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REVISION HISTORY

Rev	Description	By	Date
0	Initial release	GM	2/26/04
1	Added appendix 6; renumbered old appendix 6 to appendix 7	GM	7/22/04
1.1	Modified section IX.E. (firestopping) Added appendix 7; renumbered old appendix 7 to appendix 8	GM	10/19/04
1.1	Inserted new section VII. (PWDS) and new section XI. (Pathways). Renumbered remaining sections. Updated Appendix 1 and added Appendices 9 & 10.	GM	10/29/04
2.0	Modified section XI. (Pathways). Modified section XII. (Acceptance Testing) paragraph A.6.b)(8)(b) - added Fluke DTX-1800 to list of acceptable Cat 6 test equipment.	GM	7/26/05
2.1	Modified Section VII. to update Systimax part #'s for 25-pair Cat 5 cable. Modified section VIII. (codes) to include "DEMOLITION OF CABLING". Various updates as per review comments.	GM	2/12/07
2.2	Removed section IV as AFUS is no longer used. Revised versions of related standards and agreements	DCD	7/15/21

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The Port of Seattle's Facilities and Infrastructure (F&I) department is the single point of responsibility and "owner" of the communications systems at Sea-Tac International Airport. F&I is responsible for system planning, developing and implementing the capital improvement plan, establishing design standards and managing the communications systems at Sea-Tac International Airport.

I. Purpose of "Design Principles"

The purpose of this Design Principles document is to assist designers of communications systems at Sea-Tac International Airport in their understanding of existing communications systems, design goals, technical and non-technical general requirements, information on the design process, and key reference material.

Note that key reference documents, standards and communications system description and commentary are included in the Appendix to these Design Principles.

II. Intent of Communications System Design Criteria

All technical design work that is performed at Sea-Tac Airport is required to follow the latest revision of the Communications Systems Standards.

Designers shall coordinate with the Port and its consultant management representatives to ensure that systems and equipment such as public address and music equipment, voice and data systems, intercommunication equipment and transient voltage suppression equipment are properly designed and specified.

III. Standard Communications Guide Specifications

The Port provides standard guide specifications for use by designers on all Airport projects. These guide specifications are more detailed (including specifier prompts) than the design criteria discussed in the subsequent sections and are intended to be edited by the designer for each Port project. Electronic copies of these guide specifications can be obtained from the Aviation Project Management Group and the Port's Engineering Department for inclusion in construction contract documents.

A. Port of Seattle-provided Standards and References

1. Regulations for Airport Construction, 1996 (this is a base reference with some superseding documents for some sections)
2. Interlocal Agreement (ILA) between Port of Seattle and the City of SeaTac, current version
3. POS drawing standards and criterias
4. Electrical System Standards
5. Mechanical System Standards
6. Water System Standards
7. Architectural Standards
8. Port of Seattle Guide Specifications

IV. Application for Connection

An *Application for Connection to the Communications System* must be completed for each project making a connection to the communications system by the designer and submitted by the project manager to F&I for approval. No connections to the communications system are allowed without an approved application. A copy of this application and associated instruction sheet are included in the Appendix to this document.

For connection to CCTV systems, the designer must also fill out the *Application for Connection to CCTV Systems*, which is an addendum to the above Communications application.

For connection to Radio Frequency systems, the designer must also fill out the *Application for Connection to RF Systems*, which is an addendum to the above Communications application.

V. Sea-Tac Airport Communications System Requirements

A. Existing Communications System Description

Sea-Tac International Airport Communications System presently consists of a fiber optic and copper backbone cable system and a copper unshielded twisted pair (UTP) Premises Wiring Distribution System (PWDS). Existing fiber optic cables are multimode and singlemode. Existing PWDS copper cables are Cat 3, Cat 5, Cat 5e and Cat 6.

Approximately one hundred (100) communications rooms, enclosures and microdistribution cabinets are located throughout the Airport (all levels). One (1) Main Distribution Room (MDR) is located on the Bridge / Ramp level. Two (2) MDR's are located in the Satellite Transit Station (STS) level.

