IT / Telecommunications
Technical and Wiring Standards

T. F. Green Airport

Green Airport
The Hassle-Free Gateway
to New England

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TECHNICAL AND WIRING STANDARDS

1. OVERVIEW

This document describes products and workmanship standards relating to the design, furnishing, and installing Telecommunications systems and cabling at T.F. Green State Airport (PVD). These standards shall be fully adhered to by all telecommunications employees, contractors, architects and consultants doing business with, for, or on behalf of the Rhode Island Airport Corporation (RIAC).

Tenants are encouraged to comply with their own corporate standards in addition to following all applicable building codes. Compliance with the standards listed herein for tenant leased spaces is optional. No inspections of tenant leased spaces will be performed in areas such as ATO's, concessions, or any other exclusively leased spaces in order to enforce the standards outlined within this document. However, tenants and their contractors will be held accountable to these standards when work is performed in common use (shared) areas of the terminal and other buildings on the airport campus.

Tenants or contractors who have been found by RIAC to have violated state or local building codes, or the standards and procedures within this document within common use areas will be required to remediate the issue(s) at their own expense within 30 days or as dictated by a state building inspector, whichever is sooner. After 30 days the Airport Corporation may take action to remediate the issue and if necessary the appropriate tenant or contractor will be billed for any expenses incurred on their behalf during the course of the remediation.

2. REGULATORY REFERENCES

All work and materials shall fully conform in every detail to the rules and requirements of the National Fire Protection Association, the local building codes, the below listed ANSI/TIA/EIA standards, and current manufacturing standards. The cabling systems described in this document are derived from the recommendations made in these recognized telecommunications industry standards. System designers, installers, and technicians shall at all times follow the requirements outlined within the referenced documents as well as the additional requirements listed within this document. If this document is found to be in conflict with the documents listed below, the more stringent of the requirements shall apply. This document does not replace any building code, either partially or wholly. The contractor must be aware of and comply with all building codes that impact this project. All reference documents listed within this document are believed to be the most current releases of the documents. However, the contractor has the final responsibility to determine and adhere to the most recent release when developing the proposal and/or performing the installation.

The documents listed below, including all currently published parts, subsections, addendums, and corrections are therefore incorporated as both regulatory and reference standards.

TIA-526-7	Optical Power Loss Measurements of Installed SingleMode Fiber Cable Plant (test method A.1)
TIA-526-14	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (test method B)
TIA/EIA-568-B.1	Commercial Building Telecommunications Cabling Standard; Part 1: General Requirements (2006)
TIA/EIA-568-B.2	Commercial Building Telecommunications Cabling Standard; Part 2: Balanced Twisted-Pair Cabling Components (2001)
TIA/EIA-568-B.3	Optical Fiber Cabling Components Standard (2000)
TIA-569	Commercial Building Standards for Telecommunications Pathways and Spaces (2004)
TIA-598	Optical Fiber Cable Color Coding (2005)
TIA/EIA-606	Administration Standard for Commercial Telecommunications Infrastructure (2002)
J-STD-607	Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications (2002)
TIA-758	Customer Owned Outside Plant Telecommunications Infrastructure Standard (2004)
NFPA-70	National Fire Protection Association / National Electrical Code (2007)
NFPA-780	Standard for the Installation of Lightning Protection Systems (2008)

3. GENERAL REQUIREMENTS

Product specifications, general design considerations, and installation guidelines are provided in this document. All telecommunications wiring shall be installed and documented in accordance with the latest revision of the TIA/EIA Telecommunications Building Wiring Standards and as referenced herein. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in the following sections and the referenced documents. If bid request documents are in conflict with any requirements listed or referenced above, the requirements specified by the telecommunications system designer shall take precedence. Contractors shall at all times meet or exceed all listed ratings for cabling systems described within this document or its referenced standards.

4. THE PVD AIRPORT NETWORK

4.1 Overview

The airport campus network consists of:

- ✈ Infrastructure
- ✈ Fiber Optic Cable Backbones
- ✈ Premise Wiring
- ✈ Dual Redundant Fiber Optic Ring Networks
- ✈ High-Speed Data Network Equipment
- ✈ Redundant, Remote PBX Equipment

- ✈ Dual Diverged T1 Internet Feeds
- ✈ Redundant Datacenters

4.1.1 **Infrastructure**
Conduit, raceways, risers, and cable trays shall be utilized for the protection of fiber optic and copper telecommunications cabling. Voice and data network electronics and cross-connecting hardware shall be maintained within secure spaces within buildings.

4.1.2 **Fiber Optic Backbones**
Fiber backbone circuits should be run using two or more cables and the total amount of strands should be divided equally between them. The total installed strand count shall be at least 200% of the anticipated need or 96 strands, whichever is greater.

4.1.3 **Premise wiring**
Data service between Telecommunications Rooms (TR's) shall be provided by fiber optic cabling. Voice service between TR's shall be provided by Category 5 or greater copper cabling.

4.1.4 **Dual redundant fiber optic ring networks**
Data service between buildings on campus is accomplished through twin fiber optic ring networks forming a total of four "live" fiber optic paths to each building. This is accomplished using two Moxa brand industrial grade gigabit ring network switches in each building's main Telecommunications Room.

4.1.5 **High speed data network equipment**
HP Procurve Layer-3 network equipment provides all service to end nodes and interconnects with the backbone ring network switches over multiple copper links.

4.1.6 **Network Redundancy**
Switch to switch meshing interlinks every Ethernet switch in a building to every other switch within that building. Each meshed link should be configured to utilize two pairs (two circuits) of fiber or copper per link (trunk).

4.1.7 **Dual diverged TI feeds**
Internet service is achieved through two separate and autonomous ISP feeds and separate groups of public IP addresses. Each ISP feed is fed into the airport campus from two separate and diverse locations, then cross connected with each other to allow access to any network from either of two datacenters.

4.1.8 **Datacenters**
The PVD campus supports two datacenters. The primary datacenter is located in the terminal building and the backup datacenter is located approximately three "fiber" miles away. Each datacenter supports both shared and independent VMware virtual infrastructures as well as a shared storage area network (SAN). The SAN is comprised of a mirrored pair of EMC Clariion storage arrays and a third independent storage array which has been dedicated to data backups.

5. SPECIAL CONSIDERATIONS FOR TELECOMMUNICATIONS ROOMS (TR)

5.1 Building Distribution

Each building must have a designated primary TR. The fiber backbone cable system links the primary TR's together between buildings. TIA/EIA 568-B.1 defines 295 feet as the maximum horizontal distance from a TR to the workstation outlet(s) it supports; therefore buildings may need additional TR's when distance limitations from a TR to an outlet would otherwise be exceeded. Premise fiber is used to link secondary TR's in a building to the primary TR. Whenever possible, the premise cabling system should be designed in a straight vertical line from the basement TR up through a separate TR on each floor.

5.2 Room Climate Control

Each TR must be independently climate controlled and capable of providing year round ambient temperature and humidity control (24 hours/day, 365 days/year) to protect the installed electronic equipment. The designer must estimate these loads and coordinate all HVAC requirements per TIA-569-B. HVAC systems must be sized appropriately in order to maintain a constant temperature between 64 and 72 degrees. Rooms must also be provided with positive atmospheric pressure to exclude dust.

5.3 Multi-Story Buildings

In multi-story buildings, a minimum of one TR should be located on each floor (extremely small facilities may use one TR for the entire facility). TRs on successive floors should be vertically stacked wherever possible. A minimum of three 4-inch rigid steel conduits must be installed between a primary TR and each secondary TR in accordance with TIA/EIA-569-B.

5.4 Size

Telecommunications Rooms must be sized in accordance with TIA/EIA-569-B for all new construction projects. Generally, the TR should be sized to approximately 1.1% of the area it serves. For example, a 10,000 square foot area should be served by a minimum of one 11 ft x 10 ft TR. Large floor areas should be divided into "serving areas" with TRs for each serving area. Each serving area can be no larger than 10,000 square feet (1,000 sq m) as stipulated in TIA/EIA-569-B. TR sizing allowances should be made only in cases of construction projects involving building renovation, and under most circumstances a TR must not be smaller than 11 ft x 7 ft. The designer must avoid irregular sized TRs, such as narrow rooms or odd shapes. Provide adequate space in telecommunications rooms to facilitate telecommunications system support equipment requirements in owner installed freestanding cabinets or racks. Total TR space (as a percentage of the building's area) must be scale upward, to reflect the increased number of circuits in buildings with more than the standard number of circuits to each workspace. Smaller building TR's are covered in Annex B of TIA/EIA-569-B.

