORMATION

1.01 Overview

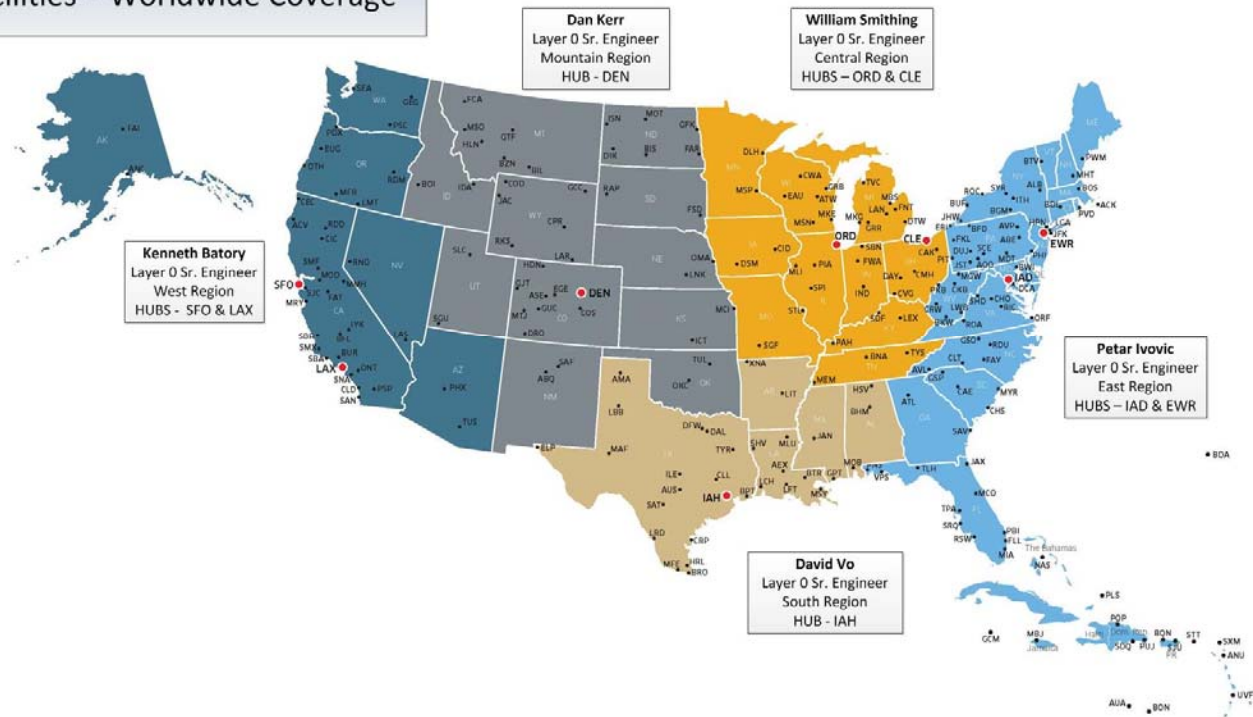
- A. This document is intended to provide the information necessary to allow both the design and construction teams the necessary requirements to plan for and implement United Airlines Information Technology Systems and to ensure that all new installations and renovations are uniform and consistent with company-wide standards. This document is intended to address design standards and installation practices related to the specific requirements of telecommunications pathways and spaces and the cabling systems necessary to support voice, data, video, radio, paging and access control and CCTV systems for new and renovated facilities. This document will establish an implementation concept that can be used to shape architectural templates and influence the design process for the information technology systems. This document will also identify proven infrastructure construction techniques, define common practices, and serve as an authoritative implementation guide.
- B. Many of the items contained in this document are dependent of the local jurisdictions where the given project is taking place. However, where more stringent requirements are desired by United Airlines, they shall be noted as such. Moreover, some items discussed in this document are directly affected by other teams managing the construction process and shall be fully coordinated therein.

1.02 IT Critical Infrastructure Group Coverage Maps - Layer Zero

- A. The following coverage maps identify the Layer-Zero Engineers that are assigned to specific regions and zones throughout the world.
 1. IT Critical Facilities – Worldwide Coverage Maps
 - United States
 - Canada
 - Mexico
 - South America
 - EMEA – Europe, Middle East, Africa
 - Pacific

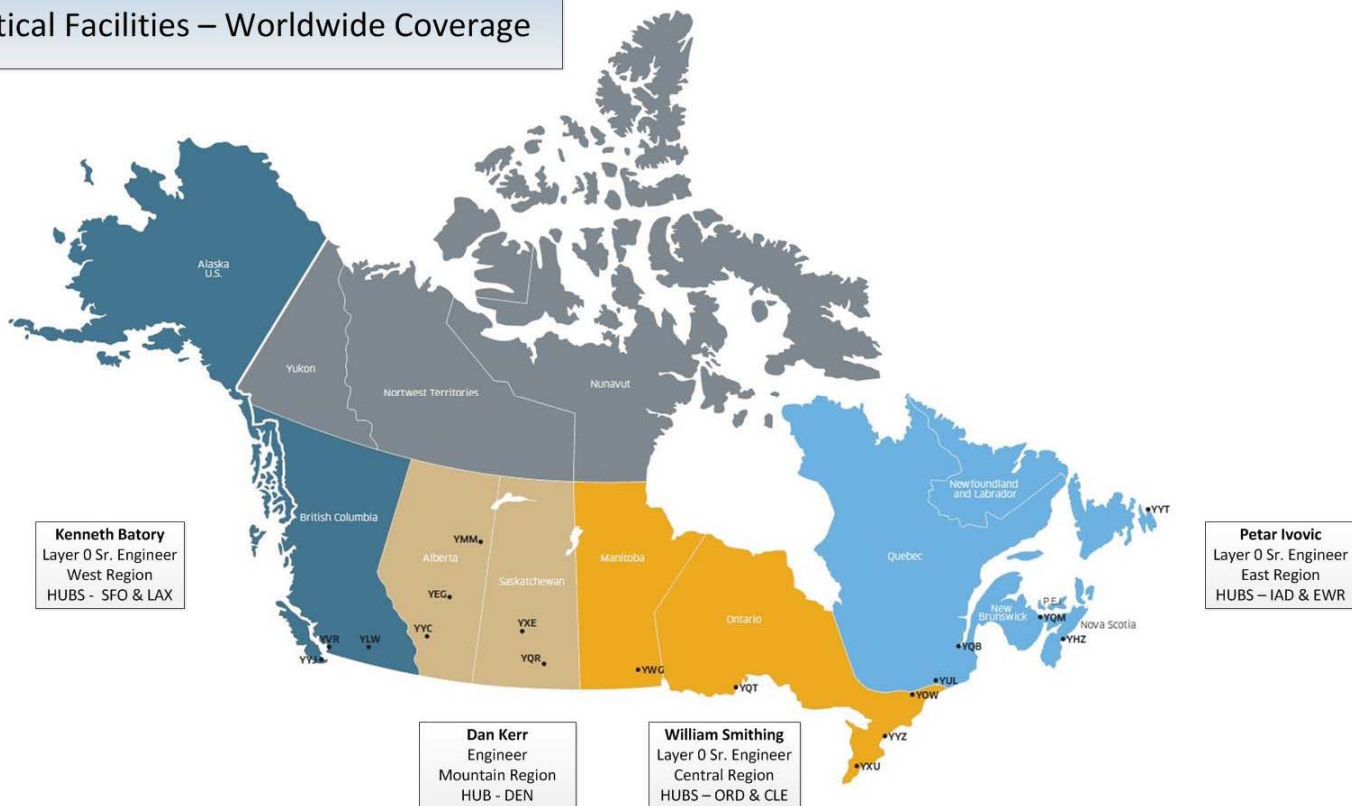
Layer 0 – IT Critical Facilities – Worldwide Coverage

United States



Layer 0 – IT Critical Facilities – Worldwide Coverage

Canada



Layer 0 – IT Critical Facilities – Worldwide Coverage

South America



David Vo
Layer 0 Sr. Engineer
South Region
HUB - IAH

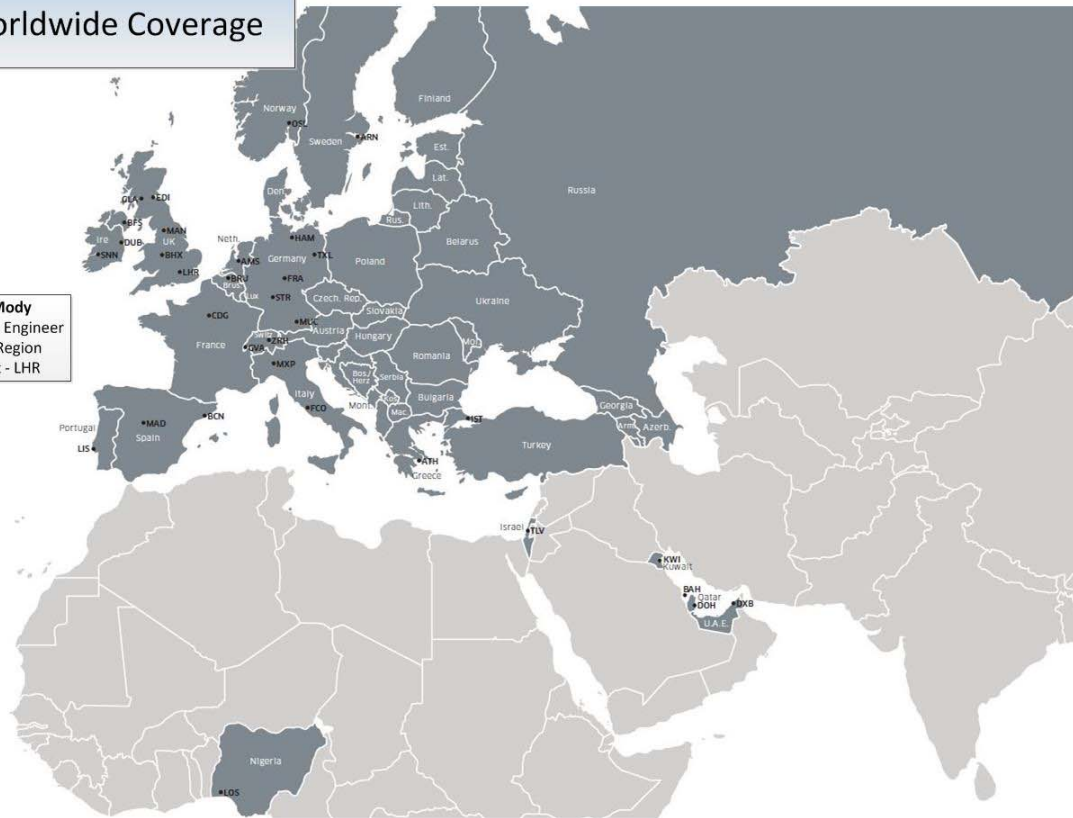
Layer 0 – IT Critical Facilities – Worldwide Coverage

Mexico



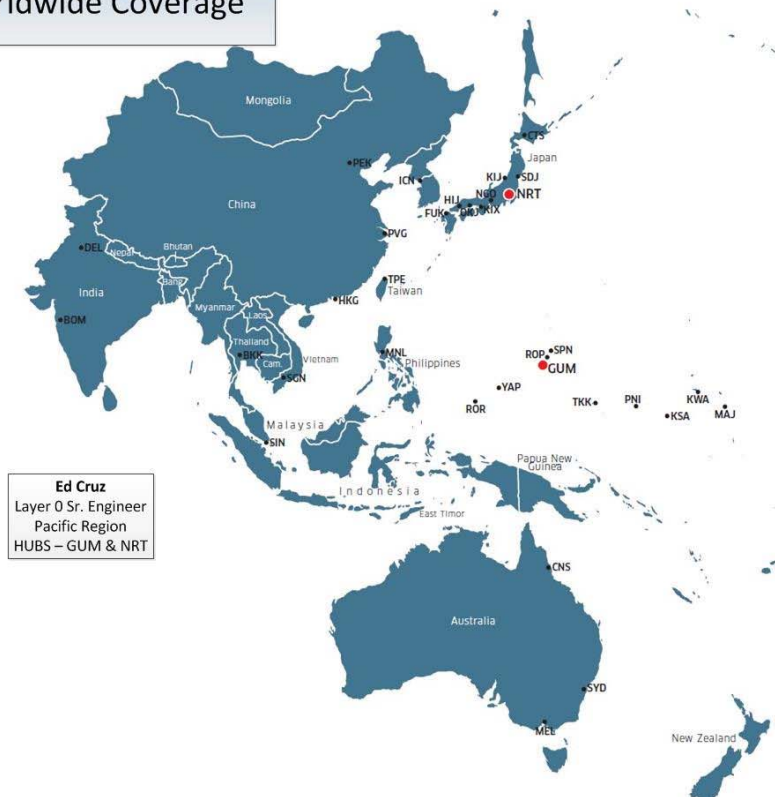
EMEA
Europe, Middle East, Africa

Eric Mody
Layer 0 Sr. Engineer
EMEA Region
Airport - LHR



Layer 0 – IT Critical Facilities – Worldwide Coverage

Pacific



1.03 IT Critical Infrastructure Group Coverage Maps - Authorized Design Firms

- A. The following coverage maps identify the only approved UAL Technology Design Firms assigned to specific regions and zones throughout the world. These two firms are tasked with performing the technology systems design work on behalf of UAL IT for projects involving Information Technology Systems. Please contact the appropriate firm responsible for the region where the work is being performed. Contact information is provided below.

1. Authorized Design Firm Contacts

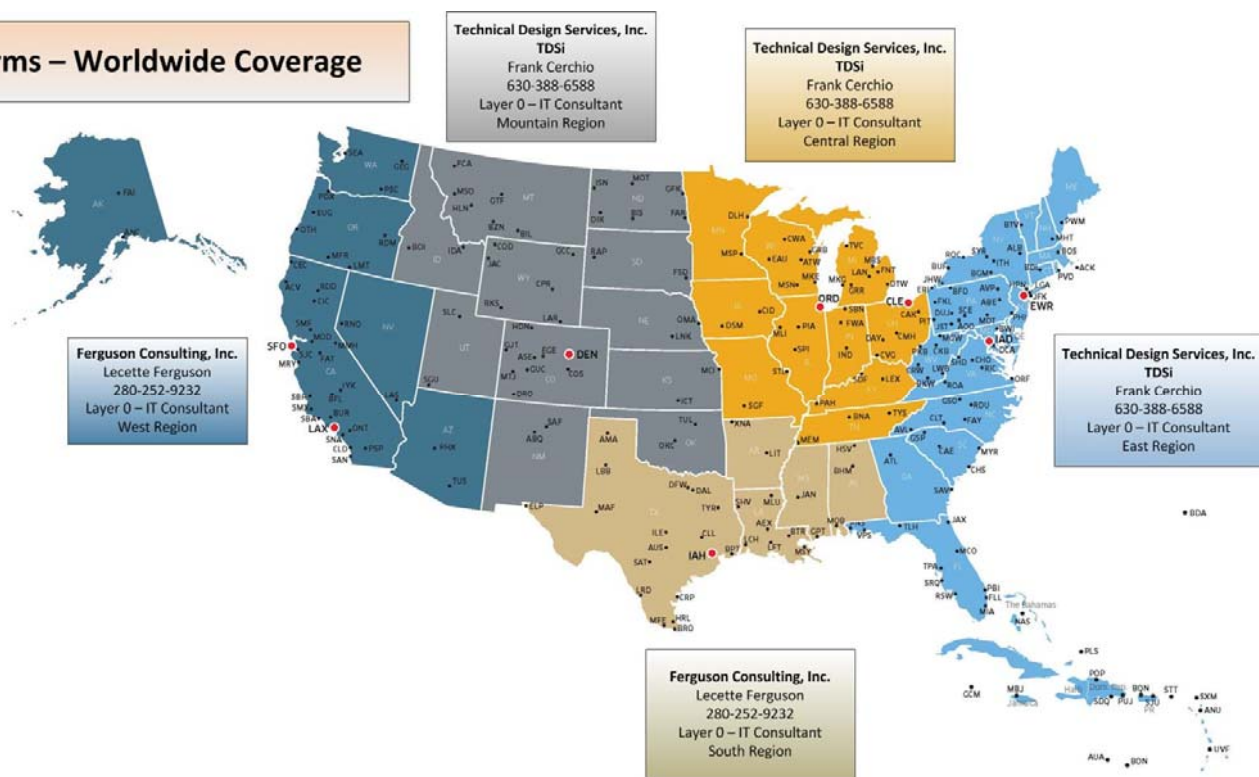
- Frank J. Cerchio, RCDD
Technical Design Services, Inc. - TDSi
1075 Shore Road, Suite A
Naperville, IL 60563
Office: 630.388.6588
Cell: 630.234.6804
fcercchio@tdsinc.biz
- Lecette Ferguson, PE, RCDD
Ferguson Consulting, Inc.
37602 Tournament Lane
Magnolia, Texas 77355
Office: 281-252-9232
Cell: 281-685-5773
lferguson@fci-engr.com

2. Authorized Design Firms – Worldwide Coverage Maps

- United States
- Canada
- Mexico
- South America
- EMEA – Europe, Middle East, Africa
- Pacific

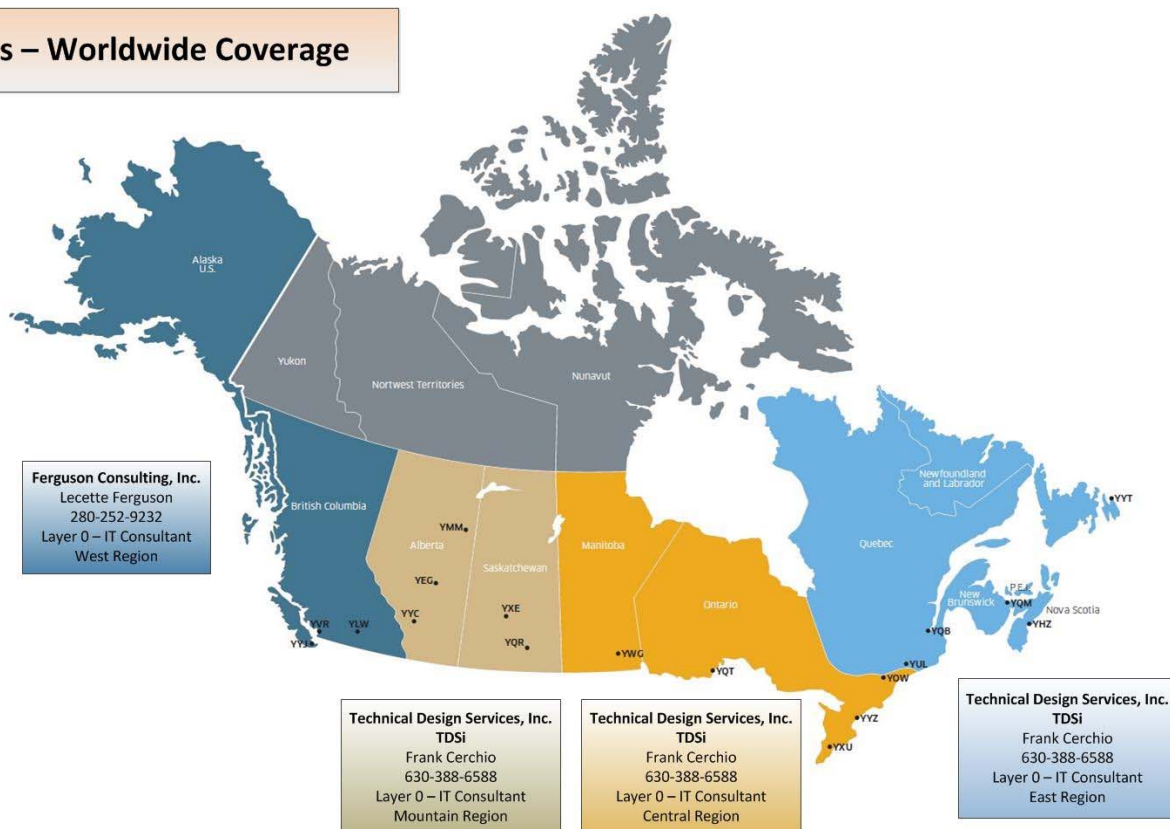
Authorized Design Firms – Worldwide Coverage

United States



Authorized Design Firms – Worldwide Coverage

Canada



Authorized Design Firms – Worldwide Coverage

Mexico



Authorized Design Firms – Worldwide Coverage

South America



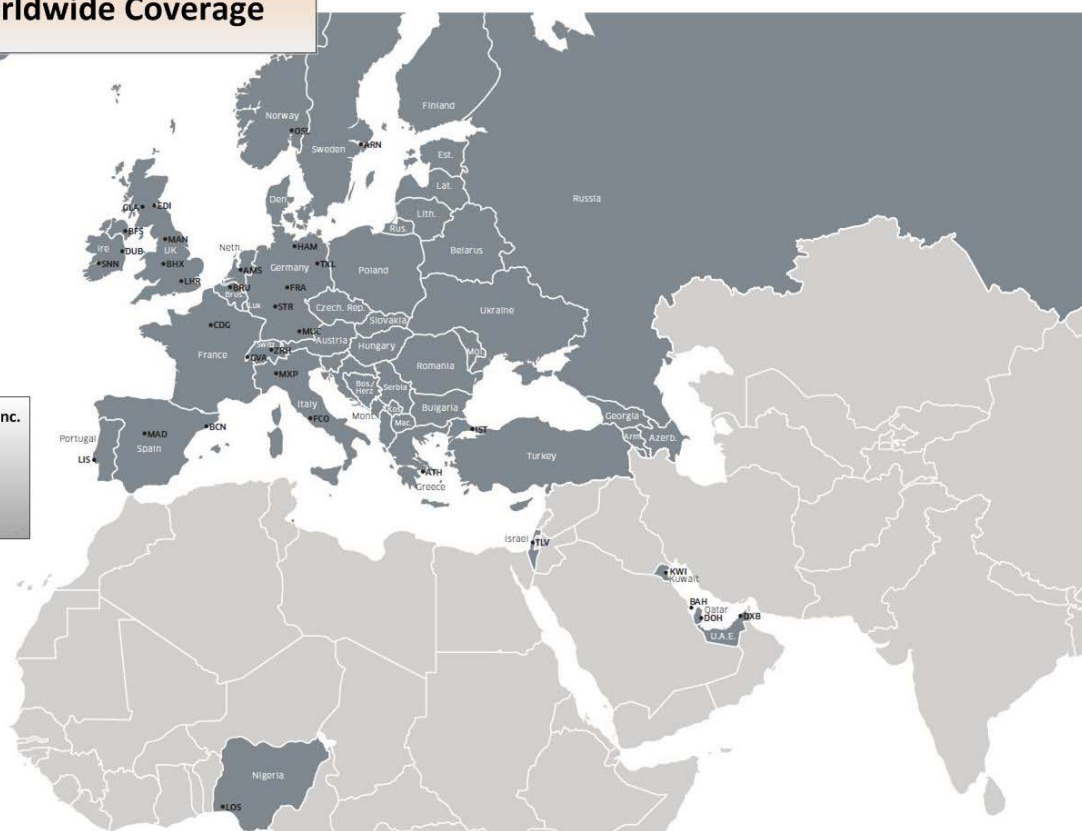
Ferguson Consulting, Inc.
Lecette Ferguson
280-252-9232
Layer 0 – IT Consultant
South/Latin America Region

Authorized Design Firms – Worldwide Coverage

EMEA

Europe, Middle East, Africa

Technical Design Services, Inc.
TDSi
Frank Cerchio
630-388-6588
Layer 0 – IT Consultant
EMEA Region



Authorized Design Firms – Worldwide Coverage

Pacific



PART 2. STRUCTURED CONNECTIVITY SYSTEM

2.01 Overview

- A. This document describes the United Airlines (UAL) standards, specifications and requirements for the Structured Cabling System (SCS), Equipment Rooms (ER), and Telecommunication Rooms (TR) as a part of UAL Critical Facilities Services (CFS). All SCS and Telecommunication Rooms in Airports, Reservation Centers and Business Facilities are part of the UAL Critical IT infrastructure and are governed by the standards as defined in this document. Within the standards and specifications detailed in this document, there are varying requirements for different facilities based on the criticality of the operation at the facility. The SCS and TR requirements apply to all facilities unless identified within the specific section of the document.
- B. Within North America, specific electrical / building codes provide for minimum requirements regarding cable types, enclosures, installation practices etc. The recommended product types described within this document should be followed as the preferred UAL standard, which in certain instances exceeds the minimum electrical / building code requirements. Special requests for providing local minimum electrical / building code requirements for product type should be forwarded to UAL-CFS Division for consideration and approval at Kenneth.Triebe@united.com or Tom.Songaila@united.com
- C. This document specifically addresses IT Critical Infrastructures initiated as per the implementation date shown herein. The enclosed information describes in detail the recommended manufacturer's products required for the implementation of an infrastructure supporting both voice and data applications. All SCS and TR/ER infrastructures currently installed at UAL locations may continue to acquire the same manufacturer's products as are currently deployed until UAL-CFS Division determines otherwise. In the event the recommended manufacturers products are unavailable, or impractical due to location restraints, equivalent products meeting these same specifications and standards criteria described within this document may be used with UAL CFS Division approval.

2.02 Glossary

- A. **AFF** Above Finished Floor
- B. **As-Built** Documentation that indicates cable routing, connections, systems, and blueprint attributes upon job completion that reflects changes from the planned to the finished state.
- C. **CFS** Critical Facilities Services
- D. **CM** Construction Manager
- E. **Contractor** The cabling installation contractor
- F. **MC** Main Cross-connect
- G. **HC** Horizontal Cross-connect
- H. **IC** Intermediate Cross-connect
- I. **IDF** Intermediate Distribution Frame
- J. **MDF** Main Distribution Frame
- K. **MER** Main Equipment Room
- L. **SCS** Structured Connectivity System
- M. **TR** Telecommunications Room
- N. **OS1** Optical fiber Single-mode
- O. **OS2** Optical fiber Single-mode (Zero Water Peak)
- P. **OM3** Optical Fiber Multimode laser optimized 50 μm (10-Gig 300 Meters)
- Q. **OM4** Optical Fiber Multimode laser optimized 50 μm (10-Gig 500 Meters)
- R. **Owner** United Airlines (UAL)

- S. **Project Documents** All documents that pertain to the project, including, but not limited to, project drawings and these Specifications.
- T. **RPS** Redundant Power Supply
- U. **Specifications** This document, which outlines general installation requirements.
- V. **UPS** Uninterruptable Power Supply

2.03 Facility Site Classification Levels

A. Level 5 (Hubs) * = International Airport

1. DEN, EWR, GUM*, IAD, IAH, LAX, NRT*, ORD, SFO

B. Level 4 (Large Airport) * = International Airport

1. ATL, AUS, BOS, BWI, CLE, CUN, DCA, DFW, FLL, FRA, HNL, IND, JFK, LAS, LGA, LHR*, MCI, MCO, MEX*, MIA, MSP, MSY, PDX, PHL, PHX, PIT, SAN, SAT, SEA, SMF, SNA, STL, TPA, YVR*, YYZ*

C. Level 3 (Medium Airport) * = International Airport

1. ABQ, ACA*, AGU*, ALB, AMS*, ANC, ANU*, ARN*, ASE, AUA*, BAH*, BCN*, BDA*, BDL, BFS*, BHX*, BIM*, BKK*, BNA, BOG*, BOI, BOM*, BON*, BQN*, BRU*, BTX, BUF, BZE*, CCS*, CDG*, CHS, CLT, CME*, CMH, CNS*, COS, CTS*, CUR*, CUU*, CVG, CZM*, DAY, DEL*, DGO*, DOH*, DSM, DTW, DUB*, DXB*, EDI*, EUG, EZE*, FAT, FCO*, FSD, FUK*, GCM*, GDL, GGT*, GHB*, GIG*, GLA*, GRR, GRU*, GSO, GUA*, GVA*, HAM*, HIJ*, HKG*, HUX*, ICN*, ICT, IST*, JAX, KIJ*, KIX*, KOA, KSA*, KWA*, KWI*, LIM*, LIR*, LIS*, LIT, LOS*, MAD*, MAJ*, MAN*, MBJ*, MDT, MEL*, MEM, MGA*, MID*, MKE, MLM*, MNL*, MSN, MTY*, MUC*, MXP*, NGO*, OAX*, OGG, OKC, OKJ*, OMA, ONT, ORF, OSL*, PAP*, PBC*, PBI, PEK*, PLS*, PNI*, POP*, POS*, PSP, PTY, PUJ*, PVD*, PVG*, PVR*, PWM, QRO*, RDU, RIC, RNO, ROC, ROP*, ROR*, RSW, RTB*, SAL*, SAP*, SBA, SDF, SDJ*, SDQ*, SGN*, SIN*, SJD*, SJO*, SJU*, SLC, SLP*, SLW*, SNN*, SQR*, STR*, STT*, SXM*, SYD*, SYR, TAM*, TCB*, TGU*, TGZ*, TKK*, TLV*, TRC*, TUL, TUS, TXL*, TYS, UIO*, UVF*, VER*, VSA*, YAP*, YEG*, YHZ*, YLW*, YMM*, YOW*, YQB*, YQM*, YQT*, YUL, YWG*, YYC*, YYJ*, ZIH*, ZLO*, ZRH*

D. Level 2 (Small Airport) * = International Airport

1. BHM, BIL, BJX, BTR, BUR, BZN, CID, DRO, ELP, GSP, JAC, LIH, MAF, MFE, MHT, MLI, SAV

E. Level 1 (UAX Airport) * = International Airport

1. ABE, ACK, ACV, AEX, AMA, AOO, ATW, AVL, AVP, BFD, BFL, BGM, BIS, BKW, BPT, BRO, CAE, CAK, CEC, CHO, CIC, CKB, CLD, CLL, CMX, COD, CPR, CRP, CRW, CWA, DAL, DIK, DLH, DRT, DUJ, EAU, EGE, ELH, ERI, EYW, FAI, FAR, FAY, FCA, FLK, FNT, FPO, FWA, GCC, GEG, GFK, GJT, GNV, GPT, GRB, GRK, GTF, GUC, HDN, HLN, HOB, HPN, HRL, HSV, IDA, IPL, ISN, ITH, ITO, IYK, JAN, JHW, JST, LAN, LAR, LBB, LCH, LEX, LFT, LMT, LNK, LRD, LWB, MBS, MFR, MGW, MHH, MKG, MLU, MMH, MOB, MOD, MOT, MRY, MSO, MTJ, MYR, NAS, OTH, PAH, PIA, PKB, PNS, PSC, RAP, RDD, RDM, RKS, ROA, SAF, SBN, SBP, SCE, SGF, SGU, SHD, SHV, SMX, SPI, SPN, SUN, TLH, TVC, TYR, VPS, XNA, YQR, YUM, YXE, YXU, YYT

F. Reservation Facilities:

1. BUERR, CHIRR, DTWRR, GUMRR, HNLRR, MEXRR, NHCRR, RAPRR, SAORR, SLCRR, TYORR

G. United Airlines Office Buildings:

1. DENTK, HQJ, HQS, MOC, NDC, OPC, WHQ

2.04 Telecom Room - Classifications

- A. **ER/MDF Room:** The minimum size for a TR that is designated as an ER/MDF for Hubs, Large Stations, and non-airport facilities, shall be 12-foot by 10-foot and shall be designed to accommodate a minimum of four (4) 19" data racks, two (2) data cabinets, and wall mounted telecommunication equipment. For Small Stations and UAX Stations, the minimum size for a TR that is designated as an ER/MDF shall be 12-foot by 7-foot, and shall be designed to accommodate a minimum of three (3) 19" data racks, one (1) data cabinet, and wall mounted telecommunication equipment. If the equipment design for an individual TR/LAN Room that is designated as an ER/MDF or ER exceeds the number of data racks in the minimum configuration as defined, the room shall be sized accordingly. (Refer to Appendix A for additional information).
- B. **TR/LAN Room:** The minimum size for a TR/LAN Room that is designated as a TR/LAN Room and services an area larger than 5000 square feet shall be 10-foot by 8-foot, and shall be designed to accommodate a minimum of two (2) 19" data racks and wall mounted telecommunication equipment. If the equipment design for an individual TR/LAN Room that is designated as a TR/LAN Room exceeds the number of data racks in the minimum configuration as defined, the room shall be sized accordingly. (Refer to Appendix A for additional information).
- C. **TR/LAN Room-Light:** The minimum size for a TR/LAN Room that is designated for areas less than 5000 square feet and requires only (1) 19" data rack shall be an 8-foot by 5-foot room or a 7-foot by 3-foot closet. A TR/LAN Room closet shall require a double door entrance of no less than 6-foot wide. This size TR/LAN Room shall be designed to accommodate a minimum of one (1) 19" data rack and wall mounted telecommunication equipment. If more than one data rack is required to accommodate data equipment, ground radio equipment, ITS or other services, this size TR/LAN Room shall not be used. (Refer to Appendix A for additional information).

- D. Telecommunications Enclosure: When an area that is designated for a TR/LAN Room “Light” does not provide adequate environmental conditions for telecommunication equipment, or the construction of a TR/LAN Room “Light” is not possible due to floor space constraints, a Telecommunication Enclosure (TE) may be installed in a non-public area with approval by UAL-CFS Division. TEs are sealed data cabinets with integrated HVAC and UPS systems. TEs have specific electrical and mechanical requirements that must be met to operate properly. Adequate supply and/or exhaust ducts must be provided for the internal HVAC. A minimum of 3-foot unobstructed clearance must be maintained in the front, rear and one side of the enclosure. The standard TE will be a Liebert MCR-H788 or MCR-R788
- E. Wall Mounted Cabinet: In limited circumstances, a wall mounted telecommunications cabinet may be installed in a non-public area with approval by UAL CFS Division. Wall mounted cabinets shall not be used when telecommunications equipment requires HVAC protection. No more than three devices totaling (9) Rack Mount Units (RMU) shall be installed in a wall mounted cabinet.

2.05 Telecom Room - General Requirements

- A. The design and construction of all Telecommunication Rooms and Equipment Rooms shall comply with NFPA 75: “Standard For The Fire Protection of Information Technology Equipment”. The criteria set forth within this standard shall address design and construction matters related to the requirements and materials/equipment for the protection of information technology equipment areas from fire damage by fire or its associated effects-smoke, corrosion, heat and water.
- B. The Equipment Room (ER/MDF) is a special purpose room that provides space and maintains a suitable operating environment for large communications and or computer equipment. Equipment Rooms differ from Telecommunication Rooms in that ERs are generally considered to serve a building or a campus whereas TRs serve floor area of a building. Therefore ERs may be connected to the backbone pathways that run both within and between buildings. The ER shall be dedicated to data and telecommunications functions, and shall not be shared with other services such as electrical rooms, mechanical rooms, storerooms, office space, etc. Equipment Rooms shall be designed and provisioned according to the requirements in ANSI/EIA/TIA-569-A/B.
- C. The Telecommunication Room (TR/LAN) is the common access point for backbone and horizontal cabling. The TR may also contain data and telecommunication equipment, computer equipment, Ground Radio equipment, ITS equipment, Vendor equipment, cable terminations, and cross-connect cabling. The TR shall be dedicated to data and telecommunications functions, and shall not be shared with other services such as electrical rooms, mechanical rooms, storerooms, office space, etc. Telecommunication Rooms shall be designed and provisioned according to the requirements in ANSI/EIA/TIA-569-A/B.
- D. There shall be a minimum of one TR/LAN Room per floor of every facility UAL occupies where data and/or telecommunication equipment is required. Additional TR/LAN Rooms shall be provided when the area to be served exceeds 10,000 square feet or when the horizontal distribution distance to the work area exceeds 90m (295ft.). When multiple TR/LAN Rooms are required, one or more of the TR/LAN Rooms shall be designated as an Equipment Room (ER/MDF) which will house the main incoming telecommunications connections in addition to data and telecommunication equipment. The ER/MDF shall be located as close as practical to the center of the areas being served. The other TR/LAN Rooms will be designated as Telecommunication Rooms (TR’s). The primary purpose of a TR/LAN Room is to provide network and telecommunication connectivity to the end-user. Computer equipment shall be installed into an ER/MDF when possible, and only into a TR/LAN Room when necessary. An ER/MDF or TR/LAN Room can be considered an Equipment Room (ER) if it contains computer equipment in addition to telecommunication equipment. Backbone cabling shall be installed from the ER/MDF to TR/LAN Rooms and ERs in a hierarchical star topology with no more than two hierarchical levels of cross-connects in the backbone cabling. The TR/LAN Rooms shall be dedicated to data and telecommunications functions, and shall not be shared with other services such as electrical rooms, mechanical rooms, storerooms, office space, etc.