B. Primary facilities consist of the following:

- Main Terminal
- Concourse A (including airport office building (AOB) and C4)
- Concourse B
- Concourse C
- Concourse D
- North and South Satellite Terminals
- Administration Building (old Main Terminal)
- Parking Terminal (Garage)
- North Toll Plaza Office
- Fire Station

D. Fiber Optic and UTP Cable Backbones

In general, the existing fiber optic and UTP cable backbones at STIA are designed with diverse routes to communications rooms from separate MDR's. Following is an outline:

1. Main Distribution Rooms (MDRs)
- MDR-1 and MDR-2 (located in Main Terminal)
- MDR-3 (located in Concourse 'A' Combined Communications Control Center (C4))
2. Communications Equipment Room (CER)
- Main Terminal
3. Telecommunications Equipment Rooms (ERs) and Closets (TCs)
- Concourse A
- Concourse A Combined Communications Control Center (C4)
- Concourse B
- Concourse C
- Concourse D
- North Satellite
- South Satellite
- Central Terminal Expansion (CTE)
- Parking Terminal
- North Toll Plaza

4. Refer to Appendix 2 for a detailed drawing of the CIBS Communications Infrastructure Backbone System, POS drawing number EC-02.

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VI. Horizontal Infrastructure (Premises Wiring Distribution System (PWDS))

Premises Wiring Distribution System (PWDS) cabling is the cabling from a telecommunications closet to receptacles at user locations. For new installations, telecommunications closet shall contain patch panels for data patching.

Station cables shall run from the patch panels to individual voice and/or data receptacle locations in offices, public areas, employee facilities, or specific equipment locations. The patch panels, 110 blocks, cables, outlets, pathways (cables trays, conduits, junction boxes, etc.) and identification labels make up the horizontal infrastructure.

A. General Requirements for Voice and Data Station Circuits

1. All 4-pair data circuits shall be Category 6 GigaSpeed station cables. Terminations for data lines at the wiring closet shall be to GigaSpeed RJ-45 patch panels. All WiFi circuits shall be 4-pair Cat 6a station cables.

- a) All new 4-pair data station circuits shall be Cat 6/6a compatible. Data circuits are those outlets and cables that shall be used for data terminal LAN connections or similar applications. The minimum acceptable performance of the PWDS for data circuits is defined in TIA-568 Category 6/6a standards by Systimax Solutions supporting 1.0/10.0 Gbps Ethernet and other 1.2 Gbps applications.
- b) For new voice cabling, 25-pair count cable shall be Cat 5e compatible. In cases where 50-pair or 100-pair cabling is required, Cat 3 cable may be acceptable, depending on project requirements and with approval from the Telecomm Design Review Committee.
- c) For special systems such as Access Control, CCTV, ACS Intercom etc, the following minimum standard will be allowed. The cable installation will allow a male RJ-45 at the equipment end. The minimum acceptable performance of the Special Systems PWDS is defined in TIA-568 Category 6 standards by Systimax Solutions supporting 1000MBps applications. To qualify for an installation of this type, the application must be reviewed and approved by the Telecomm Design Review Committee.

B. Summary of Voice and Data Requirements

1. TIA-568 Category 6 Systimax Solutions GigaSpeed station cables, GigaSpeed patch panels, and GigaSpeed outlets
2. RJ-45 station outlets and RJ-45 patch panel ports, 8-pins active, non-keyed 4-pair station cables, wired per T568B (AT&T) pinout scheme as illustrated in Figure 1 below:

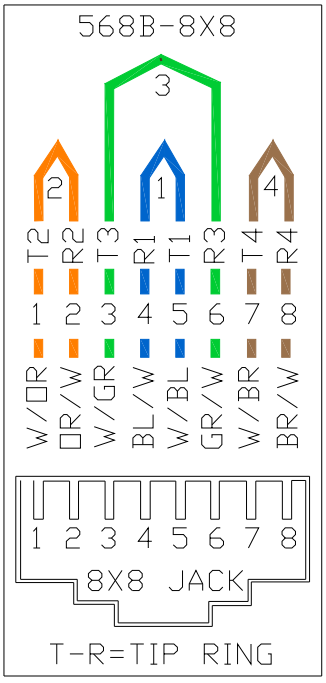

Figure 1: 4-pair station cables, wired per T568B (AT&T) pinout scheme (pins 1, 2, 3 & 6 used)

C. Color Coding of Voice and Data Circuits

Refer to POS standard specification section 17190B.