5.5 Space Location

Telecommunications Rooms must be dedicated spaces and not shared with other functions (i.e., electrical rooms, mechanical rooms, etc). TRs should be centrally located in the area they serve. TRs must also be located such that the maximum copper cable

distance from the patch panel through the structured cabling system to the furthest outlet does not exceed 295 feet. In rehabilitation projects, rooms containing transformers, air handling units, etc., should be avoided if at all possible. If shared facilities cannot be avoided, ensure that proper electrical/telecommunications cable separations are maintained per NEC.

5.6 Room Contaminants

Information system equipment must not be installed in spaces where moisture, liquid or gaseous spillage, or other contaminants may be present.

5.7 Interior Finishes

Floors, walls, and ceilings must be treated to eliminate dust. Finishes should be light in color to enhance room lighting. Dropped (suspended) ceilings must never be installed in TRs or in datacenters.

5.8 Doors

Doors must be a minimum of 36” wide, 80” tall, without doorsill, hinged to open outward and be fitted with a lock to control access to the room. Special consideration should also be given to providing 48" wide doors whenever possible.

5.9 Room Lighting

Light fixtures must be mounted a minimum of 9-feet above the finished floor and provide a minimum of 50 foot candles (500 lx) of illumination measured 3-feet above the finished floor in all areas after installation of racks and cabinets.

5.10 Telephone Backboards

A minimum of one wall should be covered with rigidly fixed 3/4 in A-C plywood, preferably void free, 8 ft high, capable of supporting attached equipment. Plywood must be fire-rated. Fire rated backboards are TIA/EIA approved and are easier to field verify than the fire retardant paint. When renovating an existing closet that does not have adequate space, the backboard must be sized as large as possible

5.11 Voice Communications

Each TR shall have one wall-outlet, installed at or near the entry door

5.12 Ladder Racks and Cable Trays

Ladder type racks (preferred) or welded wire cable tray must be used in the TR to provide cable distribution between the telephone backboard, equipment racks or cabinets, and the building distribution cable tray or conduits. Appropriate inserts and cable drop adapters appropriate to the ladder rack or cable tray must be provided to properly maintain the bend radius for the installed wire or cable.

6. EQUIPMENT RACKS AND CABINETS

6.1 General Requirements

Equipment Racks and Cabinets shall be provided within a TR to provide a consolidated location for connection of LAN circuits. Units must be floor mounted, have a 19 inch wide square punched rail system, and be located at or near the center of the TR. Racks and cabinets should be configured with at least a 36" interior depth with a 39" interior depth provided whenever possible. Equipment racks and cabinets may be floor mounted adjacent to a wall, but must provide a minimum of 36 inches of clear space both in front and in back, and a minimum side clearance of 24 inches on at least one side. Floor mounted racks and cabinets shall be a minimum height of 84 inches unless otherwise specified. Spare rack and/or cabinet space must be provided for the mounting of owner purchased and installed LAN and telephone equipment. Provide not less than one-half rack of spare capacity based on the final amount of capacity utilized by the patch panels or other equipment provided by the project.

6.2 Power Distribution Units (PDU)

Floor mounted racks and cabinets shall be equipped with a minimum of two "zero U" 208 volt 30 amp Power Distribution Units (PDU). Wall mounted racks and cabinets shall have at least one 1U high 120 volt PDU per rack installed. The exact quantity of PDU's to be installed will be based on the amount of IEC 320-C13 connectors each PDU device supports and the overall equipment requirements of the design. Every PDU must provide management capabilities through SNMP and a web based interface. Every PDU must be equipped with built-in ampere metering capability. PDU's shall be configured with L6-30P plugs to connect into source power or UPS.

6.3 Cabinets

Equipment cabinets should be used where physical security is required, to mount secure or mission critical equipment, in circumstances where controlled access is desired such as CATV or CCTV, distribution in offices, or by specific request. Premise cables may be terminated in an enclosed 19-inch cabinet in order to provide enhanced protection for terminations and patching facilities. Cabinets must provide sufficient space for current and owner anticipated future equipment. Equipment cabinets should be logically grouped based on the purpose of the equipment they enclose.

6.3.1 Unless otherwise specified, all cabinets shall have the maximum configurable amount of cooling fans installed. For floor mounted cabinets, this generally means installing fans on both the rear door and the cabinet top. All cooling fans shall have finger guards installed on both sides of the fan to prevent personnel injury. Floor mounted cabinets shall be configured with a perforated metal front door to enhance airflow unless cooling is provided through a raised panel floor

6.3.2 Cabinets installed in a room with raised panel floors and under-floor cooling shall be configured with solid front doors and the same fan configuration as described in the previous section. However, these cabinets shall be configured so as to direct all airflow through the bottom of the cabinet(s) and into the void in the front of the cabinet between the door and the active components installed within so as to provide positive pressure

cold air to the intake of each active component. Cabinets shall be configured with blanks installed in all unused slots/positions (U's) to ensure positive air pressure at the cabinet front. Additionally, foam inserts shall be used between the cabinet sides and the vertical rails to further prevent air leakage between the cabinet front plenum area and other portions of the cabinet.

6.4 Wall Mounted Cabinets

Wall mounted racks or cabinets may be substituted in small buildings or spaces upon written approval from the IT dept. Warm air from inside the cabinet should be exhausted from the top of the cabinet through the use of multiple cabinet mounted fans. Cooling fans shall have appropriate finger guards installed on both sides of the fan. Fans shall be mounted to both cabinet top and cabinet bottom and shall be configured for optimum flow-through ventilation. Wall mounted cabinets should be configured with a perforated metal front door.

7. ELECTRICAL REQUIREMENTS

7.1 Telecommunications Room Electrical Power

Provide a minimum of two dedicated 120 volt, 20-amp duplex receptacles in each telecommunications room. Each receptacle must be on a separate 20-amp branch circuit serving only that receptacle. Additional duplex convenience receptacles must be provided at not greater than six foot intervals around the perimeter walls.

7.2 Rack Electrical Power

For all projects; provide a minimum of (2) dedicated 120 volt, 20-amp circuits with quad receptacles for each 19 inch rack or cabinet. All circuits shall be wired to building emergency power. All power receptacles shall be permanently affixed to building surfaces (floors, ceilings, or walls) and not directly attached to racks or cabinets. Outlets shall be located so as to minimize the exposure of connected circuits and thus reduce trip hazards. Permanently wired high outlet density Wiremold type power strips with a similar or greater quantity of outlets may be substituted for 120 volt quad outlets as necessary, upon written approval of the IT department. In addition to the requirements listed above, floor mounted racks and cabinets shall be configured with two dedicated 208 volt, 30 amp circuits per rack or cabinet. L6-30R receptacles shall be specified and installed for all 208v power.

7.3 Uninterruptible Power Supply (UPS)

Whenever a UPS is specified or provided by a project, an "online" style UPS with SNMP, EPO, and web management capability shall be provided. EPO features must be configured and wired appropriately into existing building systems. An EPO "panic switch" with a guard to prevent accidental activation must be provided on both the inside and outside face of the doorway(s) servicing the room in which the UPS is installed in. The EPO circuitry must also be tied into and be activated by the fire alarm sensor and configured to shut down the UPS within the room it supports in the event of a fire. UPS input shall be 208 volts and be either factory or field configured for plug & receptacle connection and not hard-wired into building electrical. UPS Output must provide at least two 208 volt 30 amp NEMA L6-30R receptacles and not less than six 120 volt 20 amp NEMA 5-20R receptacles. UPS capacity shall be at the discretion of the design engineer

who shall take into consideration all proposed and future power loads before selecting a UPS size or manufacturer. Whenever practical, a UPS shall be selected which has the ability to expand and support future increased loads by means of add-on or replacement modules.

8. GROUNDING

8.1 Building Earth Electrode Subsystem (EES)

The building EES forms the primary electrical, life-safety grounding system. Typically, a grounding electrode conductor connects the main building-grounding electrode to the main electrical entrance panel or cabinet. NFPA 70, Article 250 Section III provides guidance on the grounding electrode system and conductor. All TRs must be connected to the building earth electrode subsystem (EES). Refer to NFPA 780 for proper lightning protection and NFPA 70 for proper fault protection grounding. The telecommunications designer must review project drawings to ensure that the lightning and fault protection grounds are addressed by the appropriate disciplines. The telecommunications designer must ensure that the different grounding systems are not mixed within the building. End user buildings (EUB) and area distribution nodes (ADN) should have a resistance-to-earth of 10 ohms or less.

8.2 Cable Entrance Grounding

All metallic shields and strength members for outside plant cable entering a building must be connected to the lightning protection ground system. The designer must ensure that the lightning protection is in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems, latest issue.

