LACCD INFORMATION TECHNOLOGY STANDARD	Orig. Date: **3.1.09**	Control No.: **ITSTD-2009-03-DC**
Title: **Data Centers**	Rev. Date: **11.8.13**	Rev. No.: **R1**
Technical Team: **CFM Group**	Approval: **DTC**	Page **1** of **25**

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I. INSTRUCTIONS

Please check latest revision of this standard at the time of implementation. This document serves as a standard and is not intended to be the specific bid document, rather a guideline for installation practices. Contractor shall utilize this document in combination with industry best practices, campus specifications and project drawings to identify project requirements.

II. PURPOSE

The District provides education programs to the community that meet the changing needs of students for academic and occupational preparation. Providing robust, sustainable technology systems at each of the nine colleges enhances these educational programs. This IT standard is meant to provide guidance in designing, building, and renovating these IT systems. Specifically, the purpose of this standard is to identify the performance and design characteristics of Data Center facilities throughout LACCD.

This Standard provides minimums and guidelines for the design, construction and renovation of data centers at all LACCD Campuses and select facilities. It ensures a secure, consistent, robust facility with physical, electrical, communication and temperature controlled environments in a redundant manner for all server, computer, network, and telephony equipment used at LACCD.

Each environment will have unique specification based on the size, local codes, regulations and function of the facility. Building Distribution Facilities and Intermediate Distribution Facilities (BDF's and IDF's) have specification for physical, electrical, communications and temperature environments defined in LACCD's IT Standard STD-001-030109.

LACCD requires meeting or exceeding the performance levels defined herein for Data Centers deployed within any of the nine colleges, District Office and satellite locations (Districtwide).

III. SCOPE

The criteria contained in this document are subject to change, revision and updating as warranted by advances in building construction techniques and communications technology.

Refer to the most recent LACCD IT Structured Cabling Design standard for cabling system and outside facilities specifications.

This standard applies to all LACCD full time, part time, temporary, consulting, architectural, engineering and contract staff.

IV. STANDARDS

Key Terms

- ***Must*** *means that the item or course of action is absolutely required.*
- ***Shall*** *means that the District intends that the supplier or consultant adhere to the instruction or command.*
- ***Will*** *means that the existing District systems or conditions require the item or course of action.*
- ***Optional*** *means that the consultant/vendor may choose to include or omit a particular item according to its preference. However, the item chosen must still interoperate or function with the District's existing systems.*
- ***Minimum of*** *means that the stated item or course of action meets the standard but may be superseded.*

1. Section 1: Data Center Classification Levels

A tiered classification approach has been developed for site infrastructure functionality that addresses the need for a common benchmarking standard. LACCD utilized the four-tier reference as a guide for design. The four-tier reference is based on the Uptime Institute and is provided below.

Defining the Tiers

The tier classification system involves several definitions. A site that can sustain at least one "unplanned" worst-case site infrastructure failure with no critical load impact is considered fault tolerant. A site that is able to perform planned site infrastructure activity without shutting down critical load is concurrently maintainable (fault tolerant level may be reduced during concurrent maintenance). All of these must be concurrently maintainable and/or fault tolerant for the entire site to be considered concurrently maintainable and/or fault tolerant.

1.1 Tier Classification

Tier Classification	
Tier I	Single path for power and cooling distribution, no redundant components
Tier II	Single path for power and cooling distribution, redundant components
Tier III	Multiple power and cooling distribution paths, but only one path active, redundant components, concurrently maintainable
Tier IV	Multiple active power and cooling distribution paths, redundant components, fault tolerant

1.2 General Guidelines (as suggested by the Uptime Institute)

General Guidelines (as suggested by the Uptime Institute)				
	Tier I	**Tier II**	**Tier III**	**Tier IV**
Number of Delivery Paths	Only 1	Only 1	2 Paths, 1 Active	2 Active
Redundant Components	N	N+1	N+1/2N	2N
Watts per /SF	30-50	60-75	150-175	150-200
Voltages	110/208	110/208/480	208/480 3PH	208/480 3PH
Raised Floor Height Under Floor	12”	18”	24”-36”	36”-48”
Floor Loads	250 lbs	750 lbs	1250 lbs	1500+ lbs
Availability	99.67%	99.75%	99.98%	99.995%

1.3 Design Guidelines (as adopted by LACCD)

Design Guidelines (as adopted by LACCD)	
Number of Delivery Paths	2 Paths, 1 Active
Redundant Components	N+1/2N
Watts per /SF	150-175
Voltages	208/480 3PH
Raised Floor Height Under Floor	12”
Floor Loads	1250 lbs
Availability	99.98

2. Section 2: LACCD Primary Data Center Room Classification & Design Guidelines

Throughout the District, Primary IT Data Center rooms will have unique requirements based on function, location at site, size requirement, support purpose, site capabilities, etc. As such, each Data Center may be designed to a higher classification than the minimum requirements listed below.

2.1 General

The room shall only house computer networking equipment and specified HVAC and electrical equipment.

2.2 Location

When selecting the Data Center site, avoid locations that are restricted by building components that limit expansion such as elevators, core, outside walls, or other fixed building walls. Accessibility for the delivery of large equipment from outside docking areas to the Data Center shall be provided. When possible, the Data Center should be placed in a single story building.