- E. Where UAL is the sole or primary tenant in Airport Terminals or areas within Airport Terminals, Reservation Centers or Business Facilities, TRs shall be provided exclusively for UAL use. When shared TRs are necessary, additional security measures shall be provided to protect UAL equipment. All UAL equipment, terminations, cross-connect cabling and UAL vendor equipment that is located in a shared TR, shall be in locked cabinets approved by UAL Critical IT Infrastructure Division. The security and access to the shared TR shall be controlled by the managing entity of the overall facility.
- F. UAL Corporate Security guidelines/requirements (Regulation 5-18, Computer Security) dictate that a TR/LAN Room, ER/MDF Room, or TR/LAN Enclosure which is a part of the IT facilities used as a wiring closet, requires that "All buildings, areas or rooms containing communications equipment and/or cables... must be located in separate, enclosed and lockable areas. Access to such areas or departments must be controlled by the Company and be limited to Company authorized personnel who use, service or support such equipment".
- G. The ER/MDF & TR/LAN Room size and type shall be determined by the type of facility, square footage of the area being served, number of end user work stations being served, and the quantity and type of equipment being housed in the room. If local codes require ER/TR sizes larger than specifications detailed in this document, the local codes shall prevail.
- H. The ER/MDF & TR/LAN Room shall be located as close as practical to the center of the area served and vertically aligned (Stacked) in multi-story buildings.
- I. Where seismic zones exist the ER/MDF & TR/LAN Rooms shall accommodate the applicable requirements.
- J. The ER/MDF & TR/LAN Rooms shall not be located near electrical power supply transformers, elevator or pump motors, generators, x-ray equipment and other potential sources of electromagnetic interference (EMI).
- K. Equipment not related to the support or function of the ER/MDF & TR/LAN Rooms (e.g. sprinkler, steam, chilled water, supply and waste piping, ductwork, pneumatic tubing, etc) shall not be installed within, pass through, pass overhead or enter the ER/MDF & TR/LAN Rooms.
- L. The ER/MDF & TR/LAN rooms shall not be located below water level unless preventive measures against water infiltration are employed. A floor drain and/or sump pump shall be provided within the room if risk of water ingress exists.
- M. A grounding system shall be installed to support the telecommunications infrastructure. Each ER/MDF & TR/LAN Room shall be equipped with a Telecommunications Ground Busbar (TGB) as required per ANSI/EIA/TIA-STD-J-607-A.
- N. Flooring in each ER/MDF & TR/LAN Room shall be non-carpeted static resistant flooring. The floor tiles must be Static Dissipative Tile (SDT), and a proper ground strap shall be installed under the floor tile and grounded to the Telecommunication ground busbar (TGB). Raised floor systems would be a site specific decision based on code, ceiling height or other constraints. Finishes shall be light in color to enhance room lighting.
- O. There shall be no non-related electrical or mechanical infrastructure such as plumbing, drainage systems, HVAC, or electrical conduits installed in or pass through the TR/LAN Room
- P. All voice, data and fiber cabling shall be installed in conduit or cable trays conforming to the National Electrical Code (NEC) standards and any state or national requirements. Voice and data cabling properly run in cable tray can be run without conduit.
- Q. Backbone fiber optic cable shall be installed using a Sumitomo Future FLEX Air-Blown Fiber Pathway Solution (ABF), and shall be installed by Sumitomo certified technicians.
- R. Where ABF cannot be used, fiber optic cable installations shall be installed using armored cable suitable to the flame rating of the surrounding environment to be installed within.

- S. Before any disruptive construction work commences in existing TR/LAN Rooms where there may be Asbestos Containing Materials (ACM), an examination by a qualified contractor shall be performed. If the TR/LAN Room is found to contain ACM, only subcontractors that have employees that are trained and qualified to work around ACM will be allowed to perform work unless the work will not disturb the ACM. Routing changes may be required to avoid areas that are found to contain asbestos containing materials. If routing changes cannot be made, or if routing changes cannot eliminate disturbing the asbestos containing materials, then the employees of the Electrical Subcontractor will be required to receive training relative to the expected ACM exposure.

2.06 Telecom Room - Design Requirements

- A. The walls of the ER/MDF & TR/LAN Rooms shall be full height partition (slab-to-slab) construction and have a one-hour fire rating. Walls shall be painted white. Glass and windows shall not be used in exterior walls and/or doors.
- B. Ceiling height shall be a minimum of 9-foot, 0-inches (clear of obstructions) above finished floor (A.F.F.). A suspended ceiling should not be provided. A finished ceiling shall not be required. If a ceiling finish is applied, the finish should minimize dust and be light in color for additional brightness in the room. If fire proofing materials are present, proper sealing techniques shall be used to prevent material falling from the ceiling.
- C. There shall be a single door opening to each ER/MDF & TR/LAN Rooms. The door opening shall consist of a 3-foot wide by 7-foot tall door without a doorsill. The door shall have a keyed locking mechanism. If applicable, electronic door strikes shall be provided for key card access. The door should swing out unless local codes prevent this.
- D. Flooring in each ER/MDF & TR/LAN Rooms shall be non-carpeted static resistant flooring. Floor tiles are not recommended. If floor tiles are installed, they must be Static Dissipative Tile (SDT), and a proper ground strap shall be installed under the floor tile and grounded to the Telecommunication ground busbar (TGB). Concrete or other hard surfaced flooring shall be properly sealed with anti-static floor sealant. Raised floor systems would be a site specific decision based on code, ceiling height or other constraints. Finishes shall be light in color to enhance room lighting.
- E. A $\frac{3}{4}$ " painted white (2 coats), and fire rated A-C grade (do not paint over fire rating) void-free plywood backboard is required in each ER/MDF & TR/LAN Room for any wall mounted equipment. The plywood shall be mounted such that the bottom of the plywood is 12-inches A.F.F. Two (2) 4-foot wide by 8-foot high plywood sheets shall be provided in each ER/MDF. One (1) 4-foot wide by 8-foot high plywood sheet shall be provided in each TR/LAN room. Finishes shall be light in color to enhance room lighting.
- F. Heating Ventilation and Air Conditioning (HVAC) must be provided to ER/MDF & TR/LAN Rooms (24x7x365 days). HVAC supply and return ducts and vents shall be installed to provide adequate temperature control for the room. The temperature and humidity shall be controlled to provide continuous operating ranges of 64 to 75 degrees Fahrenheit with 30% to 55% relative humidity. A positive pressure shall be maintained within the TR/LAN Room, with a minimum of one air change per hour or as required by local code. If a generator power source is available in the building, the HVAC system serving the TR/LAN Room should be connected to the generator power source. Redundancy is not required, but should be considered for Mission Critical data rooms.
- G. All ER/MDF, TR/LAN Rooms and TEs shall be protected from dust and contaminants that could affect the operation of the installed equipment.

- H. Voice, data and fiber cabling penetrating fire-rated gypsum or masonry walls within the TR shall be installed within re-penetrable, round cable management devices (sleeves) for use with new or existing cable bundles. The following products are acceptable:
 - 1. Hilti Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
 - 2. Hilti Firestop Sleeve (CFS-SL SK)
 - 3. Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
 - 4. Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
 - 5. Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.
- I. To facilitate cable pulling to a cable trough system, a minimum of three (3) 4-inch sleeves shall be installed in each ER/MDF Room and a minimum of two (2) 4-inch sleeves shall be installed in each TR/LAN Room. Copper and fiber cabling entering and leaving the TR/LAN Room shall not share the same 4-inch sleeve. Installation shall be in close proximity to the door if possible. Sleeves shall not be left open except during cable installation, and shall be properly fire-stopped per applicable codes.
- J. The TR/LAN Room grounding and bonding methods shall follow the requirements as defined by ANSI/TIA/EIA-607. Each ER/MDF & TR/LAN Room shall have a Telecommunications Grounding Busbar (TGB) with minimum dimensions of 6 mm x 50 mm wide and variable length to meet the room requirements. The TGB shall be interconnected to the building's Telecommunications Main Grounding Busbar (TMGB) with an insulated copper conductor not less than a # 6 AWG. All equipment racks, wire basket tray, and cable tray and each conduit is to be grounded to the TGB with a # 6 AWG Green cable. Each conduit is to have grounding bushings. All grounding conductors and busbars shall be labeled to ANSI/EIA/TIA-606A specifications.
- K. Fire protection of the ER/MDF & TR/LAN Rooms shall be provided as per local codes.
- L. Sprinkler heads, if required, shall be provided with wire cages to prevent accidental operation. Pipes for sprinkler heads shall not be located directly above electronic equipment racks and/or cabinets.
- M. All penetrations made in the fire-rated barriers shall be properly fire-stopped to prevent fire, smoke or water from passing through the barrier penetration. Check local codes for approved fire-stop materials and methods.
- N. All TR/LAN and ER/MDF Rooms shall have a single voice wall phone drop location installed at 54" AFF. This wall phone drop location shall be wired and connected as a traditional voice connection (POTS) and not as a VoIP connection. This wall phone drop location is required to function during a power outage, network shutdown and/or emergency situation.

2.07 Telecom Room - Electrical Power Requirements

- A. Lighting shall be uniformly distributed above the maintenance aisles (not above equipment cabinets, racks, and/or ladder tray). The lighting shall be the equivalent of 50-foot candles when measured at 3-foot A.F.F. Fluorescent strip light fixtures with protective slide-on tube covers shall be provided. Light switches shall be located near the entrance. Emergency lighting as required by local codes shall be provided. A minimum of one emergency light will be provided in each TR/LAN Room and be connected to standby power if available. The emergency light should be a two-headed battery powered unit similar to Dual Lite # EZ-2.

- B. A minimum of two dedicated Nema 5-20R, 20 Amp for TR/IDF's and two (2) Nema L5-30P 30 Amp 120V for ER/MDF's nominal, non-switched, AC duplex electrical receptacles, each on a separate branch circuit with isolated ground, shall be provided to each equipment rack or enclosure. When the expected equipment wattage for an individual rack or enclosure exceeds 1800 watts, and is less than 2800 watts, two dedicated 30 Amp 120V nominal, non-switched, AC locking L5-30P electrical receptacles, each on a separate branch circuit with isolated ground, shall be provided to each equipment rack or enclosure. Receptacles should be mounted on the basket tray or on the ladder rack above the data rack on the back side or enclosure. For wall mounted telecom equipment, receptacles shall be installed on the plywood backboard wall below the wall mounted equipment.
- C. Convenience duplex outlet receptacles shall be placed at 6-foot intervals around the perimeter walls.
- D. All electrical outlet receptacles shall be labeled with the panel and circuit numbers.
- E. All Critical IT Infrastructure equipment shall be protected by one or more UPS systems, except as noted in specific subsections of the Electrical Power Requirements listed below. UPS Systems may be Enterprise class or standalone rack mounted systems based on the individual facility requirements. UPS systems should be sized on the basis of desired run-time and volt-amp load. UPS systems shall be capable of network alarm notification and remote monitoring by network based monitoring software. Monitoring capabilities shall include operating, alarm and environmental conditions. If a generator power source is available, UPS systems should be connected to the generator source.
- F. When installing a blade server like a HP c7000 you must install two (2) L14-30P receptacles. One will be for a Tripp-Lite UPS (SU6000RTUL) and the second receptacle is for a L-1430 vertical PDU. You will also need to order a second PDU which will plug into the Tripp-lite UPS.

2.08 Telecom Room - Equipment Specifications

A. General

1. The standard 19" data rack shall be an open floor-mount two post rack 19"W x 7'H x 45 RMU, with attached vertical and horizontal cable management. Refer to the "Product Data Table" for the recommended material. Data racks shall only be used in secure, environmentally controlled TR/LAN Room rooms. No more than 24 RMU of active equipment should be installed in one rack to allow for equipment refresh.
2. The equipment installed in a standard rack should use the following guidelines:
 - a. RMU 01-06 reserved for rack mounted UPS & vertical PDU's.
 - b. RMU 07-34 reserved for IT hardware.
 - c. RMU 35-38 reserved for copper patch panels.
 - d. RMU 39-42 reserved for fiber patch panels.
 - e. RMU 43-44 reserved for horizontal cable management.
 - f. RMU 45 Spare.
3. The standard full size free standing or floor mounted equipment cabinet or data cabinet shall be a standard 24"W x 79.3"H x 40.4"D cabinet. Refer to the "Product Data Table" for the recommended material. All cabinets shall be installed and secured to meet all seismic and any other local, state, and national codes. No more than 24 RMU of active equipment should be installed in one rack to allow for equipment refresh. Equipment should be installed using the standard rack guidelines.
4. The standard wall mounted equipment/data cabinet shall be swing-out cabinet design with a rear panel capable of accepting up to 3" conduit. The cabinet body shall be vented and come with adjustable depth 19" equipment mounting rails. The front door and rear panel must be lockable to provide equipment security. Refer to the "Product Data Table" for the recommended material. These are available in several sizes and configurations to meet specific requirements. All enclosures shall be installed and secured to meet all seismic and any other local, state, and national codes.

5. In the event the TR/LAN Room is not protected by an Enterprise UPS system, a rack mounted or shelf supported UPS units will be required per equipment rack to support the telecommunications equipment. When using a rack mounted or shelf supported UPS unit for equipment totaling less than 1200 watts, a 1500VA or 2200VA shall be used. These models will require a 20 Amp 120V circuit with a Nema 5-20R receptacle. When using a rack mounted or shelf supported UPS unit for equipment totaling less than 2400 watts and greater than 1200 watts, a 3000VA or 6000VA shall be used. These models will require a 30 Amp 120V circuit with a Nema L5-30R locking receptacle.
 6. The appropriate UPS unit should be selected from units listed in Product Data Table, based on anticipated equipment wattage in each data rack or enclosure and desired run-time. All UPS systems shall be capable of network alarm notification and remote monitoring by network based monitoring software. Monitoring capabilities shall include operating, alarm and environmental conditions.
 7. Data and Telecommunication equipment shall be installed with redundant power supplies when appropriate, and connected to two dedicated electrical circuits. Power redundancy should follow the Level 1 through Level 5 Electrical Power Requirements.
 8. Each equipment rack or cabinet shall have appropriate fiber and copper patch panels as required for the specific installation. Specific fiber and copper patch panels are listed in the Product data Table.
- B. All voice, data and fiber cabling shall be installed in conduit, cable trays or ladder racks conforming to the National Electrical Code (NEC) standards and any state or national requirements. Voice and data cabling properly run in cable tray/ladder rack can be run without conduit. Cable tray/ladder rack may be installed in ER/MDF & TR/LAN Rooms to provide a raceway for horizontal and backbone cable and fiber to data racks or enclosures. Fiber optic cable run in cable tray/ladder rack shall be run in ABF tube cable or inner-duct. Multi-Mode Fiber (MMF) cables shall be run in orange inner-duct, and Single-Mode fiber (SMF) cables shall be run in yellow inner-duct. The minimum requirements for cable tray/ladder rack required in ER/MDF & TR/LAN Rooms shall be an aluminum or steel type system with a width of 12" and a loading depth of 3". The recommended cable tray/ladder rack shall be a CPI Chatsworth product (see Product Data table). All transitions in routing shall be made using manufacturers horizontal bends, vertical bends, horizontal tees, large radius drops, and crosses. Covers on trays will not be required. Proper grounding of all cable tray/ladder rack is required. Installation height of cable tray/ladder rack should be a minimum of 7' 0" and a maximum of 8' 0" A.F.F.
- C. All equipment racks or cabinets, cable tray/racks and conduits shall be grounded to the TGB with a # 6 AWG green cable and labeled to ANSI/EIA/TIA-606A specifications.

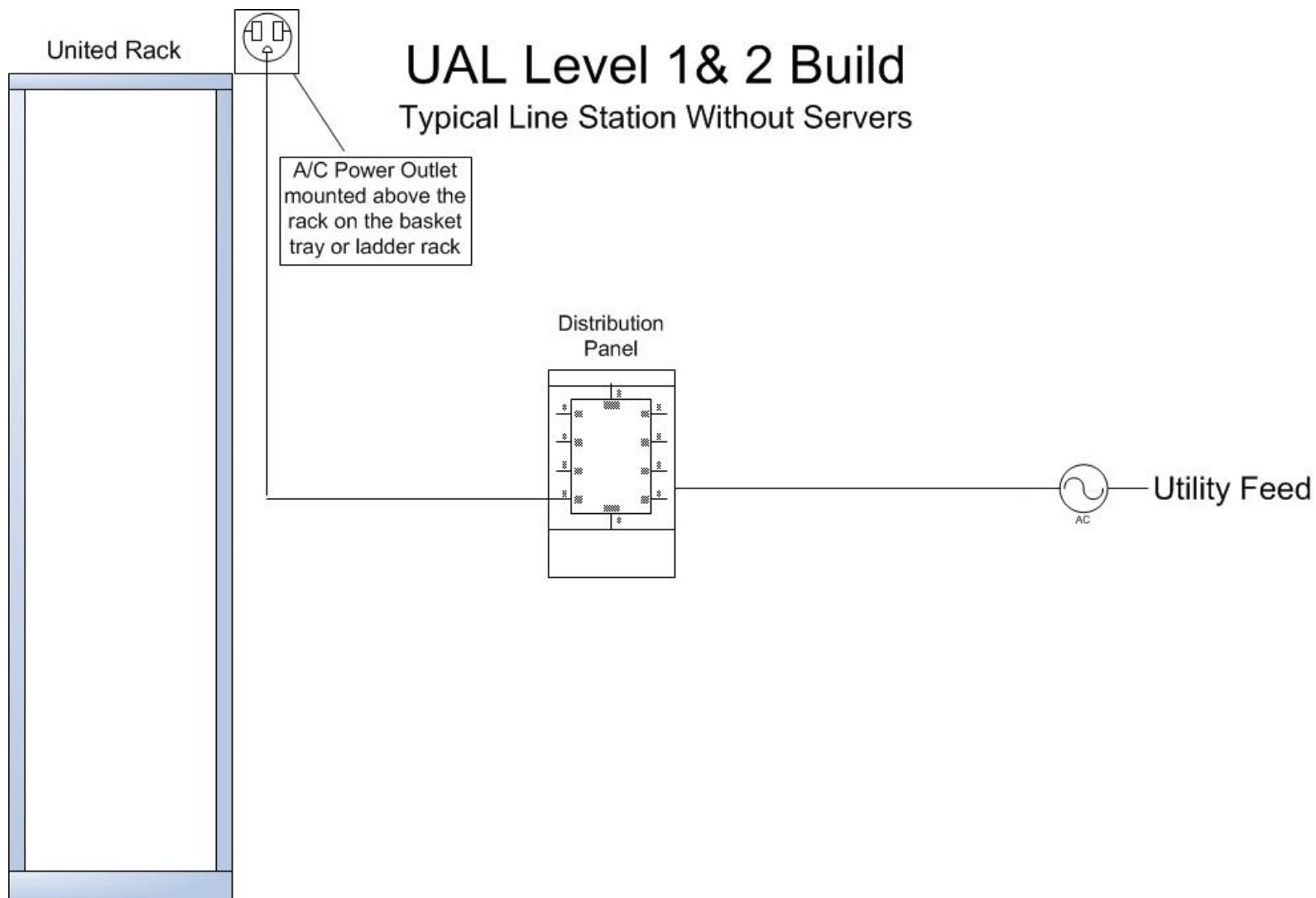
2.09 Telecom Room - Network Equipment

- A. Cisco Catalyst 6500/6500-E & 4506/4506E Series switches shall be installed with redundant power supplies connected to (2) dedicated 30 amp electrical circuits.
- B. HP ProCurve switched or Cisco 3500 and 3700 "X" Series switches shall be installed with redundant power supplies connected to (2) dedicated 20 amp electrical circuits.
- C. Cisco 2800 Series Modular Access Routers shall be installed with redundant power supplies connected to (2) 120 volt electrical circuits.

2.10 Redundant Power Distribution Diagrams For Airport Levels

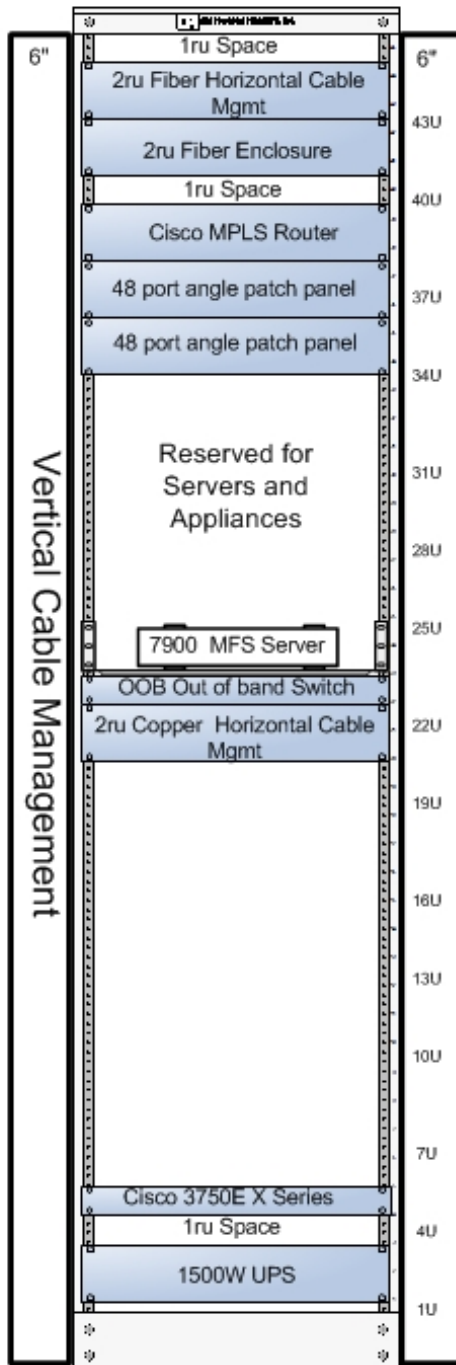
A. The following drawings detail the required Redundant Power Distribution for Airports classified by UAL Levels.

- **Level 1 Build - Small Stations and UAX Stations without servers, Operation Center (OPC) and Other Non-Airport Facilities:** ER/MDF and TR/LAN Rooms shall not be protected by a UPS system. Equipment shall not be required to have dual power cords and redundant power supplies.



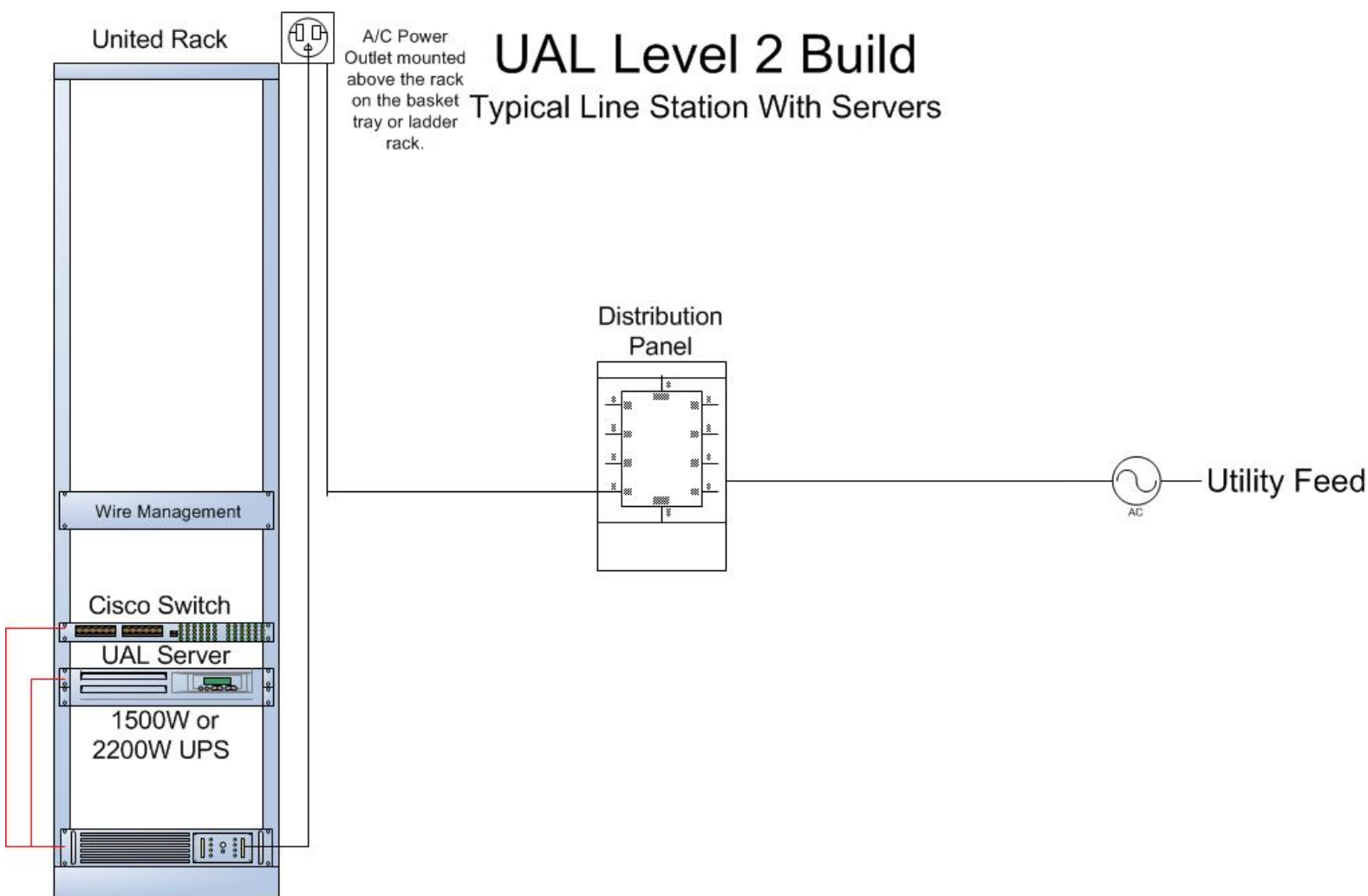
Level 1 MDF Single Collapsed

MDF 1 of 1 R1



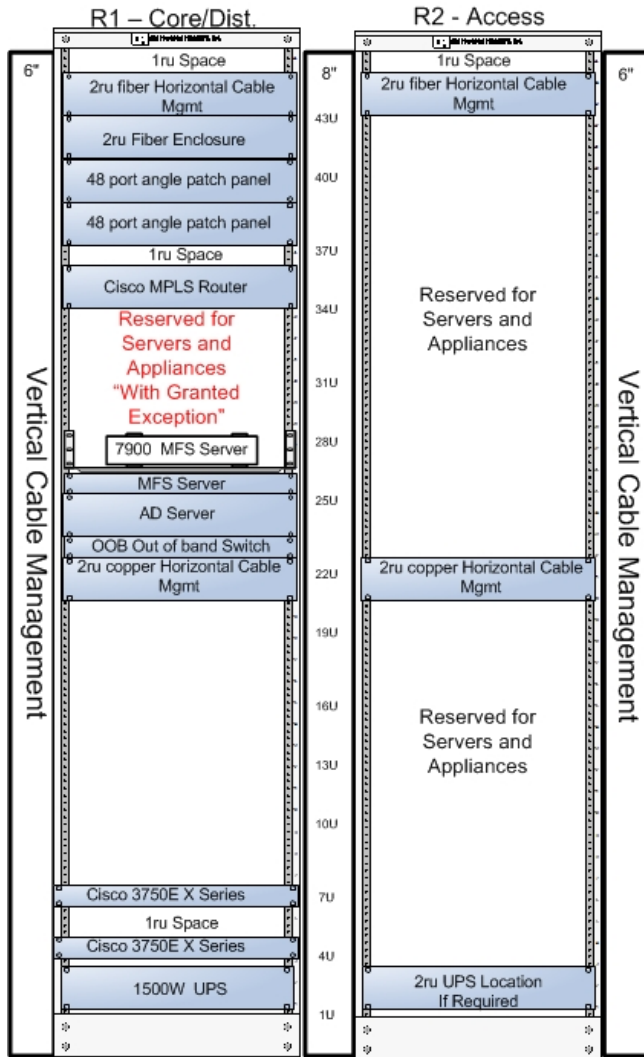
Chatsworth Products 55053-203

- **Level 2 Build - Small Stations and UAX Stations with servers, Critical Non-Airport Facilities:** ER/MDF and TR/LAN Rooms shall be protected by one UPS system. TR/LAN Room that contains only routers and end-user switches shall not be required to be protected by UPS. Equipment installed in TR/LAN Room should be limited to routers and switches required to service end-user connectivity. Equipment shall not be required to have dual power cords and redundant power supplies.



Level 2 MDF Dual Collapsed

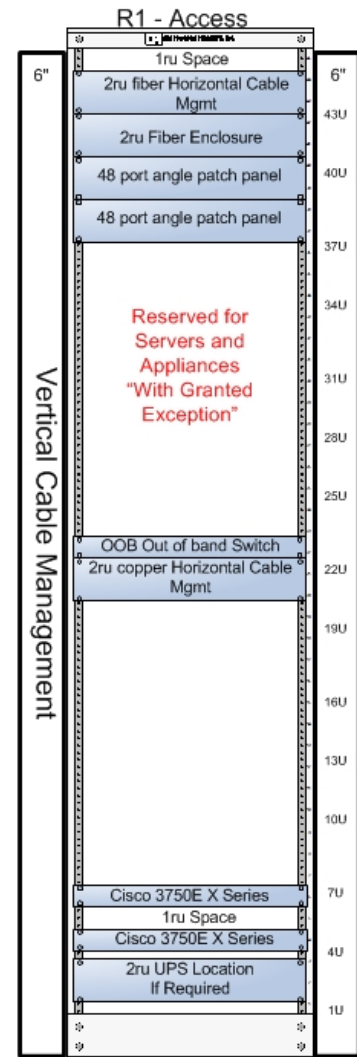
MDF 1 of 2



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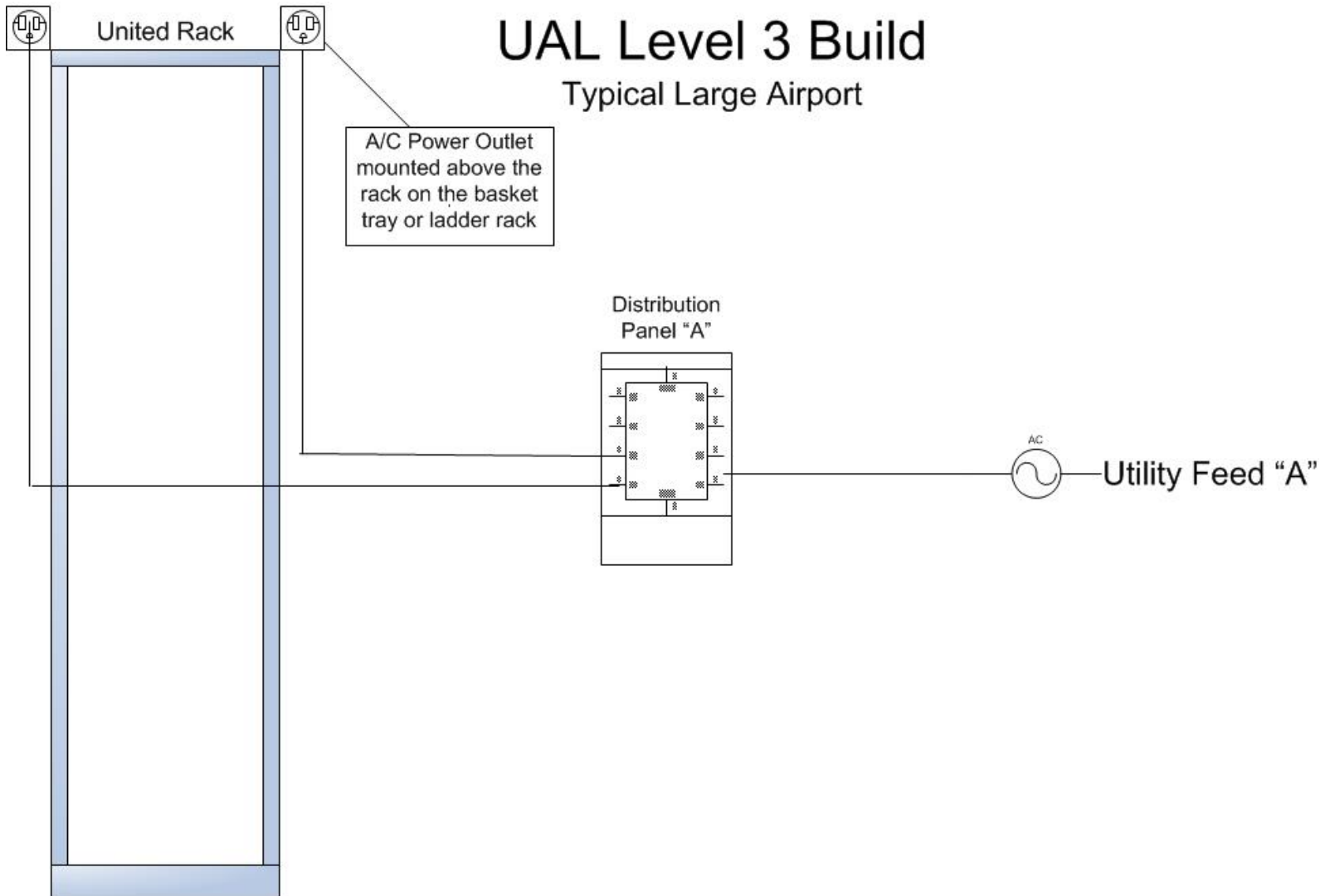
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IDF - Up to 3



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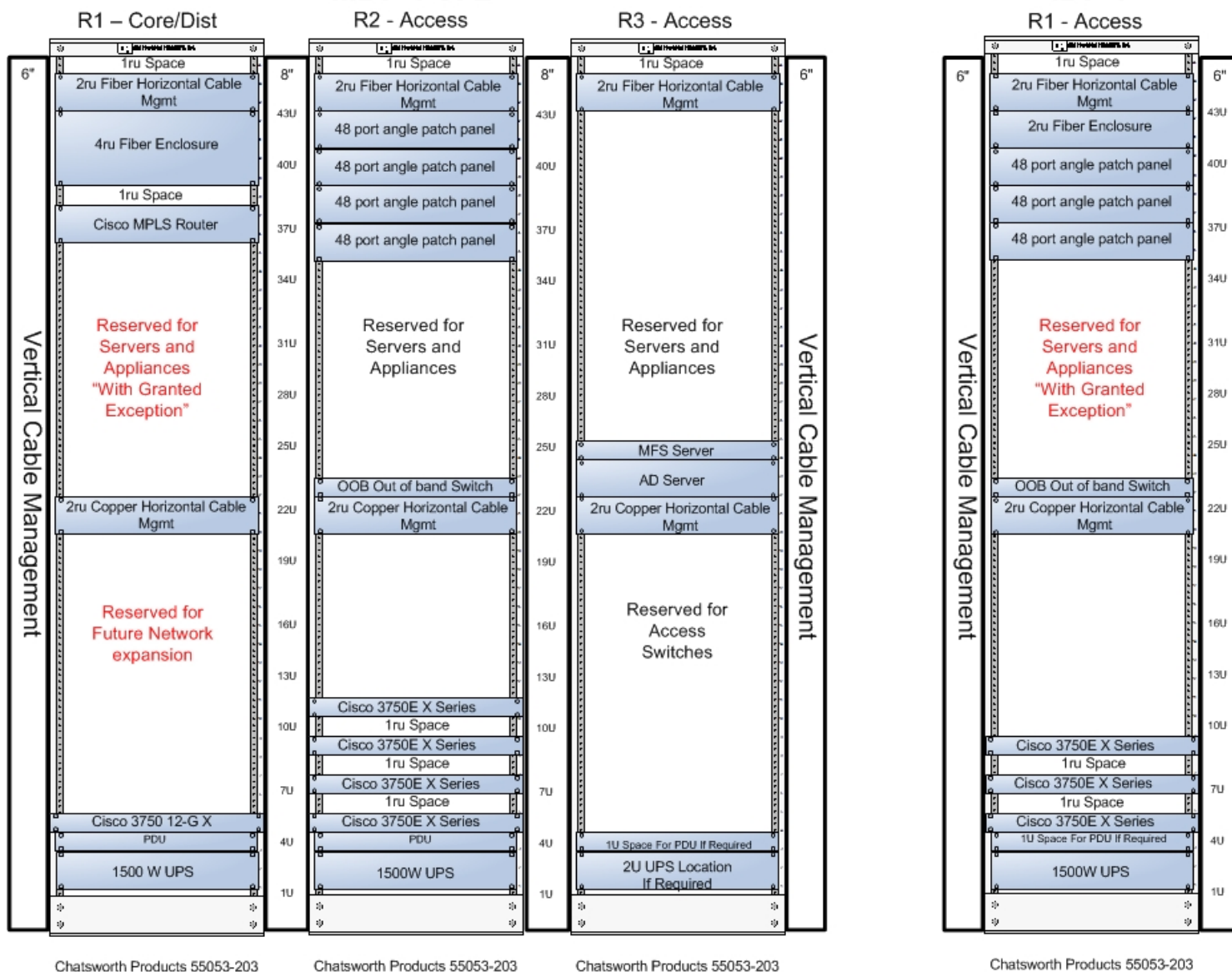
- Level 3 Build - Large Stations, Reservation Centers and Cargo Facilities:** ER/MDF and TR/LAN Rooms shall be protected by one or more UPS systems. All equipment shall have dual power cords and redundant power supplies. When two UPS systems are available, one power cord shall be connected to each of the UPS systems. When one UPS system is protecting the dual corded equipment, one power cord shall be connected to the UPS system, and the other power cord shall be connected to an unprotected dedicated electrical receptacle.