8.3 Building Point of Entrance

NFPA 70 defines the point of entrance as the location where “the wire or cable emerges from an external wall, from a concrete floor-slab, or from a rigid metal conduit or an intermediate metal conduit grounded to an electrode in accordance with 800.400(B).” The Telecommunications Entrance Facility (TEF) is the space housing the point of entrance of the telecommunications service.

8.4 Copper Cable Entrance

The Outside Plant (OSP) copper cable shield, armor, and metallic strength member must each be bonded to the Lightning Protection Subsystem as close as possible to the building point of entrance with a No. 6 AWG or larger ground wire. The designer should use a non-bonded splice case for the transition from OSP rated cable to interior rated cable, or must indicate that the implementer not install the splice case carry-through bonding conductor. If the designer must extend the OSP copper cable past 50 feet in accordance with NFPA 70 section 800.50, the metallic strength member must be bonded to the lightning protection ground as close as possible to the conduit egress point with a No. 6 AWG or larger copper ground wire.

8.5 Fiber Cable Entrance

The OSP fiber optic cable armor and metallic strength member must be bonded to the Lightning Protection Subsystem as close as possible to the building point of entrance with a No. 6 AWG or larger ground wire. The designer should use a non-bonded splice case

for the transition from OSP rated cable to interior rated cable, or must indicate that the implementer not install the splice case carry-through bonding conductor. If the designer must extend the OSP fiber cable past 50 feet in accordance with NFPA 70 section 770.50, the metallic strength member must be bonded to the lightning protection ground as close as possible to the conduit egress point with a No. 6 AWG or larger copper ground wire. If inside/outside cable is used, a cable shield isolation gap must be incorporated.

8.6 Copper Protector Block

All OSP copper cables must be terminated on primary protector blocks, equipped with 5-pin solid state or gas protector modules. The protector blocks must be bonded to the Lightning Protection Subsystem with a No. 6 AWG or larger copper ground wire. Blocks must be UL listed. Place the protector block as close as possible to the lightning protection ground.

8.7 Telecommunications Room (TR) Signal Ground

All TRs must have a high frequency signal ground. The signal ground should consist of a ground ring around the inside perimeter of the TR or a bus bar for small TR's. The signal ground ring or bar should be connected to the building EES by using the building steel girders or a ground cable if the girders are not accessible. The size of the grounding electrode conductor of a grounded or ungrounded ac system shall not be less than given in NEC Table 250.66 The values in NEC Table 250.66 are based on the size of the service-entrance conductors but the grounding electrode conductor is not required to exceed 3/0 AWG copper or 250-kcmil aluminum. The telecommunications designer must ensure that the different signal grounding system does not interconnect with the fault protection and lightning protection sub-systems within the building.

8.8 Telecommunications Rack and Supporting Structure

All telecommunications racks and supporting structures (cable trays, ladders, conduits and baskets) within a TR must be bonded to the TR signal ground ring or bus bar as defined in TIA/EIA-569

9. LABELING

9.1 Conformance to Standards

Telecommunications systems labeling must be performed in full compliance with TIA/EIA-606-A for class 3 administration. Additional requirements are listed within this document. The TIA/EIA documents shall take precedence if any conflict is found or perceived. New installations shall not mimic an existing installation which does not fully comply with the standards outlined or referenced within this document.

9.2 Label Size

In lieu of a manufacturer provided label, field generated labels with industrial strength glue shall be used. All labels must be a minimum of ¼ inch high, use block letters, and be generated using standard and readily available commercial labeling machines and consumables. Handwritten labels must not be used for the final configuration

9.3 Telecommunications Outlet Color Coding

All room outlets configured with RJ45 jacks shall have the top left keystone position designated for voice and be labeled "VOICE" and be WHITE in color. The top right position shall be labeled "SPARE" and be YELLOW in color. The row-2 left position shall be labeled "DATA" and be BLUE in color. If designs specify the need for additional ports, subsequent colors shall be used in the order of Green, Red, and Grey or as designated by the design engineer. Keystone positions in excess of the first three may be populated with "F" connectors for CATV use. All keystone positions not populated with connectors shall have blanks inserted which match the faceplate color.

9.4 Cable and Jack Color Matching

All cables shall be of a color closely matching that of the keystone jack installed within the outlet faceplate which the cable is connected to.

9.5 Forbidden References

Identification labels which contain references to a specific tenant, project, or type of service shall not be allowed as part of the required standard labeling. However separate additional non-handwritten labeling may be added to reflect any additional information which is deemed necessary for identifying the circuit.

9.6 Cable labeling

Cable labels shall match the label on the patch panel or insert where that cable is installed. Labels shall be applied as either a wrap or heat shrink sleeve within 12 inches from cable end. For fiber optic cables, labels shall be placed on the outer jacket and within 12 inches of the beginning of the furcation kit. Wrap type cable labels shall be applied tightly around the entire circumference of the cable without wrinkles or voids and shall have a minimum 20% overlap. Lettering for all cables in a bundle or panel shall be oriented to read from the same direction and be not less than 1/8 inch high.

9.7 110 block Labeling

Within a TR, all 110 style blocks shall be individually labeled with identifying information unique to that TR and to the mounting frame or column of mounting frames. Labels shall consist of an engraved placard permanently bonded to the plywood backer board. Additional labeling shall uniquely identify each cable pair and the far end connectivity for that pair, either individually, or as a group. The recommended labeling solution from the 110 block manufacturer shall be used for this identification.

9.8 Outlet Labeling

Each outlet in a room or space must be labeled with the room number combined with a unique numeric suffix in sequence, starting at number one (-1) and proceeding clockwise around the room. Each label must additionally identify the servicing TR, the patch panel ID, and the port number within the patch panel the circuit is serviced from.

9.9 Patch Panel Labeling

A unique self-identification number shall be affixed to all patch panels. Identification numbers shall contain the TR number or physical location, an abbreviated reference to the cable type which the panel supports, and a unique one or two digit serial number. Panel ID labels shall be at least three quarters of an inch in height, but not more than one and one half inches.

9.10 Fiber Circuits

Fiber-optic panel labeling must conform to TIA-598, including the color to number translation table located within that document. Fiber buffer tubes shall be documented by numeric designation. Individual fiber strands shall be documented by color. Fiber patch panels shall have each panel insert individually identified by the unique cable number from section 9.6 above, by fiber buffer tube, and by fiber strand. If it already exists, manufacturer's silk-screened or embossed labeling of individual panel connectors for specific fiber strand positions or colors shall be followed at all times and may not superseded in the field by add-on or replacement labeling.

In addition to individually labeling each panel insert inside each patch panel, secondary labeling must be applied to the panel cover. Separate from the Panel ID number, the secondary labeling will be used to quickly identify the far end panel(s) with which each fiber within the panel services. All secondary labeling on panel covers shall be uniform in size and font, using approximately one-half inch high labels.

9.11 Distribution System Labeling

The distribution system is described in TIA/EIA-606-A for pathways. In addition, all transitions, wall penetrations, and changes in distribution system size and type must be labeled and documented. Each cabinet or patch panel must be labeled and documented with a unique designation indicative of its function and the cable type(s) it supports. The location of the labeling must be visible from a distance of at least six feet away.

10. GENERAL INSTALLATION REQUIREMENTS

10.1 Network Diagrams

Diagrams reflecting the final configuration ("As-Builts") shall be provided to the IT department at the completion of each project. Diagrams may be provided in the form of AutoCAD, Visio 2000, or portable document format (.pdf) only.

10.2 Plenum Rating Requirement

Plenum rated cable shall be used within all telecommunications closets and other areas which have no ceiling or are otherwise exposed to the void between floors or walls. Plenum rated cable shall also be used whenever a cable transits between rooms or telecommunications closets, through any other type of void, cable tray, or plenum unless that cable is fully enclosed (end-to-end) in conduit. Devices or equipment which is installed in plenums, in voids above ceilings, or any other location which could reasonably be assumed to carry fire or smoke between rooms shall be individually plenum rated or shall be installed only within a plenum rated enclosure.

10.3 Cable Bend Radius and Pulling Tension

Special care must be exercised by installers so as to not exceed the allowed bend radius and pulling tension for cables. Bend radius and pulling tension is defined by the cable manufacturer and by TIA/EIA standards. Bend radius and pulling tension is defined within addendum 1 of the TIA/EIA 568-B.1-1 for UTP and ScTP and in TIA/EIA 568-B.3 for fiber. Any cabling that has exceeded either the manufacturer's or the EIA/TIA listed tolerances for bend radius or pulling tension must be replaced at the installer's expense regardless of whether or not there is a detectable cable failure.