D. Voice and Data Cable

1. U.L. listed and labeled on cable jacket
- Non-plenum (riser) cable marked for CMR
- Plenum cable marked for CMP

2. Voice cable (25 pair): Cat 5e, as follows:
- Systimax solutions 25-pair PVC part number 760026518_ 1061F SL 25/24 R1000 (non-plenum)
- Systimax solutions 25-pair part # 2061025AWH-R1000 (107 369 845) (plenum)

3. Data cable (4 pair): Cat 6/6a, as follows:
   - (1)Non-plenum:
     - Cat 6: Systimax Solutions p/n 700212020 GigaSpeed XL (red)
     - Cat 6a: Systimax Solutions p/n 760107136
   - (2)Plenum:

- Cat 6: Systimax Solutions p/n 700210263 GigaSpeed XL (red)
- Cat 6a: Systimax Solutions p/n 760107243 GigaSpeed XL (red)

E. Voice and Data Cable Products (Non-Cable)

1. Patch Panels:

- Category 6 GigaSpeed compliant, RJ-45 patch panels, Systimax Solutions p/nPM-GS3-24 or PM-GS3-48, no substitutions.

2. Data Outlets:

- Systimax Solutions p/nMGS400-317 (Red), no substitutions, 568B pinout. Outlets may be mounted in any Systimax Solutions Series M modular faceplate. Preferred mounting is at 45 degree down angle.
- WiFi: Systimax Solutions p/nMGS600, no substitutions, 568B pinout. Outlets may be mounted in any Systimax Solutions Series M modular faceplate.

F. Innerduct Standards

1. Innerduct is required in conduits 2" and larger, and in cable trays. Innerduct requirements are as follows:
   a) Fabric Innerduct:
   - 2" conduits: use 3-cell innerduct, ½" cell
   - 3"-4" conduits: use 3-cell innerduct, 3" cell

   b) Corrugated innerduct: for use in cable trays

2. Refer to the following sections for product data and installation requirements:
   - 27 05 28 – Communication Pathways
   - 27 05 53 – Identification and Labeling
   - 27 05 53.13 – Communications Standard for Labeling and Nomenclature
   - 27 05 53.23 – Port of Seattle Color Code Requirements
   - 27 13 00 – Backbone Cabling Requirements
   - 27 15 00 – Horizontal Cabling Requirements

G. Fiber Optic Product Standards

1. General
   - a) In order to provide standardized products, color coding, and labeling of fiber optic jumpers (patch cords) for use throughout the Airport, standardized products help assure the quality of the products and connections.
   - b) Color coding and labeling standards provide rapid identification of categories of connections and reduce the risk of human error while making and breaking patched connections.
   - c) The following definitions shall apply:
   - (1) Jumper: Jumpers and patch cords are synonymous terms. Jumpers have LC connectors on both ends and are configured as simplex (one fiber), duplex (two fibers), or quad (four fibers) types.
   - (2) Patch Cord: see Jumper.

- 2. The fiber optic backbone cable plant and patch panels have been standardized as Systimax Solutions products. Refer to POS Guide Specification Sections 27 13 00 – Communications Backbone Cabling and 2715 00 – Communications Horizontal Cablingfor fiber optic product standards.

4. Duplex jumpers shall be selected as appropriate for the application of usage. Duplex jumpers shall be the default configuration.

5. Fiber Optic Color Coding
   - Refer to POS standard specification Section 27 05 53.23 – Port of Seattle Color Code Requirements.

6. Labeling
   - Refer to POS standard specification Section 27 05 53 – Identification and Labeling and 27 05 53.13 – Communications Standard for Labeling and Nomenclature.

H. Cabling bending radii requirements

1. UTP cable bending radii
   a) Unshielded twisted pair cable bending radii shall be no less than 4 times the cable diameter.
2. Fiber optic cable bending radii
   a) Fiber optic cable bending radii shall be 20 times the internal diameter of the innerduct during installation, and at least 10 times the internal diameter of the innerduct after installation.

VII. General Requirements / Codes

A. Applicable Codes and Industry Standards Include But Are Not Limited To:

1. National Electrical Safety Code
2. State of Washington Standards and Codes
   - a) National Electrical Code® as amended and administered by the State of Washington.
   - b) Washington Administrative Code (WAC), particularly WAC 296-46 and 296-401A for electrical.
   - c) Revised Codes of Washington (RCW), particularly RCW 19.28 for Electricians and Electrical Installations.
   - d) Washington Codes for Seismic Structural design and bracing
   - e) Washington revised version of the Uniform Building Code
3. State of Washington Department of Labor and Industries Regulations (L&I)
4. National Electrical Manufacturers Association (NEMA)
5. National Fire Protection Association (NFPA), including:
   a) NFPA-70, National Electrical Code® (NEC®), 2002 edition, particularly:
   - Article 110, Requirements for Electrical Installations
   - Article 250, Grounding and Bonding