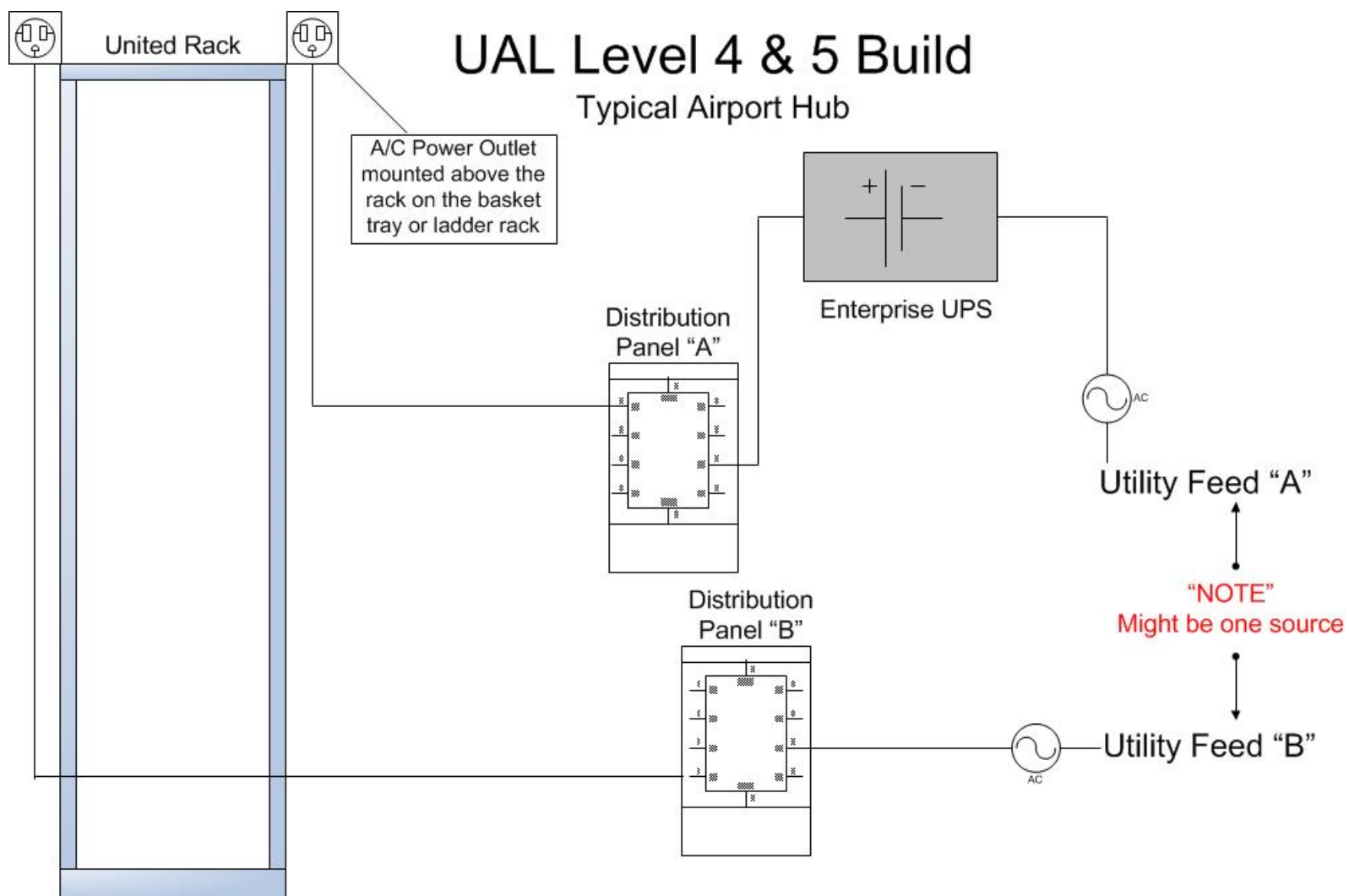
Level 3 MDF Dual Collapsed Core/ Distribution

MDF 1 of 2

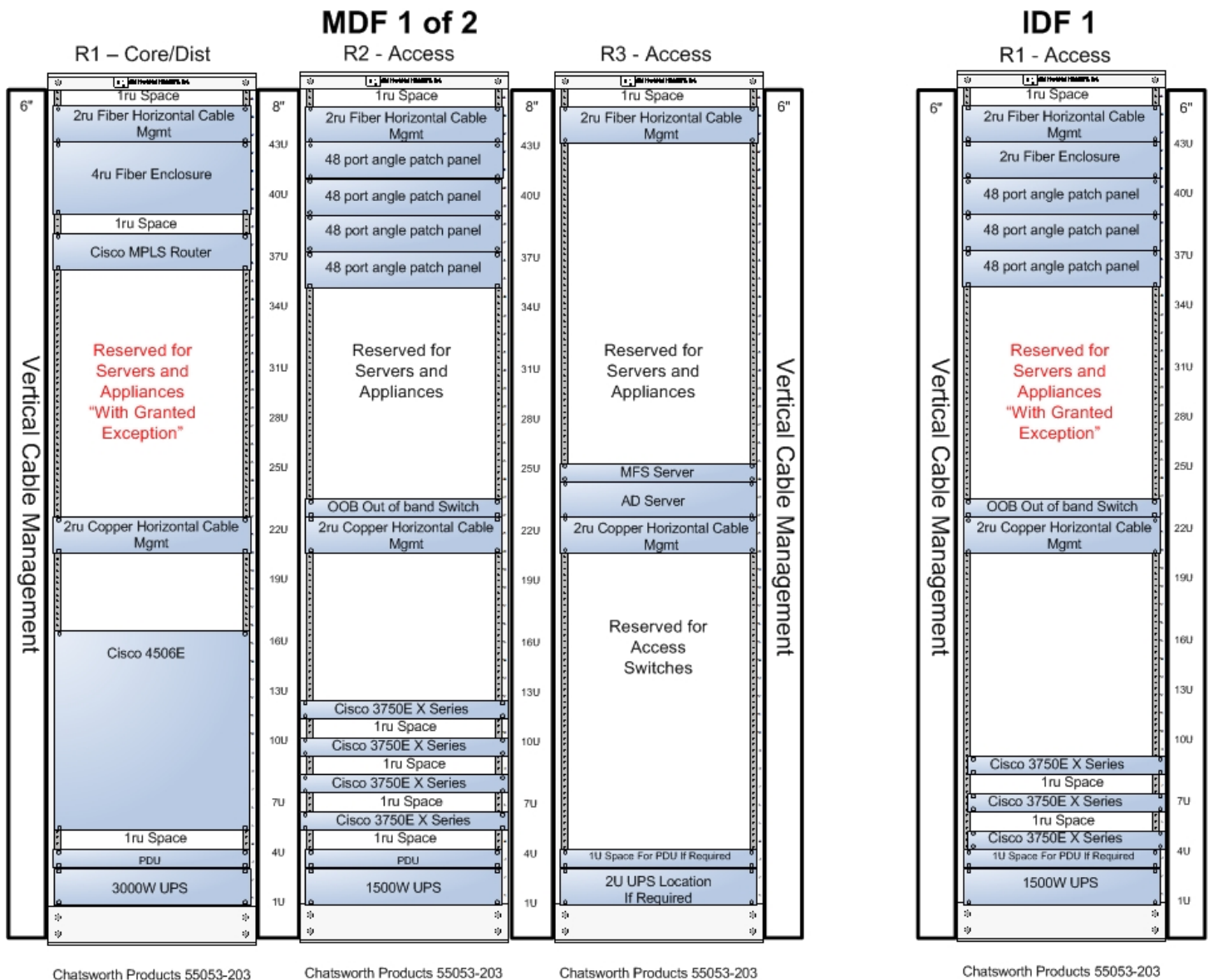
IDF 1



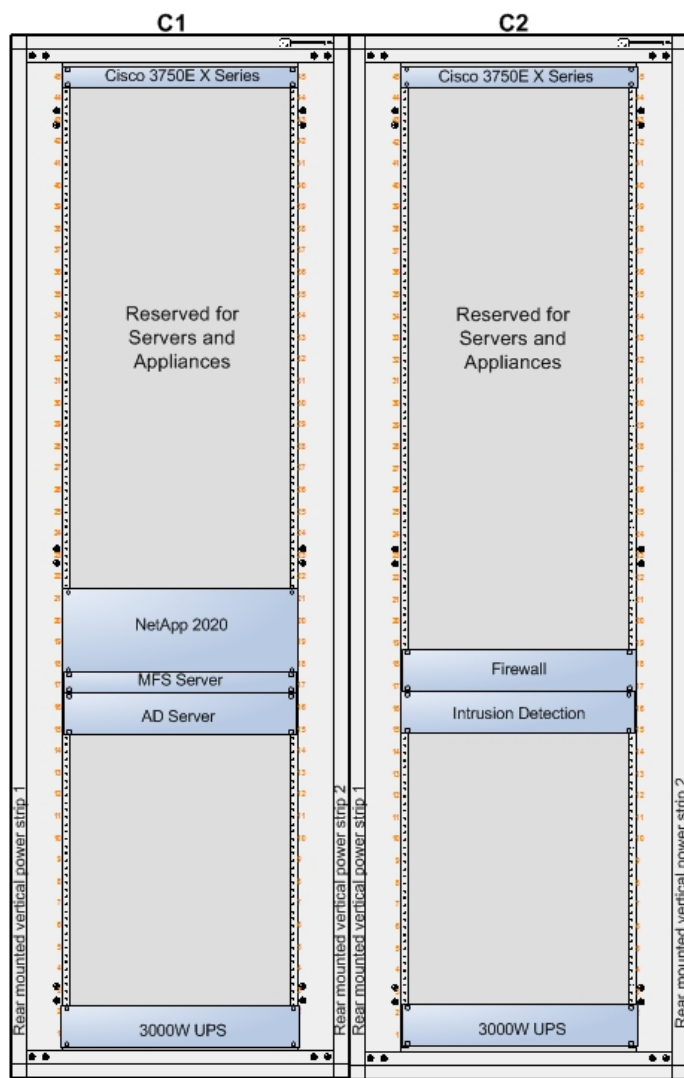
- **Level 4 Build – Typical Airport Hub:** ER/MDF and TR/LAN Rooms shall be protected by one or more UPS systems. All equipment shall have dual power cords and redundant power supplies. When two UPS systems are available, one power cord shall be connected to each of the UPS systems. When one UPS system is protecting the dual corded equipment, one power cord shall be connected to the UPS system, and the other power cord shall be connected to an unprotected dedicated electrical receptacle.
- **Level 5 Build – Typical Airport Hub:** ER/MDF and TR/LAN Rooms shall be protected by one or more UPS systems. All equipment shall have dual power cords and redundant power supplies. When two UPS systems are available, one power cord shall be connected to each of the UPS systems. When one UPS system is protecting the dual corded equipment, one power cord shall be connected to the UPS system, and the other power cord shall be connected to an unprotected dedicated electrical receptacle.



Level 4 MDF Dual Collapsed Core/ Distribution



Level 4 Services Block Cabinets



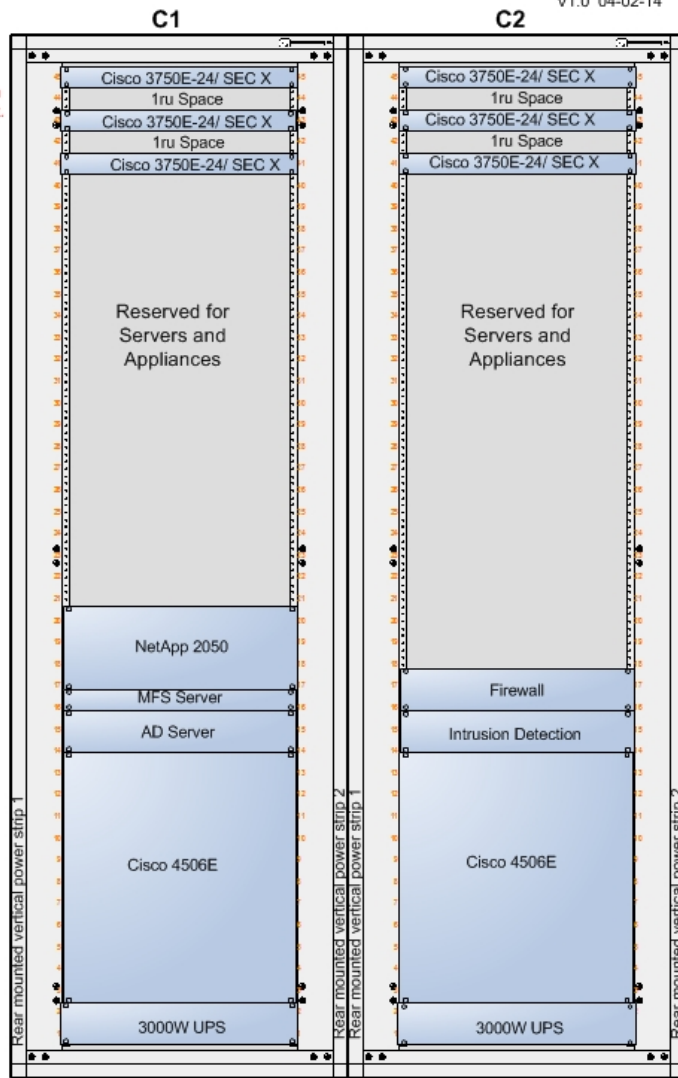
* Additional details on last page of document.

*Note!! Rail depth is 5" Inches from front face of cabinet

*Note!! Vertical power strips or "PDU's" will be needed for all cabinet installations"

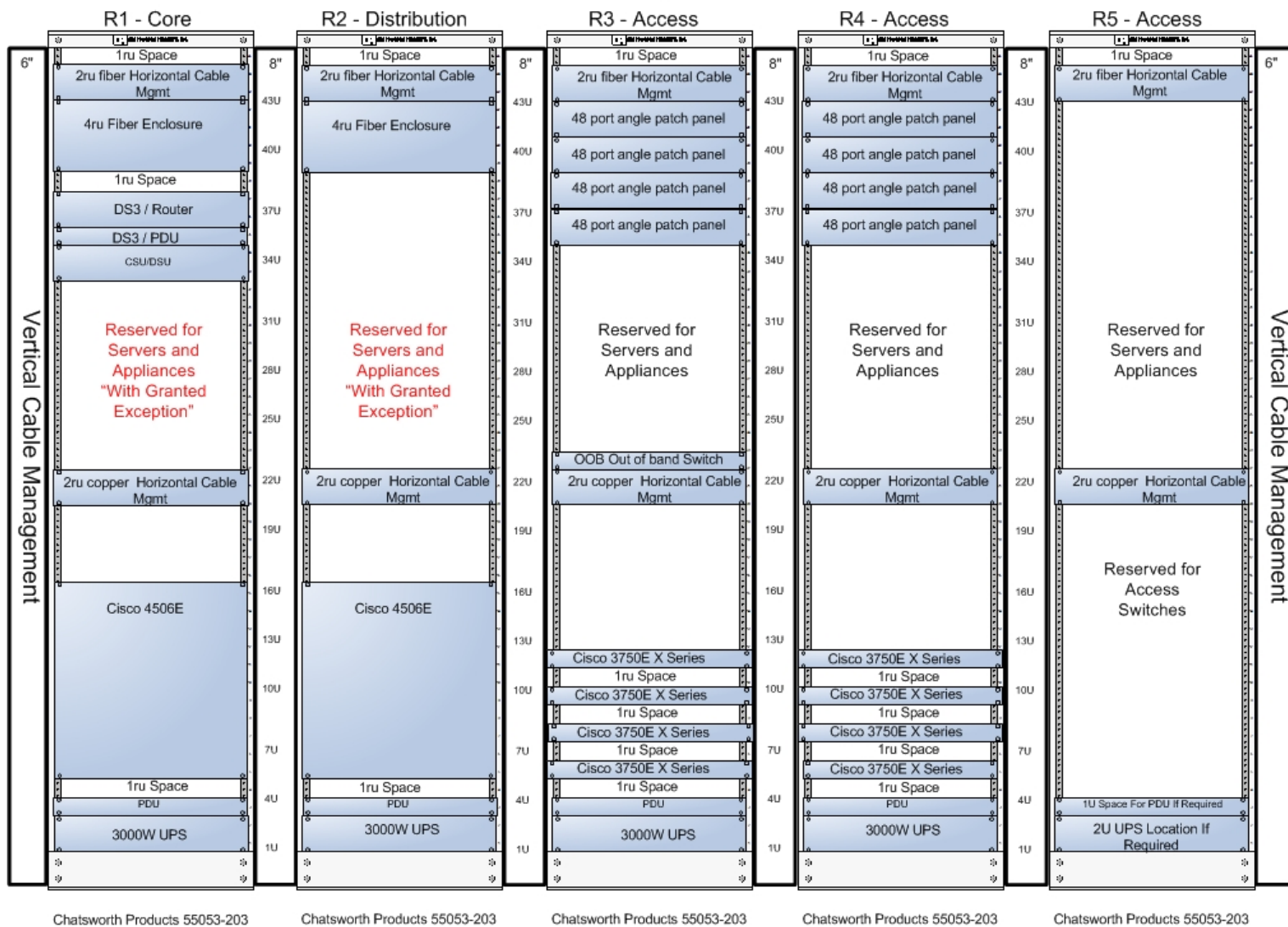
Level 5 Services Block Cabinets

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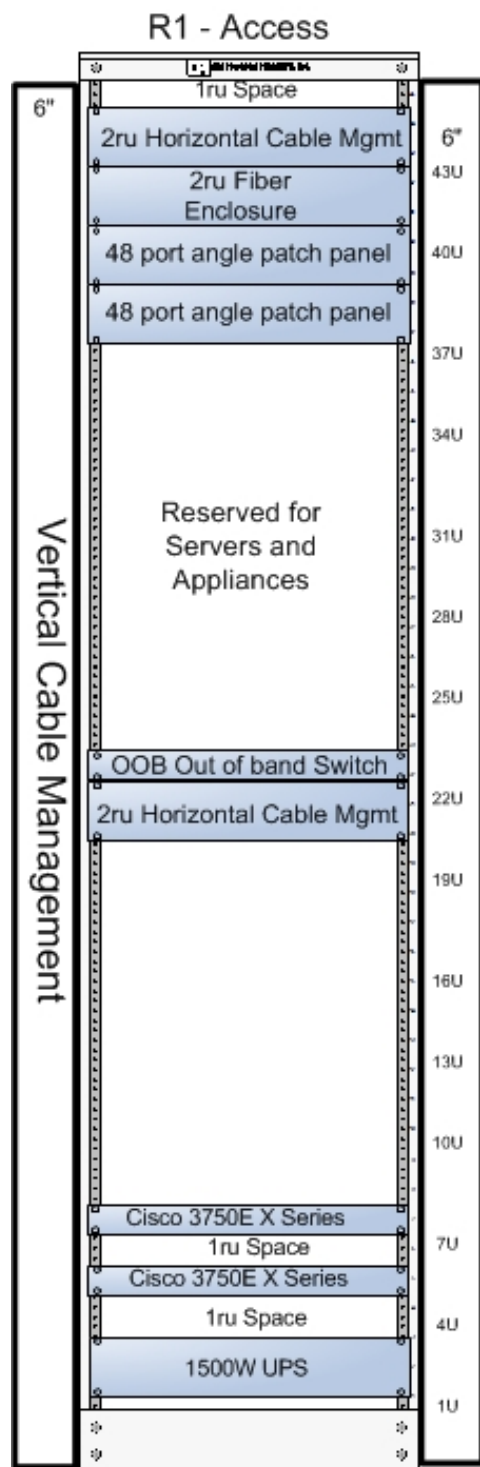


Level 5 MDF 3 Tier Topology

MDF 1 of 2

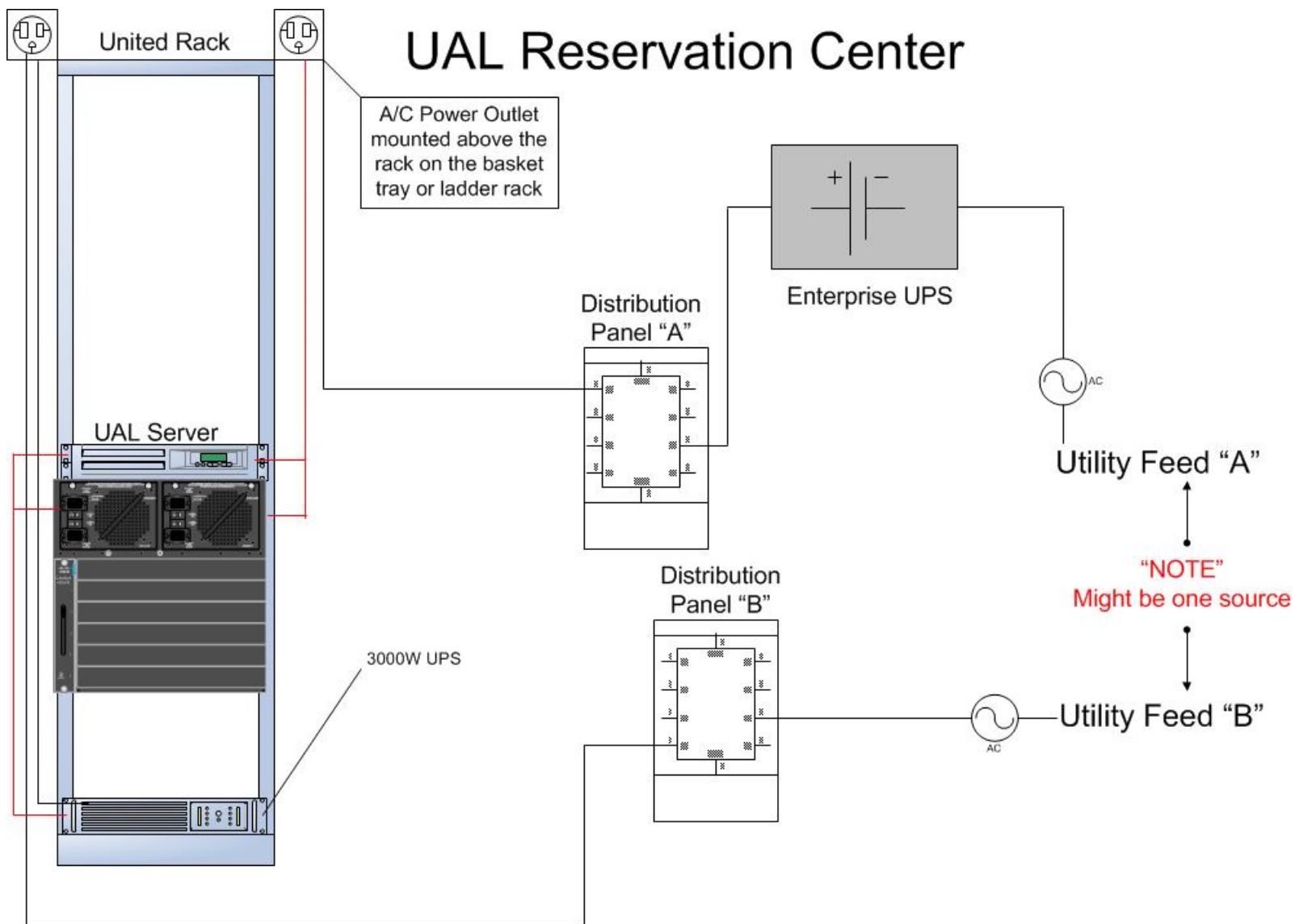


Level 5 IDF



Chatsworth Products 55053-203

- **Reservation Center:** Reservation Center Rooms shall be protected by one UPS system. All equipment shall have dual power cords and redundant power supplies. When one UPS system is protecting the dual corded equipment, one power cord shall be connected to the UPS system, and the other power cord shall be connected to an unprotected dedicated electrical receptacle until the second UPS system can be installed.



2.11 Airport Critical Infrastructure Service Level Tables

A. The following tables detail the Equipment Standards and Service Level Requirements.

Airport Critical Infrastructure Equipment Standards and Service Level Requirements

12/21/12

Requirements	Level 1 - No Redundancy 1 MDF Room	Level 2 - Some Redundancy 2 MDF Rooms	Level 3 - Mostly Redundant 2 MDF Rooms	Level 4 - Mostly Redundant 2 MDF Rooms	Level 5 - Full Redundancy 2 MDF Rooms
1 WAN Circuits	1	2	2	2	2
2 WAN bandwidth	Single T1 standard. Additional T1's as needed	Dual T1's standard. Additional T1's as needed	Dual T1's standard. Additional T1's or fractional DS3 as needed.	Dual T1's standard. Additional T1's or fractional DS3 as needed.	Dual 50M Metro Ethernet standard. Additional 50M as needed.
3 Routers, vendor	1 Cisco 2821	2 Cisco 3825	2 Cisco 7206 VXR with G4	2 Cisco 7206 VXR with G4	2 Cisco 7206 VXR with G4
4 Backup WAN	Air card	2 MPLS	2 MPLS	2 MPLS	2 MPLS
5 WAN optimization	None	None	None standard. Dual Juniper WAN optimization appliances if needed	None standard. Dual Juniper WAN optimization appliances if needed	Dual Juniper WAN optimization appliances
6 IDF LAN/TR rooms	IDF rooms - TR's determined by Layer 0 using Section 2 of the United Airlines Critical IT Infrastructure - Telecommunication Rooms Standards and Practices document. Each TR will contain Distribution Blocks and/or Access stacks as determined by Network.				
7 Additional distribution blocks	No additional distribution blocks for Level 1 and Level 2 sites.		Additional distribution blocks as determined by Network, based on the physical site properties and distribution requirements.		
8 UAX or partner IT	MDF or IDF rooms that have UAX or partner IT systems require independent cabinets to be installed for partner and cabinets used in the place of racks for UAL.				
9 Power redundancy	1 receptacle per rack.	1 receptacle per rack.	2 receptacles per rack.	2 receptacles per rack.	2 receptacles per rack.
10 Domestic UPS "Uninterruptible Power Supply"	No UPS protection required for routers, switches, firewalls, IDS or Out of Band Mgmt. 1500 watt UPS used for MDF racks with servers up to 1200 watts, 3000 watt UPS used for MDF racks with servers above 1200 watts.	No UPS protection required for routers, switches, firewalls, IDS or Out of Band Mgmt. 1500 watt UPS used for MDF racks with servers up to 1200 watts, 3000 watt UPS used for MDF racks with servers above 1200 watts. IDF's will not require UPS.	1 enterprise UPS or rack mount UPS and 1 utility circuit per MDF rack. 1500 watt UPS used for non-server racks up to 1200 watts. 3000 watt UPS used for racks with servers and racks above 1200 watts. IDF's will not require UPS.	1 enterprise UPS or rack mount UPS and 1 utility circuit per MDF rack. 1500 watt UPS used for non-server racks up to 1200 watts. 3000 watt UPS used for racks with 4506E switches, servers, and racks above 1200 watts.	1 enterprise UPS and 1 rack mount UPS or 2 rack mount UPS per rack. 1500 watt UPS used for non-server racks up to 1200 watts. 3000 watt UPS used for racks with 4506E switches, servers, racks above 1200 watts.
10 International UPS "Uninterruptible Power Supply"	All International MDF rooms and rooms with incoming WAN circuits will have UPS protection. Servers should be installed in MDF rooms with UPS protection. 1500 watt UPS used for racks up to 1200 watts. 3000 watt UPS used for racks above 1200 watts.				
11 Network Bandwidth	1G Network bandwidth	1G Network bandwidth	1G/2G Network bandwidth	10G Network bandwidth	10G Network bandwidth
12 Network Topology	Single collapsed 3750X or 3560 core/distribution/access.	Redundant collapsed 3750X or 3560 core/distribution/access.	Redundant collapsed 3750X-12G core/distribution.	Redundant collapsed 4506E core/distribution.	Redundant 3-tier topology.
13 Core Switches	3750X or 3560 24 port switch for 20 users or less. 3750X or 3560 48 port switch for more than 20 users. Additional 3750X or 3560 stack members added based on users or connections	Redundant 3750X or 3560 24 port switches for 20 users/TR LAN room or less, redundant 3750X or 3560 48 port switches for more than 20 users/TR LAN room. Additional 3750X or 3560 stack members added based on users or connections.	Redundant 3750X-12G core/dist switches for less than 7 attached switches. Above 6 attached switches requires Level 4.	Redundant 4506E core/dist switches.	Redundant 4506E core switches.
14 Distribution Switches, initial MDF distribution switches or additional IDF distribution switches (Network)	Collapsed in MDF core.	Collapsed in MDF core.	Collapsed in MDF core. Additional distribution, redundant 3750X-12G switches for less than 7 attached switches. Above 6 attached switches requires Level 4.	Collapsed in MDF core. Additional distribution, redundant 3750X-12G switches for less than 7 attached switches, redundant 4506E switches for more than 6 attached switches.	Redundant 4506E switches.
15 Services Block, installed in MDF	None.	None.	None Standard. Redundant collapsed distribution/access 3750X 48 port switches in one MDF if	None Standard. Redundant collapsed distribution/access 3750X 48 port switches in one MDF if	Redundant collapsed distribution/access 4506E switches in one MDF.
16 Access switches, type and quantity of access switches based on users or connections	One to four 3750X stackwise switches, with 24 to 48 ports, will be used to provide connectivity to users. Standard build for each Level is identified. Additional matching switches will be added to each stack based on users or connections.	None - collapsed in MDF core.	Collapsed in MDF core. Maximum of 3 additional IDF access switch stacks. Two member 24 port 3750X switch for 40 users or less. Two member 48 port 3750X switch for more than 40 users. Additional 3750X stack members added based on users or connections.	Two member 24 port 3750X switch for 40 users or less. Two member 48 port 3750X switch for more than 40 users. Additional 3750X stack members added based on users or connections.	Two member 24 port 3750X switch for 40 users or less. Two member 48 port 3750X switch for more than 40 users. Additional 3750X stack members added based on users or connections.
17 Remote Power Supply (RPS) for 3750X switches	no	no	1 RPS-2300 per 3750X stack	1 RPS-2300 per 3750X stack	1 RPS-2300 per 3750X stack
18 Out of Band Management, Network and Security (Network)	N/A	Out of Band Management required in MDF's if firewalls are installed.	One 16 port appliance in each MDF. One 4 or 8 port appliance in each IDF based on network devices.	One 16 port appliance in each MDF. One 4 or 8 port appliance in each IDF based on network devices.	One 16 port appliance in each MDF. One 4 or 8 port appliance in each IDF based on network devices.
19 Unified Communications	no	no	HP Cluster server solution with Cisco Call Manager	HP Cluster server solution with Cisco Call Manager in Services	HP Cluster server solution with Cisco Call Manager in Services
20 Wireless AP	Cisco 1252 802.11a/b/g/n. Quantity and location of AP's determined by network. Poe provided on access layer switches.				
21 Wireless Controllers. Domestic Sites	Centralized controller functionality provided in data center.	Centralized controller functionality provided in data center, except HNL	Centralized controller functionality provided in data center, except HNL	Centralized controller functionality provided in data center, except HNL	One Cisco 4404 controller installed in each MDF.

21	Wireless, International Sites	Wireless services typically provided by Airport Authority				
22	Cameras	Quantity and location of cameras determined by Network. Poe provided on access layer switches. Server and storage requirements based on site information				
23	Multicast support	yes	yes	yes	yes	yes
24	DNS/DHCP support	yes	yes	yes	yes	yes
25	IP Telephony (Network)	1 PSTN WAN circuits and XYZ	2 PSTN WAN circuits and XYZ	2 PSTN WAN circuits and XYZ	2 PSTN WAN circuits and XYZ	2 PSTN WAN circuits and XYZ
26	IP Addressing Scheme	IP Addressing Scheme provided by Network.				
27	Firewalls (Security)	None standard. UTM-272 firewall appliance required with 3rd party network connections, WLC controllers, servers with sensitive data (PCI, PII, Conf.).	None standard. UTM-272 firewall appliance required on each WAN circuit with 3rd party network connections, WLC controllers, servers with sensitive data (PCI, PII, Conf.).	None standard. UTM-572 firewall appliance required on each WAN circuit with 3rd party network connections, WLC controllers, servers with sensitive data (PCI, PII, Conf.).	None standard. Two DL380's w/Checkpoint Splat software required with 3rd party network connections, WLC controllers, servers with sensitive data (PCI, PII, Conf.).	Two DL380's w/Checkpoint Splat software installed on each WAN circuit in MDF's.
28	Intrusion Detection systems (IDS)	None (TBD)	None (TBD)	None (TBD)	One Sourcefire 3D2100 appliance required with 3rd party network connections, WLC controllers, servers with sensitive data (PCI, PII, Conf.).	Two Sourcefire 3D3500 appliances installed, one in each MDF.
29	IDS Taps (network)	None (TBD)	None (TBD)	None (TBD)	Taps installed in two MDF's and connected to IDS.	Taps installed in two MDF's and connected to two IDS.
30	DMZ Network. Cisco switches 2960G-24 or 3750X-24, based on network requirements	2 Cisco 3750X-24 DMZ switches required when WLCs are used. 2 Cisco 3750X-24 DMZ switches required for vendor's on UAL network. 2 Cisco 3750X-24 DMZ switches required for servers with sensitive data (PCI, PII, Conf.).	2 Cisco 3750X-24 DMZ switches required when WLCs are used. 2 Cisco 3750X-24 DMZ switches required for vendor's on UAL network. 2 Cisco 3750X-24 DMZ switches required for servers with sensitive data (PCI, PII, Conf.).	2 Cisco 3750X-24 DMZ switches required when WLCs are used. 2 Cisco 3750X-24 DMZ switches required for vendor's on UAL network. 2 Cisco 3750X-24 DMZ switches required for servers with sensitive data (PCI, PII, Conf.).	2 Cisco 3750X-24 DMZ switches required when WLCs are used. 2 Cisco 3750X-24 DMZ switches required for vendor's on UAL network. 2 Cisco 3750X-24 DMZ switches required for servers with sensitive data (PCI, PII, Conf.).	2 Cisco 3750X-24 DMZ switches required when WLCs are used. 2 Cisco 3750X-24 DMZ switches required for vendor's on UAL network. 2 Cisco 3750X-24 DMZ switches required for servers with sensitive data (PCI, PII, Conf.).
31	MFS Server	One HP 7900 or equivalent MFS server installed at sites with 1 to 75 workstations/clients. One HP DL180 or equivalent MFS server installed at sites above 75 workstations/clients.				
32	AD Server	One HP DL180 or equivalent AD server installed at sites with 100 or more users. Sites below 100 users do not receive AD server.				
33	Backup/Storage, NetApp (Storage/Backup)	NetApp agent installed on MFS server for sites with less than 1TB storage required. One NetApp 2020 installed in MDF at non-hub sites with more than 1TB storage required.	One NetApp 2020 installed in MDF with MFS servers.	One NetApp 2020 installed in MDF with MFS servers.	One NetApp 2020 installed in MDF with MFS servers.	one NetApp 2050 installed in MDF with MFS servers. 2050 used in hubs and Willis Tower.
34	Ground Radio	See Ground Radio Tab	See Ground Radio Tab	See Ground Radio Tab	See Ground Radio Tab	See Ground Radio Tab
35	BIDS, FIDS, GIDS, LIDS, E	Quantity of external connections required to determine total network connections				
36	End User workstations	Quantity of End User workstations required to determine total network connections and MFS/AD server requirements				
37	Network connections to each LAN/TR room	Number of network connections at each LAN/TR room access layer switch required to determine switch type and quantity				

Airport Critical Infrastructure
Integration Worksheet

Draft 5/01/10

Enter Site Name					
Enter Site Service Level					
Layer 0 integration criteria provided by:					
Network integration criteria provided by:					
Security integration criteria provided by:					
Server integration criteria provided by:					
Storage/Backup integration criteria provided by:					
Ground Radio integration criteria provided by:					
Integration Criteria	Level 1 - No Redundancy 1 MDF Room	Level 2 - Some Redundancy 2 MDF Rooms	Level 3 - Mostly Redundant 2 MDF Rooms	Level 3 - Mostly Redundant 2 MDF Rooms	Level 4 - Full Redundancy 2 MDF Rooms
1 WAN circuits	1	2	2	2	2
2 WAN Bandwidth					
3 Routers, vendor	1 Cisco 2821	2 Cisco 3821	2 Cisco 7206 VXR with G4	2 Cisco 7206 VXR with G4	2 Cisco 7206 VXR with G4
4 Backup WAN	Air card	2 MPLS	2 MPLS	2 MPLS	2 MPLS
5 WAN optimization	N/A	N/A			
6 IDF LAN/TR rooms (qty)	N/A				
7 Additional IDF distribution switch blocks (quantity)	N/A	N/A			
8 UAX / partner IT Sys (y/n)					
9 Power redundancy	1 receptacle per rack.	1 receptacle per rack.	2 receptacles per rack.	2 receptacles per rack.	2 receptacles per rack.
10 Power/UPS - rack mount 1500 watt UPS (quantity)					

10	Power/UPS - rack mount 3000 watt UPS (quantity)					
11	LAN Bandwidth, 1G-10G	1G	1G	1G - 2G	10G	10G
12	Network Topology	Single collapsed 3750X core/distribution/access.	Redundant collapsed 3750X core/distribution/access.	Redundant collapsed 3750X-12G core/distribution.	Redundant collapsed 4506E core/distribution.	Redundant 3-tier topology.
13	Core switches 3750X 24 port (quantity)			N/A	N/A	N/A
13	Core switches 3750X 48 port (quantity)			N/A	N/A	N/A
13	Core switches 3750X-12G (quantity)	N/A	N/A		N/A	N/A
13	Core switches 4506E (quantity)	N/A	N/A	N/A		
14	Distribution switches 3750X-12G (quantity)	N/A	N/A			
14	Distribution switches 4506E (quantity)	N/A	N/A	N/A		
15	Services Block switches 3750X (quantity)	N/A	N/A			N/A
15	Services Block switches 4506E (quantity)	N/A	N/A	N/A	N/A	
16	Access switch members 3750X-24 port (quantity)	N/A				
16	Access switch members 3750X-48 port (quantity)	N/A				
17	Remote power Supply	N/A	N/A			
18	Out of Band 4 port (qty)					
18	Out of Band 8 port (qty)	N/A				
18	Out of Band 16 port (qty)	N/A				
19	Unified Communications	N/A	N/A			
20	Wireless AP (qty)					
21	Wireless Controllers (qty)	N/A	N/A	N/A		
22	Cameras (quantity)					
22	Camera servers/storage					
23	Multicast support	yes	yes	yes	yes	yes
24	DNS/DHCP support	yes	yes	yes	yes	yes
25	IP Telephony					
26	IP Addressing Scheme and Workbook					
27	Firewall UTM 1-272			N/A	N/A	N/A
27	Firewall UTM 1-572	N/A	N/A		N/A	N/A
27	DL380 w/checkpoint	N/A	N/A	N/A		
28	IDS (quantity)	N/A	N/A	N/A		
29	Taps (quantity)	N/A	N/A	N/A		
30	MFS Svr, HP 7900 (qty)					
30	MFS Svr, HP DL180 (qty)					
30	AD Svr, HP DL180 (qty)					
31	Backup/Stg, NetApp					N/A
31	Backup/Stg, NetApp	N/A	N/A	N/A	N/A	
32	Ground Radio					
33	BIDS,FIDS,GIDS,LIDS,E CU (qty)					
34	End User					
35	Network connections to each LAN/TR room	Number of network connections at each LAN/TR room access layer switch required to determine switch type and quantity. Please fill out Room Detail Worksheet.				