The room shall be located away from sources of electromagnetic interference. Special attention shall be given to electrical power supply transformers, motors and generators, x-ray equipment, radio or radar transmitters, and induction sealing devices.

Data Centers shall be designed without windows as they increase additional heat load and reduce security.

2.3 Access

The Data Center shall have controlled access. The access list will be managed by the Data Center Management and consistent with LACCD Standards for access control.

Doors providing access to other areas of the building through the Data Center shall be avoided in order to limit access to the space to authorized personnel only.

2.4 General Architecture Considerations

The following are Information Technology requirements regarding Data Center construction. For more detailed requirements regarding Data Center Architectural and Structural requirements, refer to the appropriate engineering specifications.

2.4.1 Structural System

The building structural system shall be either steel or concrete. At a minimum, the building frame shall be designed to withstand wind loads in accordance with the applicable building codes for the location under consideration.

2.4.2 Slabs

Slabs on grade shall be a minimum of 12.7 cm (5 in) and have a bearing capacity of 12kPa (250 lbf/ft^2). Elevated slabs shall be of hard rock concrete and have a 10 cm (4 in) minimum cover over the tops of metal deck flutes in seismic zones

3 and 4 to allow for adequate embedment of epoxy or KB-II anchors. Floors within UPS areas shall be designed for a minimum loading of 15 to 24 kPa (300 to 500 lbf/ ft^2) deck and joists, 19.2 kPa (400 lbf/ ft^2) girders, columns and footings. Local building codes and/or specific computer equipment dictate final requirements, which may necessitate structural modifications to increase the load carrying capacity in certain areas of the floor system. Battery racks will typically require supplemental supports in order to properly distribute the applied loads.

2.4.3 Raised Curbs

Raised curbs, berms, or a raised "plinth" will be provided whenever a threat of water infiltration is possible in the design. This will be on an as needed basis and dependent upon local conditions such as water tables, as well as adjacencies to bathrooms, cafeterias, kitchens, production areas, etc.

2.4.4 Roofs

Roofs shall be designed for actual mechanical equipment weights plus an additional 1.2 kPa (25 lbf/ ft^2) for suspended loads. Roof areas over UPS rooms shall be designed to accommodate a suspended load of 1.4 kPa (30 lbf/ ft^2).

2.4.5 Mechanical Equipment

All mechanical equipment shall be positively anchored to the supporting element. Equipment is often vibration sensitive, and precautions must be taken to insure that sources of vibration are carefully controlled. Vibrating equipment must be mounted on vibration isolators to the extent possible. Also, the vibration characteristics of the floor structure must be carefully reviewed.

2.4.6 Yard Equipment

All yard equipment shall be anchored in a manner consistent with the Code. All pipe racks shall be designed and detailed to limit the lateral drift to 1/2 that allowed by Code, but shall not exceed 2.5 cm (1 in) elastic or 6.4 cm (2.5 in) inelastic deformation. All equipment screens shall meet Code mandated allowable deformation, however, shall any equipment or piping be attached to the equipment screen, supports shall be designed and deflections limited. All interior walls shall be at least 1-hour fire rated partitions (2 hours preferred), designed from slab to slab.

2.4.7 Truck doors

Truck doors shall be provided as required to handle deliveries and shall be provided with a level of security consistent with LACCD standards. Consideration shall be given to equipment staging and secured storage for computers/network equipment, and for delivery to equipment burn-in and testing areas. Raised floor spaces may require higher load ratings in areas of delivery traffic.

2.4.8 Ceiling

A clean-room ceiling system shall be provided in the computer areas, particularly where fireproofing materials could shed dust into the computer equipment. Suspended ceilings can also reduce the volume of gas required for clean-agent fire suppression systems, which can greatly impact total installed cost. However, the elimination of a ceiling can provide additional thermal inertia to the Data Center and provide for a more flexible installation. Ceiling tiles shall be of a class 100,000 rating. There must be minimum 18" clearance below sprinkler heads to avoid disrupting water dispersion from the sprinklers. The height between the finished floor and the lowest point of the ceiling shall be a minimum of 3 m (10 ft) to accommodate taller frames and overhead pathways. Finished floor elevation must take into account the 12" height requirement for the raised floor.

In some situations, a ceiling system may not be required or possible due to height restraints within an existing building or leased facility. In this case, appropriate coatings must be applied to all exposed structural components, piping and electrical to seal from dust and to reduce noise.

2.4.9 Treatment

The floor, walls, and ceiling shall be sealed to reduce dust. Under floor sealant used to seal the concrete must be compatible with adhesives used for raised floor pedestals. Finishes shall be white in color to enhance room lighting. Flooring materials shall have antistatic properties.

2.4.10 Lighting

Lighting shall be a minimum of 500 lux (50 foot candles), measured 1 m (3 ft) above the finished floor in middle of all aisles between cabinets. Power provisioning for lighting shall be one watt per sq. ft., code permitting.

Note: Lighting fixtures shall not be powered from the same electrical distribution panel as the telecommunications equipment in the Data Center. Dimmer switches shall not be used and emergency lighting and signs shall be properly placed such that an absence of light will not hamper emergency exit. 33% of lighting ballasts shall be of battery back-up type and operate when UPS and/or generator emergency power is applied.