- Article 392, Cable Trays
- Article 110-V, Manholes and other Electric Enclosures Intended for Personnel Entry
- Article 645, Information Technology Equipment
- Article 770, Optical Fiber Cables and Raceways
- Chapter 8, Communications Systems
- Article 800, Communications Circuits

b) NFPA-70E, Standard for Electrical Safety in the Workplace

- NFPA-72, National Fire Alarm and Signaling Code
- e) NFPA-75, Standard for the Fire Protection of Telecommunications Facilities
- f) NFPA-101, Life Safety Code
- g) NFPA-262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
- h) NFPA-297, Guide on Principles and Practice for Communications Systems
- i) NFPA-780, Standard for the Installation of Lightning Protection Systems

6. American National Standards Institute (ANSI)
7. Underwriters Laboratories Inc.® (UL), including:
   - a) UL Subject 444, Communications Cables
   - c) UL 1310, class 2 power units
   - d) UL 1651 Standard for Optical Fiber Cable
   - e) UL 1666, Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
   - f) UL 2024, Standard for Cable Routing Assemblies and Communications Raceways
   - g) UL 2257, Identification Tests for Jacket and Insulation Materials Used in Plenum Cables
8. The Institute of Electrical and Electronics Engineers (IEEE), including:
   - a) ANSI/IEEE PC62.41-1, Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits
   - b) ANSI/IEEE C62.43-1, IEEE Guide for Surge Protectors and Surge Protective Circuits Used in Information and Communication Technology Circuits
   - c) ANSI/IEEE Standard P1187-2013, IEEE Recommended Practice for Installation Design and Installation of Valve Regulated Lead-Acid Storage Batteries for Stationary Applications.
   - d) IEEE Standard 81-2012, IEEE Guide to Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
   - e) IEEE Standard 3003.1-2019Recommended Practice for Grounding of Industrial and Commercial Power Systems
   - g) IEEE Standard 450-2020, IEEE Recommended Practice for Maintenance, Testing and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
   - i) IEEE Standard 1184-2006, IEEE Guide for Batteries for Uninterruptible Power Systems.
   - j) IEEE Project 802, Local and Metropolitan Area Network Standards Committee (LMSC)
10. International Electrical Testing Association

11. National Electrical Contractors Association
12. Federal Aviation Administration (FAA) Regulations
13. Federal Communications System (FCC) Regulations as applicable:
14. International Building Code (IBC)
15. InterNational Electrical Testing Agency (NETA)
16. Occupational Safety and Health Administration (OSHA)
17. SeaTac Telecommunications Review Team
18. International Cable Engineers Association, Inc. (ICEA), including:
    - a) Telecommunications Cable for Outside Plant Applications
    b) Communications Wire and Cable for Premises Wiring
19. Telecommunications Industry Association / Electronic Industries Alliance (EIA/TIA) standards, including:
    - a) TIA/EIA-455-B, Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
    - b) TIA/EIA-526, Standard Test Procedures for Fiber Optic Systems
    - c) ANSI/TIA/EIA-568, Commercial Building Telecommunications Cabling Standard
    - f) ANSI/TIA/EIA-569, Telecommunications Pathways and Spaces
    - g) ANSI/TIA/EIA-598, Optical Fiber Cable Color Coding
    - h) ANSI/TIA/EIA-606, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
    - i) ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications
    - j) TIA/EIA-758, Customer Owned Outside Plant Telecommunications Infrastructure Standard
21. American Society for Testing and Materials (ASTM)
22. Alliance for Telecommunications Industry Solutions (ATIS)
24. International Electrotechnical Commission (IEC), including:
    - a) IEC 60603-7, Part 7 (addresses modular connector physical dimensions, mechanical and electrical characteristics)
    - b) IEC 60874, Sectional Specification for Optical Fiber Connectors
25. Information Technology Industry Council (ITI)
26. National Institute of Standards and Technology (NIST)
27. Uniform Building Code (UBC)

C. References

Applicable Industry References Include:

1. Building Industry Consulting Service International (BICSI), Telecommunications Distribution Methods Manual (TDMM)
2. BICSI LAN and Internetworking Manual
3. BICSI Telecommunications Cabling Installation Manual
4. BICSI LAN and Internetworking Applications Guide
5. BICSI Customer-Owned Outside Plant Design Manual

D. Design Considerations

1. Investigate and verify existing conditions before proceeding with design.
2. Identify and coordinate impacts to Airport operations with the Port project manager.
3. Identify and evaluate alternates with the Port project manager early in the design process.
4. Develop construction cost estimates and schedules.