10.4 Cable, Jack and Panel Ratings

All jacks, ports, connectors, and patch panels must be rated in the same category and for the same use as the copper or fiber cables attached to them.

10.5 Mixing of Ratings

Fiber or copper cables within a single patch panel or punchdown block shall not be intermixed with different cable types or ratings. For example, mixing Singlemode fiber with Multimode, mixing 62.5um with 50um fiber, or mixing Cat5 and Cat6 copper within the same panel or block is not allowed.

10.6 Pull Strings

Pull-string, rope, or mule-tape, whichever is appropriate to the conduit diameter and length must be left installed inside every conduit at the completion of every job regardless of whether one existed in that conduit at the start of the job.

10.7 Pathway Fill Factor

Conduits and pathways should be populated to not greater than 60 percent of its capacity so as to provide for future expansion.

10.8 Routing of Wiring and Cabling

Telecommunications cables which are routed together must be routed in parallel and either fully behind, fully in front of, or fully on top of all other cabling or cable bundles. When installed in or added to an existing bundle, individual cables must maintain its approximate relative position within that bundle throughout the entire span. Spiraling individual cables or cable bundles around or between existing cabling or routing a new cable through existing cable service loops is not allowed at any time.

10.9 Wire bundles

Wires and cables which run in parallel to one-another shall be bundled together and secured with hook and loop type (Velcro) fasteners in order to present a neat and orderly appearance.

10.9.1 Velcro fasteners shall be installed so that the loop side faces outward and the hook side faces the wire bundle.

10.9.2 Plastic tie-wraps, also known as cable ties are not authorized for use anywhere except to securely fasten the end of a fiber optic cable to the rear of a patch panel.

10.9.3 To preclude future maintenance issues, wires and cables shall not be attached with any type of fastener in locations not easily accessible after the job is completed. E.g. between racks, between wall partitions, etc… In these types of inaccessible locations, either conduit or four sided cable trays or duct banks must be used in lieu of fasteners.

10.10 **Cable Clamps and D-Rings**

Cable clamps and D-Rings shall only be attached to plywood backer boards or directly to masonry walls. Any installation of cable clamps or D-Rings directly to drywall, either with or without inserts or adapters is not allowed at any time.

10.10.1 Cable clamps should be used to secure both copper and fiber cables to walls wherever possible, or as called for in other sections of this document. All cable clamps shall be manufactured with a fixed diameter and shall be sized appropriate to the cable(s) being secured to form a snug fit. Clamps shall be made of nylon or a similar plastic. Rubber covered stainless steel clamps may be substituted as necessary. Oversized cable clamps may be used for securing several lines in parallel, or for cable service loops. Cable clamps shall be installed with self-tapping Pan-Head screws (SPAX brand or equivalent). The use of any type of countersunk (flat or bugle) head screw either with or without an adapting washer is not allowed for use with cable clamps due to tendency for that type of head to inadvertently distend the mounting hole.

10.10.2 Electrical D-Rings combined with Velcro tape may be substituted for cable clamps as necessary, but only when multiple cables are routed as a bundle. The size of D-ring selected must be appropriate to the cables being managed.

10.10.3 Electrical “D” Rings are occasionally split or cut by installers to form hooks. While this practice is not discouraged, the cut end of these “D” rings must be ground and polished to be completely smooth or dipped in several coats of quick-set plastic (tool dip) in order to prevent wires from chafing on the cut edges. Electrical tape wrapped around the cut ends of split D-rings is not permissible as a remediation of burrs and sharp edges.

10.11 **Fire Stopping**

All room penetrations for cables, pathways, trays, and conduits shall have the appropriate fire stop material applied. When applied as a gel or caulk, fire stop material shall be applied to both sides of the penetration whenever it is physically possible.

10.12 **Testing**

Installed cable systems must be tested and certified to conform to the the currently documented TIA/EIA standards for that type of cable system. Test results along with a complete list of the comparison values used during testing must be provided in electronic format to the construction manager and to the IT department along with the certification of compliance for each cable prior to that cable system being released for use.

10.12.1 Unshielded and Screened Twisted Pair
All metallic cable pairs must be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals must be corrected. Correct color-coding and termination of each pair must be verified in the communications closet and at the outlet. Horizontal wiring must be tested from and including the termination device in the communications closet to, and including the modular jack in each room. Premise wiring must be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective telecommunications closets. These tests must be completed and all errors corrected before any other tests are started.

10.12.2 Copper Data Circuits
All category 5, 5e and 6 circuits must be tested using a test set that meets the accuracy requirements of TIA/EIA-568-B.1 and TIA/EIA-568-B.2-1. All test requirements must be completed as specified in TIA/EIA-568-B.1 and TIA/EIA-568-B.2-1.

10.12.3 Fiber Optic Circuits
All fiber optic circuits must be tested using a test set that meets the accuracy requirements of TIA/EIA-568-B.1, TIA/EIA-568-B.3. All test requirements must be completed as specified in TIA/EIA-568-B.1, in TIA/EIA-568-B.3, and either TIA-526-7 or TIA-526-14 whichever applies. Unless stated otherwise, tests must be performed from both ends of each circuit. Connectors must be visually inspected for scratches, pits or chips and must be re-terminated if any of these conditions exist.

11. COPPER CABLING AND PATCH PANELS

11.1 Premise and Backbone Cables
All copper cabling between TR's shall be rated as Category 5 or better for all circuits regardless of intended use and shall terminate in a 110 style block or connectors. Backbone cables shall be configured with a Protected Entrance Terminal on each end in order to protect the inside plant premise wiring and equipment from power surges.

11.2 Station (Horizontal) Cabling
All horizontal cabling installed between an outlet and its supporting TR shall be rated as Category 6 or better for all circuits regardless of intended use. Cables must not exceed 295 feet from the patch panel to the outlet. A minimum of three (3) home-run cables shall be installed per outlet. All outlet wiring shall be terminated in an RJ-45 keystone style jack wired to the T568B standard as illustrated in TIA-568-B.1-4.

11.2.1 Outlet Position 1
Position 1 (top left) of every outlet shall be designated for voice traffic and be WHITE in color with a corresponding WHITE cable. The TR end shall be terminated at a 110 style block with a category rating matching that of the cable. Note: this cable shall not be directly connected to the same blocks used by the premise cable to connect two TR's.

11.2.2 Outlet Position 2 through 6
Excluding outlet position number 1 (voice), all remaining horizontal cabling from a single outlet must be terminated in the TR in separate patch panels by cable color and each at the same port number. E.g. if the BLUE wire from station outlet # 3027-1 is terminated at

port number 20 in the TR's BLUE patch panel, all other wires originating from outlet 3027-1 shall also be terminated at port 20 in the TR, albeit in their own panel (by color).

11.3 **Patch Panels**

Unshielded Twisted Pair Patch Panels (UTP) and Screened Twisted Pair (ScTP) patch panels should be installed in or adjacent to the equipment racks or cabinets which will house LAN equipment. Patch panels should consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, category rated for the UTP or ScTP system being installed, and arranged in rows or columns in 19-inch rack mounted panels or cabinets. Nineteen-inch wall mounted racks may be utilized only when absolutely necessary. Jacks must conform to the requirements of T568B standard and must be of the same rating as the installed cable. Provide a minimum spare jack capacity of 25%. Provide a maximum individual panel size of 48 jacks. Panels and cables must be installed and populated so as to support only one (1) color of cable per patch panel and so that all horizontal cabling from the same outlet be installed in the same port number in a similarly dedicated panel.

12. FIBER OPTIC CABLING AND PATCH PANELS

12.1 **Fiber Installation**

Due to their sensitive nature, fiber optic cables shall be attached to a secure structure using cable clamps, or a combination of D-rings and Velcro whenever a cable is routed outside of a conduit or ladder rack and within eight (8) feet of a floor. Fasteners shall be placed at least every sixteen inches. Fiber optic premise and backbone cables shall be terminated inside a dedicated fiber optic patch panel at both ends.

12.2 **Fiber Types**

Existing installed fiber size and mode varies by application and installation date. Due to varying diameters in use, extreme caution should be exercised on the part of the field technician when cross-connecting fibers in order to ensure precisely matching fiber diameters are used in order to prevent future connectivity errors and subsequent data loss.

12.2.1 Backbone Fiber

The standard fiber backbone between buildings is Berk-Tek's Adventum SingleMode cabling. Only this specific brand of cabling is approved for installation between buildings or for premise applications where MultiMode cabling is deemed inappropriate.

12.2.2 Premise Fiber

New fiber installations shall be 50um Laser Optimized MultiMode when installed on behalf of the building owner for its own use between two TR's in the same building and when the distance between TR's does not exceed 300 meters. For distances over 300 meters, designers and installers shall follow the standards for backbone fiber.