2.4.11 Doors

Door opening shall be a minimum of 1.37 m (54 in) wide and 2.43 m (96 in) high, without doorsill, hinged to open outward (code permitting) or slide side-to-side, or be removable. The door shall be fitted with a card reader consistent with LACCD standards

2.4.12 Signage

Signage, shall be developed within the security plan of the building and be consistent with LACCD standards, building architecture and naming conventions.

2.4.13 Seismic Considerations

Seismic hardware for related facilities shall accommodate the applicable seismic zone requirements. Equipment racks mounted to the raised floor shall be installed with through-bolts to seismic raised floor rack supports. Equipment cabinets shall be mounted to base-isolation platforms.

2.4.14 Guidelines for Other Equipment

Environmental control equipment, conditioner systems, power distribution and UPS systems shall be located in a compartmentalized portion of the Data Center or in an adjacent room.

Equipment not related to the support of the Data Center (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed in, pass through, or enter the Data Center.

2.4.15 Access Floor Systems (Raised Floors) - Access Floor Performance Considerations

The access floor shall meet the minimum performance criteria for information processing centers in ANSI/TIA/EIA-569-B Annex C.2.

Floor loading capacity in the Data Center shall be sufficient to bear both the distributed and concentrated load of the installed equipment. The minimum distributed floor loading capacity 12 kPA (250 lbf/ ft^2). The floor shall also have a minimum of 1.2 kPA (25 lbf/ ft^2) hanging capacity for supporting loads that are suspended from the bottom of the floor (for example, cable ladders suspended from the ceiling of the floor below). The recommended hanging capacity of the floor is 2.4 kPA (50 lbf/ ft^2).

Access floors for Data Centers shall use all-steel access floor tiles rated at a minimum of 1250 lb - 24" Access Floor w/ heavy duty bolted stringers.

Greater floor loading may be required due to specific equipment requirements.

2.4.16 Floor Tile Cuts

Floor tile cuts shall be no larger than necessary. Floor tile cuts for cabinets shall be placed under the cabinets, not adjacent to the cabinets in the aisles. Floor tile cuts for racks shall be placed either under the rack or cabinet (at the opening between the bottom angles) or under the vertical cable managers between the racks. Tile cuts shall be identified on project layout drawings with manufactures engineered cut-sheets prior to installation.

Use cabinet or rack vertical wire management combinations that are the same width as the floor tiles, so that cabinets and racks can be placed on an even floor tile and floor tile cuts can be sectioned.

Access floor tile cuts must have edging or grommets along all cut edges. If the edging or grommets are higher than the surface of the access floor – they shall be installed as not to interfere with placement of racks and cabinets. The edging or grommets shall not be placed where the racks and cabinets normally contact the surface of the access floor.

All tile cuts shall be fitted with "cold-lock" air locks (or an equivalent mechanism) to maintain a high level of air conditioning efficiency.

2.4.17 Overhead Cable Runway

Low voltage and optical fiber cable distribution in the Data Center shall be accomplished via overhead ladder rack. Overhead ladder rack in the Data Center shall be of rectangular steel tubing, from 12" to 24" wide with black powder-coat finish and shall include all radius bends and drops, junctions and support kits. All cable runway segments shall be properly grounded to each other and to the signal reference bonding grid.

2.4.18 Cable Runway Support

Cable runways shall be suspended from the ceiling and not attached to the top of the racks and cabinets so as to allow for seismic movement. Planning of overhead cable runway for communications cabling shall be coordinated with the manufacturer, architects, mechanical engineers, and electrical engineers that are designing lighting, plumbing, air ducts, power, and fire protection systems. Lighting fixtures and sprinkler heads need to be placed between cable trays, not directly above cable trays.

2.5 Racks and Cabinets

2.5.1 Standard Racks

Provide 19"x29"x 84" open equipment racks for patch panels and equipment. Vertical cable managers (10" Wide) shall be installed between racks and at both ends of every rack (in Data Centers). The vertical cable managers shall be double-sided (14.94" overall depth.) The cable managers shall extend from the top of the racks down.

Horizontal cable management panels shall be installed above and below each patch panel and device. The preferred ratio of horizontal cable management to patch panels is 1-to-1. The minimum shall be 2-to-1.

2.5.2 Cabinets

Provide 24"x42"x84" welded frame cabinets with solid side-panels and perforated doors. Cabinets shall be rated at 2200 lbs. capacity, and have integral cable management.

2.5.3 Adjustable Rails

Cabinets shall have adjustable front and rear rails.

If patch panels are to be installed on the front of cabinets, the front rails shall be recessed at least 150 mm (6 in) to provide room for cable management between the patch panels and doors and to provide space for cabling between cabinets. Similarly, if patch panels are to be installed on the rear of cabinets, the rear rails shall be recessed at least 150 mm (6 in).

Patch panels shall not be installed on both the front and rear rails of a cabinet or rack in a manner to prevent service access to the rear of the patch panels.

2.6 LACCD Power Standards for Data Centers

2.6.1 Power Strips

The typical configuration for power in cabinets is listed in the tables below. Equipment power consumption and BTU output shall be determined on a case by case basis. The power strips should be metered with LED readouts. The actual power strip configuration should be determined by the equipment each rack or cabinet is intended to support, as well as local electrical standards. High voltage power strips should be installed at the rear of the cabinet or rack, usually mounted on the right side of the cabinet. Power strips should be labeled with the PDU/panel identifier and circuit breaker number.