POTS lines, out of band					
Wall phone					

2.12 Cable Specifications

A. General

1. This standard specifies a telecommunications cabling system that will support a multi-product multi-vendor environment. The standard is designed to provide for installation of a structured cabling system that will accommodate current and future voice and data specifications. In order to support the UAL Intelligent Network, it has been concluded that the cable types listed provide the greatest flexibility, growth potential, economies of scale and specification compliance when used in conjunction with the compatible products described within this document.

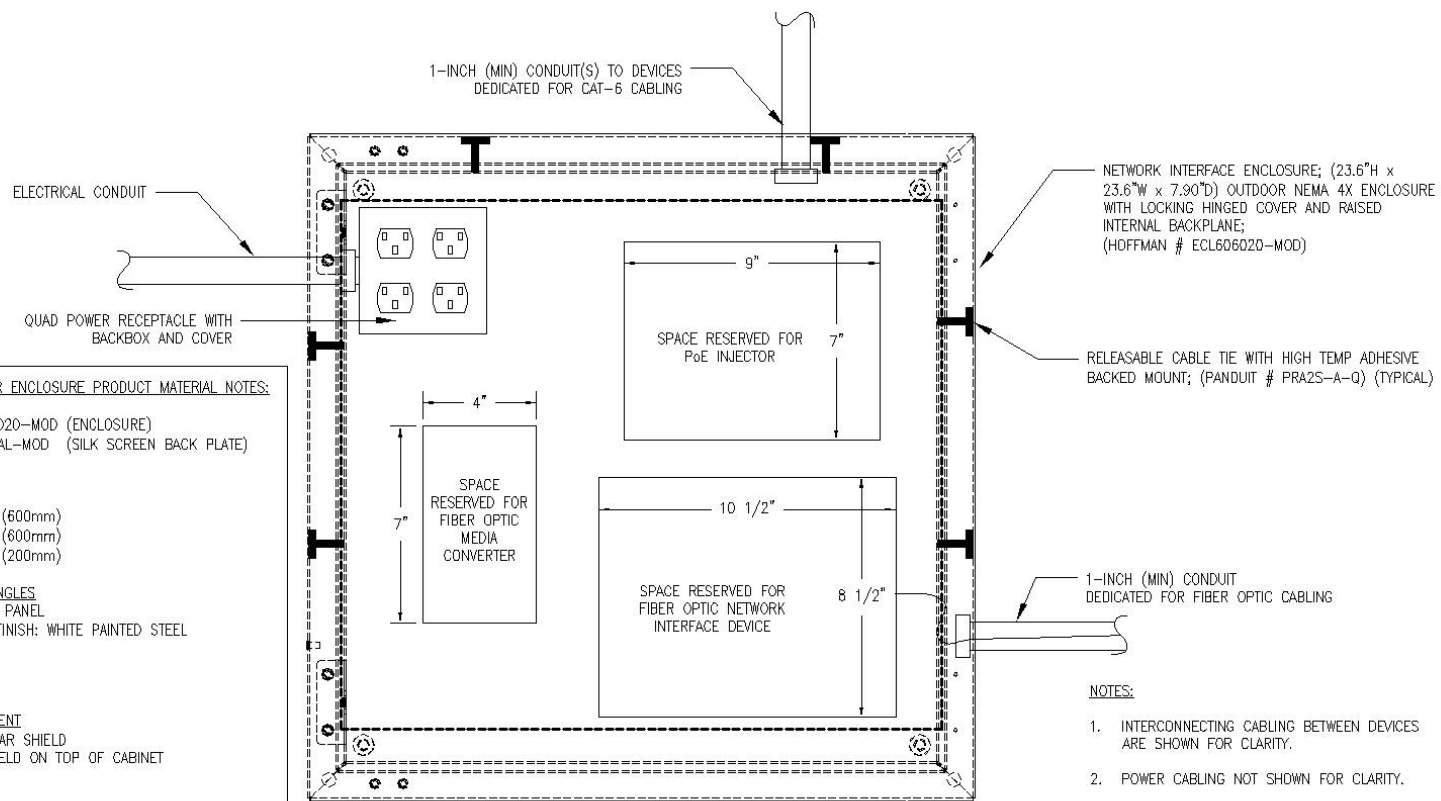
B. Horizontal Voice, Data and Wireless Access Point (Wi-Fi) Cabling

1. Horizontal Cabling is the portion of the telecommunications cabling system that extends from the work area to the horizontal cross-connect in the TR/LAN Room. The horizontal cabling includes horizontal cables, telecommunication outlets at the work station, patch cords or jumpers and consolidation points. When deploying a VoIP system the standard cable drop will consist of two (2) Category 6 blue 4-pair data cables. When deploying a conventional phone system the cable drop will consist of two (2) Category 6 blue 4-pair cables and one (1) Category 6 yellow 4-pair cable.
2. The maximum distance of horizontal cabling shall be 90m (295-ft), independent of media type. The length of the cross-connect jumpers or patch cords attached to the horizontal cabling should not exceed 5m (16-ft). For each horizontal cable run, the total length of patch cords at the work station and in the TR/LAN Room shall not exceed 10m (33-ft).
3. Horizontal Data workstation cables will be 4-Pair Category-6 1-Gig UTP non-plenum or plenum rated as code dictates with an blue jacket.
4. Horizontal Wireless Access Point (Wi-Fi) cables will be 4-Pair Category-6A 10-Gig UTP non-plenum or plenum rated as code dictates with an orange jacket.
5. Horizontal Data Patch Cords and cross-connects will be TIA/EIA-568-B.2-9 Category-6 stranded copper, non-plenum rated, fitted with RJ45 (8P8C) type modular connectors. All Category 6 and above patch cords shall be factory terminated. Field terminated patch cords with RJ45 type modular connectors shall only be allowed when using Category 5e cable for Voice cables and legacy systems using Category 5e backbone cabling. Patch cord length should not exceed 5m (16-ft).
6. Horizontal voice cables and patch cords will be 4pr Category 6 UTP non-plenum or plenum rated as code dictates with a yellow jacket. If site is to be VoIP- IP Telephony enabled, no voice cable shall be installed.

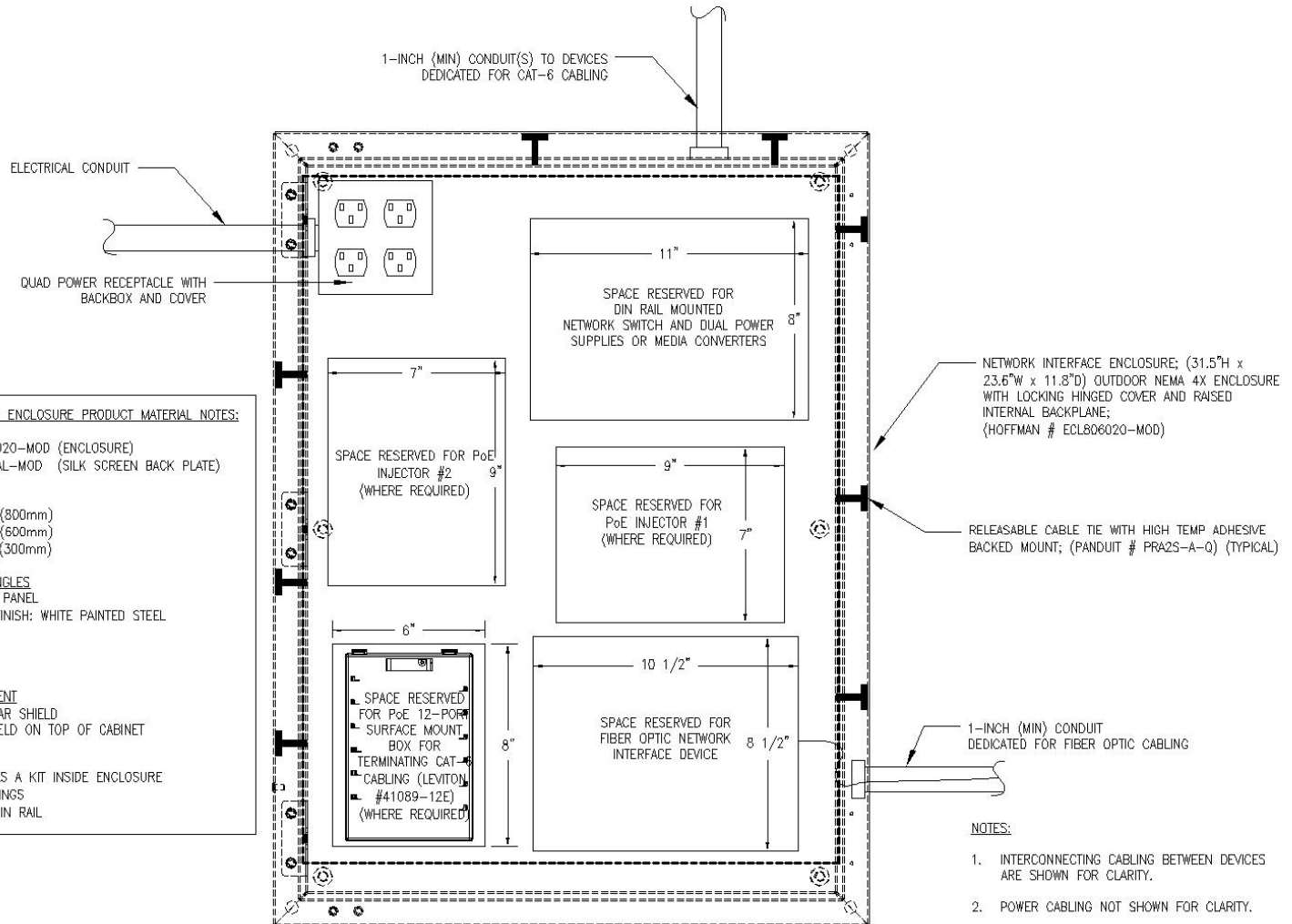
C. Outdoor Exterior Device Cabling (CCTV, Wi-Fi, etc.)

1. All exterior (outdoor) network electronics inclusive of, but not limited to, Security Cameras (CCTV), Image Display Devices and Wireless Access Devices (Wi-Fi) shall be equipped with appropriate Grounding, Lightning Protection and Surge Protection components.
2. Electrical protection shall be provided for all cables that are subject to lightning, power contact, ground potential rise, or induction. All copper circuits between building(s) and exterior network devices shall be provided with an entrance cable protector panel. All exterior cable circuits shall be routed through this protector. Each protector panel shall be provided with plug-in "Solid State" protector modules for each copper cable pair of wires. Fiber optic cabling is the preferred cable media to install at outdoor connections.
 - a. All lightning/surge protector panels shall be grounded with a properly sized insulated (green color) copper bonding conductor between the protector unit ground lug and the TC ground point (TGB or TMGB).
3. All outdoor cabling shall be rated for outdoor / exterior use. All outdoor enclosures utilized for housing network equipment and terminations shall be NEMA 4X outdoor rated.

4. The following two diagrams show a typical layout of network equipment and cable terminations within an outdoor NEMA 4X enclosure. The outdoor NEMA 4X enclosures shall be sized to accommodate the amount of equipment that will be required to be installed within them. Two size options are available for consideration and are noted within the following diagrams as “Small” and “Large”. The “Small” enclosure option shall be utilized for installations that do not have a horizontal copper cable requirement between the end point network device (CCTV Camera, etc.) and network switching equipment located within the outdoor enclosure. The “Large” enclosure option shall be utilized for installations that have a horizontal copper cable requirement between the end point network device (CCTV Camera, etc.) and network switching equipment located within the outdoor enclosure. Refer to the following diagrams for additional information. Coordinate all outdoor design and installation practices with United Layer Zero for formal approval prior to design issuance or installation.



SMALL EXTERIOR-OUTDOOR ENCLOSURE DETAIL



LARGE EXTERIOR-OUTDOOR ENCLOSURE DETAIL

D. Backbone Voice and Data Cabling

1. Backbone cabling is the portion of the telecommunications cabling system that provides the interconnections between the telecommunication rooms, equipment rooms, and entrance facilities. Backbone cabling consists of backbone cables, main and intermediate cross-connects, and patch cords.
2. The maximum supportable distances for backbone cabling are application and media dependent.
3. Backbone data cables will be TIA/EIA-568-B.2-9 Category 6 UTP non-plenum or plenum rated as code dictates with a blue jacket, unless otherwise indicated by an existing installation (i.e., Cat 5e).
4. Backbone Data Cross-connects will be TIA/EIA-568-B.2-9 Category 6 stranded copper, non-plenum rated, fitted with RJ45 (8P8C) type modular connectors. All Category 6 and above patch cords shall be factory terminated. Field terminated patch cords with RJ45 type modular connectors shall only be allowed when using Category 5e cable for Voice cables and legacy systems using Category 5e backbone cabling. Patch cord length should not exceed 5m (16-ft).
5. The backbone cabling shall be installed in a hierarchical star topology with no more than two levels of cross-connects.

E. Optical Fiber Cabling

1. All backbone optical fiber installations will use Sumitomo Future FLEX Air-Blown Fiber Pathway Solution (ABF). ABF installations shall be completed by Sumitomo Inc. certified technicians. All ABF designs shall be reviewed by Sumitomo and UAL CFS prior to sign-off and initiation of installation. Non-ABF fiber trunks shall be non-plenum or plenum rated as code dictates tight-buffered in composition unless otherwise specified by UAL Critical IT Infrastructure Division. United under certain circumstances may allow the Duraline/AFL eABF fiber solution as an approved alternate in place of Sumitomo. This substitution will require prior written approval from Mr. Ken Triebe Kenneth.Triebe@united.com
2. All optical fiber terminations, whether factory or field terminated, shall be made with LC type connectors unless the specific application requires alternate connectors.
3. All fiber connectors, whether patch cord or premise, will be constructed of ceramic (zirconia). No "phos-bronze" materials may be used and must be field terminated NO pre-terminated fiber connectors. Refer to the "Product Data Table" for the recommended material.
4. All fiber cable segment installations will be designed to meet IEEE 802.3z (Gigabit Ethernet) at a minimum. Multi-mode fiber shall be 50 micron 10 Gig laser-optimized. Distance limitations shall be 300m or 500m for multi-mode fiber and 2000m for single-mode fiber.
5. Optical fiber patch Cord will be two (2) strand, non-plenum rated, tight buffered in composition, with a maximum length of 5m (16-ft).
6. All non-ABF horizontal and backbone fiber cable runs will use non-plenum or plenum rated (as code dictates) armored cables in cable tray, conduit or standalone in riser applications.
7. All non-ABF, ABF tube cable, and/or conduit containing fiber cables will be clearly marked at each end as well as at 50-foot intervals in exposed runs showing the type of fiber enclosed, together with the originating and terminating locations, as well as company name. Where the cable and/or conduit are concealed, labeling will be attached as described in exposed areas or at the discretion of IT.

F. Optical Fiber Transmission Table:

	Optical Fiber Cabling Media					
	ANSI/TIA/ISO Class	Performance Bandwidth (min)	Max Distance (1Gb/s)	Max Distance (10Gb/s)	Max Distance (40Gb/s)	Max Distance (100Gb/s)
Multimode	OM1 62.5/125µm	200 MHz/850nm 500 MHz/1300nm	550 m (1,805 ft)	33 m (108 ft)	-	-
	OM2 50/125µm	500 MHz/850nm 500 MHz/1300nm	550 m (1,805 ft)	82 m (269 ft)	-	-
	OM3 50/125µm	2000 MHz/850nm 500 MHz/1300nm	800 m (2,625 ft)	300 m (984 ft)	100 m (328 ft)	100 m (328 ft)
	OM4 50/125µm	4700 MHz/850nm 500 MHz/1300nm	800 m (2,625 ft)	550 m (1,805 ft)	150 m (492 ft)	150 m (492 ft)
Singlemode	OS1	Considered virtually Unlimited	5000 m (16,405 ft)	10,000 m (32,800 ft)	10-40 K* (6.2-25 mi)	10-40 K* (6.2-25 mi)
	OS2					

G. Air-Blown Fiber Optic Cable (ABF)

1. Air Blown Fiber is a technology that allows for flexible deployment and redeployment of optical fiber through a sophisticated tube infrastructure. ABF makes sense in environments where future fiber needs are hard to predict. One type of optical fiber can be deployed and later be removed to be reused elsewhere. ABF is recommended for all new installations. Much care must be taken in the initial design of the tube distribution unit infrastructure to ensure the reusability (and subsequent cost-effectiveness) of the system. All ABF installations should be completed by Sumitomo Inc.-certified technicians. All ABF designs shall be reviewed by Sumitomo and UAL CFS prior to sign-off and initiation of installation.

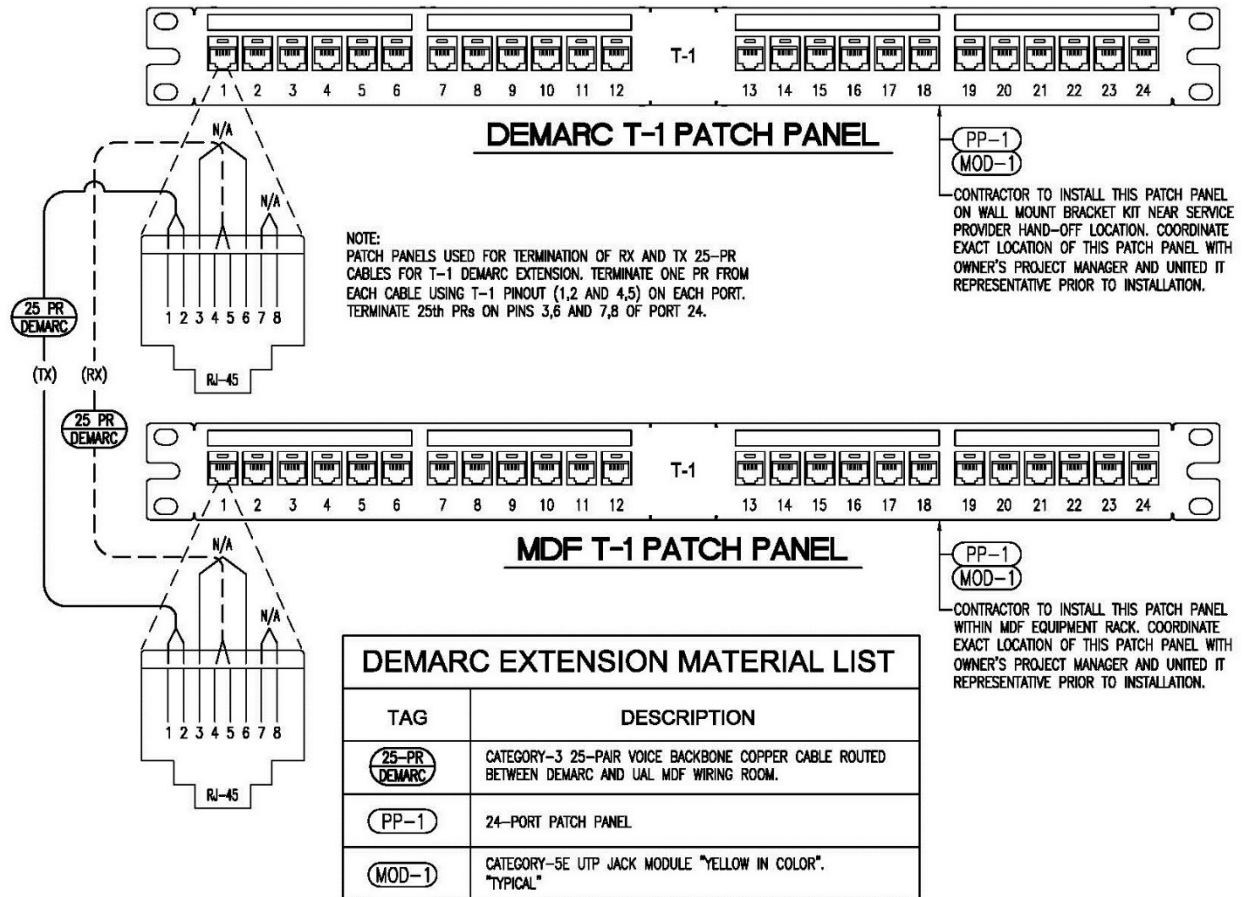
H. Demarc Extension Requirements

1. In some cases the service provider Demarc circuit may need to be extended to interface with the UAL “edge” premise equipment located within the MDF Telecom Room. Refer to the transmission table below for general guidelines pertaining to circuit types and required cable and distance requirements for extending various Demarc circuits.

- Demarc Extension Transmission Table:

Circuit Type	Cable Type	Distance Limit	Speed	Hand Off	Connector Type
T1	2 Pair STP 4 Pair UTP*	655 Ft	1.544 Mbps	Smart Jack CX	RJ 48X or 8 pin mod plug
DS3	DS3 Dual COAX	440 Ft	44.763 Mbps (28 T-1)	BNC Panel	BNC or 440
OC3	Fiber Single Mode	Unlimited for premise	155 Mbps (100 T-1)	Fiber Panel	SC,LC,ST,FC

2. T1 Circuits shall be extended using (2) 25-Pair Cat-3 UTP cables. One cable shall be used for Transmit (TX) and the other one shall be used for Receive (RX) signals. Cables shall be terminated onto 24-Port RJ-45 patch panels at each end. Cable pairs shall



2.13 Cable Termination Specifications

A. General

1. Optical Horizontal and Backbone Fiber will be terminated in rack mounted fiber enclosures with fiber adapter panels housing LC type connectors. Duplex LC patch cords will be used for connectivity between the patch panel and electronics equipment. Duplex LC type connectors will be used as required for field termination. Blank adapter panels will be used where required.
 - (See Product Data Table for specified products)
2. Voice station cables will terminate on '110' (recommended) or '66' type blocks with distribution / riser backbone cables terminating on five (5) blocks with C5 clips, and voice station cables (yellow) terminating on four (4) blocks with C4 clips. Vertical and horizontal cable / cross connect managers are to be used to produce orderly installations.
 - (See Product Data Table for specified products)
3. Data Horizontal and Backbone cables will terminate in rack mounted modular patch panels. Empty positions in the patch panel will be filled with blank couplers. The modular patch panels will be mounted in either a standard floor mounted rack system, or as a complete rack and cable management assembly package.
 - (See Product Data Table for specified products)
4. The minimum standard telecommunications outlet will consist of a single gang, 4-position, off-white faceplate that can accept Mini-com inserts. Inserted into the unit will be jacks that are colored as indicated in Section 9.2 – 9.3. Voice will be installed in the two upper openings and data in the two lower openings. For fiber connection, the recommended spool and jack will be used. Furniture applications will be provided with executive style snap-on faceplates for 4 position copper jacks, or for 2 position fiber jacks. Extender may be used if required on older furniture. Surface mount receptacles will use the Mini-com style units for either copper or fiber applications. All voice and data telecommunications jack outlets will be wired to the TIA-568B wiring scheme. An alternative wiring scheme may be dictated or required by the telephone equipment manufacturer. As most manufacturers analog and digital voice terminals use a single pair for connectivity, this optional wiring scheme becomes redundant unless ISDN type terminals are to be used.
 - (See Product Data Table for specified products)

2.14 Radio System Specifications

A. General

1. Fixed Point Radio Cable Requirements should be complied with on all new radio base station installations. All base station radios require coaxial cable between the radio and the permanently installed antenna. This coaxial cable is referred to as the antenna feed-line. The antenna feed-line is considered to be one of the critical elements of every antenna system.
2. Coaxial Cable uses two concentric conductors that are carefully separated by a dielectric. The distance between the inner conductors and the outer jacket is maintained by the dielectric. It is this distance, as well as the diameter of the conductors, that give coaxial cable its characteristic impedance. If coaxial cable is bent beyond the minimum recommended bend radius, the inner conductor will eventually migrate out towards the outer conductor and change the characteristic impedance of the cable.

3. Coaxial antenna feed-lines as used by UAL may be flexible, semi-rigid or rigid. Trained personnel must install the antenna feed-line within electrical conduit. These antenna feed-lines are difficult to pull and require large diameter conduit to facilitate their ease of installation. Table one (1) describes both cable and conduit requirements for new installations. The electrical conduit enclosure will protect the antenna feed-line from being damaged by means of extreme bending, crushing, or by being cut. It is necessary to always install coaxial cables in conduit and / or cable trays. A coaxial cable with an extreme bend radius will represent an impedance lump in the cable that will reflect power back to the transmitter. Eventually the transmitter power amplifier will be destroyed by the reflected power.
4. All radio base station equipment must be bonded to earth ground potential. This is usually accomplished by tying into the building superstructure. The National Electrical Code discusses grounding in detail and should be consulted. The NEC article 100 states that antennas such as those used on UAL installations must be; *"intentionally connected to earth through a ground connection or connections of sufficiently low impedance, and having sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or to persons."*
5. In order to minimize the impact of a lightning strike on radio and other nearby electronic apparatus, each open-air antenna must be grounded. Most rooftops on commercial buildings have some type of rooftop lightning protection. In this scenario, bonding of the antenna mounting to the rooftop ground system must be performed with a green #6 or larger gauge stranded copper wire treated with zinc coating to inhibit corrosion. Where there is no existing rooftop lightning protection, bonding of the antenna ground wire must be made to the building superstructure. If the antenna mast is bonded to the building superstructure, no other rooftop grounding measures are required.
6. Inside the radio base station room, each radio cabinet or individual piece of electronic apparatus must be grounded. A halo type copper ground system should be provided in all new installations. This system consists of a 1/4" x 2" copper bus bar insulated from the wall, drilled and tapped to accept numerous ground connections. The bus bar must be extended around the room so that the radio to bus connection is as short as possible. The copper bus bar itself must be electrically bonded to the building earth ground system via #6 or higher gauge stranded copper wire. Each piece of radio equipment must be individually connected to the ground bus.
7. All antenna feed-lines connected to open-air antennas must have a lightning strike protection device installed between them and the radio, to which they are connected. UAL currently uses one of two types of lightning surge protection. Either an inline or rack mounted device is chosen depending upon the physical installation. The device has three connections, an input, output and ground. This protection device, also known as a Polyphaser® must be connected to an earth potential ground to deplete and discharge any electrical energy absorbed during a strike.
8. Only the coaxial cable recommended in the table will be used in new radio installations. In extremely dense RF environments such as nearby paging or cell phone stations, Andrew (LDF) type cable should be used to provide better RF isolation between transmitters. Generally, Times Microwave (LMR) type cable is sufficient for UAL installations. Depending upon other factors such as frequency, distance, permissible attenuation, etc., different cables must be selected for varying applications. Refer to 'Table 1' to verify the correct cable for the application.
9. Two (2) weather proofing techniques are acceptable for cables exposed to the elements. The 3M® Company manufactures a cold shrink weatherproofing kit and is available through Andrew Corporation. Also available is a tar based flexible weather proofing kit that comes as a two-part kit, also available from Andrew. The cold shrink method is recommended for dry climates and the two-part tar based kit for wet climates.

10. Where coaxial feed-lines exit conduits outdoors, weatherproofing must be provided along with the appropriate conduit. The 180-degree downward bend of rooftop conduits will provide adequate drip.
11. Protection if the conduit is filled with foam insulation after cable installation. Weather-heads with a 1 ½" bend radius is acceptable for LMR-600.
12. All coaxial cables must be installed in metal electrical conduit. Where the conduit is to also functioning as the antenna mounting mast, it should be of a rigid type where it penetrates a rooftop. Rooftop penetrations should extend above the roofline no less than thirty-six inches with a bend radius of 180 degrees minimum, respecting the minimum bend radius of the cable used.
13. Upon completion of the installation, each antenna feed-line must be tested with either a time domain reflectometer, or an inline watt-meter to verify that its assembly and installation is acceptable. It is not unusual to find that a feed-line will exhibit an unusually high SWR, or power loss after initial installation. An SWR of 1.15:1 or less is acceptable.
14. Radio base stations are often connected to control devices via multi-conductor copper cable throughout an installation. Generally these devices take the form of desk phones, wall mounted phones and control consoles. There are numerous types of these devices throughout UAL and each serves different needs. Where copper cable is required for this type of connection, 24 gauge, 4pr Cat6 plenum rated cable with an 'orange' jacket specific for radio associated applications is to be used. Typically, a single cable is required to support a single or dual channel radio control device. Larger systems must be considered on a case-by-case basis to determine the number of cables required. Cat6 cables must be terminated at the control end per T568A, 4 pair standard. Cables entering a wiring closet or equipment room will terminate on standard '110' or '66' style terminating blocks.

15. Radio Cabling Characteristics and Considerations Cart:

Coaxial Cable Size	3/8in	1/2in	7/8in	1-1/4in
Conduit size for 1 cable	3in	3in	3in	3in
For 2 cables	3in	3in	3in	4in
For 3 cables	3in	3in	N/A	N/A
Minimum bend radius	5in	5in	10in	15in
Maximum Cable Run				
VHF 118 to 136 Mhz	100ft	200ft	N/A	N/A
UHF 450-512 MHz	N/A	100ft	200ft	300ft
UHF 800-1000Mhz	N/A	50ft	100ft	200ft
Recommended Cable Type	3/8in	1/2in	7/8in	1-1/4in
Times Microwave	LMR-400	LMR-600	LMR-900	LMR-1200
Andrew-Heliox (non-plenum rated)	N/A	LDF4-50A	LDF5-50A	LDF6-50
Cable connectors-Andrew		LDF4-50A	LDF5-50A	LDF6-50
Connectors 'N' type				
Male		L4PNM	L5NM	L6PNM
Female		L4NF	L5NF	L6PNF
Connectors 'UHF' type				
Male		L44P	L45P	N/A
Female		L44U	L45U	N/A
Cable Connectors-Times Micr	LMR-400	LMR-600	LMR-900	LMR-1200
Connectors 'N' type				
Male	EZ-400-NMH-D	EZ-600-NMH-D	EZ-900-NMC	EZ-1200-NMC
Female	EZ-400-NF-BH U/M	EZ-600-NF	EZ-900-NFC	EZ-1200-NFC
Connectors 'UHF' type				
Male		TC-600-UMC	N/A	N/A
Female		N/A	N/A	N/A

2.15 Product Material

HORIZONTAL WIRING			
Manufacturer	Part No.	Application or Rating	Description
Panduit	PUP6004BU-UY	Indoor / Plenum	Category-6 1-Gig 4-Pair (Data Workstation Blue)
General Cable	7131900		
Berk-Tek	10032094		
Panduit	PUR6004BU-UY	Indoor / Riser	Category-6 1-Gig 4-Pair (Data Workstation Blue)
General Cable	7133900		
Berk-Tek	10032090		
Panduit	PUP6A04OR-UG	Indoor / Plenum	Category-6A 10-Gig 4-Pair (Wireless Access Point Orange)
General Cable	N / A		
Berk-Tek	11084255		
Panduit	PUR6A04OR-UG	Indoor / Riser	Category-6A 10-Gig 4-Pair (Wireless Access Point Orange)
General Cable	N / A		
Berk-Tek	11085546		
Panduit	PUP6004YL-UY	Indoor / Plenum	Category-6 4-Pair (Voice Yellow)
General Cable	7131902		
Berk-Tek	10032090		
Panduit	PUR6004YL-UY	Indoor / Riser	Category-6 4-Pair (Voice Yellow)
General Cable	7133902		
Berk-Tek	10032461		
Panduit	UTPSP*Y-**		Category-6 Patch Cord. (Refer to section “UAL Patch Cords Jacket Color Coding” for required color of patch cord. The patch cord lengths shall vary between 3’ through 10’ in length depending on cable management requirements) (** indicates Length and Color)
Leviton	62460-**		

Panduit	UTP6A***		Category-6A Patch Cord. (Refer to section "UAL Patch Cords Jacket Color Coding" for required color of patch cord. The patch cord lengths shall vary between 3' through 10' in length depending on cable management requirements) (** indicates Length and Color)
Leviton	6AS10-**		
Panduit	SP688-C		Category-6 Field Terminated RJ-45 Modular Plug
Leviton	47613-EZ6		
Panduit	MP588-L		Category-5e Field Terminated RJ-45 Modular Plug
Leviton	47613-EZR		

BACKBONE WIRING - INDOOR COPPER			
Manufacturer	Part No.	Application or Rating	Description
Berk-Tek	N / A	Indoor / Riser	Category-3 25-Pair ARMM
General Cable	2019000		
Superior Essex	02-097-03		
Berk-Tek	10032396	Indoor / Riser	Category-3 25-Pair
General Cable	2133033		
Berk-Tek	10032111	Indoor / Plenum	Category-3 25-Pair
General Cable	2131505		
Berk-Tek	10061456	Indoor / Riser	Category-5e 25-Pair
General Cable	2133269E		
Berk-Tek	10089521	Indoor / Plenum	Category-5e 25-Pair
General Cable	2131550E		

BACKBONE WIRING - INDOOR ARMORED FIBER

*Note: The use of Armored Fiber Cabling is **NOT** the preferred media to be installed for fiber backbone systems.*

The preferred Fiber cable media is Air-Blown Fiber (ABF). The use of Armored Fiber Cabling will require prior authorization from United IT.

Manufacturer	Part No.	Application or Rating	Description
Panduit	FSPR906Y	Indoor / Riser	6-Strand Armored OS2 Singlemode (Zero Water Peak)
General Cable	AP0061PNR-ILRA		
Berk-Tek	N/A		
Panduit	FSPR912Y	Indoor / Riser	12-Strand Armored OS2 Singlemode (Zero Water Peak)
General Cable	AP0121PNR-ILRA		
Berk-Tek	PDRK012AB0707		
Panduit	FSPR924Y	Indoor / Riser	24-Strand Armored OS2 Singlemode (Zero Water Peak)
General Cable	AP0241PNR-ILRA		
Berk-Tek	PDRK024AB0707		
Panduit	FSPP906Y	Indoor / Plenum	6-Strand Armored OS2 Singlemode (Zero Water Peak)
General Cable	AP0061PNU-ILPA		
Berk-Tek	N/A		
Panduit	FSPP912Y	Indoor / Plenum	12-Strand Armored OS2 Singlemode (Zero Water Peak)
General Cable	AP0121PNU-ILPA		
Berk-Tek	PDPK012AB0707		
Panduit	FSPP924Y	Indoor / Plenum	24-Strand Armored OS2 Singlemode (Zero Water Peak)
General Cable	AP0241PNU-ILPA		
Berk-Tek	PDPK024AB0707		
Panduit	FOPRX06Y	Indoor / Riser	6-Strand Armored OM3 Multimode (10-Gig 300 Meters)
General Cable	BE0061PNR-ILRA		
Berk-Tek	N/A		

Panduit	FOPRX12Y	Indoor / Riser	12-Strand Armored OM3 Multimode (10-Gig 300 Meters)
General Cable	BE0121PNR-ILRA		
Berk-Tek	PDRK012EB3010/25		
Panduit	FOPRX24Y	Indoor / Riser	24-Strand Armored OM3 Multimode (10-Gig 300 Meters)
General Cable	BE0241PNR-ILRA		
Berk-Tek	PDRK024EB3010/25		
Panduit	FOPPX06Y	Indoor / Plenum	6-Strand Armored OM3 Multimode (10-Gig 300 Meters)
General Cable	BE0061PNU-ILPA		
Berk-Tek	N/A		
Panduit	FOPPX12Y	Indoor / Plenum	12-Strand Armored OM3 Multimode (10-Gig 300 Meters)
General Cable	BE0121PNU-ILPA		
Berk-Tek	PDPK012EB3010/25		
Panduit	FOPPX24Y	Indoor / Plenum	24-Strand Armored OM3 Multimode (10-Gig 300 Meters)
General Cable	BE0241PNU-ILPA		
Berk-Tek	PDPK024EB3010/25		
Panduit	FOPRZ06Y	Indoor / Riser	6-Strand Armored OM3 Multimode (10-Gig 500 Meters)
General Cable	BL0061PNR-ILRA		
Berk-Tek	N/A		
Panduit	FOPRZ12Y	Indoor / Riser	12-Strand Armored OM3 Multimode (10-Gig 500 Meters)
General Cable	BL0121PNR-ILRA		
Berk-Tek	PDRK012EB3010/F5		
Panduit	FOPRZ24Y	Indoor / Riser	24-Strand Armored OM3 Multimode (10-Gig 500 Meters)
General Cable	BL0241PNR-ILRA		
Berk-Tek	PDRK024FB3010/F5		
Panduit	FOPPZ06Y	Indoor / Plenum	6-Strand Armored OM3 Multimode (10-Gig 500 Meters)
General Cable	BL0061PNU-ILPA		
Berk-Tek	N/A		

Panduit	FOPPZ12Y	Indoor / Plenum	12-Strand Armored OM3 Multimode (10-Gig 500 Meters)
General Cable	BL0121PNU-ILPA		
Berk-Tek	PDPK012FB3010/F5		
Panduit	FOPPZ24Y	Indoor / Plenum	24-Strand Armored OM3 Multimode (10-Gig 500 Meters)
General Cable	BL0241PNU-ILPA		
Berk-Tek	PDPK024FB0310/F5		

BACKBONE WIRING - SUMITOMO AIR-BLOWN FIBER TUBE CABLE

Manufacturer	Part No.	Application or Rating	Description
Sumitomo	TC02TRX	Indoor / Riser	2-Tube Cable
	TC04TRX	Indoor / Riser	4-Tube Cable
	TC07TRX	Indoor / Riser	7-Tube Cable
	TC19TRX	Indoor / Riser	19-Tube Cable
	TC01TPX	Indoor / Plenum	1-Tube Cable
	TC02TP2	Indoor / Plenum	2-Tube Cable
	TC04TP2	Indoor / Plenum	4-Tube Cable
	TC07TP2	Indoor / Plenum	7-Tube Cable
	TC19TP2	Indoor / Plenum	19-Tube Cable
	TC02TOX	Outdoor	2-Tube Cable Blk, wrapped with water-blocking tape and blk outer polyethylene
	TC07TOX	Outdoor	7-Tube Cable Blk, wrapped with water-blocking tape and blk outer polyethylene
	TC19OX	Outdoor	19-Tube Cable Blk, wrapped with water-blocking tape and blk outer polyethylene

BACKBONE WIRING - SUMITOMO AIR-BLOWN FIBER BULK OPTICAL FIBER			
Manufacturer	Part No.	Application or Rating	Description
Sumitomo	FB04SX	OS2	4-Strand Singlemode (OS2 Zero Water Peak)
	FB06SX	OS2	6-Strand Singlemode (OS2 Zero Water Peak)
	FB12SX	OS2	12-Strand Singlemode (OS2 Zero Water Peak)
	FB18SX	OS2	18-Strand Singlemode (OS2 Zero Water Peak)
	FB24SX	OS2	24-Strand Singlemode (OS2 Zero Water Peak)
	FB06G53	OM3 / 10-Gig	6-Strand Multimode (OM3 10-Gig 300 Meters)
	FB12G53	OM3 / 10-Gig	12-Strand Multimode (OM3 10-Gig 300 Meters)
	FB18G53	OM3 / 10-Gig	18-Strand Multimode (OM3 10-Gig 300 Meters)
	FB24G53	OM3 / 10-Gig	24-Strand Multimode (OM3 10-Gig 300 Meters)
	FB06G55	OM4 / 10-Gig	6-Strand Multimode (OM4 10-Gig 500 Meters)
	FB12G55	OM4 / 10-Gig	12-Strand Multimode (OM4 10-Gig 500 Meters)
	FB18G55	OM4 / 10-Gig	18-Strand Multimode (OM4 10-Gig 500 Meters)
	FB24G55	OM4 / 10-Gig	24-Strand Multimode (OM4 10-Gig 500 Meters)
	.*	.*	Intra-Building Indoor / Plenum Ribbon Cables. Refer to Sumitomo Electric Lightwave 4 th Level Ordering Information Guide for product descriptions and product numbers.
	.*	.*	Data Center Indoor / Plenum Cables. Refer to Sumitomo Electric Lightwave 4 th Level Ordering Information Guide for product descriptions and product numbers.