E. Tenant Spaces

1. Each tenant space requires a tenant demark. Tenant spaces include:

- Airport Dining and Retail spaces
- Airline tenant leased spaces.

2. Each tenant leased space is required to have a separate demark package if it is non-contiguous with spaces leased by the same tenant.

- It is not acceptable to run horizontal cabling to a tenant-leased space through a space that is not leased by the same tenant.

F. Demolition and Remodel

1. Keep shutdowns to a minimum.
2. All shutdowns require coordination and approval of POS project management.
3. Coordinate communications power to be used during construction.
4. Refer to the POS Tenant Design Guide for Communications Systems (in Appendix), for detailed requirements.

G. Interdiscipline Coordination

1. The prime design consultant shall provide a formal interdiscipline coordination check of all contract documents to ensure compatibility of design.
2. Indicate communications wiring interfaces between systems.

H. Miscellaneous Coordination Items

1. Division of responsibilities between the Port and tenants shall be determined by lease agreements and on a project-by-project basis.
2. Coordinate size of communications equipment and equipment arrangements within communications rooms and spaces as noted in Paragraph X, “Requirements for Communications Rooms and Spaces.”
3. Make provisions for noise, dust and contaminant control, access control, safety, material staging, outages, and testing on operations and maintenance.
4. Shutdowns: All shutdowns must be coordinated with the Communications staff. Shutdowns may take several weeks of planning to coordinate with affected departments to plan operations around them. Provide project shutdown and start-up procedures.
5. SeaTac Telecommunications Review Team attendance as required by F&I. Contact F&I prior to all reviews and final issue of plans for the need to present to START.

6. Refer to the "Tenant Design Guide for Communications" in the Appendix for POS tenant improvement design requirements.

I. Listing and Labeling

1. All communications equipment and subassemblies shall be listed and labeled by Underwriters Laboratories Inc., CSA, or a recognized Washington State Labor and Industries (L&I) listing organization.

J. Calculations

1. Perform system calculations in accordance with ANSI/TIA/EIA-568-B for fiber-optic cabling and Cat 6/6a cabling, including:
   - a) Attenuation
   - b) Bandwidth
   - 2. Perform conduit fill calculations in accordance with EIA-569.

K. Tests

1. Perform tests as stated in ANSI/TIA/EIA 568 for fiber optic cabling and Cat 6/6a cabling. Refer to Section X. "Acceptance Testing" for more detail.

VIII. Underground Infrastructure

A. Duct Banks

1. The standard ductbank is reinforced concrete with encased Schedule 40 PVC conduits.
2. Entries or sweeps into building or equipment shall be rigid galvanized steel. Unreinforced concrete ductbanks not allowed.
3. F&I approval is required for any exceptions to 1. and 2. above.
4. Refer to Red Concrete Section 26 05 43 of the POS Electrical Standards, "Underground Ducts and Raceways".

B. Manholes

1. Size manholes per latest NEC Article 110-V. "Manholes and Other Electric Enclosures Intended for Personnel Entry."
2. Seal with electrical duct sealant and 100# strength nylon pull cord all ducts entering and leaving manholes and keep as dry as possible. Provide 'true tape' in all ducts.
3. Provide F&I approved signage on all manholes for controlled entry to manholes. Weld manhole ID in 4" letters on top.

D. Documentation Required

1. Communications riser diagrams showing all communications system elements and plan drawings showing equipment locations and specific rack elevations.
2. Test reports as required.

3. Logical and physical network diagram documentation.

E. Ensure That Following Items are Specified:

1. Ground all metal equipment in manholes.
2. Identify communications cable at all accessible locations in manholes, cable vaults and trenches. Refer to Appendix "Communications System Labeling Standard" for identification of communications cables and conduits.
3. Verify that bending radius of cable meets manufacturer's requirements.
4. Seal all communications conduits that exit out of a building.