2.6.2 Standard Server Cabinets (Medium Density)

Standard Server Cabinets (Medium Density) 3.5 kW max power load – Fed from UPS		
Below raised floor	(2) 208v 30 amp circuits	Distributed "A" and "B" feeds – **NEMA L6-30R**
Below raised floor	(2) 120v 20 amp circuit	Distributed "A" and "B" feeds every other rack **– NEMA L5-20R**
Vertical Power Strip	Metered Dual	Circuit 208v 30 amp

2.6.3 High Density Server Cabinets (High Density)

High Density Server Cabinets (High Density) 6.0 kW max power load – Fed from UPS		
Below raised floor	(4) 208v 30 amp circuits	Distributed "A" and "B" feeds – **NEMA L6-30R**

Below raised floor	(2) 120v 20 amp circuit	Distributed "A" and "B" feeds every rack – **NEMA L5-20R**
Vertical Power Strip	Metered Dual	Circuit 208v 30 amp

2.6.4 Specialty Server Cabinets (Blade or SAN)

Specialty Server Cabinets (Blade or SAN) up to 10.0 kW max power load – Fed from UPS*		
Below raised floor	(4) 208v 30 amp circuits	Distributed "A" and "B" feeds – **NEMA L6-30R**
Below raised floor	(2) 120v 20 amp circuits	Distributed "A" and "B" feeds every rack – **NEMA L5-20R**
SAN Switch	If Cisco, it should be powered the same as a standard 6509 chassis	
If EMC or other large Storage System	50 amp, 3 phase circuits as stated above	
Blade Server cabinet	Will most likely require Manufacture's Power Strip (Specify that it be Metered) which may require as stated above 4 – 208v 50 amp circuits	

*Possible 50 amp, 3 phase power requirement – if so, the cabinet will require (4) 208v 50 amp circuits AND supplemental cooling may be required. Receptacle type to be determined by equipment requirement.

2.6.5 Active Network Racks in Data Center Rooms

Active Network Racks in Data Centers Rooms 3.0 kW max power load – Fed from UPS		
Mounted above racks on Unistrut bracing or below raised floor*	(4) 208v 30 amp circuits	Distributed "A" and "B" feeds – **NEMA L6-30R**
Below raised floor	(2) 120v 20 amp circuit	Distributed "A" and "B" feeds every rack – **NEMA L5-20R**
Horizontal Power Strip	Metered, Single Circuit 208v 30 amp	
Smaller Cisco chassis that run on 208v	Horizontal mount power strip-Metered	

**Mounted below floor if other power is also below floor, only mount above rack if no power below floor.*

2.6.6 Hot and Cold Aisle Containment

Cabinets and racks should be arranged in an alternating pattern, with fronts of rows of cabinets/racks facing each other to create hot and cold aisles. Maintain a minimum of 48" of clearance between cabinets and equipment. Review equipment requirements with LACCD IT Management as some devices are wider and deeper than the standard equipment cabinets.

Cold aisles are in front of racks and cabinets and should be a minimum of 48" wide or two full raised floor tile widths. Power distribution cables may be installed here under the access floor and secured to the slab.

Hot aisles are behind racks and cabinets and should be a minimum of 36" or one and a half raised floor tile widths. If there is a need for any under floor cable trays for communications cabling, it shall be located under the access floor in the hot aisles.

In some cases, the use of hot isle containment systems such as floor to ceiling plastic curtains or other isolation systems may be considered to direct and/or segregate conditioned air supply and hot air exhaust. These systems shall be designed to accommodate fire sprinkler and suppression system activation.