12.2.3 Tenant Fiber

Legacy installations of 62.5um MultiMode fiber with ST connectors exist throughout and between most buildings on campus. This fiber is occasionally used by the building owner and is the only fiber type which is subsequently leased to tenants at their request. New

fiber installations should therefore be 62.5um MultiMode with ST connectors when installed by or on behalf of a tenant in order to maintain maximum compatibility with their systems. Tenants shall be allowed to install any other type of fiber for their own use, at their own discretion. However, both the design engineer and installer must be aware of the connectivity issues surrounding mixing various fiber diameters and modes.

12.3 **Service Loops**

Service loops shall be provided for all finished (terminated) fiber cables. Service loop length shall be not less than three (3) feet and not greater than twelve (12) feet long.

12.4 **Color Coded Fiber Furcation**

Color-coded fiber furcation (breakout) kits or fusion spliced fiber pigtails shall be installed on all loose tube type fiber optic cables. Installed kits shall provide a uniform usable length across all individual strands of terminated fiber and shall be approximately 24 inches long. Installation issues and technician error which reduce the usable length of even a single strand of fiber to less than 18 inches after termination will not be accepted and remediation will be at the sole expense of the contractor.

12.5 **Patch Panels**

Fiber optic patch panels should be installed in or adjacent to the equipment racks or cabinets which house LAN equipment. Connectors and couplers must be LC type for all new installations. ST type connectors may be used on 62.5 um Multimode fiber (only). No other fiber connector types are authorized. Patch Panels must provide strain relief for cables. Patch panels must provide for termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Provide a minimum spare panel insert/adapter capacity of 25% for all projects with all panel positions either fully populated or covered with blank inserts. Subsequent projects shall first utilize any existing contiguous spare panel space (when available) before adding new patch panels.

12.5.1 Patch Panel Inserts

Patch Panels shall be configured with removable inserts and duplex LC connectors. Inserts may only contain fiber strands from ONE cable and shall be populated so that the connector quantity on each insert exactly matches the amount of available fiber strands in either the buffer tube or the complete fiber cable.

12.5.2 Panel Usage

Premise fiber which is used to connect two TR's or fiber which extends connectivity into either an outlet or patch panel in another distinct room or location shall be terminated inside of, and permanently attached to the rear of a patch panel. Only a cable whose complete installed path does not exit the TR may be attached to the front side (end-user or patch side) of a patch panel inside that TR.

12.6 **Splices**

Whenever fiber optic cables must be repaired or permanently extended, fusion splices shall be used in all cases. Splice trays, panels and other dedicated enclosures shall be utilized so as to protect the finished splices from further damage, and if necessary to preserve the watertight integrity of the cable. Splice enclosures may be rack mounted, wall mounted, or mid-span, but must be designed by the manufacturer exclusively for the

purpose of containing splices. Cables shall be individually labeled in accordance with the requirements listed elsewhere in this document and at both the ingress and egress points to a splice enclosure. Because of the somewhat higher db loss associated with air-gap connections, patch panels shall never be used as splice points.

12.7 Fiber Pairs

Fiber servicing a single circuit shall at all times be utilized in pairs using the position number sequence defined in TIA/EIA 598-C. Pairs shall be defined as positions: 1&2, 3&4, 5&6, etc… This translates to fiber circuit pair colors of Blue/Orange, Green/Brown, Slate/White, etc… For circuits which require only a single fiber, one of the two positions in a designated pair may either be unused, or used for another circuit; however a single circuit must never be split between two designated pairs.

12.8 Fiber Connectors

Fiber connectors shall be field installed onto raw fiber as fusion spliced, factory polished pigtails. Termination of fiber with any other type of connector, such as using mechanical grip connectors (e.g. Panduit OptiCam or equivalent) requires a written waiver from RIAC's IT department. Waivers will only be granted for small-scale projects and at no time will it be permitted to install mechanical connectors in locations subject to uncontrolled temperatures.

13. NETWORK EQUIPMENT

13.1 General Requirements

All equipment which supports network connectivity must be individually addressable and manageable via the SNMP protocol. Configuration of the SNMP service on each device will be the responsibility of the installer with community names and trap destinations provided by RIAC IT upon request. All network equipment shall have the capability to communicate at speeds of at least 100 MBps full duplex over copper networks and/or 1,000 MBps, full duplex over single-mode fiber networks.

13.2 Harsh Locations

Industrial grade devices shall be used in locations where exposure to dust, uncontrolled temperature or humidity, vibration, or limited access exists; or as directed by the system designer or IT department.

13.3 Administration

Administrative user accounts and passwords (i.e. 'root' access) shall be provided to the IT department for all installed equipment.

13.4 Backbone LAN Switches

Fiber backbone connectivity shall be made through industrial grade "ring" switches with two switches and two backbone trunks per primary TR. Each switch shall be gigabit capable over both fiber and copper and be configured with redundant power supplies.

13.4.1 Two complete fiber backbones exist on the PVD campus. Each backbone is redundant to the other and both carry the same information. Four pairs of fiber per

primary TR are therefore required for full connectivity to the two backbone fiber rings.

13.4.2 Each backbone ring switch shall have two Ethernet (copper) uplinks into the primary TR's premise network. A minimum of one Ethernet link per ring switch shall be gigabit capable. The two Ethernet links on the two ring switches (four Ethernet links total) shall be configured as two trunks into the premise LAN switch(es).

13.4.3 Ring switches shall be configured with an automated configuration backup, stored locally on a removable flash device. Backup configurations shall be easily and automatically downloadable to replacement switches in the event of switch replacement.

13.5 Premise LAN Switches

All premise switches must support the full Layer-3 (or higher) protocol set and speeds of 100/1000 MBps with automatic switching between MDI and MDIX on every port. Switches must support customized port names. Switch features such as STP, RSTP, and LACP in both active and passive configurations must be supported natively within the device. Advanced features such as BGRP, OSPF, and VRRP must also be supported either natively, or though an add-on license.

13.5.1 Switches with dual power supplies are required in primary TR's and in TR's which support more than one department or more than eight outlets.

13.5.2 All switches must support SFP style field replaceable modules and SingleMode SFP laser modules shall be utilized for all fiber optic communications, even when that communication path is over MultiMode fiber.

13.5.3 Primary TR LAN switches (or switch pairs when configured in tandem), shall uplink to each of the two backbone ring switches servicing that TR. Each uplink between a premise LAN switch and a backbone switch shall also be redundant.

13.5.4 Switches must support PoE on all downlink (workstation) ports.

13.5.5 Switches must have the ability to support future upgrades to 10G network links between switches over fiber.

13.5.6 Switches installed within a single building must be connected and configured by the installer so that they form a complete HP switch "matrix" with multiple routing paths to and between each switch.

13.6 WAN Access

Perimeter systems such as firewalls which are used for connecting the primary corporate LAN to the internet shall be installed in pairs with active/active failover enabled. Fully redundant internet feeds should be considered whenever practical.

13.7 Media Converters

All devices which cannot natively communicate over, or be converted to support TCP/IP networking, but can instead support other communications protocols such as RS422/485 shall have media converters provided, installed, and be fully supported as part of the

vendors or manufacturers solution and the “deliverable” system as a whole.

13.7.1 Conversion of any device to TCP/IP networking through the use of third party media converters is allowed only as a “last resort” and will not receive favorable consideration when compared with systems, devices or solutions which communicate natively over TCP/IP networks without third party conversion equipment.

13.7.2 A Media Converter which is used to convert signals to TCP/IP networking must be individually network addressable/manageable and may only be used to support one “foreign protocol” device. Devices should not be cascaded or daisy-chained if those devices could otherwise be served by their own media converter.

13.7.3 When used, media converters shall be installed so as to maximize the use of Ethernet and fiber optic networking and minimize the use of other types of wiring and communications protocols. Generally speaking, media converters shall be placed inside or within a few inches of the device being converted to Ethernet.

13.7.4 When several media converters must be used in series, such as to convert fiber to Ethernet and then to RS485, only the media converter which converts data to/from a non-TCP/IP signal is required to be network addressable. However, in this instance, the media converters must installed within mere inches of one another.

14. SERVERS

All servers provided or purchased as part of a RIAC project or bid shall be installed in RIAC’s Primary Datacenter and/or Disaster Recovery Datacenter and meet all of the requirements of each subsection below. Waivers of the specific requirements listed below may only be requested in writing from the airport Chief Technology Officer (CTO).