IX. Requirements for Communications Rooms and Spaces

A. General

1. Definitions: "Communications Spaces" shall include the following:
   - a) Main Distribution Rooms (MDRs)
   - b) Communications Equipment Rooms (CERs)
   - c) Communications Rooms and Closets (ERs)
2. Provide supports and restraints for IBC seismic requirements for all equipment and raceways. Refer to Section XIV "Seismic Supports for Communications Equipment" below for seismic support requirements of communications equipment.
3. Provide "dedicated space," "working space" and exits for low-voltage equipment complying with latest NEC Article 110 as a minimum.
4. Coordinate keys for locked communications spaces with Aviation Communications Maintenance Department.
5. Locate equipment to provide 110-degree door swings minimum.
6. As a general guide, provide a communications Main Distribution Room (MDR) to serve each 15,000 to 20,000 square feet of new floor space.
7. As a general guide, provide a Communications Equipment Room (ER) to serve each 5,000 to 10,000 square feet of new floor space. Each Communications Equipment Room shall have a minimum size as per TIA/EIA-569-A, chapter 7.
8. Do not provide ceilings (drop-in tile or hard lid) in communications rooms.
9. Do not provide ceilings in communications equipment rooms unless approved by F&I.
10. Standard exit door swing for dedicated communications rooms is "out" using tamper proof hinges and panic bar hardware for room exit.
11. Positive pressure ventilation of at least 0.1" of water is required in all communications rooms using filtered supply air. Filtered air shall be provided such that entry into the room shall not be required in order to change the air filter.
12. HVAC equipment sized for maximum temperature in communications rooms of 85o Fahrenheit. Design supported by calculated values of BTUs generated by the equipment.
13. Communications spaces must provide for installation of panels and equipment and for vertical wiring. Locate rooms and closets on each floor with risers in direct vertical alignment.

14. Communications spaces shall be provided with furniture adequate for use as a writing surface. Slide-out shelfs are acceptable.
15. Communications spaces shall be locked in locations accessible to the general public.
16. Airline tenants and vendors shall not install equipment in Port telecomm equipment rooms in order to maintain PCI compliance.
- Port of Seattle does not allow shared comm rooms with tenants and vendors.
- In limited circumstances, a variance may be granted by F&I and ICT.
17. Service provider equipment may be allowed in Port telecomm rooms with F&I and ICT approval.
18. Seal all communications conduits that exit out of a building.
19. Refer to POS standard specification Section 27 05 13 for further requirements.

B. Lighting, Power and Grounding

1. Provide emergency lighting in all communications spaces. Emergency lighting of 50 footcandles average for maintenance is required in all communications spaces.
2. Exposed raceways are standard in dedicated communications spaces.
3. Label all raceways leaving communications rooms and closets as to location of opposite end and equipment served. Concealed raceways are allowed.
4. Refer to Section XIII "Grounding" for grounding requirements in communications spaces.
5. Refer to Section XIV "Surge Protection, Power Conditioning and Receptacles" for power requirements in communications spaces.
6.
7. Provide separate rooms for power and communication systems. Electrical panels may be installed in telecomm equipment rooms and MDR if they feed only loads within the telecomm room.

C. Telecommunications Backboards

1. Telecommunications backboards shall be provided on all wall surfaces in communications spaces. Backboards shall consist of three-quarter (3/4)-inch A-C marine grade fire retardant plywood, painted with two coats of light colored, non-conductive fire retardant paint.
2. Backboards shall be free of surface defects such as knots or cracks.
3. The plywood shall extend from the floor to eight (8) feet above the finished floor, and shall be mounted with the "A" side exposed. Cutouts shall be provided around existing power and telecommunications outlets.
4. In new construction, power and telecommunications outlets and light switches shall be surface mounted on the plywood backboard.

D. Equipment Racks and Cabinets

1. Sea-Tac airport has standardized on a general purpose open-frame 19-inch wide EIA standard equipment rack. The rack may be either floor standing, from five (5) feet to seven (7) feet tall, or may be a wall-mounted rack with a swing-out front section to provide access to the rear of the equipment.

2. Floor-standing equipment racks must always be securely bolted to the floor.
3. Cable ladders shall be used to interconnect multiple equipment racks, to brace equipment racks to the wall, and as a means of routing cables to and from the rack.
4. Some electronic equipment, such as large LAN switches, shall require an equipment rack with both front and read mounting rails. Provide 36" clear work space in the front, rear and at one end of each equipment rack. All rack-mount equipment cabinets shall have a minimum of 20" from the front rail to the rear aisle workspace.
5. All racks must be equipped with an appropriate number and type of horizontal, both front and rear, with strain relief brackets to ensure proper bend radius and strain relief for all data and power cables. Provide 4” vertical cable management on both sides of each rack or cabinet. Provide 4” vertical cable management for shared use between adjacent racks.