BACKBONE WIRING - SUMITOMO AIR-BLOWN FIBER MISCELLANEOUS MATERIAL			
Manufacturer	Part No.	Application or Rating	Description
Sumitomo			
	FT02L06		2-RMU Fiber Panel for Standard LGX Adapters (144-LC Ports)
	FT02H24		2-RMU Fiber Panel for High Density Adapters (288-LC Ports)
	FT03L09		3-RMU Fiber Panel for Standard LGX Adapters (216-LC Ports)
	FT03H36		3-RMU Fiber Panel for High Density Adapters (432-LC Ports)
	FT04L12		4-RMU Fiber Panel for Standard LGX Adapters (288-LC Ports)
	DE00SPL		Tube Cable Splice Kit (for 2- or 4-Tube Cables)
	DE01SPL		Tube Cable Splice Kit (for 7-Tube Cables)
	DE02SPL		Tube Cable Splice Kit (for 19-Tube Cables)
	DE02TOX		Bushing for 2-Tube Cable Liquid Tight Kellum Fitting
	DE04TOD		Bushing for 4-Tube Cable Liquid Tight Kellum Fitting
	FT2MFB		Tapered Bushing (for 2-, 4-, or 6-fiber bundle)
	FT3MFB		Tapered Bushing (for 12- or 18-fiber bundle)
	DE08MA		Tube End Cap (8mm), available only in packs of 10
	DE04HS1		Cable End Seal (Heat Shrink, TC02-TC04 Tube Cables)
	DE07HS1		Cable End Seal (Heat Shrink, TC07 Tube Cables)
	DE19HS1		Cable End Seal (Heat Shrink, TC19 Tube Cables)
	DE08MA		Tube End Cap (8mm), available only in packs of 10
	DE08MC2		Straight Tube Coupling (8mm), available only in packs of 10
	DE08MT		Tee Coupling (8mm)
	DE06MDU		Tube Distribution Unit, Modular, Indoor (16 x 16 x 4 in.)
	FTFLD06		6-fiber Bundle Breakout Kit (w/ 900 micron Tubing)
	FTFLD12		12-fiber Bundle Breakout Kit (w/ 900 micron Tubing)
	FTFLD18		18-fiber Bundle Breakout Kit (w/ 900 micron Tubing)
	FTFLD24		24-fiber Bundle Breakout Kit (w/ 900 micron tubing)
	BE02DW		Blowing Head Drive Wheels (2-, 4- or 6-Fiber Bundle)
	BE02SL		Blowing Head Seal (2-, 4- or 6-Fiber Bundle)
	BE03DW		Blowing Head Drive Wheels (12- or 18-Fiber Bundle)
	BE03SL		Blowing Head Seal (12- or 18-Fiber Bundle)
	BE2MFT		Blowing Tip (2-, 4-, or 6-Fiber Bundle)

	BE3MFT		Blowing Tip (12- or 18-Fiber Bundle)
	BEBB01P		5 mm Plastic Beads (for Obstruction Testing)
	BETC001		Tube Cutter
	BETC00B		Replacement Blade for Tube Cutter
	BETL01		Tube Cable Cutter
	BETL02		Replacement Blade for Tube Cable Cutter
	LYNX2-SCPCM510G-900LT		Multimode OM3 and OM4 “SC-Type” Splice-on Connectors
	LYNX2-LCPCM510G-900LT		Multimode OM3 and OM4 “LC-Type” Splice-on Connectors
	LYNX2-SCUPCSM-900LT		Singlemode “SC-Type” Splice-on Connectors
	LYNX2-LCUPCSM-900LT		Singlemode “LC-Type” Splice-on Connectors

WIRING COMPONENTS - BACKBONE & HORIZONTAL

Manufacturer	Part No.	Application or Rating	Description
Panduit	P110KB1004Y	Category-6	100 Pair 110 Wall Mount Block With C-4's
Leviton	41AB2-1F4		
Panduit	P110KB1005Y	Category-6	100 Pair 110 Wall Mount Block With C-5's
Leviton	41AB2-1F5		
Panduit	P110KB3004Y	Category-6	300 Pair 110 Wall Mount Block With C-4's
Leviton	41AB2-3F4		
Panduit	P110KB3005Y	Category-6	300 Pair 110 Wall Mount Block With C-5's
Leviton	41AB2-3F5		
Panduit	P110JTW-X		110 Style Horizontal Wall Mount Jumper Trough

Siemon	66M150		Split M Block 50-Pair (66M1-50) 66 Block
Leviton	40066-M50		
Siemon	89B		66 Block Standoffs (89B Bracket)
Leviton	40089-00D		
Panduit	FCE2U		2RU Fiber Rack Mount Fiber Enclosure
Leviton	5R2UH-S06		
Panduit	FCE4U		4RU Fiber Rack Mount Fiber Enclosure
Leviton	5R4UH-S12		
Panduit	FAP6WAQDLCZ	Multimode / 10-Gig	6 Duplex LC Fiber Adapter Panels (12-Strand)
Leviton	5F100-12A		
Panduit	FAP12WAQDLCZ	Multimode / 10-Gig	12 Duplex LC Fiber Adapter Panels (24-Strand)
Leviton	5F100-24A		
Panduit	FAP6WBUDLCZ	Singlemode	6 Duplex LC Fiber Adapter Panels (12-Strand)
Leviton	5F100-12Z		
Panduit	FAP12WBUDLCZ	Singlemode	12 Duplex LC Fiber Adapter Panels (24-strand)
Leviton	5F100-24Z		
Panduit	FAPB		Blank Fiber Adapter Panel
Leviton	5F100-BLK		
Panduit	FLCSMBLY	Multimode	Field Terminated LC Connector
Leviton	49990-MDL		
Panduit	FLCSSBUY	Singlemode	Field Terminated LC Connector
Leviton	49990-SDL		
Panduit	R200X225V1T		Self-Laminating Cable Labels (Turn-Tell Labels)

Panduit	CPPLA24WBLY		24-Port Angled Patch Panel with Labeling Solution
Leviton	49256-H24		
Panduit	CPPLA48WBLY		48-Port Angled Patch Panel with Labeling Solution
Leviton	49256-H48		
Panduit	CPPL24WBLY		24-Port Flat Patch Panel with Labeling Solution
Leviton	49255-H24		
Panduit	CPPL48WBLY		48-Port Flat Patch Panel with Labeling Solution
Leviton	49255-H48		
Panduit	SRB19BLY		Strain Relief Bar for 24-Port and 48-Port Patch Panels
Leviton	49257-QHD		
Panduit	CJ688TGBL	Category-6	UTP Data Module (Black in Color) for 24-Port and 48-Port Patch Panels
Leviton	61110-RE6		
Panduit	CJ6X88TGOR	Category-6A	UTP Data Module (Orange in Color) for 24-Port and 48-Port Patch Panels for Wireless Access Point Drop Locations
Leviton	6A10G-RO6		
Panduit	CJ88TGBU	Category-6	UTP Data Module (Blue in Color) for Workstation Drop Location
Leviton	61110-RL6		
Panduit	CJ6X88TGOR	Category-6A	UTP Data Module (Orange in Color) for Wireless Access Point Drop Location
Leviton	6A10G-RO6		
Panduit	CJ88TGYL	Category-6	UTP Data Module (Yellow in Color) for Workstation Drop Location (Used on projects where VoIP is not implemented)
Leviton	61110-RY6		
Panduit	CHB2BL-X		Blank Insert Module (Black in Color) for 24-Port and 48-Port Patch Panels
Leviton	41084-BEB		
Panduit	* *	Category-6	Workstation Patch Cord (color & length)
Leviton	* *		

Panduit	*.*	Category-6	TR Patch Cord (color & length)
Leviton	*.*		
Panduit	R200X225V1T		Patch Cord Wrap Around Label
Panduit	CFPE2**Y		Single Gang 2-Port Flush Mount Faceplate (** indicates Color (IW,IG,BL))
Leviton	42080-2*S		
Panduit	KWP6PY		Single Gang Wall Phone Flush Mount Faceplate
Leviton	42080-1*S		
Panduit	CFFPL4**		4-Port Modular Furniture Faceplate (** indicates Color (IW,IG,BL))
Leviton	49910-U*4		
Panduit	CBXJ2**-A		2-Port Modular Surface Mount Box (** indicates Color (IW,IG,BL))
Leviton	41089-2*P		
Panduit	CBX12**-AY		12-Port Modular Surface Mount Box (** indicates Color (IW,IG,BL))
Leviton	41089-12*		
Panduit	CHB2**-X		Blank Insert Module (Match Faceplate Color) for Workstation Faceplates. (** indicates Color (IW,IG,BL))
Leviton	41084-B*B		
Oberon	1064-00		Suspended Ceiling Wireless Access Point Enclosure. Note that this enclosure is to be used with the following wireless access point devices: Cisco 1040/1140/1260/1600/3500/3600 series 802.11n access points.
Oberon	1015-C		Surface Mount Wireless Access Point Enclosure. Note that this enclosure is to be used with the following wireless access point devices: Cisco 1040/1140/1260/1600/3500/3600 series 802.11n access points.
Panduit	TDP43ME		Network Label Printer

Hoffman	ECL606020-MOD (Enclosure) EP6060AL-MOD (Silk Screen Back Plate)	Small Enclosure Exterior / Outdoor	NEMA-4X corrosion resistant aluminum wall-mount enclosure 23.60"Hx23.60"Wx7.90"D for use in exterior applications where telecom termination equipment and network electronics need to be co-located. Enclosure shall be equipped with the silk screen back plate to indicate equipment mounting locations within the enclosure.
Hoffman	ECL806020-MOD (Enclosure) EP8060AL-MOD (Silk Screen Back Plate)	Large Enclosure Exterior / Outdoor	NEMA-4X corrosion resistant aluminum wall-mount enclosure 31.50"Hx23.60"Wx11.80"D for use in exterior applications where telecom termination equipment and network electronics need to be co-located. Enclosure shall be equipped with the silk screen back plate to indicate equipment mounting locations within the enclosure.
Leviton	N502H		Fiber Optic Network Interface Device. This enclosure shall be utilized within at exterior locations where fiber optic cable requires termination.

TELECOM ROOM EQUIPMENT			
Manufacturer	Part No.	Application or Rating	Description
CPI Chatsworth	GF-1A320	Global Frame	Locking Data Cabinet 79.3"Hx24"Wx40.4"D
CPI Chatsworth	11972-742		Locking Seismic rated Data Cabinet 84"Hx 24"Wx 36"D
CPI Chatsworth	55053-703		19" Data Rack (19"W x 84"H) Black
CPI Chatsworth	35521-703		6" Vertical Cable Manager Double Sided
CPI Chatsworth	35522-703		8" Vertical Cable Manager Double Sided
CPI Chatsworth	35523-703		10" Vertical Cable Manager Double Sided
CPI Chatsworth	35441-702		2-Ru Horizontal Cable Manager Single Sided
CPI Chatsworth	11840-724		Wall Mounted Locking Cabinet 24"x24" solid door
CPI Chatsworth	11900-724		Wall Mounted Locking Cabinet 24"x24" tinted door
CPI Chatsworth	11996-724		Wall Mounted Locking Cabinet 24"x30" solid door
CPI Chatsworth	12419-724		Wall Mounted Locking Cabinet 24"x30" tinted door

CPI Chatsworth	11911-712		12" Cable runway kit (includes (1) 12 x4' ladder rack,(1) wall angle bracket, (1) rack to runway mounting plate, (1) pair of end caps, & (6) J-blots
CPI Chatsworth	11275-712		12" x 10' ladder rack
CPI Chatsworth	11294-719		19" Low Profile Shelf for the HP 7900
CPI Chatsworth	14072-719		Adjustable shelf for Data Cabinet
CPI Chatsworth	40074-700		19" half shelf for supporting UPS's, power injectors, est.
CPI Chatsworth	12310-702		6" Extension Brackets for UPS's
CPI Chatsworth Ontrac	*.*	Shaped Tray	20" Wire Basket Cable Tray (Black in Color)
CPI Chatsworth Ontrac	*.*	Shaped Tray	12" Wire Basket Cable Tray (Black in Color)
CPI Chatsworth	35441-702	For use with Flat Patch Panels only	Horizontal Cable Management
Tripp-Lite	SU750RTXL2U		Smart Online 750VA 120V Rack Mount
Tripp-Lite	SU2200RTXL2UA		Smart Online 2200VA 120V Rack Mount
Tripp-Lite	SU3000RTXL2UA		Smart Online 3000VA 120V Rack Mount
Tripp-Lite	SU6000RT4UL1430-BDL		Smart Online 6000VA 120V Rack Mount
Tripp-Lite	SNMPWEBCARD		SNMP Web Card for Remote Management and Control
Tripp-Lite	ENVIROSENSE		Environmental Sensor Module (Temperature Probe)
Tripp-Lite	2POSTRMKITWM		2-Post 19" Rack Mounting Kit
APC	*.*	Rack Mounted UPS	APC's SMX series rack mounted UPS's with NIC & Temp sensor can be used @ international sites.
CPI Chatsworth	P3-1K0K4		Vertical Mounted Power Strip for use within MDF Telecom Rooms. (2) Power Strips are to be installed within each cabinet and/or equipment rack.
Leviton	05500-UAL/05500-190		Horizontal Power Strip for use in IDF Telecom Rooms.
Liebert	MP2-120C		20 amp Maintenance Bypass Switch
Liebert	MP2-130C		30 amp Maintenance Bypass Switch
Liebert	LGH D7838BFGK		19" Environmental Enclosure (discontinued)
Liebert	MCR H788		19" Environmental Enclosure (replaces LGH)
Liebert	MCR R788		23" Environmental Enclosure (replaces LGH)
Hubbell	*.*		Twist-Lock Receptacle
Panduit	RGS134-1Y		Grounding Strip for Equipment Rack (1 per rack)
Panduit	RCESD2-1		ESD Port Kit (2 per TR/LAN Room)
Panduit	RGESDWS		ESD Wrist Strap (2 per TR/LAN Room)

Panduit	RGCBNJ660P22		CBN Jumper Kit (1 per rack and as required for cable runway)
Panduit	GJS660U		Equipment Jumper Kit (1 per rack)
CPI Chatsworth	40153-020		20" two-hole lug Grounding Busbar
Hilti	CP 653 Speed Sleeve		Re-penetrable cable management device (sleeve) with integrated smoke seal fabric membrane
Hilti	CFS-SL SK		Firestop Sleeve
Hilti	CFS-SL RK		Split Firestop Sleeve for use with existing cable bundles
Hilti	CFS-SL GP		Firestop Gangplate for use with multiple cable management devices (sleeves).
Hilti	CFS-SL GP CAP		Firestop Gangplate cap for use at blank openings in gangplate for future penetrations.

2.16 Labeling Requirements - EIA/TIA 606 Section 8

A. Patch Cord Jacket Color Coding – New Installations

- | | |
|---------------------|--|
| 1. Blue (Cat-6) | Data / VoIP |
| 2. Yellow (Cat-6) | Voice |
| 3. Orange (Cat-6A) | Wi-Fi (Wireless Access Point) |
| 4. White (Cat-6) | Security CCTV Camera |
| 5. Violet (Cat-6) | Security Access Control Door Swipe / Card Reader |
| 6. Gray (Cat-6) | Audio Visual |
| 7. Green (Cat-6) | Printer |
| 8. Red (Cat-6) | Building / Tenant Automation System (BMS) |
| 9. Black (Cat-6) | End User Equipment (VoIP Handsets, Computers and Printers) |
| 10. Orange (Cat-6A) | End User Equipment (Wi-Fi Wireless Access Point) |
- Note: Remediation of existing cabling shall not be required to follow the color coding standards.

B. RJ-45 Modular Jack Color Coding (End User Side)

- | | |
|--------------------|---|
| 1. Blue (Cat-6) | Data, Printers, Door Swipes/Card Reader, Audio Visual and Servers |
| 2. Yellow (Cat-6) | All Voice (Exception being VoIP or Hybrid Phone Systems) |
| 3. Orange (Cat-6A) | Wi-Fi (Wireless Access Point) |

C. RJ-45 Modular Jack Color Coding (TR/LAN Room Side)

- | | |
|--------------------|--|
| 1. Black (Cat-6) | All Devices with exception of Wi-Fi as noted below |
| 2. Orange (Cat-6A) | Wi-Fi (Wireless Access Point) |

D. Cable Labeling Identification

- Workstation Cable - All cables, outlet jacks, patch panels, patch panel jacks, cable termination blocks, etc. shall be labeled and identified as specified.
- Workstation Outlet Jack - Each outlet jack, voice or data, shall be labeled using the format depicted within this section. In UAL locations where a single room containing multiple station outlets, each jack faceplate will be numbered starting on the right hand side of the primary entrance to the room.
- Telecommunication room - All data cables shall be identified with a printed label covered by clear shrink-wrap tubing. The label will identify the same information as depicted on the station jack outlet and the termination jack located in the patch panel. This label should be attached to the cable a minimum of 6 inches from the end of the terminated connection. All TR/LAN Room racks, patch panels and jacks will be identified by their own unique number.
- Backbone Cable - Voice and data copper distribution cables will be identified on the terminating backboard and cable end as to its originating point. Likewise the same information required will be identified at the originating point identifying the terminating location. Where these cables pass through TR/LAN Rooms, this information will also be identified at both the originating and terminating locations. Where distribution cables are split, each split (binder) will be identified by pair count, its originating and termination points.

5. Data fiber cables will be clearly identified as to their originating and terminating points. Each cable, fiber and patch panel will also be identified as per IT requirements. All inner-duct and / or conduit containing fiber cables will be clearly marked at each end as well as at 50-foot intervals in exposed runs showing the type of fiber enclosed, together with the originating and terminating locations, as well as company name. Where the inner-duct and / or conduit are concealed, labeling will be attached as described in exposed areas or at the discretion of IT.
6. All voice cables will be labeled and identified using the same format as data cables at the station outlet as well as the TR/LAN Room block location. All voice station information will be identified on the TR/LAN Room blocks to correspond to the cable identification.

E. Labeling Guideline: TR, Equipment/LAN Room

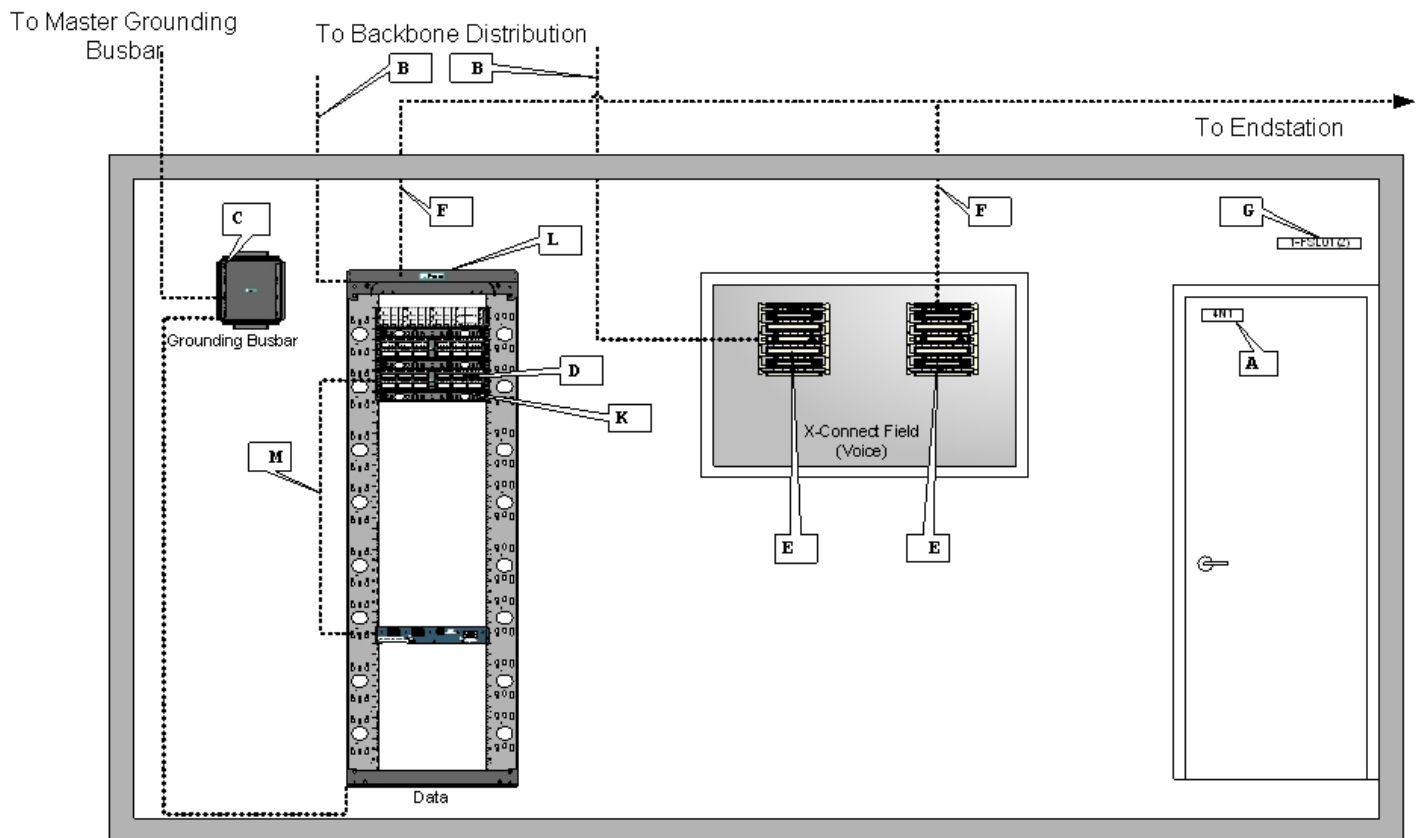


Figure 1: TR, Equipment/LAN Room Labeling Guideline

F. Labeling Guideline: Station Outlet

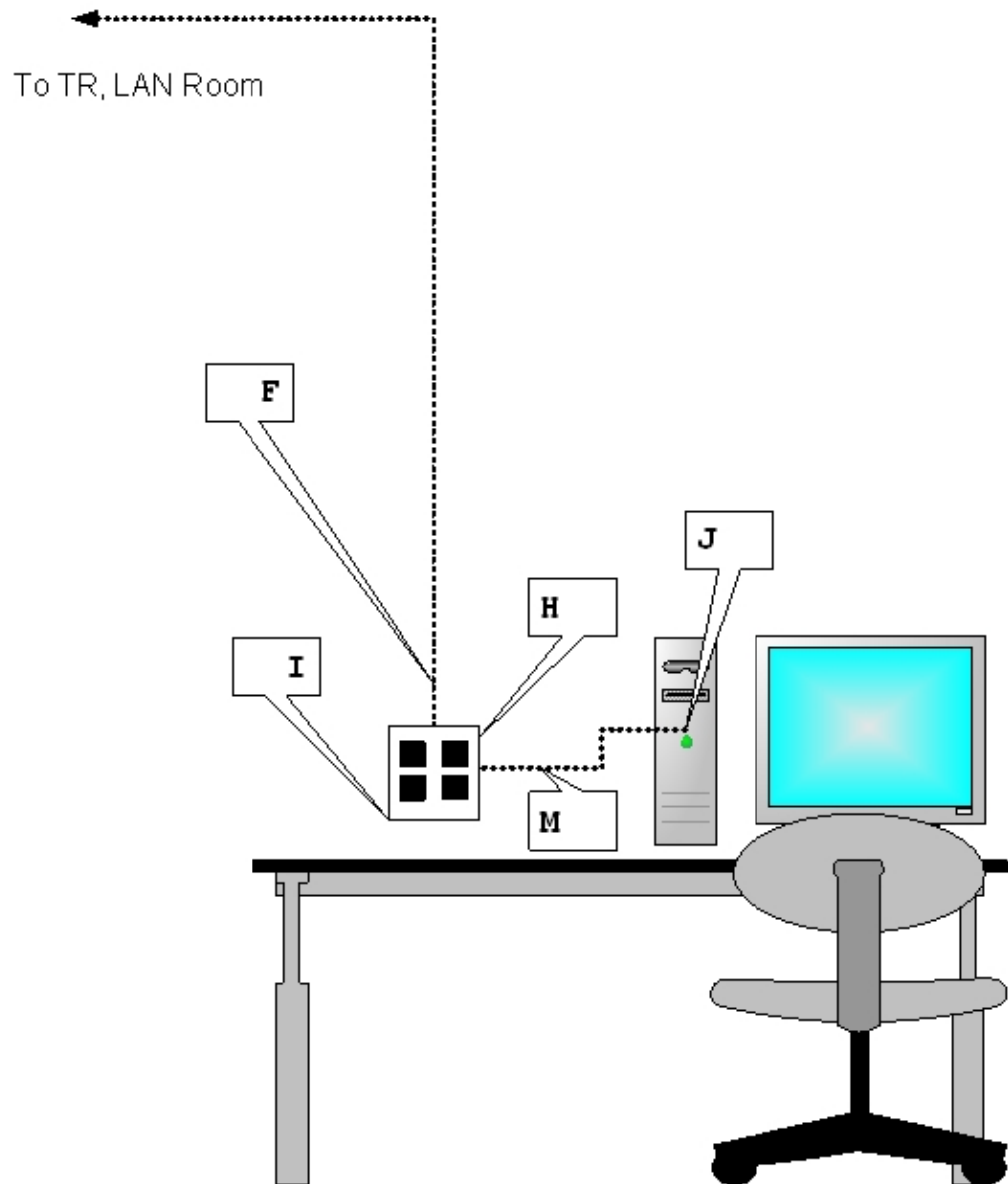
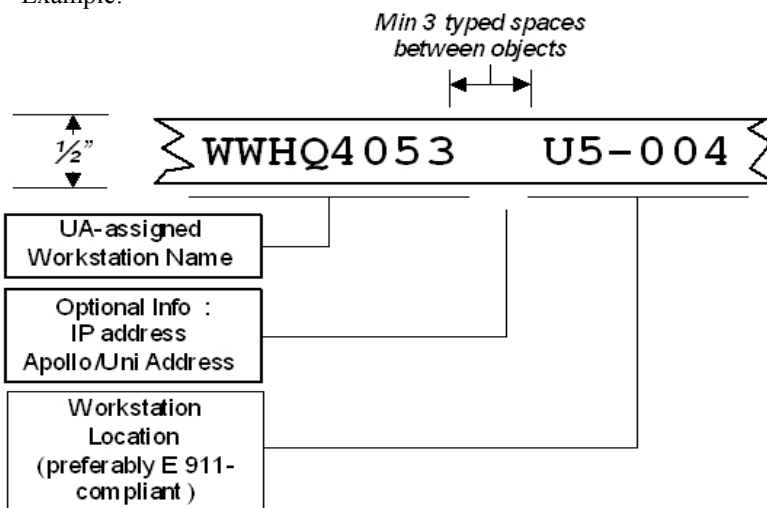


Figure 2: Station Outlet Labeling Guideline

G. Label Layouts

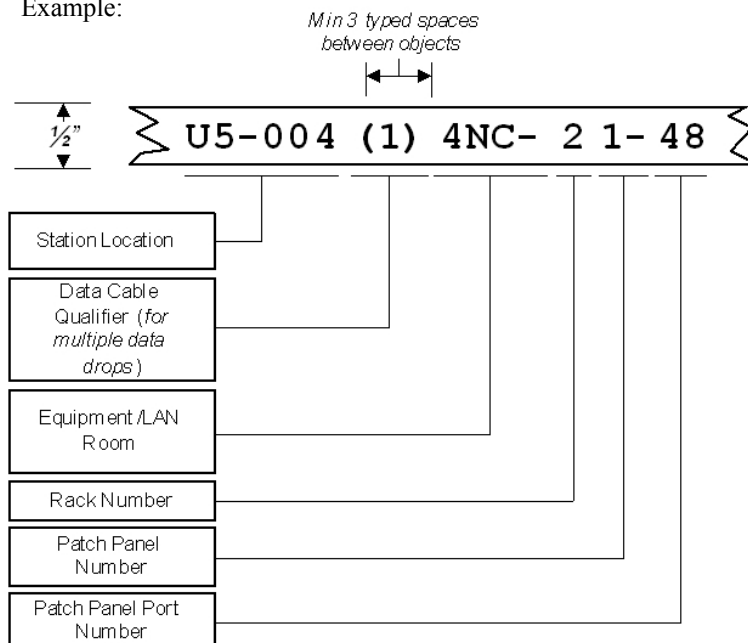
1. Workstation Address Label (Item J in Figure 2)

- Label width shall be 0.5 in.
- Font shall be the largest that can be printed on label
- Labels shall be located at the bottom of faceplate identifying all jack outlets
- Example:



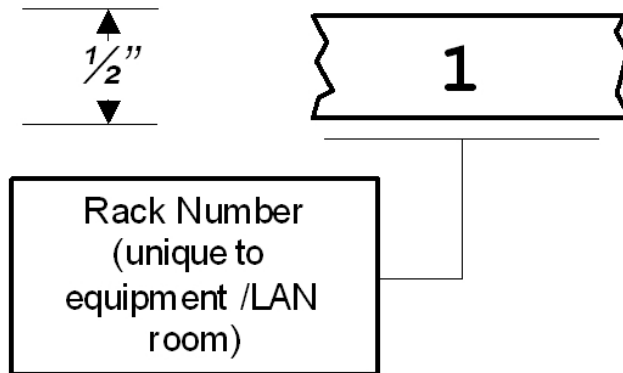
2. Station Outlet DATA Label (Item I in Figure 2)

- Label width shall be 0.5 in.
- Font shall be the largest that can be printed on label
- Labels shall be located at the bottom of faceplate identifying all jack outlets
- Example:



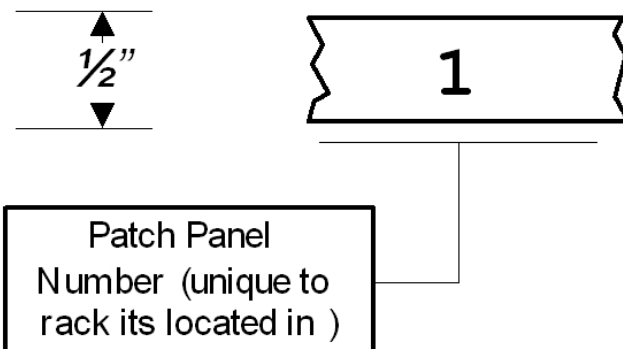
3. Rack Label (Item L in Figure 1)

- Label width shall be 1.0 in.
- Font shall be the largest that can be printed on label
- Labels shall be located front and rear of rack at top
- Rack shall be numbered unique for the equipment/LAN room
- Example:



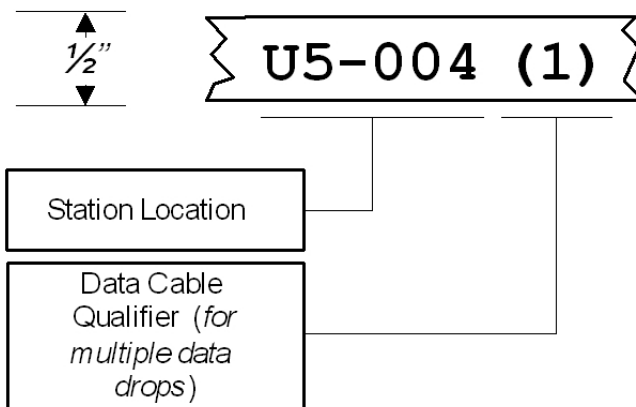
4. Patch Panel Label (Item D in Figure 1)

- Label width shall be 0.5 in.
- Font shall be the largest that can be printed on label
- Labels shall be located front and rear of patch panels
- Panel shall be numbered unique for its respective rack
- Example:



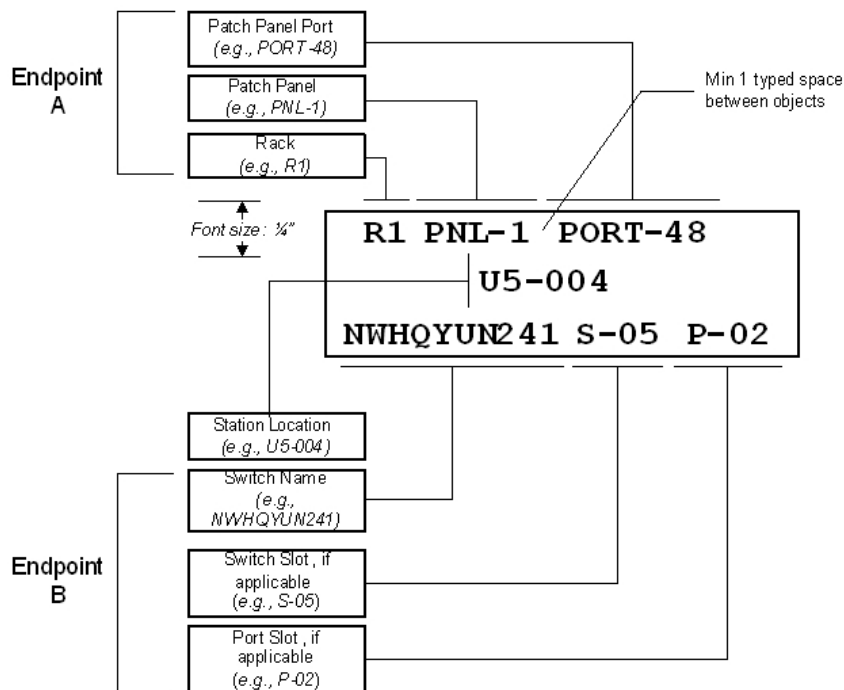
5. Patch Panel Data Port Label (Item K in Figure 1)

- Label width shall be 0.5 in.
- Font shall be the largest that can be printed on label
- Labels will be located front and rear of patch panels
- Example:



6. Patch Cords DATA Label (Item M in Figure 1)

- Font sizes will be 0.25 in.
- Labels will be located at both ends of the patch cord minimum of 1.0 in. from connector
- Labels will include information about originating and terminating locations on **both** ends of cable.
- Recommended label product: Brady, p/n WML-317-292
- If labeling fiber patch cords, use Panduit p/n NWSLC-2Y for label stabilization
- Example:



7. Station Outlet VOICE Label (Item H in Figure 2)
 - Label width shall be 0.5 in.
 - Font shall be the largest that can be printed on label
 - Labels will be located on the top of the faceplate identifying all jack outlets
8. Equipment/LAN Room Voice Field Label (Item E in Figure 1)
 - Labels on '110' frame equipment on station cable side shall identify the Quadrant, Gate or Room number followed by the Station number and finally the jack outlet number.
 - Labels on '110' frame equipment on the house / distribution cable side shall identify the Frame Column number and the Frame Block number.
 - Labels identifying the house / distribution cables shall be placed above the respective frame column on the backboard and shall include the originating and the terminating locations. The label shall include the MDF, and / or the Building Riser / IDF Room number, the Column number and the cable size. This shall be identified regardless of the number of IDF frames the station cable route follows. Font sizes shall be a minimum of 1.0 in.
9. Backbone/Distribution Cable Label (Item F in Figure 1)
 - Labels attached to inner-duct shall include the fiber cables (strands) enclosed as well as the originating and terminating points of the fiber cable run. Fiber cables and fiber patch panels shall identify both originating and terminating points including; equipment room location, rack number and patch panel number. Font sizes should be a minimum of 0.5 in.