14.1 General Requirements

All quotes for products or services which include servers shall clearly state the ability of the software or service to be fully operable and be fully supported within an existing VMware Virtual Infrastructure environment as described in paragraph 4. The inability of a proposed product or service to operate in, or be supported by the supplier or manufacturer as a guest VM in a VMware environment will normally disqualify a vendor and/or their proposed solution from being considered unless the virtualization requirement is specifically waived prior to any bids or proposals being received

If the virtual server requirement is not specifically waived by the CTO beforehand, specific functional reasons may be cited by the vendor within their bid or proposal when they feel that it is not possible to meet this requirement. In these instances, a waiver of the virtual server requirement will be granted, and equal consideration will be granted to any vendor, provided that all of the following three conditions are met.

a. A specific disaster recovery (site failover) solution is offered by the vendor which will allow RIAC to quickly recover the server or service in the event of a major catastrophe.

b. A verifiable letter of corroboration by an independent, third party VMware Certified

Professional (VCP) is submitted which clearly explains the specific reasons why the specific product or service cannot function in a virtual server environment. The letter shall clearly define the specific issue which prevents server virtualization and why minor adaptations (i.e. Ethernet based COM ports) cannot be used to resolve the issue.

c. No other vendor has submitted a proposal or bid on a system with equal or greater functionality which can effectively function in a virtual environment.

14.2 Virtual Server Support

The support provided by the vendor for the virtual servers delivered shall be at least equivalent to the support they provide to any other (physical) installation, sans any hardware support.

14.3 Physical Servers

Physical servers are required to host the VMware ESX operating system, and in turn the virtualized server environment. In rare cases physical servers may be needed for other functions, or to provide services which must be physically separated from the virtual environment.

14.3.1 All physical servers shall be manufactured by HP and configured with the largest on-chip cache available for the speed of processor installed. Deviation from the HP brand of servers is not allowed for the convenience of a vendor or contractor.

14.3.1.1 If it is not possible to provide an HP brand server for a particular project due to the physical features of that manufacturer's product line (e.g. AGP or PCIx buss), a waiver must be requested in writing from the airport CTO. Waiver requests must specify a proposed alternative server, and will only be granted for IBM or generic "white box" type servers with COTS Intel brand motherboards.

14.3.2 All physical servers, regardless of brand shall be "rack mount" style, have front loading, hot swappable removable disk drives, four gigabit network ports which support teaming/bonding, and a separate TCP/IP addressable network connection for web-based remote management (i.e. HP's Integrated Lights Out Management (iLO)).

14.3.3 Special consideration should be given to blade type servers in order to capitalize on the energy savings afforded by that style of server

14.3.4 Server sliding rail kits manufactured specifically for the server being installed and appropriate to the server racks shall be provided and installed by the vendor with each physical server delivered. It is the responsibility of the vendor to ensure that servers, rails, and installation kits fit the rack structure and the existing rail spacing, or that appropriate additions and adjustments to the existing rack(s) are made.

14.3.5 Software licenses shall be provided to enable all advanced features for remote control and management of physical servers e.g. HP's "*iLO Advanced Pack.*"

14.3.6 RAID1 or RAID5 (preferred) shall be utilized for all server disks. Server disks shall be sized in accordance with the estimations of the project designer, but shall never be configured with less than 50GB of usable space prior to the installation of the server operating system.

14.3.7 Remote connectivity from servers to peripheral devices such as printers, modems, and other devices shall be performed over the network either natively or through network addressable media converters whenever it is not possible to have those peripheral devices collocated with the server.

14.3.8 Administrative accounts and passwords shall be provided to the IT department for all operating systems and vendor software installed. User accounts and passwords shall be set up by the vendor for all non operating system software.

15. WORKSTATIONS

All end-user workstations provided by or purchased as part of a RIAC project or bid must be constructed with Intel brand CPUs and Intel brand Motherboards and be configured to run the latest business version of Microsoft's desktop operating system (i.e. Windows 7 Professional). The Linux operating system may be installed upon written approval by or through specific request from the IT department. Internal workstation components such as CPU's, motherboards, and disks must be fully and easily interchangeable with typical COTS[1] products found in local computer stores or online.

Notes: [1]This requirement typically excludes workstations from HP, Dell, and many others as they utilize unique self-branded and unusually sized components such as motherboards which require repair technicians to obtain repair or replacement components only from the original manufacturer. This leads to unacceptable maintenance delays for users and/or stockpiling of nonstandard parts.

15.1 Minimum Ratings

All workstations shall have the following minimum components: 3.0Ghz CPU; 1GB RAM; 80GB SATA-II drive; Gigabit NIC; DVD +RW; 3.5" Floppy; Front USB; Desktop Stereo Speakers, 19" LCD display, standard keyboard, Microsoft brand optical mouse.

15.2 Rack Mounts

In unusual situations, certain workstations may need to be rack mounted. In these instances it may not be possible to fully meet the requirements of this section on workstations. In these instances, the requirements discussing the physical attributes of the "Servers" section above shall apply, and add-on components such as sound cards must be provided in order to bring workstation functionality to the server chassis.

15.3 Thin Client PC's

Thin Client computers may be installed and utilized as situations dictate. Microsoft Windows XP Embedded Edition and Linux are currently the only authorized operating systems for Thin Client PC's at RIAC.

16. PHYSICAL PLANT

16.1 General Requirements

HVAC systems, Lighting Controls, Security Systems and other modern building systems typically have standard or optional components to allow support personnel or automated systems to monitor and/or control the various devices within that system by using a computer network. This capability shall be identified and included as standard equipment for all systems being installed or proposed on behalf of RIAC.

16.2 Network Capability

Systems shall meet the requirements outlined in the "Network Equipment" section of this document. Network capability shall be provided through the primary manufacturer's own options, add-ons, and upgrades wherever they are available. If the manufacturer does not supply its own options or upgrades to enable network communications, appropriate third party equipment shall be provided as part of the proposal.

16.3 Network Connectivity

Sufficient Ethernet or fiber optic network cabling and any required interconnecting devices (e.g. switches, routers, and media converters) or parts thereof which are necessary for interconnecting into the existing corporate network shall be included as part of the basic installation for all systems.

16.4 Support

Regardless of whether network capability is built into a device or system, or is added by the vendor as an optional component, the network connectivity capability and any associated devices must be fully supported under the manufacturers or vendors maintenance agreement for the system as a whole.

17. DEVICE INTER-COMPATIBILITY

17.1 General Requirements

All devices of the same kind and which performs the same general function and are installed as part of a single project or its subsequent change orders shall be configured identically. Basic items such as manufacturer, model, firmware revision, BIOS, and operating systems (including patches) shall be the most current released version and be no different between any two or more installed devices of the same type for any given project -- as measured at time of final project acceptance by RIAC staff.

17.2 Custom Options

Devices installed as part of a single project may occasionally need to be customized with additional hardware or software to resolve an operational need. For those devices that require add-on hardware or software, those options shall conform to the requirements of paragraph 17.1 when similar customizations are required by two or more devices.

APPENDIX 1: LABELING EXAMPLES FOR FIBER

Appropriate abbreviations for cable types should be used for labeling cables and patch panels alike. Acceptable examples are “SM” for single mode fiber, “MM50” for 50 um fiber, and “Cat6” for Category 6 copper. Additional abbreviations may be used as necessary for other cable types.

Telecommunications Cable Labels

[AMF212/OPS101-SM2]
Note: This cable identifier would be appropriate for a cable which has one end terminated in the Airfield Maintenance Facility (AMF), room 212 and the other end terminated in the Operations Building, room 101. The label also identifies that it is the second SingleMode cable running between those locations. This is a slight embellishment of the standards outlined in TIA/EIA-606-A in that it further identifies the cable type as SingleMode vs. MultiMode.

Patch Panel Cover Labels

[3014-PP12-MM62.5] [to 115-PP-03]
Note: All MultiMode fiber ports within this patch panel (number 12) are connected straight through to a single remote panel as denoted by the single secondary label.

[3014-PP13-SM] [to 115-PP-06]
[to 47D-PP-03]
Note: The SingleMode fiber ports within this patch panel (number 13) are connected to multiple remote panels, therefore individual labels on the panel cover must identify each remote panel individually.

Patch Panel Inside Labels

[AMF212/OPS101-SM2-1] [AMF212/OPS101-SM2-2]
Note: Building upon the standard cable label shown above, a one digit suffix is added to identify the buffer tube number if two or more buffer tubes exist for that fiber cable. Buffer tube numbers are identified by the color code cross-reference chart listed in TIA-598-C. The labels shown above would be affixed inside the patch panel to individually identify each patch panel insert (connector panel).