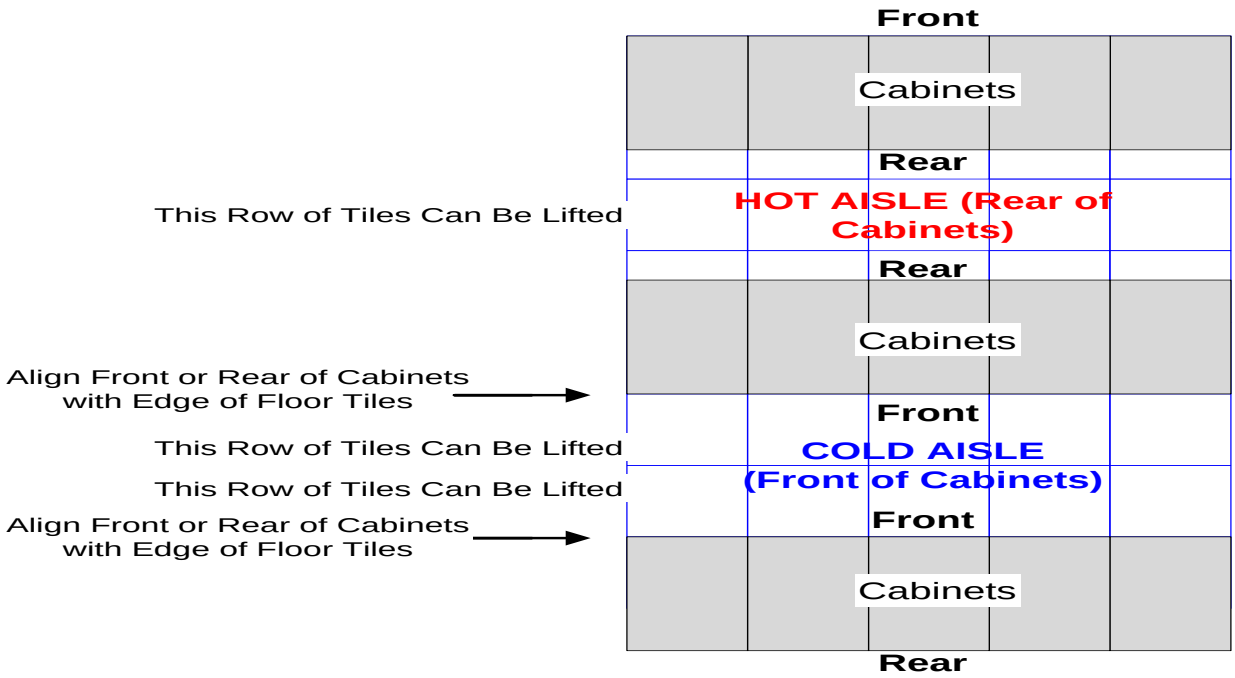

Figure 1: Example of hot aisles, cold aisles and cabinet placement

2.6.7 Cabinets

Provide 24”x42”x84” welded frame cabinets with solid side-panels and perforated doors. Cabinets shall be rated at 2200 lbs. capacity, and have integral cable management.

2.6.8 Data Equipment Placement

Equipment shall be placed in cabinets and racks with cold air intake at the front of the cabinet or rack, and hot air exhaust out the back. Reversing equipment in the rack will disrupt the proper functioning of hot and cold aisles.

2.6.9 Placement Relative to Floor Tile Grid

Cabinets and racks shall be arranged on the access floor to permit tiles in the front and rear of the cabinets and racks to be lifted. Cabinets shall be aligned with either the front or rear edge along the edge of the floor tile. Racks shall be installed toward the center of the floor tile to ensure that threaded rods that secure the racks to the slab will not penetrate a raised floor stringer.

2.6.10 Installation of Racks and Cabinets on Access Floors

Equipment racks mounted to the raised floor should be installed with through-bolts to seismic raised floor rack supports.

When in Seismic Zone 3 or greater, or if severe vibration from adjacent equipment is present, equipment cabinets may be mounted to base-isolation platforms (WorkSafe Technologies ISO Base™ platform or equivalent). Consideration should be given on a case by case basis and determined by the project team.

Sharp edges on the top of the threaded rods shall be covered using domed nuts or other method. Exposed threads under the access floor shall be covered using split tubing or other method.

2.6.11 Clearances

Provide a minimum of 1.2 m (4 ft) front and rear clearance for installation of equipment. Provide equal or greater clearance for ramps, entry and egress areas, side corridors and to meet current ADA requirements.

2.7 Mechanical Systems Requirements

2.7.1 HVAC

Primary Data Centers, Automation should have HVAC provided on a 24 hours-per-day, 365 days-per-year basis. The HVAC system of a Data Center facility shall include multiple air conditioning units with the combined cooling capacity to maintain critical space temperature and relative humidity at design conditions, with sufficient redundant units to allow failure of service to one electrical switchboard (N+1). The piping system or systems are dual path, whereby a

failure of or maintenance to a section of pipe will not cause interruption of the air conditioning system. Alternative resources of water storage are to be provided when evaporative systems are in place.

2.7.2 Standby Operation

The HVAC system shall be supported by the Data Center standby generator system but not tied into the UPS. If the Data Center does not have a dedicated standby generator system, the Data Center HVAC shall be connected to the building standby generator system.

2.7.3 Operational Parameters

The mechanical system shall be capable of achieving the following Data Center environmental parameters:

Temperature: 19° C (67° F) to 25 ° C (77° F)

- Normal set point -73°F
- Control ± 5°F

Relative Humidity: 40% to 60%

- Normal set point 50% RH
- Control ± 10%

Humidification and dehumidification equipment may be required depending upon local environmental conditions.

Coordinate cooling system design and equipment floor plans so that airflow from cooling equipment travels in a direction perpendicular to the rows of cabinets / racks. The preferred flow for air movement is supply from the floor and return in the ceiling.

The ambient temperature and humidity shall be measured in the room at 4 points per 1000 sq. ft. at a distance of 1.5 m (5 ft) above the floor level, after the equipment is in operation, at any point along an equipment cold aisle centerline. Monitoring and reporting of temperature and humidity shall be consistent with appropriate LACCD Building Management System.

2.7.4 Positive Pressure

A positive pressure differential with respect to surrounding areas should be considered. A positive pressure level of .02 inches of water ± .01 shall be maintained.

2.7.5 Air Filtration

The HVAC system shall incorporate an air filtration system that will provide a minimum filtration factor of 85%.

2.7.6 Contaminants

The Data Center shall be protected from contaminants and pollutants that could affect operation and material integrity of the installed equipment. The EPA Office of Air Quality Planning and Standards (OAQPS) has set National Ambient Air Quality Standards. When contaminants are present in concentrations greater than indicated in table 1, vapor barriers, positive room pressure, or absolute filters shall be provided.