2.17 Contractor Requirements & Responsibilities

A. Contractor Capability Requirements

1. The cabling contractor shall be licensed to do business in the state and city in which the installation is to take place.
2. The contractor may be requested, prior to award of contract, to submit written evidence of financial position, and current commitments.
3. United Airlines (UAL) may make such further investigations of contractors as he deems necessary to determine the ability of the contractor to perform the work and the contractor shall furnish to UAL all such data for this purpose as UAL may request. UAL reserves the right to reject any bid if the evidence submitted, or investigation of such contractor, fails to satisfy UAL that such contractor is properly qualified to carry out the obligations of the contract and to complete the work contemplated.
4. The contractor is required to be a Certified Installer of the specified cable system manufacturer (Leviton or Panduit) and have the staff technicians assigned to this project certified for the products being installed. The contractor must also provide UAL with a 25 year warranty from the manufacturer.
5. The contractor is required to be Sumitomo Electric Lightwave Authorized and Certified Contractor and have the staff technicians assigned to this project certified by Sumitomo for the products being installed. The contractor must also provide UAL with 25 year warranty from Sumitomo.
6. The contractor must submit documentation signed by the manufactures (Panduit, Leviton, & Sumitomo FutureFlex®) with the bid that states the contractor is authorized and certified in install their products.

7. The contractor shall have worked satisfactory for a minimum of five (5) years on systems of this type and size.
8. Upon request from UAL furnish a list of references with specific information regarding type of project and involvement in providing of equipment and systems.
9. The cabling contractor shall guarantee all of the installation work to be performed and materials to be furnished under this contract against defects in material and workmanship for the warranty period of said manufacturer from the date of final acceptance of the completed work by UAL. The cabling contractor shall, at their expense and without cost to UAL and within a reasonable time after receiving a written notice thereof, make good any defect in materials and/or workmanship of the installation which may develop during the guarantee period. Any associated damage to other items and/or finished surfaces caused by the defect shall also be corrected by the cabling contractor to the satisfaction of UAL and at no additional cost.
10. The contractor must submit shop drawings, product data, and samples. By doing so the contractor represents that he or she has carefully reviewed and verified materials, quantities, field measurements, and field construction criteria related thereto. It also represents that the cabling contractor has checked, coordinated, and verified that information contained within shop drawing, product data, and samples conform to the requirements of the work and of the contract documents.
11. All cabling is to be installed according to the latest EIA/TIA-568 & 569 standards and the latest BICSI proposed installation procedures as outlined in Telecommunications Distribution Methods Manual and Telecommunications Cabling Installation Manual.

B. Contractor Project Completion Requirements

1. Contractor responsibilities will not end with the installation and connection of various communications apparatus. The Contractor will provide personnel to properly adjust the various electrical devices, make the required tests etc., until such time as the entire cabling installation functions correctly in every detail. This will include, but is not limited to, the following:
 - b. Cables are to be tested after the installation is complete. If for any reason, a drop location raceway and/or faceplate are removed for additional work of any nature, the drop location is to be re-tested if previously tested. All cables associated with the drop location are to be re-tested. The cost of re-testing is the responsibility of the cabling contractor. Any cable that does not maintain integrity, continuity and polarity and therefore fails the test will be repaired or replaced as required.
 - c. Each test result shall indicate the cable number, test date and tester name. All test results are to be submitted to UAL via a CD and a summary report printed in a neat, clean and orderly nature within a folder. No hand written test results will be accepted by UAL.
 - d. Every cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA/EIA-568-B.2-10.
 - e. Every fiber optic cabling link in this project shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standards ANSI/TIA/EIA-568-C.1, "Commercial Building Telecommunications Cabling Standard, Part 1, General Requirements", additional guidelines for field testing length, loss & polarity of optical fiber cabling systems.
 - f. When Sumitomo's ABF solution has been installed the contractor shall pressure test each individual cell with-in the tube cable per Sumitomo's recommended procedure SP F-04-003- tube pressure testing procedure. The test shall be submitted to UAL on appropriate forms showing; test date, installer's name, tube cable ID, tube# (in) tube # (out), test pressure (PSI), and time held.

- g. When Sumitomo's ABF solution has been installed the contractor shall perform the obstruction test on each individual cell with-in the tube cable per Sumitomo's recommended procedure SP F-04-004- tube obstruction testing procedure. The test shall be submitted to UAL on appropriate forms showing; test date, installer's name, tube cable ID, tube# (in) tube # (out), span length, travel time, and PSI test rate.
- h. All test and certification documents shall be submitted to UAL's IT Critical Infrastructure Engineer for review and acceptance.

C. Contractor Warranty Requirements

- 1. All fiber and copper cable, connectors and connection specifications will be certified and guaranteed as per the manufacturers' warranty period. Where specific manufacturer warranties apply, contractors shall fulfill manufacturer's certification requirements. This period will commence from the date of work completion and customer acceptance.
- 2. Any equipment installed by the Contractor that fails to meet performance ratings that are specified will be removed and replaced by new equipment that meets all specified requirements, without additional cost to UAL.
- 3. The Contractor will keep their entire portion of the work in repair so far as defects in workmanship, apparatus, material and / or construction are concerned, for a minimum of one year up to and including the manufacturer's documented warranty period. This period will commence from the date of work completion and customer acceptance. Repairs of defective material, apparatus, workmanship and or construction will be performed in a timely manner to minimize user down time.

D. Contractor Work Effort Requirements

1. Housekeeping

- a. The Contractor shall, daily, at the completion of the work, remove and dispose of all rubbish, surplus materials, equipment, etc., and shall leave the site absolutely clean and in good order to the satisfaction of UAL.
- b. The Contractor shall take all necessary precautions and provide all necessary protection and enclosures to insure that dust and debris created as a result of the installation does not get out of the work area and into other parts of the building(s). If the cleanup is not acceptable, then UAL will have the option to hire a janitorial firm to properly clean the area and back charge the Contractor.
- c. The Contractor shall have on site a portable shop vacuum cleaner capable of cleaning up all debris and dust caused by the installation. All finished surfaces are to be kept clean of any installation debris and dust.
- d. The Contractor shall, at all times, keep the premises free from the accumulation of waste material and/or rubbish caused by their installation work. All waste material and/or rubbish shall be suitably and legally disposed of by the Contractor, at their expense, off of the project site.
- e. The areas of work are to be cleaned of any and all installation dust and debris at the end of each day's work. Drop cloths are to be used to protect all furniture from damage, and surfaces are to be cleaned to their existing conditions.
- f. UAL must approve the use of a dumpster on site prior to placement by the Contractor. The UAL disposal containers are not to be utilized without prior authorization.
- g. At the completion of the project, the Contractor shall:
 - i. Remove all their waste materials and rubbish from and about the installation site.
 - ii. Remove all their tools, installation equipment and surplus materials.
 - iii. Leave finished areas free of installation dust and non-finished areas broom clean.

2. Safety

- a. The Contractor is responsible for the safe passage of pedestrian traffic for the duration of the job. Any precautionary measures, necessary warning signs, etc., required to assist the Contractor in the performance of the work shall be at the Contractor's expense and provided for in their quoted price.
- b. The Contractor shall provide and maintain all suitable barriers to regulate access, to assure public safety and to protect the work in progress.

3. Material / Equipment Staging

- a. The Contractor will be responsible for coordinating with UAL for the delivery, acceptance, unloading and storage of their materials to the premises. The Contractor must comply with all project specific regulations regarding hours, method and location of material delivery.
- b. UAL will provide, within reason and at their discretion, adequate space for the Contractor to store a limited quantity of material and tools, but does not agree to provide space for the entire inventory of material and tools for the project. UAL will make attempts to provide secure storage but does not guarantee safety and security of stored material and tools.
- c. Contractor construction equipment and project material shall not be stored within active UAL telecommunication rooms.

4. Use Of The Site

- a. Use of the site shall be at UAL's direction in matters in which the UAL deems it necessary to place restriction.
- b. Access to building wherein the work is performed shall be as directed by UAL.
- c. Schedule necessary shutdowns of plant services with the owner, and obtain written permission from UAL.
- d. Contractor to perform work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the owner.

5. Continuity of Services

- a. Take no action that will interfere with or interrupt, existing building services unless previous arrangements have been made with a UAL representative. Contractor to arrange the work to minimize shutdown time.
- b. UAL personnel will perform shutdown of operating systems. The contractor shall give a minimum of seven (7) days' advance notice for systems shutdown.
- c. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.
- d. During the construction activity, there may be periods of time where installed equipment will be commissioned. As such there may also be periods of time where this will create minor inconveniences to the Contractor. The Contractor shall make every effort to continue working in the office building during the commissioning activities.

2.18 Requirements for Construction Hand Off to UAL IT

- A. TR/IDF room construction is to be complete prior to the installation of any UAL owned IT equipment. In not doing so, there is an inherent risk of premature electronics failure due to contamination of sensitive system boards and electronics. UAL-IT deems TR/IDF room construction is complete when the following criteria are met:
1. All construction work is to be 100% complete within the room. This includes but is not limited to all electrical power, grounding, fire alarm, HVAC, and architectural features. Plywood should be installed on indicated walls and painted, flooring installed, doors installed. Furthermore, construction in rooms adjacent to the TR/IDF room that may require access to the TR/IDF room should be complete as well. Contractors shall not be allowed in and out of the room once IT officially has keys.
 2. All firestopping and conduit sealing has been completed.
 3. The room shall be thoroughly cleaned including floors swept, mopped, waxed with anti-static wax, no debris on floors, all data racks and data cabinets must be free of dust. Plywood backboards should include fresh coat of paint, no scuff marks from construction. The room shall not include any storage of construction materials and no desk or other furniture unless depicted on the contract documents for IT use.
 4. The rooms shall be air conditioned with the room temperature between 64 degrees F to 75 degrees F with a relative humidity between 30% to 50% and positive pressure.
 5. Secure – Doors locked. Locks cored with the IT key used for the site.
 6. All communication cabling must be complete including installed, terminated, tagged, labeled and tested with test results approved. Any failed test results must be corrected before the room will be considered acceptable for move-in. The room will not be considered complete until United Critical Infrastructure approves the test results. All cables are to be labeled at both ends according to UA IT standards. Also note that this includes backbone cabling for UAL systems as well as Airport Authority Demarcations.
 7. Power is installed to all data racks, cabinets and other room equipment to United standards. (Includes local codes and manufacturer standards).
 8. Power – IDF/TR room is on permanent building power and power tests are complete including continuity, insulation resistance, etc. following div 16.
 9. As Builts are posted on the wall.
 10. All Telecommunication grounding is complete including Bus Bars, Bonding Conductors, equipment grounding conductors, labels and associated terminations and testing.
 11. All wall sleeves and conduits have bushings installed (grounded where required) and fire-sealed.
 12. All cabletray is properly installed, grounded and includes associated transitions and adapters.
 13. All equipment cabinets are labeled.
 14. All cables are properly installed, supported, neatly bundled and installed with appropriate strain relief.
 15. All spare equipment is installed.
 16. All patch cords are turned over to the owner.
- B. In the event that the IDF/TR rooms are complete prior to the construction efforts outside the LAN rooms, the following precautions should take place:
1. Vestibule built around the IDF/TR room door.
 2. Steps shall be taken to mitigate the infiltration of dust into the room through operation of HVAC systems.

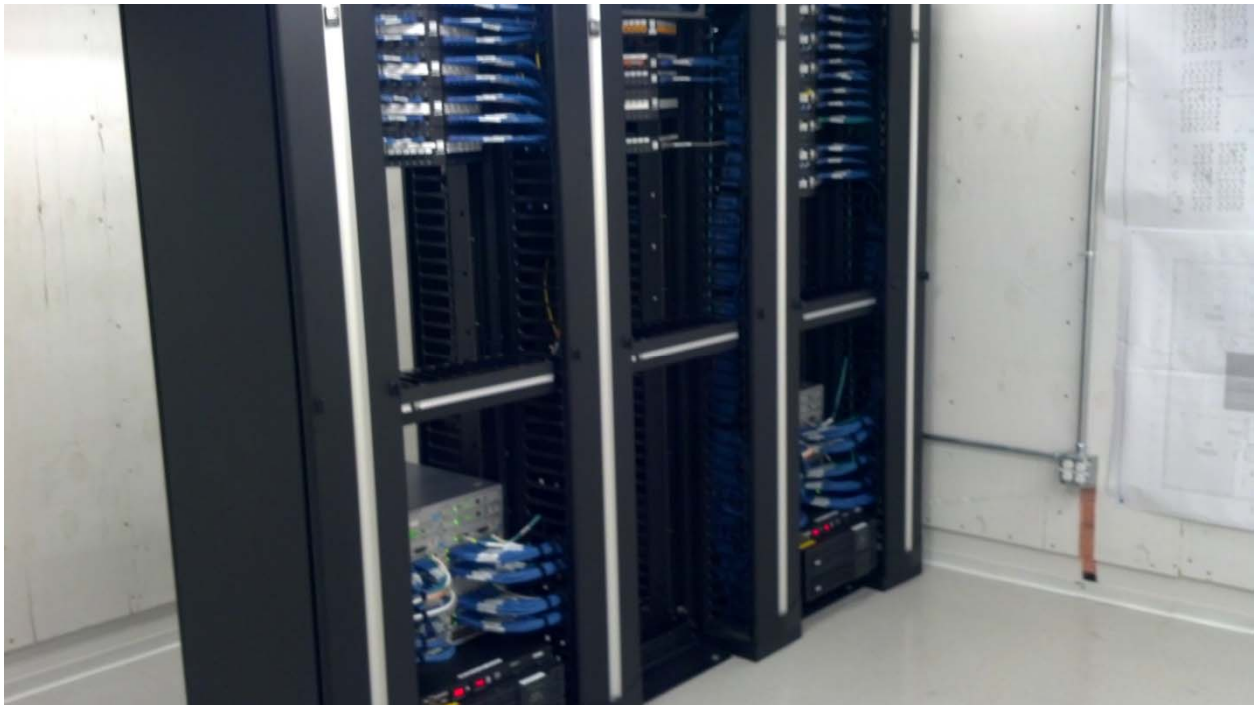
3. IDF/TR room floors cleaned daily
4. All people who enter the IDF/TR room will be required to wear booties over their shoes. Booties are to be provided by the contractor.
5. Tack paper shall be provided to step on once booties are donned.
6. Any electrical service work that may interrupt power and/or air conditioning within the IDF/TR room needs to be coordinated with United Critical Infrastructure.

- Example of IDF/TR Room that is **NOT** ready for Handoff to IT



- Note: This room is still considered under construction and not suitable for installation of sensitive and expensive IT equipment.

- Good Example of a Complete IDF/TR Room ready to be handed off to IT



C. Examples of Unacceptable conditions for IT installation in Customer Areas

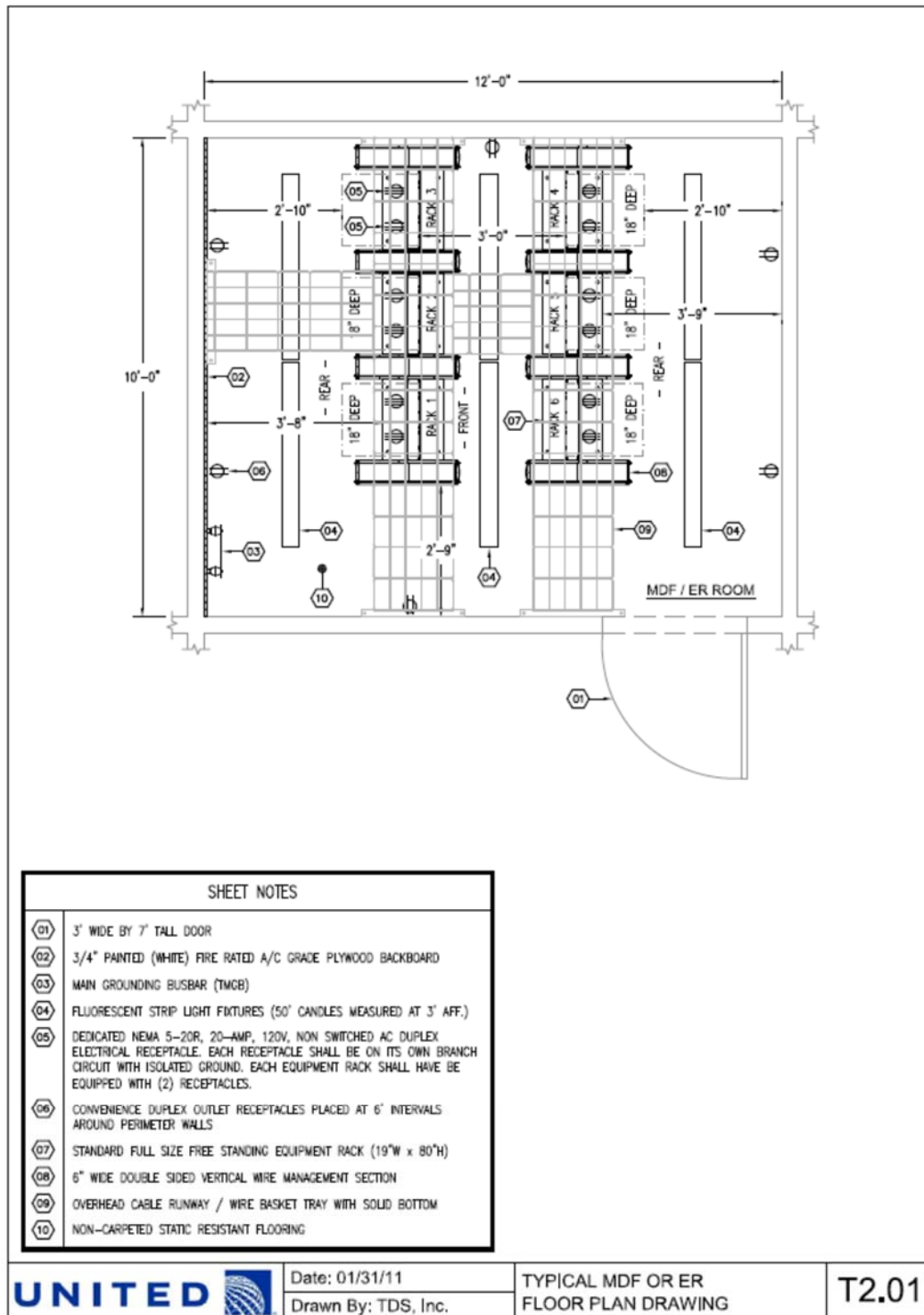
1. All millwork and desks must be permanently installed prior to IT installation of computers, monitors, printers, phones, etc. There are multiple IT teams that are responsible for the installation. If millwork, desks, or construction are not complete, this delays the deployment and is more costly.
2. IT resources are scheduled for the dates of deployment. Delays due to millwork will impact schedules for other deployments and/or resources will not be readily available to complete the work.



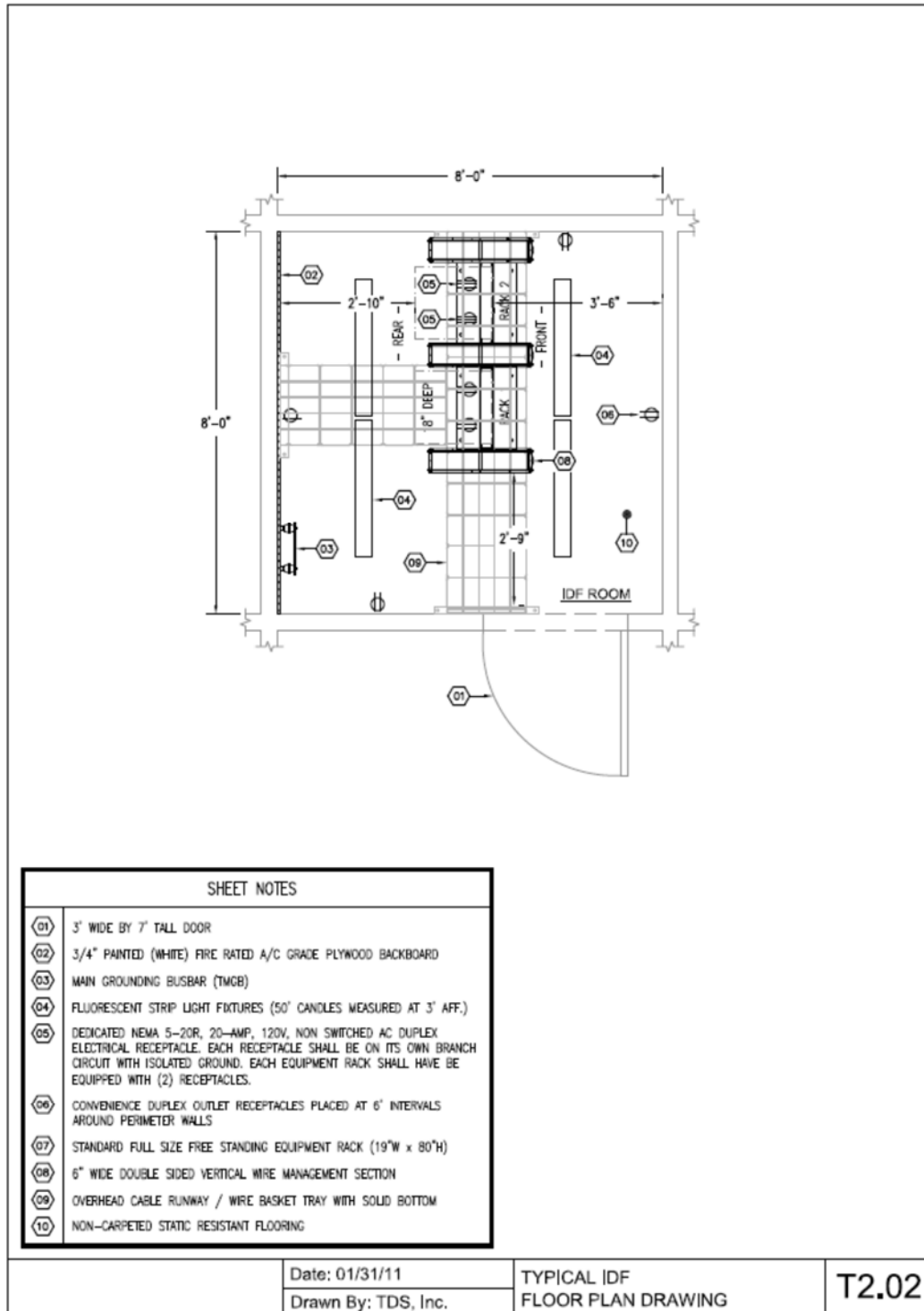
2.19 Appendix A - Telecom Room Support Drawings

- A. Typical ER/MDF Floor Plan Drawing (T2.01)
- B. Typical TR/LAN Floor Plan Drawing (T2.02)
- C. Typical TR/LAN-Light Room Floor Plan Drawing (T2.03)
- D. Typical TR/LAN-Light Closet Floor Plan Drawing (T2.04)

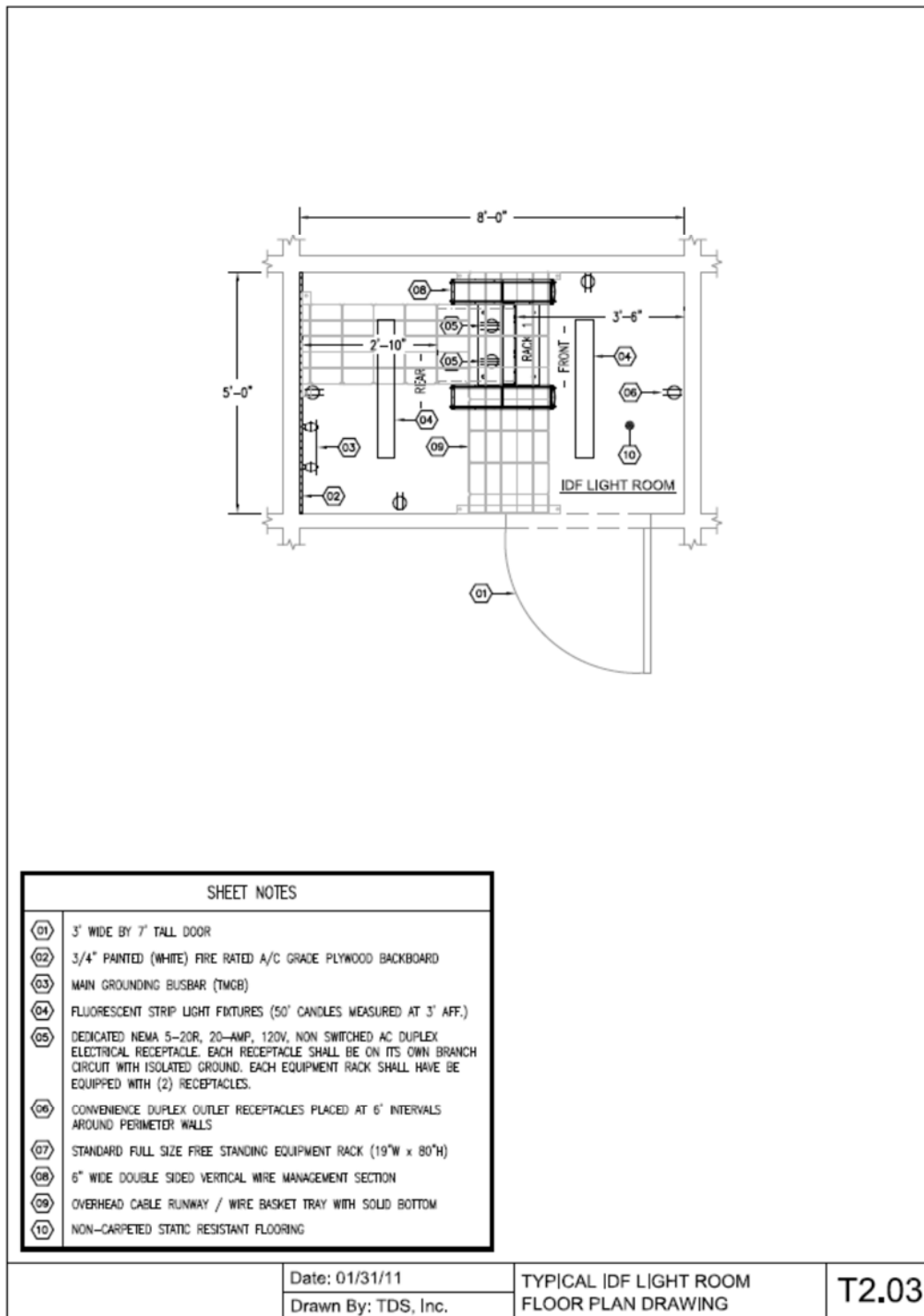
1. Typical ER/MDF Floor Plan Drawing (T2.01)



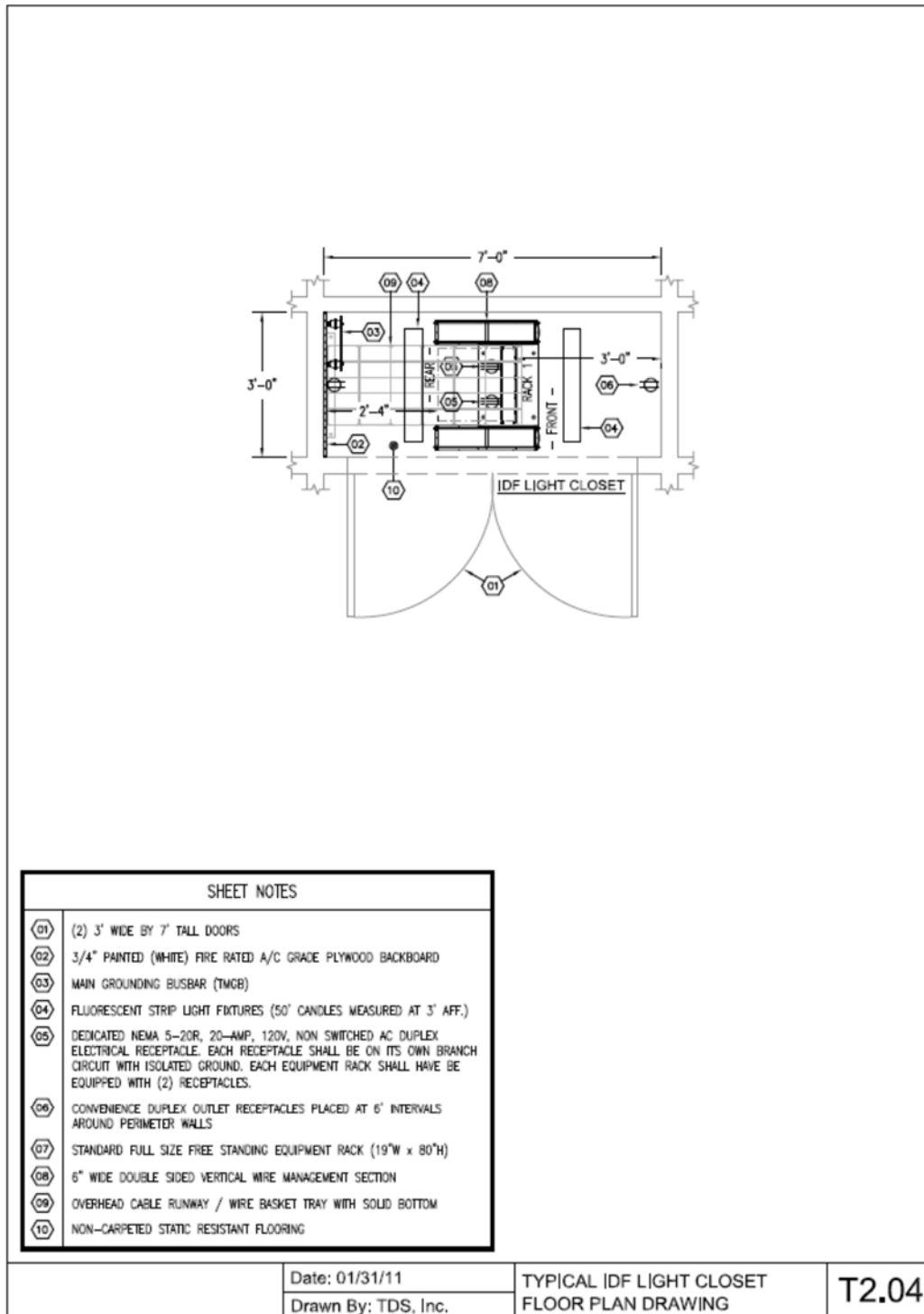
2. Typical TR/LAN Floor Plan Drawing (T2.02)



3. Typical TR/LAN-Light Room Floor Plan Drawing (T2.03)



4. Typical TR/LAN-Light Closet Floor Plan Drawing (T2.04)



2.20 Appendix B - Telecom Room Support Photos

A. Typical TR/LAN ROOM Equipment Rack layouts/Details

1. Room View Rack Elevation: (Example - Figure 1)



Figure 1

2. Enlarged Rack Elevation: (Example - Figure 2)



Figure 2

3. Enlarged Rack Elevation: (Cable Management Routing Example - Figure 3)

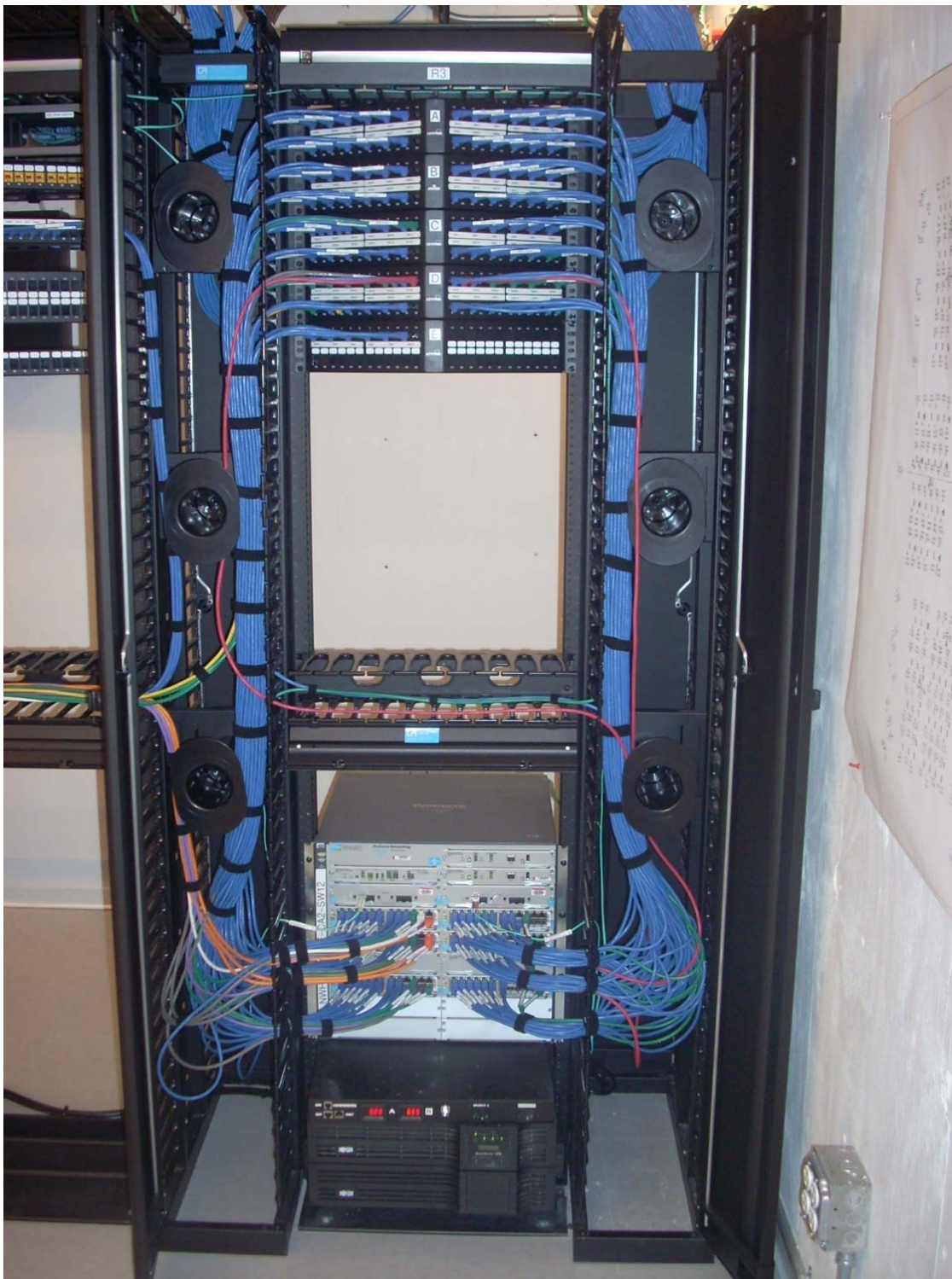


Figure 3

4. Enlarged Rack Elevation: (Patch Panel Labeling Example - Figure 4)

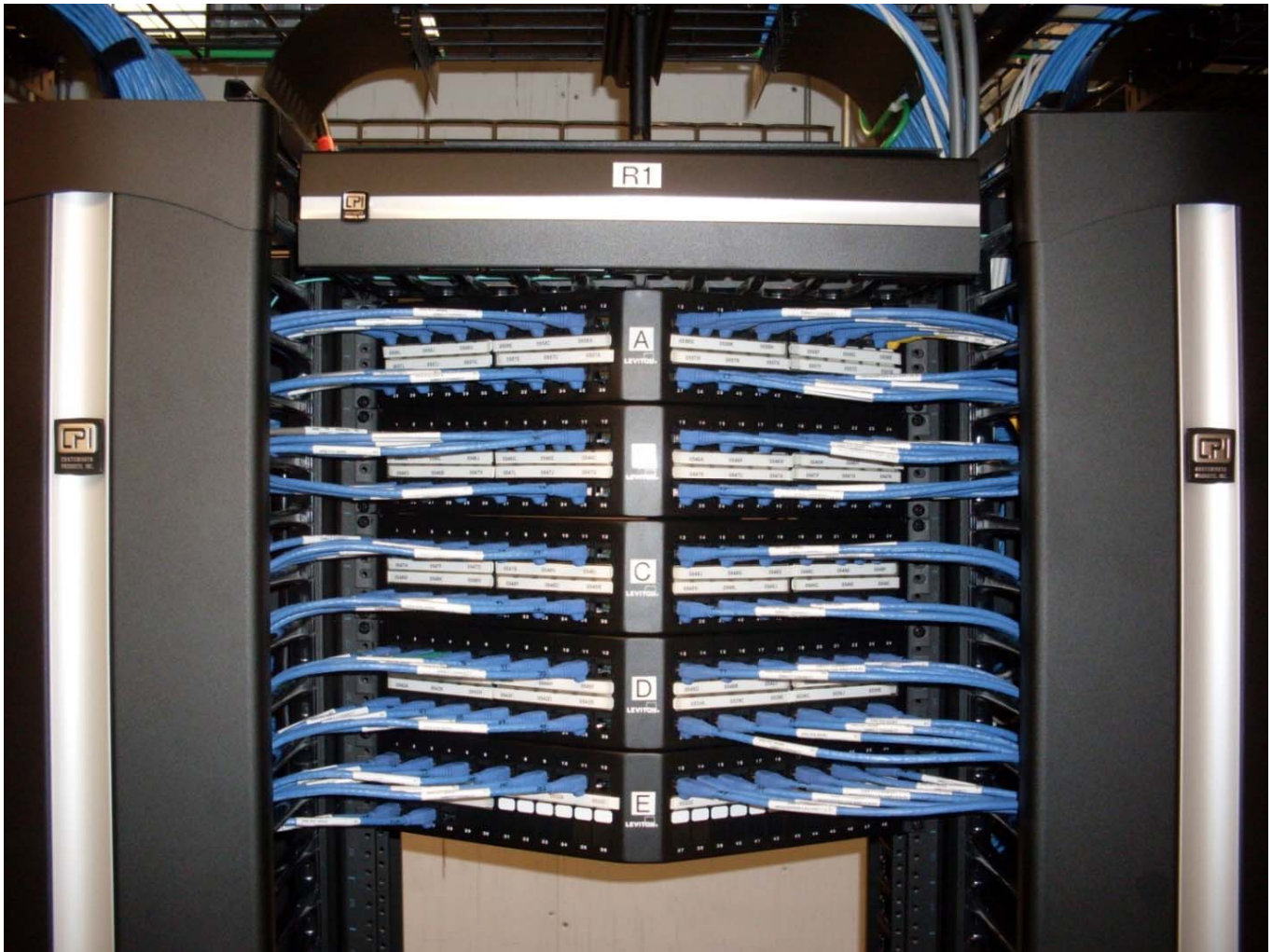


Figure 4

5. Enlarged Rack Elevation: (Patch Panel & Patch Cord Labeling Example - Figure 5)



Figure 5

6. Enlarged Rack Elevation: (Back of Patch Panel Cable Routing Example - Figure 6)



Figure 6

7. Telecommunications Grounding Busbar: (TGB Example - Figure 7)



Figure 7

8. Grounding / Bonding: (Equipment Rack Grounding Example - Figure 8)



Figure 8

9. Grounding / Bonding: (Equipment Rack Network Electronics Grounding Example - Figure 9)



Figure 9

10. Grounding / Bonding: (Overhead Cable Tray Grounding Example - Figure 10)



Figure 10

11. Equipment Rack Network Electronics: (Redundant Power Supply Example - Figure 11)



Figure 11

Note: The male ends of the power cords for the HP ProCurve's & Cisco 3750X needs to be C-15.