Splice Panel/Tray Labels

[3014-SP1] [AMF212/OPS101-SM2]
Note: Any Splice Tray or Splice Panel may contain more than one media type (SingleMode or MultiMode), therefore the SM or MM suffix is not used. However appropriate cable ID labels shall be affixed to both the splice panel cover and each individual cable supported by the splice tray or panel.

APPENDIX 2: LABELING EXAMPLES FOR COPPER

Appropriate abbreviations for cable types should be used for labeling cables and patch panels alike. Acceptable examples are “SM” for single mode fiber, “MM50” for 50 um fiber, and “Cat6” for Category 6 copper. Additional abbreviations may be used as necessary for other cable types.

PREMISE CABLING & 110 Blocks

Installers should follow the guidelines and examples in TIA/EIA-606-A for Class 3 Administration.

PATCH PANELS

[3014-Cat6-BLUE] (master label, one per panel)
[3007-1] [3007-2] [3009-1] [3009-2] [3009-3] (individual port labels)

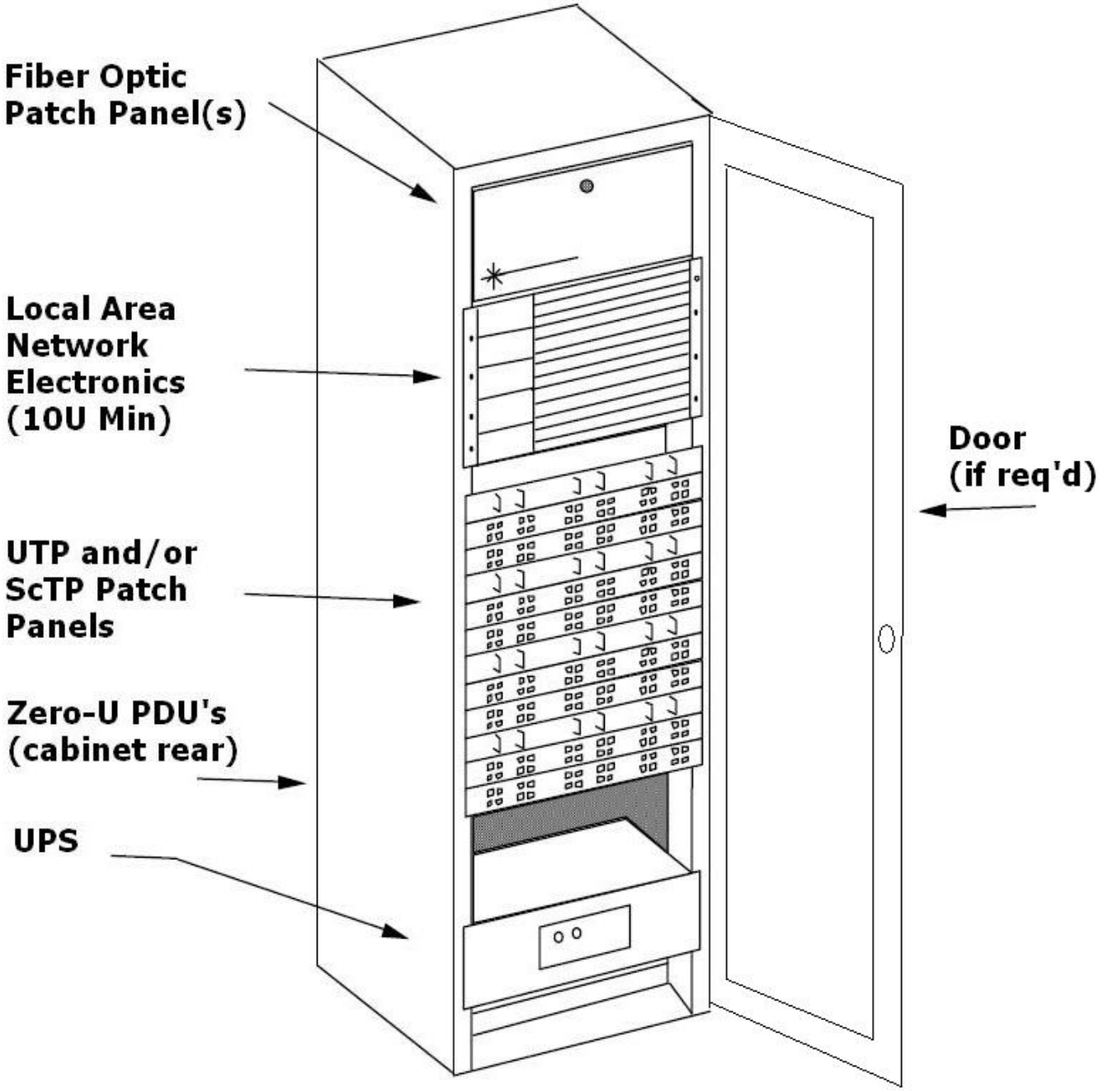
[3014-Cat6-YELLOW] (master label, one per panel)
[3007-1] [3007-2] [3009-1] [3009-2] [3009-3] (individual port labels)

Note that each patch panel must bear a Panel Identifier label and labels for each port based on the outlet ID served by that port. The example above assumes two patch panels are installed, one for Blue cables, the other for Yellow. Two rooms and five total wall outlets are supported by the example. Two outlets are installed in room 3007 and three outlets are installed in room 3009. All outlets have both a Blue and Yellow cable.

OUTLETS

[3007-2 to TR3014-26]
This label identifies wall plate #2 in room 3007. It also identifies that the cables are connected to a patch panel in TR 3014 and the patch panel port numbers are #26 Blue, #26 Yellow, #26 Red, etc… Individual outlet ports need not be labeled, but must be color-coded.

APPENDIX 3: RACK LAYOUT EXAMPLE



APPENDIX 4: PRE-APPROVED MANUFACTURERS

1. Allied Telesys brand network media converters are approved for TR's and datacenter use for converting one computer network signal type to another.

2. Aten / Altusen products are approved for KVM use provided that the model selected is both multi-user and non-blocking.

3. Barracuda Networks for their product lines relating to load balancing, network content filtering, and Anti-Spam.

4. Berk-Tek Adventum brand SingleMode Fiber is to be used wherever SingleMode fiber is called for. No other brand, style, or flavor is authorized.

5. Brady TLS200 Cable Labels

6. Brother PTouch TZ Labels with Industrial Strength Adhesive (flat surfaces only).

7. Chatsworth Megaframe cabinet model M1043-1xx when combined with Fan Door model 13222-xxx, overhead Fan kit 12480-70x, and either the Air Dam or Air Diverter kits (as appropriate) are approved.

8. Cisco for ASA series Firewalls and 1841 series routers shall be used exclusively for all network security and routing applications.

9. Dymo RhinoPRO Cable Labels

10. EMC for their Clariion CX3, CX4, storage arrays (fibre channel use only).

11. Garrettcom industrial grade switches and media converters are approved for all uses including harsh environments.

12. HP Procurve switches are approved for all uses in TR's and Datacenters, except for use on the RING network. .

13. HP DL360, DL380, DL580 and BL series servers are approved for all uses.

14. KRONE brand wall plates, keystone jacks, 10 blocks and copper patch panels are approved for exclusive use

15. Lantronix brand UDS1100 devices are approved for conversion of non-network signals such as RS232/422/485 to Ethernet networks.

16. Linksys (Cisco) model SRW2016 switches. These devices are only approved for limited use such as direct connections to Cisco firewalls and routers when there is a need for Ethernet port multipliers prior to the premise network(s).