E. Firestoppping

1. Provide firestopping for all pipe, conduit, innerduct, cable, cable tray, duct and other items which penetrate walls, floors and ceilings.
2. Firestop all penetrations with appropriate materials in accordance with manufacturer’s specifications, NFPA practices, Factory Mutual (FM), UL, applicable codes, statutes and ordinances with NELS, 3M, HILTI CIBA or Specified Technologies, Inc. products.
3. Provide firestopping materials:
   - a) Elastomeric components – used in pre-manufactured mechanical systems.
   - b) Putties – may be used in conjunction with ceramic fiber or rock wool.
   - c) Caulks - dispensed in tube form.
   - d) Cementious materials – supplied as a dry powder to be mixed with water; or, in some cases, premixed.
   - e) Intumescent sheets – usually used in conjunction with caulk or putty, to fabricate a honeycomb-partioned opening for cable or conduit.
   - f) Intumescent wrap strips – used to wrap plastic or metal piping, or cable bundles that may burn away and leave a significant void.
   - g) Fire-rated pathway device with built-in, self-contained fire sealing system which automatically adjusts to installed cable loading ("EZ Path" from Specified Technologies, Inc., or equivalent).
   -

X. Pathways / Cabling / Conduit

A. General - refer to POS Standard 27 05 28 - Communication Pathways

B. Cabling

1. Routing of voice or data cables (Cat5e, Cat6, Cat6a RG6 and RG11) in the same conduit as power conductors is not allowed.
   - Exception: This is only allowed if a Class 2 power supply is used, and the power conductors have a voltage of 24 volts or less, and the load is less than 100VA.
   -

2. Cabling shall be installed in metallic conduit or cable tray. No j-hooks or other cable hangers are allowed. (Exception: radio frequency "RF" cabling for the 800 MHz radio system).

3. Cabling in ceiling interstice (i.e. - between false ceiling and structure) shall be one of the following:
   - a.) Riser or plenum rated when cable is installed in metallic conduit or fully enclosed metal tray. Plenum rating is optional in this case.
   - b.) Plenum rated when cable is installed in open tray, ventilated tray, or ladder tray, or otherwise exposed.
   - c.) Cabling in areas with open ceilings (like bagwell) can be Riser or Plenum rated. Plenum rating is optional in this case.

C. Conduit

1. Conduit Color Codes
   - POS has standardized on the following color codes for communications systems. The color shall be applied with a clearly visible ring of paint on both ends of the conduit, in addition to the conduit connectors. The paint ring shall be 1" width, marked with oil based primer and oil based paint.

Systems	Color	**FEDERAL STANDARD NO. 595A COLOR CODE**
Tel/Data	Orange	32473
Security/Intercom	Pink	31638
CATV	White	37886
CCTV	Green	34138
Fire Alarm	Red/5ft	31302
120/208V	Blue	35180
277/480V	Yellow	33793
Paging	Brown	30140
Controls	Black	37038

   -
   -

C. Cable Tray

1. Refer to POS Standard Sections 27 05 53 and 27 05 53.23.

XI. Acceptance Testing

A. Comply with testing requirements as described in:

1. 27 05 13 – General Communication Requirements
2. 27 08 00 - Communications Infrastructure Commissioning
3. 27 13 00 – Backbone Cabling Requirements
4. 27 15 00 – Horizontal Cabling Requirements

XII. Safety

A. The applicable State of Washington safety rules and health standards including but not limited to WAC, WAC-296-45, and WAC 296-24, Part L shall be observed and complied with in every detail by tenants and contractors.

B. All work at Sea-Tac International Airport requires controlling hazardous energy by performing lockout/tagout as defined by WAC 296-24 Part L, Safety Procedures and OSHA 1910.147.

XIII. Grounding

A. Comply with ANSI/TIA/EIA-607.

B. Refer to the Grounding, Bonding and Electrical Protection section of the BICSI TDMM for general information regarding the design of grounding, bonding and electrical protection systems. See also the Grounding, Bonding and Electrical Protection section of the BICSI Customer-Owned Outside Plant Design Manual for more information. The following requirements take precedence over the BICSI TDMM guidelines for telecommunications infrastructure at Sea-Tac Airport:

1. A Telecommunications Main Grounding Busbar (TMGB) shall be installed at an accessible and convenient location in each Entrance Facility. A Telecommunications Grounding Busbar (TGB) shall be installed at an accessible and convenient location in each Communications Room and Communications Closet.
2. TMGBs and TGBs shall be sized to accommodate 30% future growth.
3. A green insulated stranded copper cable (sized between a minimum of #6 AWG and a maximum of 3/0 AWG) shall be provided between each TGB and TMGB and from the TMGB to the building main electrical service ground electrode.
4. The Designer shall evaluate the grounding cable size that shall be appropriate for each application.