Table 1: Contamination Limits

Contaminant	Concentration
Chlorine	0.01 ppm
Dust	100 µg/m^3/24 h
Hydrocarbons	4 µg/m^3/24 h
Hydrogen Sulfide	0.05 ppm
Nitrogen Oxides	0.1 ppm
Sulfur Dioxide	0.3 ppm

2.7.7 Ventilation Air

The Data Center shall receive outside air ventilation for occupants. The ventilation air shall be introduced at the ceiling level, at a sufficient distance from the Data Center air conditioning units so as not to confuse the CRAC units into requiring heat.

The Data Center shall receive supply air for ventilation and positive pressurization purposes.

2.7.8 Leak Detection System

A leak detection system consisting of both distributed-type cable sensors and point sensors should be provided in all Data Center spaces. A framed plan indicating cable routing and periodically indicating cable lengths calibrated to the system shall be provided adjacent to the system alarm panel.

2.7.9 Building Management System

A Building Management System (BMS) shall monitor all mechanical, electrical, and other facilities equipment and systems. The system should be capable of

local and remote monitoring and operation. Individual systems shall remain in operation upon failure of the central BMS or head end. Consideration shall be given to systems capable of controlling (not just monitoring) building systems as well as historical trending and logging. 24-hour monitoring of the BMS system shall be provided by facilities personnel, security personnel, paging systems, or a combination of these. Emergency plans shall be developed to enable quick response to alarm conditions.

Refer to the appropriate LACCD Building Management System design documents.

2.7.10 Plumbing Systems

No water or drain piping shall be routed through or above the Data Center that is not associated with Data Center equipment. Water or drain piping that must be routed within the Data Center shall be either encased or provided with a leak protection jacket. A leak detection system shall be provided to notify building operators in the event of a water leak.

2.7.11 Drainage Piping

No floor drain(s) within the Data Center shall be installed due to the possibility of backups and flooding. Instead, open drainage or troughs using gravitational piping into adjacent support rooms should designed into the flooring. Floor drains in the support spaces shall receive the condensate drain water and humidifier flush water from the Data Center air conditioning units. All drain piping terminations shall be set in the sink, below floor grade, and be provided with a splash-guard.

2.7.12 Fire Protection Systems

The following describes the various levels of fire protection that may be provided for the Data Center. The minimum level of protection required by code includes an ordinary sprinkler system along with the appropriate clean-agent fire extinguishers. This standard dictates that any sprinkler systems required by code be shall be “double-interlocking” pre-action systems.

Advanced detection and suppression systems beyond minimum code requirements shall be provided. These systems include air sampling smoke detection systems, pre-action sprinkler, high pressure water mist systems and clean agent suppression systems.

A high level risk assessment will need to be performed on any LACCD Data Center rooms to evaluate the impact on the operations of the facility in the event of a fire incident. The risk assessment will take into account the business interruption and site disaster recovery plan if the room is impacted.

2.7.13 Fire Detection and Alarm

Air Sampling Smoke Detection - An air sampling smoke detection system shall be provided for the Data Center. This system shall be provided in lieu of ordinary smoke detectors. The smoke detection system shall provide Very Early Warning Smoke Detection (VESDA) via continuous air sampling and particle counting and have a range up to that of conventional smoke detectors. These features will enable it to also function as the primary detection system and thus eliminate the need for a redundant conventional detection system to activate suppression systems.

The air-sampling system shall consist of a network of piping in the ceiling and below the access floor that continuously draws air from the room into a laser based detector. The system shall have four levels of alarm that range from detecting smoke in the invisible range up to that detected by conventional detectors. Designs may call for two or more systems. One system shall be at the ceiling level of the Data Center as well as at the intake to the Data Center air-handling units. A second system shall cover the area under the access floor in the Data Center.

2.7.14 Primary Data Centers

The data center contains the main computer servers for the building/site. Due to the criticality of these systems, two suppression systems will be provided:

1. A clean agent fire extinguishing system in the room, and under the raised floor (if applicable)
2. A high-pressure water mist fire extinguishing system, with unlimited water supply, as the secondary system shall be designed in accordance with NFPA 750.
    - A double interlock pre-action sprinkler system may be used as an alternate to water mist upon direction of the site fire protection representative.

An air sampling smoke detection system will initiate the clean agent fire extinguishing system, and spot type smoke or heat detection will initiate the water mist system. The smoke or heat detection provided shall be approved for the operating temperature of the room following plan review by the site fire protection representative.

A separate room adjacent to the data center shall be provided for storage of the clean agent extinguishing cylinders and water mist system. The control panels for the suppression systems shall be located adjacent to the room entrance, or in the cylinder room, depending on site preference. The type of clean agent shall be confirmed with the site fire protection representative.

2.7.15 Data Tape Storage Rooms

If applicable, the type of storage used for tape back-ups of the computer system will need to be evaluated as part of the data center risk assessment. The storage type and criticality of the files will determine the type of protection to be used.

2.7.16 Hand Held Fire Extinguishers

A clean agent fire extinguisher shall be provided for the Data Center.

2.8 Electrical Systems Requirements

2.8.1 Utility Service Entrance and Primary Distribution

The primary switchgear shall be designed for growth, maintenance, and redundancy. A double-ended (main-tie-main) or isolated redundant configuration shall be provided. The switchgear bus shall be oversized as this system is the least expandable once operations begin. Breakers shall be interchangeable where possible between spaces and switchgear lineups. Design shall allow for maintenance of switchgear, bus, and/or breakers.