12. Sumitomo Air-Blown Fiber Optic Distribution: (TDU Example - Figure 12)



Figure 12

13. Equipment Rack Power: (Power Receptacle Example - Figure 13)



Figure 13

Note: Equipment Rack power outlets shall be installed on back side of equipment rack on the outside vertical section of the overhead wire mesh cable tray.

14. Equipment Rack Power: (Power Receptacle Example - Figure 14)



Figure 14

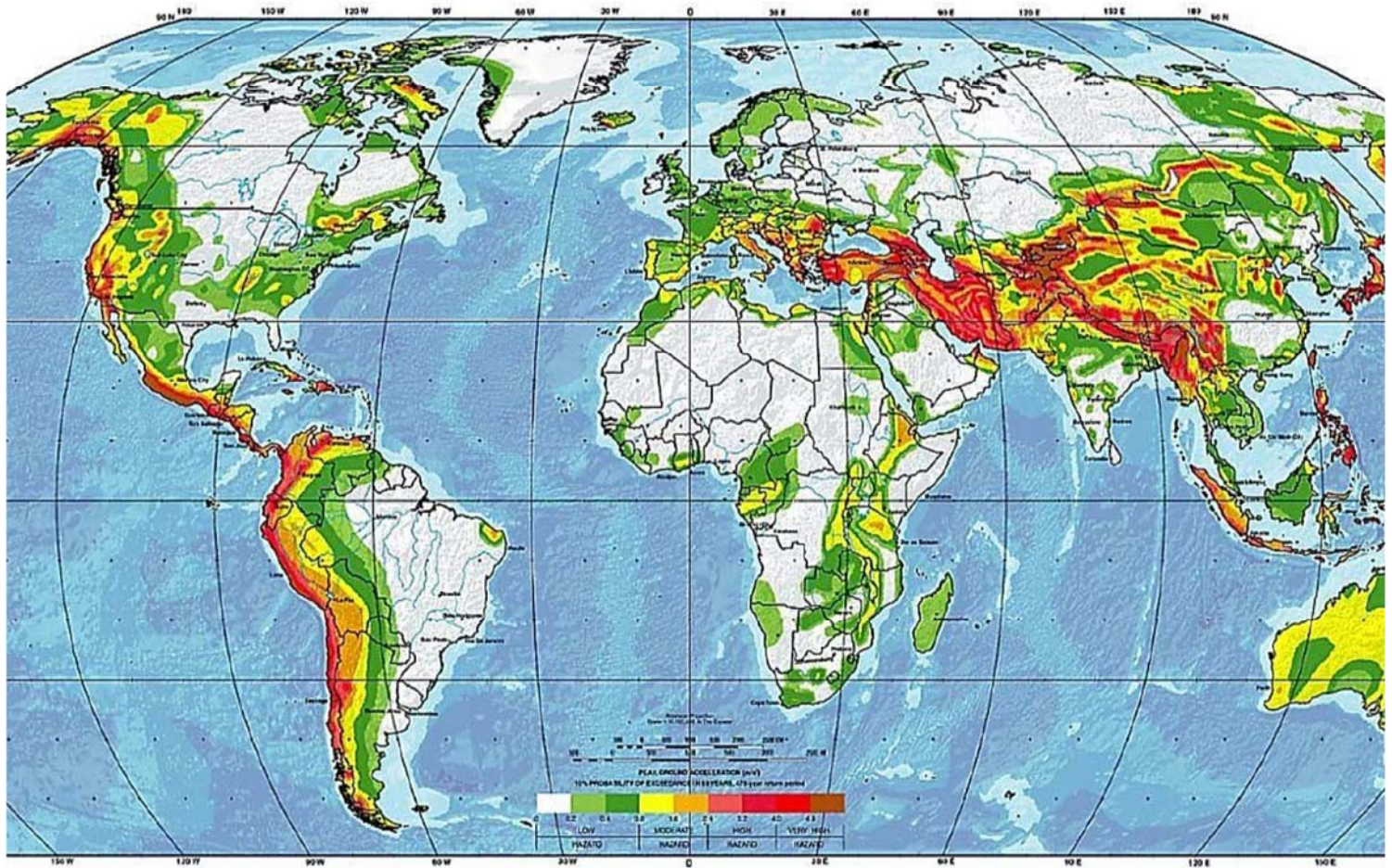
Note: Equipment Rack power outlets shall be labeled with power panel and circuit identification.

2.21 Appendix C - Seismic Zone Maps

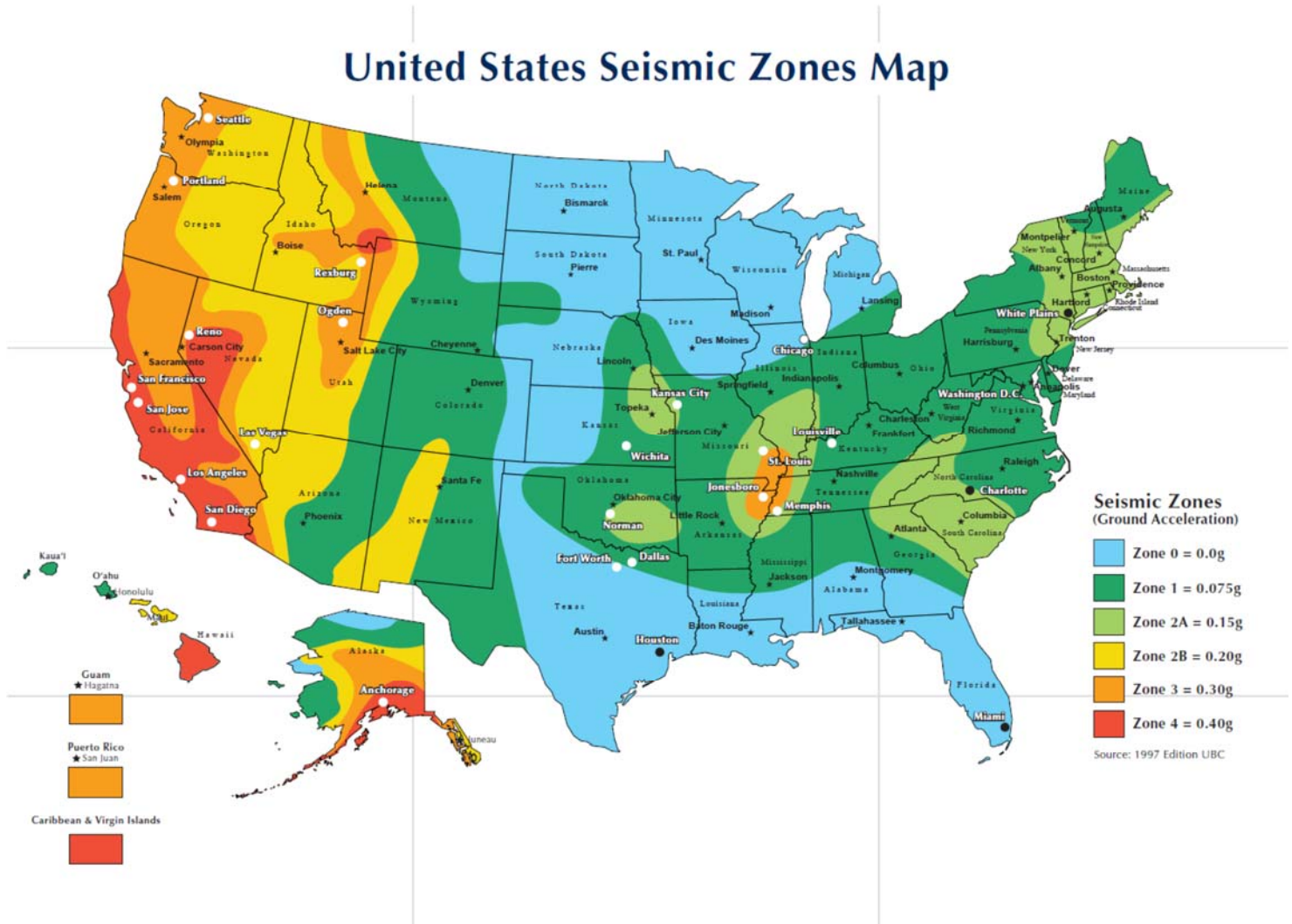
A. Global Seismic Hazard Map

GLOBAL SEISMIC HAZARD MAP

Produced by the Global Seismic Hazard Assessment Program (GSHAP),
a demonstration project of the UN/International Decade of Natural Disaster Reduction, conducted by the International Lithosphere Program.
Global map assembled by D. Giardini, G. Grötnah, K. Shedlock, and P. Zhang
1999



B. United States Seismic Hazard Map



PART 3. ELECTRONIC SECURITY SYSTEM

3.01 Overview

- A. This document describes the United Airlines (UAL) standards, specifications and requirements for the Electronic Security System (ESS) as a part of UAL Critical Facilities Services (CFS). All UAL ESS installations within Airports, Reservation Centers and Business Facilities are part of the UAL Critical IT infrastructure and are governed by the standards as defined in this document. Within the standards and specifications detailed in this document, there are varying requirements for different facilities based on the criticality of the operation at the facility. This document is intended to address design requirements of pathways and cabling necessary to support access control, intrusion detection, and video surveillance systems required for new and renovated facilities. This document will establish an implementation concept that can be used to shape architectural templates and influence the design process for electronic security systems. It will identify proven infrastructure construction techniques, define common practices, and serve as an authoritative implementation guide.
- B. The security access control and video surveillance systems specified in this section consist of individual, but integrated systems. These include access control, intrusion detection, and video surveillance, system management and recording.
- C. Twenty-four hours a day, seven days a week monitoring/recording will be enabled for onsite and offsite monitoring.
- D. The access control system will limit and control access into and within UAL's grounds and facility. From a secure workstation, the system will allow personnel to retrieve recorded events as well as monitor live events, in order to investigate possible theft, damage, and destruction of the facility.
- E. The surveillance system will monitor and record activity in and around United's facility. From a secure workstation, the system will allow personnel to retrieve recorded video as well as monitor live events, in order to investigate possible theft, damage, and destruction of the facility.

3.02 Glossary

- A. **As-Built:** Documentation that indicates cable routing, connections, systems, and blueprint attributes upon job completion that reflects changes from the planned to the finished state.
- B. **ACS:** Access Control System.
- C. **CM:** Construction Manager.
- D. **C.C.:** The communications cabling installation contractor.
- E. **CCTV:** Closed-circuit television.
- F. **Central Station:** A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.
- G. **Controller:** An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.
- H. **CPU:** Central processing unit.
- I. **Credential:** Data assigned to an entity and used to identify that entity.
- J. **E.C.:** The electrical installation contractor.
- K. **File Server:** A PC in a network that stores the programs and data files shared by users.
- L. **G.C.:** The general contractor.
- M. **GFI:** Ground fault interrupter.

- N. **Identifier:** A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- O. **I/O:** Input/Output.
- P. **LAN:** Local area network.
- Q. **LED:** Light-emitting diode.
- R. **Location:** A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with network communications. Where this term is presented with an initial capital letter, this definition applies.
- S. **PC:** Personal computer. This acronym applies to the Central Station, workstations, and file servers.
- T. **PCI Bus:** Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).
- U. **PDF:** (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.
- V. **PIR:** Passive Infrared.
- W. **RF:** Radio frequency.
- X. **ROM:** Read-only memory. ROM data are maintained through losses of power.
- Y. **RS-232:** An TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.
- Z. **RS-485:** An TIA/EIA standard for multipoint communications.
- AA. **S.C.:** The Security installation contractor.
- BB. **TCP/IP:** Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- CC. **UPS:** Uninterruptible power supply.
- DD. **VSS:** Video Surveillance System.
- EE. **WAN:** Wide area network.
- FF. **WAV:** The digital audio format used in Microsoft Windows.
- GG. **Wiegand:** Patented magnetic principle that uses specially treated wires embedded in the credential card.
- HH. **Windows:** Operating system by Microsoft Corporation.
- II. **Workstation:** A PC with software that is configured for specific limited security system functions.
- JJ. **WYSIWYG:** (What You See Is What You Get.) Text and graphics appear on the screen the same as they will print.
- KK. **Owner:** United Air Lines.
- LL. **Project Documents:** All documents that pertain to the project, including, but not limited to, project drawings and these Specifications.
- MM. **Specifications:** This document, which outlines general installation requirements.
- NN. **TR:** Telecommunications Room

3.03 References

- A. The systems shall conform to the following codes, standards and guidelines. Where standards and publications are identified, they shall be the most current version.
 1. United Airlines Critical IT Infrastructure –latest edition.
 2. Federal Communications Commission (FCC) Publications:
 - a. 47 CFR PART 15 Radio Frequency Devices
 - b. 47 CFR PART 68 Connection Of Terminal Equipment To The Telephone Network
 - c. 47 CFR PART 90 Private Land Mobile Radio Services
 3. American National Standards Institute (ANSI) Publications:
 4. National Electrical Safety Code
 5. American Society For Testing And Materials (ASTM) Publications
 6. F 967-87 Standard Practice For Security Engineering Symbols
 7. Institute Of Electrical And Electronics Engineers (Ieee) Publications:
 8. IEEE 829 Software Test Documentation
 9. International Building Code (IBC)
 10. National Fire Protection Association (NFPA) Publications:
 11. National Electrical Code
 12. Standard For Electrical Safety Requirements For Employee Workplaces
 13. Life Safety Code
 14. National Electrical Manufacturers Association (NEMA) Publications:
 - a. 1CSZ-83 Industrial Control Devices And Assemblies
 - b. 1CS-6 Enclosures For Industrial Controls And Systems
 - c. 1CSG-83 Enclosures For Industrial Controls And Systems
 - d. 250 Enclosures For Electrical Equipment
 15. Underwriters Laboratories, Inc., Standard For Safety: all applicable, to include, but not limited to;
 - a. UL 294 Standard For Access Control System Units
 - b. UL 639 Standard For Intrusion Detection Units
 - c. UL 827 Standard For Central-Station Alarm Services
 - d. UL 983 Standard For Surveillance Camera Units
 - e. UL 1076 Standard For Proprietary Burglar Alarm Units And Systems
 - f. UL 1635 Standard For Digital Alarm Communications System Units
 - g. UL 1778 Standard For Uninterruptible Power Supply Equipment
 - h. UL 1981 Standard For Central-Station Automation Systems
 - i. UL 3044 Standard For Surveillance Closed Circuit Television Equipment
 16. Specified manufacturer's design and installation guidelines.

17. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully parts of the specifications as if herein repeated or hereto attached. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the owner's representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

3.04 Electronic Access Control

A. System Overview

1. An acceptable building access control system encompasses: access control software, servers, client software, electric lock, card readers, balanced magnetic switch, request-to-exit devices, door controller panel, input module, cabling, and labeling to limit access into and within the owner's facility or space.

B. Access Control Software and Database

1. The access control system will utilize UALs existing access control software and database installed on a remote server.
2. The security contractor shall furnish and install additional license(s) for the site as required.
 - Lenel: OnGuard Pro.
3. Access Control Client Software
 - The security contractor shall furnish and install the quantity of client license(s) per UAL direction on UAL provided workstations.
 - Typical "Electronically Monitored" Access Portal

C. Typical "Electronically Monitored" access portal:

1. Request-to-Exit (REX) Back Box
 - Furnished and installed by electrical contractor.
 - The REX back box shall be mounted on the secure side above the door.
 - REX back box shall be a single gang 2" by 4" by 2-1/4" (51 mm x 102 mm x 57 mm), electrical box recess mounted, equipped with a single gang trim ring.
 - Coordinate exact location with security contractor.
2. Rex PIR Sensor
 - Furnished and installed by security contractor.
 - The Passive Infrared (PIR) REX Sensor shall be installed in the REX back box.
 - Approved manufacturers:
 - i. Bosch # DS160.

3. Door Contact

- Furnished and installed by security contractor.
- A flush mounted recessed door contact shall be installed at the top of the door frame.
- A surface mounted door contact shall be installed at the top of the door frame for wide gap applications.
- Approved manufacturers:
 - i. Flush mount: GE # 1078
 - ii. Wide gap surface mount: GE # 2500

4. Input Panel

- A door controller panel shall be associated with the access control devices and mounted within the panel enclosure.
- Approved manufacturers:
 - i. Lenel # LNL-1110 Series 2

5. Panel Enclosure, Power Supply & Charger

- The panel enclosure shall be wall mounted in the area serving TR.
- The panel shall be keyed and monitored with a contact closure.
- Approved manufacturers:
 - i. Lenel # LNL-AL400ULX
 - ii. Lenel # LNL-AL600ULX-4CB6

6. Door Controller LAN Interface Cable

- Furnished and installed by communications contractor.
- As described in the Critical IT Structured Cabling System.

7. PIR Rex Cable

- Furnished and installed by security contractor.
- 1 pair, twisted, no. 22 AWG, stranded (19x30) tinned copper conductors.
- Unshielded.
- Plenum-rated: NFPA 70, type CMP.
- Standard Cable: NFPA 70, Type CM.

8. Door Contact Cable

- Furnished and installed by security contractor.
- 1 pair, twisted, no. 22 AWG, stranded (19x30) tinned copper conductors.
- Unshielded.
- Plenum-rated: NFPA 70, type CMP.
- Standard Cable: NFPA 70, Type CM.

9. Pathways

- Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- Cabling routed through exposed areas are to be routed within enclosed raceway.
- Enclosed Wiring Method:
 - i. Furnished and installed by electrical contractor.
 - ii. Install manufactured conduit sweeps and long-radius elbows whenever possible.
 - iii. 3/4-inch (min) EMT conduit shall be routed from each device to the control panel enclosure.
- Unenclosed Wiring Method:
 - i. Furnished and installed by security contractor.
 - ii. Support brackets with cable tie slots for fastening cable ties to brackets.
 - iii. Lacing bars, spools, J-hooks, and D-rings.
 - iv. Straps and other devices.

10. Installation of Conductors And Cables

- Comply with NECA 1, "Good Workmanship in Electrical Contracting."
- Comply with TIA/EIA-568-B.1.
- Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
- Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
- Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
- Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- Install end-of-line resistors at the field device location and not at the Controller or panel location

D. Typical "Card Reader" Access Controlled Portal

1. Electric Lock

- Furnished and installed by the door hardware contractor.
- Unless otherwise approved by UAL IT, electric strike or lockset shall have the maximum current draw limited to 650mA at 12V DC and wired hinge as required.
- If approved by UAL IT, electric locks over 12V DC shall be powered via power distribution module as described in paragraph B.

2. Power Supply/Charger

- Furnished and installed by security contractor.
- Wall mounted in the Telecommunications Room (TR).
- 120V AC circuit shall be wall mounted in the approximate location of the panel.
- 120V AC circuit shall be connected to the TR power panel. If the TR power panel is not on UPS power the panel shall include an internal back-up battery.
- A fire alarm relay shall be wall mounted in the approximate location of the panel.
 - i. Approved manufacturers:
 - Altronix # AL1024ULACM.

3. Reader Box Back Box

- Furnished and installed by electrical contractor.
- Wall mounted 44" AFF on the unsecure side and within 36-inches of the door.
- Card Reader back box shall be a double gang 1900 electrical box of at least 2-1/8" (54 mm) depth, wall recessed mounted, equipped with a single gang trim ring.

4. Card Reader.

- Furnished and installed by security contractor.
- The card reader shall be installed in the reader back box.
 - i. Approved manufacturers:
 - HID # RP40.

5. Request-to-Exit (REX) Back Box

- Furnished and installed by electrical contractor.
- The REX back box shall be mounted on the secure side above the door.
- REX back box shall be a single gang 2" by 4" by 2-1/4" (51 mm x 102 mm x 57 mm), electrical box recess mounted, equipped with a single gang trim ring.
- Coordinate exact location with security contractor.

6. Rex PIR Sensor

- Furnished and installed by security contractor.
- The Passive Infrared (PIR) REX Sensor shall be installed in the REX back box.
 - i. Approved manufacturers:
 - Bosch # DS160.

7. Door Contact

- Furnished and installed by security contractor.
- A flush mounted recessed door contact shall be installed at the top of the door frame.
- A surface mounted door contact shall be installed at the top of the door frame for wide gap applications.
 - i. Approved manufacturers:
 - Flush mount: GE # 1078
 - Wide gap surface mount: GE # 2500

8. Door Controller Panel – PoE

- Furnished and installed by security contractor.
- The power-over-ethernet (PoE) door controller panel shall be associated with the access control devices and mounted within the panel enclosure.
 - i. Approved manufacturers:
 - Lenel # LNL2210.

9. Door Controller Panel Enclosure

- Furnished and installed by electrical contractor.
- The panel enclosure shall be located on the secure side in the ceiling space, plenum rated as required, above the access controlled door within the facility.
- The panel cover shall be security screws and monitored with a contact closure.

10. Door Controller LAN Interface Cable

- Furnished and installed by communications contractor.
- As described in the Critical IT Structured Cabling System.

11. Reader Cable

- Furnished and installed by security contractor.
- Multi-conductor, no. 20 AWG, stranded (7x28) tinned copper conductors, overall aluminum foil-polyester tape shield with 100 percent shield coverage plus tinned copper braid shield with 85 percent shield coverage, and jacket.
- Plenum-rated: NFPA 70, type CMP.
- Standard Cable: NFPA 70, Type CM.

12. Low-Voltage Lock Control Cable

- Furnished and installed by security contractor.
- 1 pair, twisted, no. 16 AWG, stranded (19x30) tinned copper conductors.
- Plenum-rated: NFPA 70, type CMP.
- Standard Cable: NFPA 70, Type CM.
- If approved by UAL, 24vdc power cabling shall be routed to the power distribution module as noted in paragraph A, line 2.

13. PIR Rex Cable

- Furnished and installed by security contractor.
- 1 pair, twisted, no. 22 AWG, stranded (19x30) tinned copper conductors.
- Unshielded.
- Plenum-rated: NFPA 70, type CMP.
- Standard Cable: NFPA 70, Type CM.

14. Door Contact Cable

- Furnished and installed by security contractor.
- 1 pair, twisted, no. 22 AWG, stranded (19x30) tinned copper conductors.
- Unshielded.
- Plenum-rated: NFPA 70, type CMP.
- Standard Cable: NFPA 70, Type CM.

15. Pathways

- Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
- Cabling routed through exposed areas are to be routed within enclosed raceway.
- Enclosed Wiring Method:
 - i. Furnished and installed by electrical contractor.
 - ii. Install manufactured conduit sweeps and long-radius elbows whenever possible.
 - iii. 3/4-inch (min) EMT conduit shall be routed from each device to the control panel enclosure.
- Unenclosed Wiring Method:
 - i. Furnished and installed by security contractor.
 - ii. Support brackets with cable tie slots for fastening cable ties to brackets.
 - iii. Lacing bars, spools, J-hooks, and D-rings.
 - iv. Straps and other devices.

16. Installation of Conductors And Cables

- Comply with NECA 1, "Good Workmanship in Electrical Contracting."
- Comply with TIA/EIA-568-B.1.
- Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
- Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
- Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

- Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
- Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- Install end-of-line resistors at the field device location and not at the Controller or panel location.

E. Typical "Biometric Reader" Access Controlled Portal

1. Electric Lock
2. Furnished and installed by the door hardware contractor.
3. 24 VDC electric strike or lockset and wired hinge as required.
4. Powered via power distribution module as described in paragraph B.

F. Power Supply/Charger

1. Furnished and installed by security contractor.
2. Wall mounted in the Telecommunications Room (TR).
3. 120V AC circuit shall be wall mounted in the approximate location of the panel.
4. 120V AC circuit shall be connected to the TR power panel. If the TR power panel is not on UPS power the panel shall include an internal back-up battery.
5. A fire alarm relay shall be wall mounted in the approximate location of the panel.
6. Approved manufacturers:
 - Altronix # AL1024ULACM.

G. Reader Back Box

1. Furnished and installed by electrical contractor.
2. Wall mounted 44" AFF on the unsecure side and within 36-inches of the door.
3. Card Reader back box shall be a double gang 1900 electrical box of at least 2-1/8" (54 mm) depth, wall recessed mounted, equipped with a single gang trim ring.

H. Card Reader/Keypad.

1. Furnished and installed by security contractor.
2. The card reader with integrated keypad shall be installed in the reader back box.
3. Approved manufacturers:
 - HID # RPK40.

I. Biometric Reader Back Box

1. Furnished and installed by electrical contractor.
2. The Biometric Reader back box shall be a double gang 1900 electrical box of at least 2-1/8" (54 mm) depth, wall recessed mounted, equipped with a double gang trim ring.
3. Wall mounted 44" AFF on the unsecure side, within 36-inches of the door, and within 12" to the left of the card reader.

J. Biometric Reader.

1. A finger print biometric reader with recessed trim ring shall be installed in the bio-reader back box.
2. Approved manufacturers:
 - L-1 # V-Flex 4G.

K. Request-to-Exit (REX) Back Box

1. Furnished and installed by electrical contractor.
2. The REX back box shall be mounted on the secure side above the door.
3. REX back box shall be a single gang 2" by 4" by 2-1/4" (51 mm x 102 mm x 57 mm), electrical box recess mounted, equipped with a single gang trim ring.

L. PIR REX Sensor

1. Furnished and installed by security contractor.
2. The Passive Infrared (PIR) REX Sensor shall be installed in the REX back box.
3. Approved manufacturers:
 - Bosch # DS160.

M. Door Contact

1. Furnished and installed by security contractor.
2. A flush mounted recessed door contact shall be installed at the top of the door frame.
3. A surface mounted door contact shall be installed at the top of the door frame for wide gap applications.
4. Approved manufacturers:
 - Flush mount: GE # 1078.
 - Wide gap surface mount: GE # 2500.

N. Door Controller Panel

1. A door controller panel shall be associated with the access control devices and mounted within the panel enclosure.
2. Approved manufacturers:
 - Lenel # LNL3300.

O. Panel Enclosure, Power Supply & Charger

1. The panel enclosure shall be wall mounted in the area serving TR.
2. The panel shall be keyed and monitored with a contact closure.
3. Approved manufacturers:
 - Lenel # LNL-AL400ULX
 - Lenel # LNL-AL600ULX-4CB6

P. Door Controller LAN Interface Cable

1. Furnished and installed by communications contractor.
2. As described in the Critical IT Structured Cabling System.

Q. Reader Cable

1. Furnished and installed by security contractor.
2. Multi-conductor, no. 20 AWG, stranded (7x28) tinned copper conductors, overall aluminum foil-polyester tape shield with 100 percent shield coverage plus tinned copper braid shield with 85 percent shield coverage, and jacket.
3. Plenum-rated: NFPA 70, type CMP.
4. Standard Cable: NFPA 70, Type CM.

R. Low-Voltage Lock Control Cable

1. Furnished and installed by security contractor.
2. 1 pair, twisted, no. 16 AWG, stranded (19x30) tinned copper conductors.
3. Plenum-rated: NFPA 70, type CMP.
4. Standard Cable: NFPA 70, Type CM
5. .If approved by UAL, 24vdc power cabling shall be routed to the power distribution module as noted in paragraph A, line 2.

S. PIR Rex Cable

1. Furnished and installed by security contractor.
2. 1 pair, twisted, no. 22 AWG, stranded (19x30) tinned copper conductors.
3. Unshielded.
4. Plenum-rated: NFPA 70, type CMP.
5. Standard Cable: NFPA 70, Type CM.

T. Door Contact Cable

1. Furnished and installed by security contractor.
2. 1 pair, twisted, no. 22 AWG, stranded (19x30) tinned copper conductors.
3. Unshielded.
4. Plenum-rated: NFPA 70, type CMP.
5. Standard Cable: NFPA 70, Type CM.

U. Pathways

1. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
2. Cabling routed through exposed areas are to be routed within enclosed raceway.
3. Enclosed Wiring Method:
 - Furnished and installed by electrical contractor.
 - Install manufactured conduit sweeps and long-radius elbows whenever possible.
 - 3/4-inch (min) EMT conduit shall be routed from each device to the control panel enclosure.
4. Unenclosed Wiring Method:
 - Furnished and installed by security contractor.
 - Support brackets with cable tie slots for fastening cable ties to brackets.
 - Lacing bars, spools, J-hooks, and D-rings.
 - Straps and other devices.

V. Installation of Conductors And Cables

1. Comply with NECA 1, "Good Workmanship in Electrical Contracting."
2. Comply with TIA/EIA-568-B.1.
3. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Install end-of-line resistors at the field device location and not at the Controller or panel location.

3.05 Video Surveillance Cameras

A. System Overview

1. An acceptable building video surveillance system encompasses: video management software, video management client software and licenses, video servers, video storage, camera licenses, cameras, cabling, and labeling.

B. Video Management Software

1. The system will utilize security video management software installed on a local server furnished and installed by UAL.
2. The security contractor shall furnish and install camera license(s) for the site as required.
 - Approved manufacturers:
 - i. Lenel: SkyPoint.
 - ii. Lenel: Prism.
 - iii. Genetec.

C. Video Storage

1. The security video management system will utilize video storage SAN furnished and installed by UAL.
2. Video Management Client Software
3. The security contractor shall furnish and install the quantity of client license(s) per UAL direction on UAL provided workstations.

D. Exterior Fixed Camera

1. The following requirements pertain to a typical exterior pole mounted fixed camera:

E. Enclosure Panel

1. An enclosure panel shall be associated with each camera that cannot be reached within a 90-meter cable distance of the TR/IDF/MDF or network switching device.
2. The panel shall contain 120VAC power, 6-strand fiber module, fiber-ethernet media convertor, and PoE mid-span power injector.

F. Camera Mount

1. A pole, parapet, or wall mount gooseneck camera mount shall be provided with each camera location.

G. Camera

1. A fixed & PTZ exterior rated PoE 3-megapixel IP camera with heater and blower shall be provided.
 - Approved manufacturers:
 - i. Axis # P3346-VE (fixed)
 - ii. Axis # Q6034-E (PTZ)

H. Device Cable

1. Cameras shall be cabled with (1) 6-strand 50 micro multimode fiber optic cabling.
2. All camera cabling shall be routed to the nearest TR/IDF/MDF. The camera shall be connected to UAL's security network.

I. Pathways

1. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
2. Cabling routed through exposed areas are to be routed within enclosed raceway.
3. Enclosed Wiring Method:
 - Furnished and installed by electrical contractor
 - Install manufactured conduit sweeps and long-radius elbows whenever possible.
 - 3/4-inch (min) EMT conduit shall be routed from each device to the control panel enclosure.
4. Unenclosed Wiring Method:
 - Furnished and installed by security contractor.
 - Support brackets with cable tie slots for fastening cable ties to brackets.
 - Lacing bars, spools, J-hooks, and D-rings.
 - Straps and other devices.

J. Installation of Conductors And Cables

1. Comply with NECA 1, "Good Workmanship in Electrical Contracting."
2. Comply with TIA/EIA-568-B.1.
3. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

K. Typical Interior Ceiling or Wall Mounted Fixed Camera

1. The following requirements pertain to a typical interior ceiling or wall mounted fixed camera:
 - The cameras shall provide video surveillance coverage of the building interior and exterior doors and passageways at access controlled portals.
2. Camera Back Box
 - The camera shall be provided with a plenum rated back box where required.
3. Camera Mount
 - A recessed ceiling mount trim shall be provided with each camera location.
4. Camera
 - A fixed interior rated PoE 1.3-megapixel IP camera shall be provided.
 - i. Approved manufacturers:
 - Axis # P3354.
5. Device Cable
 - Cameras shall be cabled with Cat-6 UTP data cabling.
 - All camera cabling shall be routed to the nearest TR/IDF/MDF. The camera shall be connected to UAL's security network.

L. Pathways

1. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.
2. Cabling routed through exposed areas are to be routed within enclosed raceway.
3. Enclosed Wiring Method:
 - Furnished and installed by electrical contractor.
 - Install manufactured conduit sweeps and long-radius elbows whenever possible.
 - 3/4-inch (min) EMT conduit shall be routed from each device to the control panel enclosure.
4. Unenclosed Wiring Method:
 - Furnished and installed by security contractor.
 - Support brackets with cable tie slots for fastening cable ties to brackets.
 - Lacing bars, spools, J-hooks, and D-rings.
 - Straps and other devices.

M. Installation of Conductors And Cables

1. Comply with NECA 1, "Good Workmanship in Electrical Contracting."
2. Comply with TIA/EIA-568-B.1.
3. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

PART 4. AUDIO VISUAL SYSTEM

4.01 Overview

- A. The audiovisual concepts discussed and listed in this document have been developed in conjunction with United Airlines. This overview is to provide a framework for the detailed design to be developed for this site. The design and implementation of the audiovisual concepts from a building and site perspective will require input, review, and approval of United Airlines. All equipment is furnished and installed by the Audio Visual Contractor unless stated otherwise.

4.02 References

- A. The systems shall conform to the following codes, standards and guidelines. Where standards and publications are identified, they shall be the most current version.
 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - a. Comply with NFPA 70.
 - b. Comply with UL 50.
 - c. Comply with UL 813, unless a more stringent standard is specified in Part 2.
 2. Specified manufacturer's design and installation guidelines.
 3. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully parts of the specifications as if herein repeated or hereto attached.

4.03 Typical Audio Visual Room Types

A. "TYPE ZERO" CANTINA / BREAKROOM AREA

1. The "typical" Type Zero area shall have the following AV features:
 - Digital Media Player:
 - i. One Cisco Digital Media Player 4310G. Furnished by UAL, installed within mount by contractor underneath the display.
 - ii. One Protective Case Mount: Cisco # DMP 4310G Protective Case Mount, Series 1 DMP-PRCASE-4310G-S1, furnished and installed by contractor.
 - iii. One HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.
 - Display:
 - i. One NEC V462 46" Public Display Monitor 1920 X 1080 (1080p), black with full AV Function.
 - ii. One Chief # LTM5364 tilt and height adjustable wall mount w/ custom interface # FHB5364.
 - Audio:
 - i. One set of NEC SP-4046PV side-display attached speakers.
 - AV Control:
 - i. Manufacturer provided Cisco DMP remote.
 - ii. Manufacturer provided display remote

- .AV Control User Interface:
 - i. Manufacturer provided Cisco DMP remote.
 - ii. Manufacturer provided display remote.
- Miscellaneous:
 - i. All necessary hardware including: cabling, connectors, labeling, unistrut, vented plates, terminal strips, lacing bars, etc.

B. "TYPE ONE" CONFERENCE ROOM

1. The "typical" Type 1 conference room shall have an affixed table, seats 8-14, single video display, and HDMI, VGA, and 3.5mm audio input for laptop.
2. The "typical" Type 1 conference room shall have the following AV features:
 - Digital Media Player:
 - i. One Cisco Digital Media Player 4310G. Furnished by UAL, installed within mount by contractor underneath the display.
 - ii. One Protective Case Mount: Cisco # DMP 4310G Protective Case Mount, Series 1 DMP-PRCASE-4310G-S1, furnished and installed by contractor.
 - iii. One HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.
 - Audio-Video User Inputs:
 - i. One Crestron DigitalMedia 8G+ Transmitter: Crestron # DM-TX-201-C, mounted to the table leg for HDMI, VGA HD-15, and 3.5mm audio table connections.
 - ii. One HDMI to HDMI Cable: Extron # HDMI Ultra/12 26-663-12 3.6 meters / 12 feet.
 - iii. One Male to Male 15-pin HD with Audio Cable: Extron # MVGA-A M-M/12 26-566-03 3.6 meters / 12 feet.
 - Audio Conferencing:
 - i. One Cisco Conference Phone. Furnished and installed by UAL.
 - Display:
 - i. One NEC P552 55" LCD Public Display Monitor 1920 X 1080 (1080p), black with full AV Function.
 - ii. One Chief # LTM5029 tilt and height adjustable wall mount w/ custom interface # FHB5029.
 - iii. One Crestron DigitalMedia 8G+ Receiver & Room Controller: Crestron # DM-RMC-100-C, mounted to the back of display for HDMI, VGA HD-15, and 3.5mm audio table connections.
 - iv. One HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.
 - Audio:
 - i. One set of NEC SP-RM1 rear-display attached speakers.