17. Micron ClientPro PC's will be approved provided all other requirements are met.

18. Moxa EDS-510A and EDS-518A switches are the only switches approved for backbone RING network connectivity.

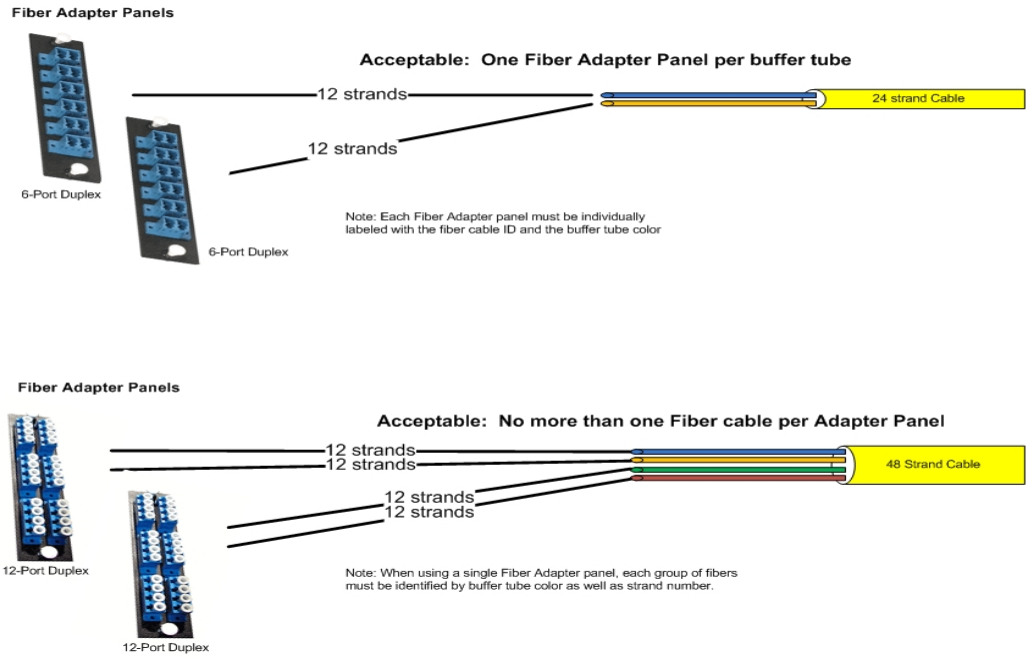
19. Nexsan for their SATABeast storage arrays (fibre channel use only).

20. Rose Electronics products are approved for KVM use provided that the model selected is both multi-user and non-blocking.

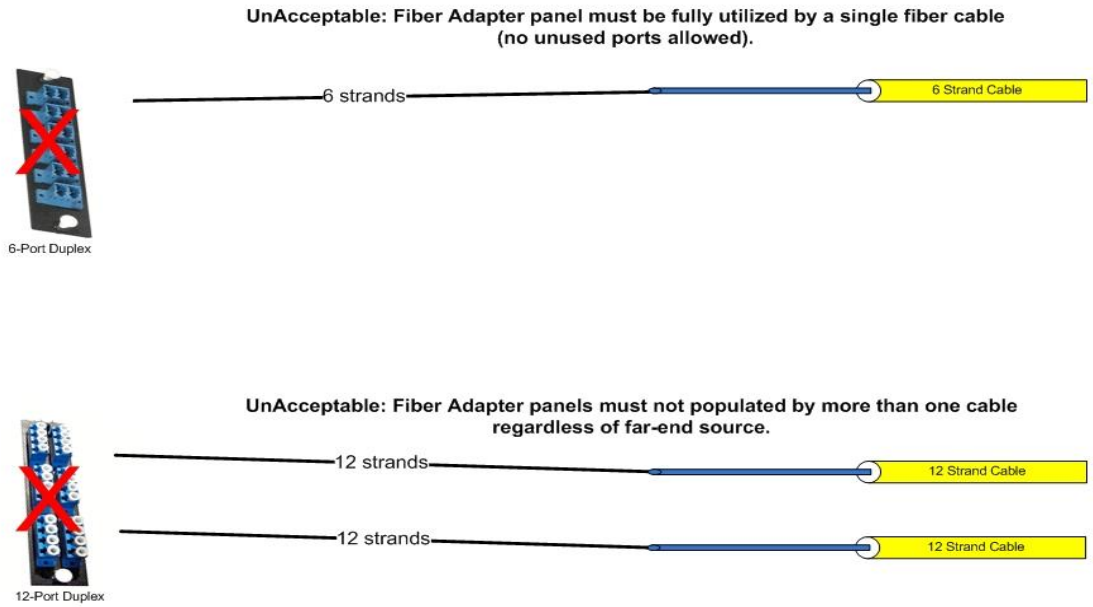
21. Seneca Data's NexLink computer workstations (Desktops) are approved unconditionally.

APPENDIX 5: Fiber Installation Examples

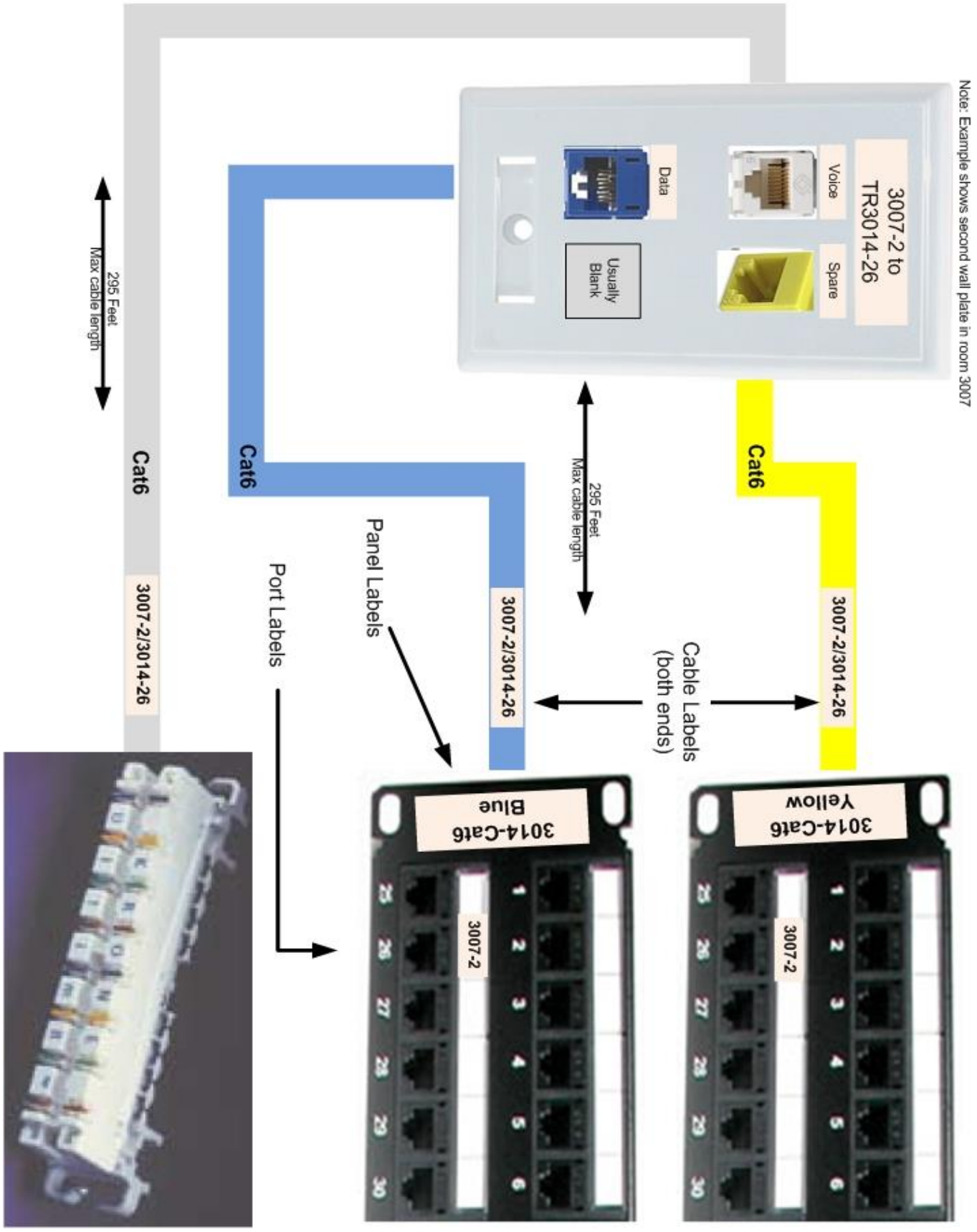
Acceptable Fiber and Adapter Panel Installation Examples



UNACCEPTABLE Fiber Adapter Panel Installation Examples for Premise and Backbone Cables



Appendix 6: Wall Plate to TR Wiring and Labeling Example



Ammendments:

January 6th 2009:

Added Chatsworth brand cabinets to the list of pre-approved products and manufacturers.

Changed wording in section 12.5.1 to reflect “Cable” vs. “Buffer Tube”

Added Appendix 5: Diagrams depicting acceptable and unacceptable fiber installations

January 12th 2009:

Added Appendix 6: Wall Plate to TR Wiring and Labeling Example

January 27th 2009:

Paragraph 14.x edited to more clearly reflect that a vendor should provide just the virtual server (Guest VM) or appliance, not the complete VMware host environment.

May 21st 2010

Added section 12.8 which defines the allowable attachment method for fiber connectors.

Added paragraph 17 which ensures that all devices of the same kind work exactly the same as any other device delivered as part of a single project.

Revised paragraph 14 to eliminate the requirement for Intel brand CPUs in servers.

Revised paragraph 15 to reflect Windows 7 operating systems.