At least two utility feeders shall be provided to serve the Data Center at medium or high voltage (above 600 volts). The configuration of the utility feeder shall be primary selective, utilizing automatic transfer circuit breakers or automatic isolation-bypass transfer switches, or 2N isolated redundant. Alternately, an automatic main-tie-main configuration can be used. Pad mount, substation, or dry-type distribution transformers can be utilized. The transformers shall be configured for N+1 redundancy and shall be sized based on open-air ratings

Isolation-bypass automatic transfer switches or automatic transfer breakers shall be provided to sense loss of normal power, initiate generator start and transfer loads to the generator system. To increase the availability of power to the critical load, the distribution system is configured in a distributed redundant (dual path) A/B topology.

A signal reference grid (SRG) and lightning protection system shall be provided. Transient Voltage Surge Suppressors (TVSS) shall be installed at all levels of the power distribution system that serve the critical electronic loads.

A central power and environmental monitoring and control system shall be provided to monitor all major electrical equipment such as main switchgear, generator system, UPS system, power distribution unit, automatic transfer switch, motor control center and transient voltage surge suppression system. A separate mechanical monitoring system shall be provided, programmed to manage the mechanical system, optimize efficiency, cycle usage of equipment

and indicate alarm condition. A redundant server shall be provided to ensure continuous monitoring and control in the event of a server failure.

All feeders and equipment shall be capable of manual bypass for maintenance or in the event of failure. Any failure will automatically transfer power to critical load from failed system to alternate system without disruption of power to the critical electronic loads. The system shall allow flexibility of switching to satisfy total maintainability. TVSS shall be installed on each distribution system serving electronic loads.

The utility service entrances shall be dedicated to the Data Center and isolated from all non-critical facilities.

2.8.2 Standby Generation

The standby generation system shall be capable of providing a supply of reasonable quality and resilience directly to the computer and telecommunications equipment if there is a utility failure.

A standby generator system shall be used to provide power to the uninterruptible power supply system and mechanical system. On-site fuel storage shall be sized to provide a minimum of 24 hours of generator operation at the design loading condition. Generator fuel shall be diesel.

Duplex pumping systems shall be provided with automatic and manual control, with each pump fed from separate electrical sources. Isolated, redundant fuel tanks and piping systems shall be provided to ensure that fuel system contamination or mechanical fuel system failure does not affect the entire generator system. Dual redundant starters shall be provided for each generator engine. Where paralleling systems are employed, they shall be provided with redundant control systems. TVSS shall be provided for each generator output.

Paralleled generators shall be capable of manual synchronization in the event of failure of automatic synchronization controls. Consideration shall be given to manual bypass of each generator to directly feed individual loads in the event of failure or maintenance of the paralleling switchgear. Generators shall be designed to supply the harmonic current imposed by the UPS system or computer equipment loads. Motor starting requirements shall be analyzed to ensure the generator system is capable of supplying required motor starting currents with a maximum voltage drop of 15%.

Standby power shall be provided to all air-conditioning equipment.

If the standby generator system is used for emergency lighting and other life-safety loads in addition to the Data Center loads, a separate transfer switch and distribution system shall be provided. Isolation/bypass shall be provided for life-safety transfer switches to facilitate maintenance. Similarly,

isolation/bypass or dual-breaker transfer switches shall be provided to serve Data Center equipment to eliminate the automatic transfer switch (ATS) as a single-point of failure and to facilitate maintenance.

2.8.3 Uninterruptible Power Supply (UPS)

This standard describes the operation and functionality of a continuous duty, three-phase, solid-state, static Uninterruptible Power Supply (UPS) hereafter referred to as the UPS.

All UPS systems shall be capable of being deployed in an N+1 redundant, scalable architecture. This UPS can be initially deployed as a single stand-alone (SA) UPS or installed with other like systems in a standard 19" four post IT enclosure for parallel capacity (PC) power applications from 12 to 60kW, or installed with other like systems in a standard 19" four post IT enclosure for parallel redundant (PR) power applications from 12 to 60kW (N+1). Any system deployment shall comprise of hot swappable / user replaceable 12kVA/12kW electronics modules. Each repalaceable12kVA/12kW electronics module contains individual UPS system logic controls, full rated power factor corrected input power converter/rectifier, full rated PWM inverter, continuous duty bypass static switch module and up to 10% battery charging circuit. Each 12kW system shall also comprise of hot swappable / user replaceable battery modules, individual user replaceable LCD interface display, intelligent automated maintenance bypass, individual battery string breaker, individual system input breaker, and individual system output breaker. The system shall be designed that all modules in parallel will all equally support the individual output breakers and receptacle used to connect to independent output distribution modules.

The UPS shall consist of the following components, as required by the project, the UPS module(s) with internal battery and internal automated maintenance bypass device, extended battery runtime modules, a paralleling power bus system located in a typical IT enclosure, rack mountable power distribution modules, and other features as described in this specification. UPS modules shall be capable of installation in any EIA-310-D, or EIA-310-E four post 19" IT enclosure, with minimum depth of 30 inches. All of the standard system components above can be housed in one standard, 24 inch wide, 42 inch.