XIV. Surge Protection, Power Conditioning and Receptacles

A. Surge Protection for Low-Voltage Power Systems Serving Electronic Equipment Loads

- 1. Provide solid-state, multiple-stage transient voltage surge suppressors employing no series-connected suppression components for electronic equipment circuits.

2. Employ OEM matched metal oxide varistor suppression modules.
3. Provide discrete protection circuitry dedicated to protect L-N, L-L, and L-G. Reduced or partial mode designs are not acceptable.
4. Parallel configured, threshold suppression network filtering – voltage envelops clamping, electrochemical heat sink encapsulated, with LED indicators, 1 per phase normally "on", UL 1449 listed.
5. Refer to Section 26 43 13 – Surge Protection for Low Voltage Electrical Power Circuits in the Electrical Standards.
6. Common mode AC power surge suppression devices shall not be utilized.

B. Power Conditioning for Low-Voltage Systems

1. UPS systems and surge protection shall be provided in all Communications Equipment Rooms (CER rooms). Provide an on-line type UPS with 4 hours of backup time (minimum).
2. Refer to Section 26 33 53 - Static Uninterruptible Power Supply in the POS Electrical Standards for additional requirements.
3. Communications equipment rooms containing UPS systems shall be environmentally conditioned as per ANSI/TIA/EIA-569-B.
4. When power-conditioning equipment is specified, the effect of electronics on the input line should be considered and means taken to prevent power line distortion.
   - a) Power conditioning equipment shall perform in accordance with "IT (CBEMA) Curve Application Note" in the Appendix.

C. Power Supplies for Electronic Systems

1. All electronic systems installed in communication rooms shall have self-contained, internal power supplies capable of being powered from 120VAC, single phase power.
   - a) Some larger equipment such as LAN switches may require 208V power. Coordinate special power requirements with F&I.
2. In no case shall electronic systems in communication rooms require external wall-type or floor-type power converters or adapters.
3. Any exceptions to above items 1. and 2. shall be approved by F&I.

D. Electrical Receptacles

1. Each telecommunication space shall be equipped with a minimum of two (2) 20-amp, 120VAC quad (4-plex) electrical receptacles.
2. Each dedicated receptacle shall be colored orange, and shall be used exclusively for electronics equipment.
3. Additionally, provide two (2) 20 amp, 120VAC twist-lock receptacles mounted 8.5 ft. above finished floor (AFF).

XV. Seismic Supports for Communications Equipment

A. General

1. Seismic mounting and bracing of all communications equipment shall be provided.
   - a) In compliance with manufacturer's recommendations
   - b) Based on engineering calculations
2. Seismic restraints and other earthquake damage reduction measures shall be used for all communications equipment and components including, but not limited to, racks and cabinets.
3. For equipment noted in Paragraph B.2 below, indicate materials, and show designs and calculations for anchorage and bracing, signed and sealed by a registered professional Structural Engineer.

B. Standards

1. Comply with seismic restraint requirements in BOCA and UBC.
   - a) Building Officials and Code Administrators International – BOCA National Building Code – latest issue.
   - b) International Congress of Building Officials – International Building Code – latest
2. The following equipment shall be submitted with designs and calculations signed and sealed by a registered professional Structural Engineer:
   a) Beam clamps.
   - b) Seismic bracing, to include hinges.

C. Materials for Restraints

1. Indoor Dry Locations: Steel, zinc plated
2. Outdoors and Damp Locations: Galvanized steel
3. Corrosive Locations: Stainless steel

D. Refer to Section 26 05 29 – Hangars and Supports for Electrical Systems in the POS Electrical Standards.

END OF SECTION

APPENDIX

1. Application for Connection to Communications System
2. Sea-Tac Airport Communications System Backbone Drawing EC-02, as follows:
   a) CIBS Communications Rooms
   b) Primary and Secondary Fiber Optic Backbone Cable One-Line Diagram
   c) CIBS Communications Rooms – Isometric View
   d) Fiber Optic Tie One-Line Diagram
   e) Copper Tie One-Line Diagram
3. Communications System Labeling Standard
4. IT (CBEMA) Curve Application Note
5. Tenant Design Guide for Communications Systems
6. Tenant Demarcation Box Drawing "Configuration 1"
7. Tenant Demarcation Box Drawing "Configuration 2" with Bill of Materials (BOM)
8. Manhole Configuration Drawing SK-5
9. Cable Tray & Conduit Details
10. CCTV Block Diagram
11. Concourse 'A' Fiber-Optic One-Line Diagram