- AV Switcher:
 - i. One Extron # SW2 HDMI 60-841-01, 2-input and 1-output HDMI Switcher with EDID Minder, mounted to back of display.
 - ii. Configured to automatically switch to the highest-numbered active input when the switcher detects a signal. The Cisco DMP shall be connected to input #1.
- AV Control:
 - i. Manufacturer provided Cisco DMP remote.
 - ii. Manufacturer provided display remote.
- AV Control User Interface:
 - i. Manufacturer provided Cisco DMP remote.
 - ii. Manufacturer provided display remote.
- Miscellaneous:
 - i. DigitalMedia Cable: Crestron # DM-CBL-8G or approved equal; Ultra high-performance CAT5e or greater shielded twisted-pair cable routed between the Crestron DigitalMedia devices, plenum rated as required.
 - ii. All necessary hardware including: cabling, connectors, labeling, unistrut, vented plates, terminal strips, lacing bars, etc.

C. “TYPE TWO” CONFERENCE ROOM

1. The “typical” Type 2 conference room shall have an affixed table, seats 8-14, projection screen, projector, and HDMI, VGA, and 3.5mm audio inputs for laptop.
2. The “typical” Type 2 conference room shall have the following AV features:
 - Media Player:
 - i. One Cisco Digital Media Player 4310G. Furnished by UAL, installed within mount by contractor on projector column above projector.
 - ii. One Protective Case Mount: Cisco # DMP 4400 Protective Case Mount, Series 1 DMP-PRCASE-4310G-S1, furnished and installed by contractor.
 - iii. One HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.
 - Audio-Video User Inputs:
 - i. One Crestron DigitalMedia 8G+ Transmitter: Crestron # DM-TX-201-C, mounted to each table leg for HDMI, VGA HD-15, and 3.5mm audio table connections.
 - ii. One HDMI to HDMI Cable: Extron # HDMI Ultra/12 26-663-12 3.6 meters / 12 feet.
 - iii. One Male to Male 15-pin HD with Audio Cable: Extron # MVGA-A M-M/12 26-566-03 3.6 meters / 12 feet.
 - Audio Conferencing:
 - i. One Cisco Conference Phone. Furnished and installed by UAL.
 - Display:
 - i. One NEC NP-P350W WXGA 16:10 LCD, 3500 Lumen Projector with RJ-45 network connection, and interchangeable lenses and H&V lens shift.
 - ii. One Ceiling mount for projector: Chief # RPMA257 Kit.

- iii. One 9-12" Adjustable Extension Column: Chief # CMS009012, black in color.
 - iv. One Crestron DigitalMedia 8G+ Receiver & Room Controller: Crestron # DM-RMC-100-C, mounted in the ceiling box for HDMI, VGA HD-15, and 3.5mm audio table connections.
 - v. One HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.
 - vi. One Draper # 102349QL Access/Series V motorized ceiling-recessed, tab-tensioned front projection screen, 109", 16:10, Matt White XT1000V, 110 V, quiet motor and Draper LVCIII-S Low voltage controller.
- Audio:
 - i. Projector speaker.
- AV Switcher:
 - i. One Extron # SW2 HDMI 60-841-01, 2-input and 1-output HDMI Switcher with EDID Minder, mounted in the ceiling box.
 - ii. Configured to automatically switch to the highest-numbered active input when the switcher detects a signal. The Cisco DMP shall be connected to input #1.
- AV Control:
 - i. Manufacturer provided Cisco DMP remote.
 - ii. Manufacturer provided projector remote.
 - iii. One wall mounted Draper LVC-S—Low Voltage Control Switch # 121059.
- AV Control User Interface:
 - i. Manufacturer provided Cisco DMP remote.
 - ii. Manufacturer provided projector remote.
- AV Equipment Mounting Frame:
 - i. One FSR # CB-12P, 1'x2' ceiling box with 2-1/2 rack, one 1-1/2" NPT female fitting to accept projector pole mounting and 5 AC outlets.
- Miscellaneous:
 - i. DigitalMedia Cable: Crestron # DM-CBL-8G or approved equal; Ultra high-performance CAT5e or greater shielded twisted-pair cable routed between the Crestron DigitalMedia devices, plenum rated as required.
 - ii. All necessary hardware including: cabling, connectors, labeling, unistrut, vented plates, terminal strips, lacing bars, etc.

D. "TYPE THREE" CONFERENCE ROOM

1. The "typical" Type 3 conference room shall have an affixed table, seats 10 - 18, single presentation screen, two HDMI, VGA, 3.5mm audio input connections for laptop, table mic, and control system.
2. The "typical" Type 3 conference room shall have the following AV features:
 - Media Player:
 - i. Cisco Digital Media Player 4310G. Furnished by UAL, installed within AV Equipment Mounting Frame in credenza by contractor on shelf.
 - ii. One 1-Rack Mount Unit Vented Shelf: Middle Atlantic # U1V-4.
 - iii. One HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.
 - Audio-Video User Inputs:
 - i. Two Crestron DigitalMedia 8G+ Transmitter: Crestron # DM-TX-201-C, mounted to each table leg for HDMI, VGA HD-15, and 3.5mm audio table connections.
 - ii. Two HDMI to HDMI Cable: Extron # HDMI Ultra/12 26-663-12 3.6 meters / 12 feet.
 - iii. Two Male to Male 15-pin HD with Audio Cable: Extron # MVGA-A M-M/12 26-566-03 3.6 meters / 12 feet.
 - Audio Conferencing:
 - i. One BiAmp AudiaFLEX, Digital Audio Processor with the following minimum cards:
 - ii. One VoIP-2: 2-channel Voice over Internet Protocol card.
 - iii. Six AEC-2HD: 2-channel TrueSound acoustic echo canceling card w/noise suppression card.
 - iv. Two IP-2: 2-channel mic/line input card.
 - v. Two OP-2e: 2-channel mic/line output card.
 - Microphones:
 - i. Four table mounted boundary microphones.
 - ii. Two Dual-Element Mic: Shure # MX396/C-DUAL, 0-180 degree Bottom Exit Cable, Mute Output, LED Input, requires two mixer channels.
 - iii. Two Tri-Element Mic: Shure # MX396/C-TRI, Adjustable to 300 Degrees or 360 Degrees Coverage, Back or Bottom Exit Cable, Mute Output, LED Input, require three mixer channels.
 - Video Conferencing:
 - i. Conduit rough-in accommodations for "Type 3 VTC" room.
 - Display:
 - i. One NEC NP-P350W WXGA 16:10 LCD, 3500 Lumen Projector with RJ-45 network connection, and interchangeable lenses and H&V lens shift.
 - ii. One Ceiling mount for projector: Chief # RPMA257 Kit.
 - iii. One 9-12" Adjustable Extension Column: Chief # CMS009012W, white in color.
 - iv. One Crestron DigitalMedia 8G+ Receiver & Room Controller: Crestron # DM-RMC-100-C, mounted in the ceiling box for switcher connections.
 - v. One HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.

- vi. One Draper # 102349QL Access/Series V motorized ceiling-recessed, tab-tensioned front projection screen, 109", 16:10, Matt White XT1000V, 110 V, quiet motor and Draper LVCIII-S Low voltage controller.
- Audio:
 - i. Six Tannoy # CMS501 BM ceiling speakers.
- AV Switcher:
 - i. One Crestron # DMPS-300-C, DigitalMedia Presentation System 300 digital AV switcher.
- AV Controller:
 - i. One Crestron # DMPS-300-C, DigitalMedia Presentation System 300 digital AV switcher.
 - ii. The following devices shall be programmed for control:
 - Table Sources.
 - Cisco Digital Media Player.
 - Projector.
 - Projection Screen.
 - Audio.
 - Audio Conferencing.
- AV Control User Interface:
 - i. One Crestron # TPMC-8X-GA, Isys 8.4 WiFi Touch Screen.
 - ii. One Crestron # TPMC-8X-DS desktop docking station for TPMC-8X-GA.
- AV Equipment Mounting Frame:
 - i. One Middle Atlantic # CFR-14-18, 14 rack space, 24-1/2 inches tall x 18 inches deep cabinet frame rack mounted within credenza.
 - ii. Low Friction Runner Kit: Middle Atlantic # 5-RS18.
 - iii. One FSR # CB-12P, 1'x2' ceiling box with 2-1/2 rack, one 1-1/2" NPT female fitting to accept projector pole mounting and 5 AC outlets ceiling box.
- Miscellaneous:
 - i. DigitalMedia Cable: Crestron # DM-CBL-8G or approved equal; Ultra high-performance CAT5e or greater shielded twisted-pair cable routed between the Crestron DigitalMedia devices, plenum rated as required.
 - ii. All necessary hardware including: cabling, connectors, labeling, unistrut, vented plates, terminal strips, lacing bars, etc.

E. "TYPE THREE VTC" CONFERENCE ROOM

1. The "typical" Type 3 VTC conference room shall have an affixed table, seats 10 - 18, single projection and dual display presentation screens, two HDMI, VGA, 3.5mm audio input connections for laptop, VTC - P2P / Multi-Point, table mic, and control system.
2. The "typical" Type 3 VTC conference room shall have the AV following features:
 - Media Player:
 - i. Cisco Digital Media Player 4310G. Furnished by UAL, installed within AV Equipment Mounting Frame in credenza by contractor on shelf.
 - ii. One 1-Rack Mount Unit Vented Shelf: Middle Atlantic # U1V-4.
 - iii. One HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.
 - Audio-Video User Inputs:
 - i. Two Crestron DigitalMedia 8G+ Transmitter: Crestron # DM-TX-201-C, mounted to each table leg for HDMI, VGA HD-15, and 3.5mm audio table connections.
 - ii. Two HDMI to HDMI Cable: Extron # HDMI Ultra/12 26-663-12 3.6 meters / 12 feet.
 - iii. Two Male to Male 15-pin HD with Audio Cable: Extron # MVGA-A M-M/12 26-566-03 3.6 meters / 12 feet.
 - Audio Conferencing:
 - i. One BiAmp AudiaFLEX, Digital Audio Processor with the following minimum cards:
 - One VoIP-2: 2-channel Voice over Internet Protocol card.
 - Six AEC-2HD: 2-channel TrueSound acoustic echo canceling card w/noise suppression card.
 - Two IP-2: 2-channel mic/line input card.
 - Two OP-2e: 2-channel mic/line output card.
 - Microphones:
 - i. Four table mounted boundary microphones.
 - ii. Two Dual-Element Mic: Shure # MX396/C-DUAL, 0-180 degree Bottom Exit Cable, Mute Output, LED Input, requires two mixer channels.
 - iii. Two Tri-Element Mic: Shure # MX396/C-TRI, Adjustable to 300 Degrees or 360 Degrees Coverage, Back or Bottom Exit Cable, Mute Output, LED Input, require three mixer channels.
 - Video Conferencing:
 - i. Extron 60-864-13 HDMI Twisted Pair Transmitter with Audio - Decora Wall plate.
 - ii. Extron 60-864-23 HDMI Twisted Pair Receiver with Audio - Decora Wall plate.
 - iii. Cisco CTS-C60-K9 Integrator Package C60.
 - iv. Cisco CON-PADN-CT partner core. Tandberg Partner core agreement for C60 package.
 - v. Cisco LIC-C60-MS CODEC C60 multisite ms option.
 - vi. Cisco LIC-C60-PR CODEC C60 premium resolution option.
 - vii. Cisco CTS-PHD-1080P PRECISIONHD 1080p X4. Camera to be mounted under left "far side" monitor. Outlets (power & AV) on each side of the camera.

- viii. ICI camera wall mount.
 - ix. SIIG CEH20511S1 HDMI to VGA adaptor with audio.
- Display:
 - i. Two NEC P552" Class Full Color Professional LCD Display.
 - ii. Two Chief pro tilt wall mount w/ custom interface.
 - iii. Two Crestron DigitalMedia 8G+ Receiver & Room Controller: Crestron # DM-RMC-100-C, mounted to the back of displays for switcher connections.
 - iv. Two HDMI to HDMI Cable: Extron # HDMI Micro/3 26-667-03 90 centimeters / 3 feet.
- Audio:
 - i. Six Tannoy # CMS501 BM ceiling speakers.
- AV Switcher:
 - i. One Crestron # DMPS-300-C, DigitalMedia Presentation System 300 digital AV switcher.
- AV Controller:
 - i. One Crestron # DMPS-300-C, DigitalMedia Presentation System 300 digital AV switcher.
 - ii. The following devices shall be programmed for control:
 - Table Sources.
 - Cisco Digital Media Player.
 - Displays.
 - Amplifier.
 - Audio Conferencing.
 - Video Conferencing.
 - Camera.
- AV Control User Interface:
 - i. One Crestron # TPMC-8X-GA, Isys 8.4 WiFi Touch Screen.
 - ii. One Crestron # TPMC-8X-DS desktop docking station for TPMC-8X-GA.
- AV Equipment Mounting Frame:
 - i. One Middle Atlantic # CFR-14-18, 14 rack space, 24-1/2 inches tall x 18 inches deep cabinet frame rack mounted within credenza
 - ii. Low Friction Runner Kit: Middle Atlantic # 5-RS18.
- Miscellaneous:
 - i. DigitalMedia Cable: Crestron # DM-CBL-8G or approved equal; Ultra high-performance CAT5e or greater shielded twisted-pair cable routed between the Crestron DigitalMedia devices, plenum rated as required.
 - ii. All necessary hardware including: cabling, connectors, labeling, unistrut, vented plates, terminal strips, lacing bars, etc.

PART 5. PAGING SYSTEM

5.01 Overview:

- A. The paging system concepts discussed and listed in this document have been developed in conjunction with United Airlines. This overview is to provide a framework for the detailed design to be developed for this site. The design and implementation of the paging system concepts from a building and site perspective will require input, review, and approval of United Airlines. All equipment is furnished and installed by the Paging System Contractor unless stated otherwise.

5.02 References:

- A. The systems shall conform to the following codes, standards and guidelines. Where standards and publications are identified, they shall be the most current version.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. Comply with NFPA 70.
 - 3. Comply with UL 50.
 - 4. Comply with UL 813
 - 5. Specified manufacturer's design and installation guidelines.
 - 6. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully parts of the specifications as if herein repeated or hereto attached.

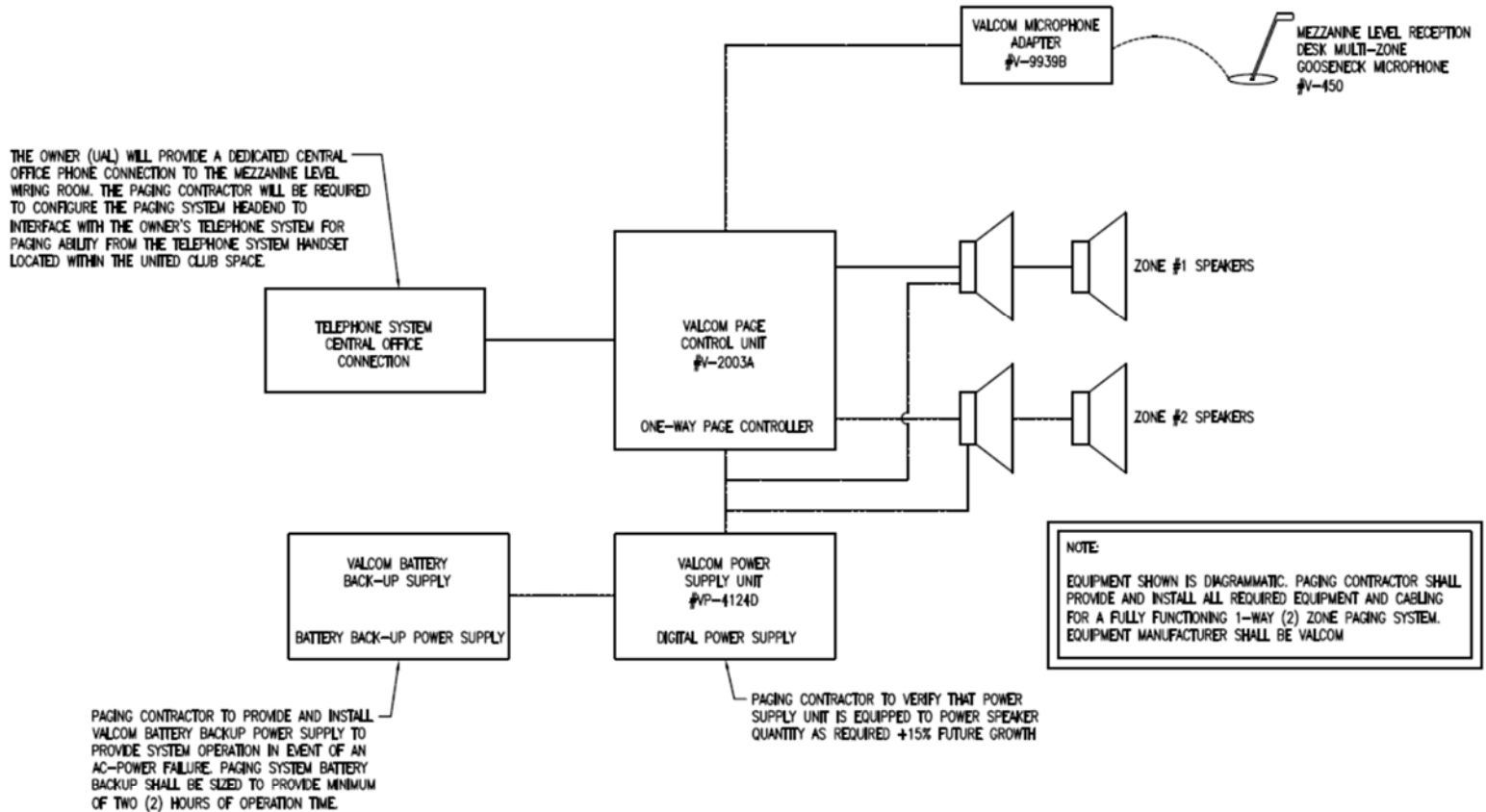
5.03 System Design Criterion:

- A. The Paging System is NFPA listed as an Emergency/Public Safety communications system which requires the entire system to be installed in a separate/dedicated conduit system.
- B. The Paging System shall be a one way system. Two way talk back functionality is not required.
- C. Zoning of the system shall be on a case by case basis. The standard system for Club environments shall be a two zone system. The primary zone shall be dedicated to common use areas for customer paging. The secondary zone shall be dedicated to Owner “back of house operations” areas. Both zones shall be active for Emergency “All Call” paging.
- D. The system shall be a 24V DC system wired with 4-Pair Category-6 Non-Plenum Rated UTP cabling.
- E. The Paging System shall be engineered to execute pages through the Owner’s phone system telephone handsets. Additionally, the system shall be equipped with a dedicated desktop microphone to initiate pages should the phone system be rendered inoperable.
- F. The Paging System Head End shall be located in the nearest Owner’s Telecommunications Telecom Room.
- G. Ceiling speaker grille covers shall be painted to match ceiling finish in which they are installed.

5.04 System Equipment:

Manufacturer	Part No.	Description
Valcom	V-2003A	Page Control Unit (1-Way Page Controller)
	VP-41240	Power Supply Unit (Digital Power Supply). Design Engineer shall verify that power supply unit is equipped to power speaker quantity required +15% future growth.
	Battery Back-Up Supply	Battery Back-Up Supply (UPS). Design Engineer shall provide battery backup power supply (UPS). System shall be sized to provide minimum of two (2) hours operation run time in an AC-Power failure.
	Telephone System Interface	Design Engineer shall provide interface to Owner phone system head-end
	V-9939B	Microphone Adapter
	V-450	Gooseneck Microphone
	V-1020C	8" (inch) Round Ceiling Speaker
	V-9915M-5	Ceiling Speaker Back Box equipped with Metal Bridge

5.05 System Single Line Diagram



PA SYSTEM SINGLE LINE DIAGRAM

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Telecommunications mounting elements.
 - 2. Backboards.
 - 3. Telecommunications equipment racks and cabinets.
 - 4. Telecommunications service entrance pathways.
 - 5. Grounding.
- B. Related Sections:
 - 1. Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
 - 2. Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.
- C. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- D. BICSI: Building Industry Consulting Service International.
- E. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches (152 mm) in width.
- F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- G. LAN: Local area network.
- H. RCDD: Registered Communications Distribution Designer.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
 - 3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- C. Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 United Airlines Requirements: See attached United Airlines Critical IT Infrastructure Design Standards and Construction Practices document for their requirements.

2.2 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 3. Lacing bars, spools, J-hooks, and D-rings.
 - 4. Straps and other devices.
- C. Cable Trays:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cable Management Solutions, Inc.
 - b. Cablofil Inc.
 - c. Cooper B-Line, Inc.
 - d. Cope - Tyco/Allied Tube & Conduit.
 - e. GS Metals Corp.
 - 2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick or hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick.
 - a. Basket Cable Trays: Dimensions as indicated on the drawings, and 4" deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - b. Ladder Cable Trays: Nominal dimensions as indicated on the drawings, and a rung spacing of 9 inches (305 mm).
- D. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes for Electrical Systems."
 - 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.3 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Section "Rough Carpentry."

2.4 EQUIPMENT FRAMES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ADC.
 - 2. Aim Electronics; a brand of Emerson Electric Co.
 - 3. AMP; a Tyco International Ltd. company.
 - 4. Cooper B-Line, Inc.

5. Hubbell Premise Wiring.
6. KRONE Incorporated.
7. Leviton Voice & Data Division.
8. Middle Atlantic Products, Inc.
9. Nordex/CDT; a subsidiary of Cable Design Technologies.
10. Ortronics, Inc.
11. Panduit Corp.
12. Simon Co. (The).

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. Power strip.
8. Baked-polyester powder coat finish.
9. All cabinets keyed alike.

E. Modular Wall Cabinets:

1. Wall mounting.
2. Steel or aluminum construction.
3. Treated to resist corrosion.
4. Lockable front and rear doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. Power strip.
9. All cabinets keyed alike.

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.5 POWER STRIPS

- A. Power Strips: Comply with UL 1363.
 - 1. Rack mounting.
 - 2. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
 - 3. LED indicator lights for power and protection status.
 - 4. LED indicator lights for reverse polarity and open outlet ground.
 - 5. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
 - 6. Cord connected with 15-foot (4.5-m) line cord.
 - 7. Rocker-type on-off switch, illuminated when in on position.
 - 8. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
 - 9. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.6 GROUNDING

- A. Comply with requirements in Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
 - 1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
 - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A.

2.7 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

3.2 Install underground entrance pathway complying with Section "Raceway and Boxes for Electrical Systems." INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

- C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

- A. Comply with requirements in Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section "Identification for Electrical Systems." Comply with requirements in Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- B. See Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section.
- C. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

SECTION 271300 - COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pathways.
 - 2. UTP cable.
 - 3. ~~62.5/125 micrometer, optical fiber cabling~~ **9/125 micrometer single-mode fiber cabling.**
 - 4. ~~Coaxial cable.~~
 - 5. Cable connecting hardware, patch panels, and cross-connects.
 - 6. Cabling identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - ~~1. For coaxial cable, include the following installation data for each type used:~~
 - ~~a. Nominal OD.~~
 - ~~b. Minimum bending radius.~~
 - ~~c. Maximum pulling tension.~~
- B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules.
 - 2. Cabling administration drawings and printouts.
 - 3. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
 - 4. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.11 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Patch-Panel Units: One of each type.
 2. Connecting Blocks: One of each type.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 2. Lacing bars, spools, J-hooks, and D-rings.
 3. Straps and other devices.
- C. Cable Trays:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cable Management Solutions, Inc.
 - b. Cablofil Inc.
 - c. Cooper B-Line, Inc.
 - d. Cope - Tyco/Allied Tube & Conduit.
 - e. GS Metals Corp.
 2. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inches (0.012 mm) thick or hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inches (0.055 mm) thick.
 - a. Basket Cable Trays: Dimensions as indicated on the drawings, and 4" deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).

- b. Ladder Cable Trays: Nominal dimensions as indicated on the drawings, and a rung spacing of 9 inches (305 mm).
 - D. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes for Electrical Systems."
 - 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
- 2.2 BACKBOARDS
 - A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).
- 2.3 UTP CABLE
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden CDT Inc.; Electronics Division.
 - 2. Berk-Tek; a Nexans company.
 - 3. CommScope, Inc.
 - 4. Draka USA.
 - 5. Genesis Cable Products; Honeywell International, Inc.
 - 6. KRONE Incorporated.
 - 7. Mohawk; a division of Belden CDT.
 - 8. Molex Premise Networks; a division of Molex, Inc.
 - 9. Nordex/CDT; a subsidiary of Cable Design Technologies.
 - 10. Superior Essex Inc.
 - 11. SYSTIMAX Solutions; a CommScope Inc. brand.
 - 12. 3M.
 - 13. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
 - B. Description: 100-ohm, 25-pair UTP, with a gray thermoplastic jacket.
 - 1. Comply with ICEA S-90-661 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 - 3. Comply with TIA/EIA-568-B.2, Category 6 **SE**.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.
 - C. United Airlines Requirements: See attached United Airlines Critical IT Infrastructure Design Standards and Construction Practices document for their requirements.**
- 2.4 UTP CABLE HARDWARE
 - A. Manufacturers **and Requirements**: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Technology Systems Industries, Inc.
 - 2. Dynacom Corporation.

3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. United Airlines Requirements: See attached United Airlines Critical IT Infrastructure Design Standards and Construction Practices document for their requirements.

- C. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- D. Connecting Blocks: 110-style IDC for Category 6 **5E**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: One for each four-pair UTP cable, plus spares and blank positions adequate to suit specified expansion criteria.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, 4-pair cables in 48-inch (1200-mm) lengths; terminated with 8-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.5 9/125 MICROMETER, SINGLE-MODE, INSIDE PLANT OPTICAL FIBER CABLE (OS1)

A. Description: Single mode, 9/125-micrometer, fiber quantity as indicated on the drawings, tight buffered, optical fiber cable.

B. Manufacturers:

1. **American Airlines: See attached American Airlines specifications 271100 for their requirements.**
2. **ILM and Delta Airlines: Subject to compliance with requirements, provide products by one of the following:**
 - a. **Berk-Tek; a Nexans company.**
 - b. **CommScope, Inc.**
 - c. **Corning Cable Systems.**
 - d. **General Cable Technologies Corporation.**
 - e. **Mohawk; a division of Belden CDT.**
 - f. **Nordex/CDT; a subsidiary of Cable Design Technologies.**
 - g. **Optical Connectivity Solutions Division; Emerson Network Power.**
 - h. **Superior Essex Inc.**
 - i. **SYSTIMAX Solutions; a CommScope Inc. brand.**
 - j. **3M.**

- k. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- 3. United Airlines: See attached United Airlines Critical IT Infrastructure Design Standards and Construction Practices document for their requirements.

C. Standards:

- 1. Comply with TIA-492CAA for detailed specifications.
- 2. Comply with TIA-568-C.3 for performance specifications.
- 3. Comply with ICEA S-83-596 for mechanical properties.

D. Conductive cable shall be aluminum armored type.

E. Maximum Attenuation: 0.65 dB/km at 1310 nm, 1383 nm, and 1550 nm.

F. Jacket:

- 1. Jacket Color: Yellow.
- 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
- 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

G. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

- 1. Riser Rated, Nonconductive: Type OFN, Type OFNG, Type OFNP, or Type OFNR in metallic conduit.

2.6 9/125 MICROMETER, SINGLE-MODE, INSIDE PLANT OPTICAL FIBER CABLE (OS1)

- A. United Airlines: See attached United Airlines Critical IT Infrastructure Design Standards and Construction Practices document for their requirements.

~~2.7 OPTICAL FIBER CABLE~~

- ~~A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:~~

- ~~1. Berk Tek; a Nexans company.~~
- ~~2. CommScope, Inc.~~
- ~~3. Corning Cable Systems.~~
- ~~4. General Cable Technologies Corporation.~~
- ~~5. Mohawk; a division of Belden CDT.~~
- ~~6. Nordex/CDT; a subsidiary of Cable Design Technologies.~~
- ~~7. Optical Connectivity Solutions Division; Emerson Network Power.~~
- ~~8. Superior Essex Inc.~~
- ~~9. SYSTIMAX Solutions; a CommScope Inc. brand.~~
- ~~10. 3M.~~
- ~~11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.~~

- ~~B. Description: Multimode, 62.5/125 micrometer, 24 fiber, nonconductive, tight buffer, optical fiber cable.~~

- ~~1. Indoor Cable: Comply with ICEA S-83-596 for mechanical properties.~~
- ~~2. Outside Plant Cable: Comply with ICEA S-87-640 for mechanical properties.~~
- ~~3. Comply with TIA/EIA-568-B.3 for performance specifications.~~
- ~~4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:~~

- a. ~~General Purpose, Nonconductive: Type OFN or OFNG.~~
 - b. ~~Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.~~
 - c. ~~Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.~~
 - d. ~~General Purpose, Conductive: Type OFC or OFCG.~~
 - e. ~~Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.~~
 - f. ~~Riser Rated, Conductive: Type OFCR, complying with UL 1666.~~
- 5. ~~Conductive cable shall be steel armored type.~~
 - 6. ~~Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.~~
 - 7. ~~Minimum Modal Bandwidth: 160 MHz km at 850 nm; 500 MHz km at 1300 nm.~~

C. ~~Jacket:~~

- 1. ~~Jacket Color: Orange for 62.5/125 micrometer cable.~~
- 2. ~~Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA 598 B.~~
- 3. ~~Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).~~

2.8 OPTICAL FIBER CABLE HARDWARE

A. **Manufacturers and Requirements:**

- 1. **American Airlines: See attached American Airlines specifications 271100 for their requirements**
- 2. **ILM and Delta Airlines: Subject to compliance with requirements, provide products by one of the following:**
 - a. **ADC.**
 - b. **American Technology Systems Industries, Inc.**
 - c. **Berk-Tek; a Nexans company.**
 - d. **Corning Cable Systems.**
 - e. **Dynacom Corporation.**
 - f. **Hubbell Premise Wiring.**
 - g. **Molex Premise Networks; a division of Molex, Inc.**
 - h. **Nordex/CDT; a subsidiary of Cable Design Technologies.**
 - i. **Optical Connectivity Solutions Division; Emerson Network Power.**
 - j. **Siemon Co. (The).**
- 3. **United Airlines: See attached United Airlines Critical IT Infrastructure Design Standards and Construction Practices document for their requirements.**

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

- 1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.

D. Cable Connecting Hardware:

- 1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
- 2. Quick-connect, simplex and duplex, **Type LC** connectors. ~~Match existing.~~ Insertion loss not more than 0.75 dB.
- 3. ~~Type SFF connectors may be used in termination racks, panels, and equipment packages.~~

2.9 ~~COAXIAL CABLE~~

A. ~~Manufacturers: Subject to compliance with requirements, provide products by one of the following:~~

1. ~~Alpha Wire Company.~~
2. ~~Belden CDT Inc.; Electronics Division.~~
3. ~~Coleman Cable, Inc.~~
4. ~~CommScope, Inc.~~
5. ~~Draka USA.~~

B. ~~General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75 ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.~~

C. ~~RG 11/U: NFPA 70, Type CATV.~~

1. ~~No. 14 AWG, solid, copper covered steel conductor.~~
2. ~~Gas injected, foam PE insulation.~~
3. ~~Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.~~
4. ~~Jacketed with sunlight resistant, black PVC or PE.~~
5. ~~Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.~~

D. ~~RG59/U: NFPA 70, Type CATVR.~~

1. ~~No. 20 AWG, solid, silver plated, copper covered steel conductor.~~
2. ~~Gas injected, foam PE insulation.~~
3. ~~Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.~~
4. ~~Color coded PVC jacket.~~

E. ~~RG 6/U: NFPA 70, Type CATV or CM.~~

1. ~~No. 16 AWG, solid, copper covered steel conductor; gas injected, foam PE insulation.~~
2. ~~Double shielded with 100 percent aluminum foil shield and 60 percent aluminum braid.~~
3. ~~Jacketed with black PVC or PE.~~
4. ~~Suitable for indoor installations.~~

F. ~~RG59/U: NFPA 70, Type CATV.~~

1. ~~No. 20 AWG, solid, copper covered steel conductor; gas injected, foam PE insulation.~~
2. ~~Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.~~
3. ~~PVC jacket.~~

G. ~~RG59/U (Plenum Rated): NFPA 70, Type CMP.~~

1. ~~No. 20 AWG, solid, copper covered steel conductor; foam fluorinated ethylene propylene insulation.~~
2. ~~Double shielded with 100 percent aluminum foil shield and 65 percent aluminum braid.~~
3. ~~Copolymer jacket.~~

H. ~~NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:~~

1. ~~CATV Cable: Type CATV.~~
2. ~~CATV Plenum Rated: Type CATVP, complying with NFPA 262.~~
3. ~~CATV Riser Rated: Type CATVR, complying with UL 1666.~~
4. ~~CATV Limited Rating: Type CATVX.~~

~~2.10 COAXIAL CABLE HARDWARE~~

~~A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:~~

- ~~1. Aim Electronics; a brand of Emerson Electric Co.~~
- ~~2. Leviton Voice & Data Division.~~
- ~~3. Simon Co. (The).~~

~~B. Coaxial Cable Connectors: Type BNC, 75 ohms.~~

2.11 GROUNDING

- A. Comply with requirements in Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.12 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.13 SOURCE QUALITY CONTROL

- A. Factory test cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Factory test ~~multimode~~ **single-mode** optical fiber cables according to TIA/EIA-526-~~14-A-7~~ and TIA/EIA-568-B.3.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays.
 1. Comply with requirements for raceways and boxes specified in Section "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 6 inches (152 mm) above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

~~F. Outdoor Coaxial Cable Installation:~~

- ~~1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.~~

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

- A. Comply with requirements in Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.
- B. Comply with requirements in Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. See Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section.
- D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- F. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
 - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 3. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271300

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. Telecommunications outlet/connectors.
 - 3. Cabling system identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- G. RCDD: Registered Communications Distribution Designer.
- H. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector. Where allowed, transition points or consolidation points will be indicated on the drawings.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The

maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of field testing program development by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes ."

2.2 UTP CABLE

A. Manufacturers **and Requirements:**

1. **American Airlines: See attached American Airlines specifications 271100 for their requirements.**
2. **ILM and Delta Airlines: Subject to compliance with requirements, provide products by one of the following:**
 - a. **Belden CDT Inc.; Electronics Division.**
 - b. **Berk-Tek; a Nexans company.**
 - c. **CommScope, Inc.**
 - d. **Draka USA.**
 - e. **Genesis Cable Products; Honeywell International, Inc.**
 - f. **KRONE Incorporated.**
 - g. **Mohawk; a division of Belden CDT.**
 - h. **Molex Premise Networks; a division of Molex, Inc.**
 - i. **Nordex/CDT; a subsidiary of Cable Design Technologies.**
 - j. **Superior Essex Inc.**
 - k. **SYSTIMAX Solutions; a CommScope, Inc. brand.**
 - l. **3M.**
 - m. **Tyco Electronics/AMP Netconnect; Tyco International Ltd.**
3. **United Airlines: See attached United Airlines Critical IT Infrastructure Design Standards and Construction Practices document for their requirements.**

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6 **and 6A**.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.3 UTP CABLE HARDWARE

A. Manufacturers **and Requirements:**

1. **American Airlines: See attached American Airlines specifications 271100 for their requirements.**
2. **ILM and Delta Airlines: Subject to compliance with requirements, provide products by one of the following:**
 - a. **American Technology Systems Industries, Inc.**
 - b. **Dynacom Corporation.**
 - c. **Hubbell Premise Wiring.**
 - d. **KRONE Incorporated.**
 - e. **Leviton Voice & Data Division.**
 - f. **Molex Premise Networks; a division of Molex, Inc.**
 - g. **Nordex/CDT; a subsidiary of Cable Design Technologies.**
 - h. **Panduit Corp.**
 - i. **Siemon Co. (The).**
 - j. **Tyco Electronics/AMP Netconnect; Tyco International Ltd.**

3. United Airlines: See attached United Airlines Critical IT Infrastructure Design Standards and Construction Practices document for their requirements.

- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: One for each four-pair conductor group of cables, plus spares and blank positions adequate to suit specified expansion criteria.
- D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- E. Patch Cords: Factory-made, four-pair cables in 48-inch (1200-mm) lengths; terminated with eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.4 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets:
 - 1. Two-port-connector assemblies mounted in single faceplate.
 - 2. Metal Faceplate: Stainless steel, complying with requirements in Section "Wiring Devices."
 - 3. Legend: Machine printed, in the field, using adhesive-tape label.

2.5 GROUNDING

- A. Comply with requirements in Section "Grounding and Bonding " for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section " Electrical Identification."

2.7 SOURCE QUALITY CONTROL

- A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Cable will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and attics, where unenclosed wiring method may be used. Conceal raceway except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section "Raceway and Boxes."
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

- A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- B. Comply with requirements in Section "Raceway and Boxes " for installation of conduits and wireways.
- C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 - 10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

- A. Comply with requirements in Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.
- B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- C. Cable and Wire Identification:
 1. Label each cable within 4 inches (100 mm) of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 30 feet (9 m).
 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- D. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 4. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
- C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 271500