2.8.4 Building Grounding and Lightning Protection Systems

A building perimeter ground loop shall be provided; consisting of #4/0 AWG (minimum) bare copper wire buried 3'-0" deep and 3'-0" from the building wall, with 10'x3/4" copper-clad steel ground rods spaced every 20 to 40 feet along

the ground loop. Test wells shall be provided at the four corners of the loop. Building steel shall be bonded to the system at every other column. This building grounding system shall be directly bonded to all major power distribution equipment, including all switchgear, generators, UPS systems, transformers, etc., as well as to the telecommunications systems and lightning protection system. Ground busses are recommended to facilitate bonding and visual inspection.

No portion of the grounding systems shall exceed 5 ohms to true earth ground as measured by the four-point fall-of-potential method.

A UL Master-Labeled lightning protection system shall be considered for all Data Centers. The Risk Analysis Guide provided in NFPA 780, which takes into account geographical location and building construction among other factors, can be very useful in determining the suitability of a lightning protection system. If a lightning protection system is installed, it shall be bonded to the building grounding system as required by code and as required for maximum equipment protection.

2.8.5 Signal Reference Grid

The Data Center Signal Reference Grid (SRG) creates an equipotential ground reference for Data Center and reduces stray high frequency signals. The SRG consists of a copper conductor grid on 2 to 8 foot centers that covers the entire Data Center space. The conductor shall be no smaller than #8 AWG or equivalent. Other acceptable solutions include a prefabricated grid of copper strips welded into a grid pattern on 8-inch centers which is rolled out onto the floor in sections or an electrically continuous raised-floor system which has been designed to function as an SRG and which is bonded to the building grounding system.

V. WARRANTY

- Minimum 5 -year on parts, labor and on-site support, unless a product is unavailable from the manufacturer for more than 3 years.
- Minimum 20 year on all cabling components

VI. SUPPORT

Provide a full range of support services including:

- Add labor or on-site service for the UPS including battery maintenance and power distribution systems, HVAC systems, Fire Suppression systems, Alarm/Monitoring systems and Generator systems
- Installation and Start-up
- Extended coverage hours and enhanced response times
- Availability and recovery services

VII. RELATED STANDARDS

In addition to the standards set forth above in Section IV "Standards," the following standards must also be compliant with:

- LACCD IT Standard - Structured Cabling Systems
- LACCD IT Standard - Infrastructure

VIII. EXCEPTIONS OR WAIVER REQUIREMENTS

Process
Exceptions or waivers to this Standard must be approved by the District Technology Committee and documented using the following process:

A request for exception or waiver to any portion of the standards listed above shall be electronically delivered to the local College IT Leadership and Chief Information Officer. In order to be considered, the request must include the following information:

1. The specific standard number, revision, and title
2. Description of standard section being considered for exception or waiver
3. Reason for request
4. Name and contact information of the requesting party

Compliance
Failure to comply with the exception or waiver requirements and process may lead to the removal of non-compliant equipment and associated software at the expense of responsible parties.

IX. REQUESTS FOR CLARIFICATION

A request for clarification on any of the standards listed above may be emailed to the local IT Leadership or Chief Information Officer. In order to be considered, the request must include the following information:

1. The specific standard number, revision and title
2. Section(s) of the standard needing clarification
3. Name and contact information of the requesting party

X. REFERENCES

Industry or best practice standards, ISO, ANSI, NEMA, IEEE, BICSI, Uptime Institute
AHRAE Standards 2012

XI. GLOSSARY

The following terms are defined as follows:

1. **Need** means that the item or course of action is essential and it will be absolutely required at the time indicated in the standard. (e.g. A high level risk assessment **needs** to be performed…)
2. **Call for** means that the item or course of action is absolutely required.
3. **Are to be provided** means that the item or course of action must be supplied in order to meet the standard.
4. **May be required if** means that if the condition stated in the standard is met, the capability, performance expectation, or any other description in the standard is absolutely required.
5. **Recommended** means that the course of action is in accordance with (Insert Applicable Area such as Security) Best Practices and should be adopted.
6. **Not Recommended** means that a course of action is not consistent with (Insert Applicable Area) Best Practices and/or other laws, codes, or requirements and should not be adopted.
7. **May/Might/Can** mean "optional." The items specified using this language may be included or omitted depending upon the consultant/vendor's preferences. However, even if one particular item is optional, the item chosen must still interoperate or function with the District's existing systems.
8. **Preferred/encouraged** mean that one item or course of action is favored over other optional courses of action because of proven favorable outcomes.
9. **Acceptable** means that the item or course of action is only a minimum, and the consultant/vendor may supersede the quality or performance of that item or course of action.

XII. DOCUMENT HISTORY

REV NO.	SECTION NO./ PARA	DESCRIPTION OF CHANGE	DTC APPROVAL DATE
R0	-	First Release	3.1.09
R1	All	Document format and installation practices	11.8.13
	2.4.19	Removed Section “Under floor cable tray”	
	2.4.23	Added Section “Hot and Cold Aisle Containment”	
	2.4.25	Added Section “Cabinets”	
	2.4.32	Updated Section “Operational Parameters” per ASHRAE Standards 2012	
	Appendix A	Removed (See separate document LACCD IT Specification “12kW-60kW Uninterruptable Power Supply & Power Distribution System” dated 8.2.2012)	
	V	Revised warranty information	