# LACCD IT Design Standards

September

# 2009

This document establishes a uniform standard for the design, construction and renovation of Data Centers and Computer Rooms at Los Angeles Community Colleges, satellite locations and District Office.

Districtwide Data Center Design Std 03-0909

## Contents

I. Purpose ..... 5
II. SCOPE ..... 5
III. Standard ..... 5
Data Center Classification Levels ..... 5
Defining the Tiers ..... 5
LACCD Primary Data Center room classification and design guidelines ..... 6
DATA CENTER DESIGN REQUIREMENTS ..... 7
Location ..... 7
Access ..... 7
General Architecture and Structural Requirements ..... 7
Ceiling ..... 8
Treatment ..... 9
Lighting ..... 9
Doors ..... 9
Signage ..... 9
Seismic considerations ..... 9
Guidelines for other equipment ..... 9
Access Floor Systems (Raised Floors) ..... 9
Access floor performance requirements ..... 9
Floor tile cuts ..... 10
Overhead Cable Runway ..... 10
Cable tray support ..... 10
Under floor cable tray ..... 10
Racks and Cabinets ..... 11
Standards ..... 11
Racks ..... 11
Cabinets ..... 11
Adjustable rails ..... 11

LACCD Power Standards for Data Centers ..... 11
Power strips ..... 11
Rack and cable placement ..... 13
Data equipment placement ..... 14
Placement relative to floor tile grid ..... 14
Installation of racks and cabinets on access floors ..... 14
Clearances ..... 14
Mechanical Systems Requirements ..... 14
HVAC ..... 14
Ventilation air ..... 16
Leak detection system ..... 16
Building management system ..... 16
Plumbing systems ..... 16
Drainage piping ..... 16
Fire protection systems ..... 17
Fire detection and alarm ..... 17
Primary Data Centers ..... 17
Data Tape Storage Rooms ..... 18
Hand held fire extinguishers ..... 18
Electrical Systems Requirements ..... 18
Utility service entrance and primary distribution ..... 18
Standby generation ..... 19
Uninterruptible Power Supply (UPS) ..... 19
Building grounding and lightning protection systems ..... 20
Signal reference grid ..... 20
IV. Exceptions or Waiver Requirements ..... 21
V. Compliance ..... 21
VI. References ..... 21
VII. Glossary ..... 21
VIII. Document History ..... 21
Appendix A ..... 22

# I. Purpose

This document establishes a uniform standard for the design, construction and renovation of Data Centers at the Los Angeles City College District (LACCD) including, but not limited to, East Los Angeles College (ELAC), Los Angeles City College (LACC), Los Angeles Harbor College (LAHC), Los Angeles Mission College (LAMC), Los Angeles Pierce College (LAPC), Los Angeles Southwest College (LASC), Los Angeles Trade Tech College (LATTC), Los Angeles Valley College (LAVC), West Los Angeles College (WLAC), and the Los Angeles City College District Office, collectively LACCD. At the direction of LACCD Information Technologies, other satellite campuses may also be included.

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.

# II. 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 LACCD IT Structured Cabling Design Std 002-030109 for cabling system and outside facilities specifications.

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

# III. Standard

## 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.

- 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.

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% |

Design Guideline 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 |
| | |

## LACCD Primary Data Center room classification and 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.

# DATA CENTER DESIGN REQUIREMENTS

General

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

## 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.

## 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.

## General Architecture and Structural Requirements

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.

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.

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.

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.

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/ $ft^2$).

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.

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.

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.

## 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.

## 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.

## 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.

## 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

## Signage

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

## 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 .

## 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.

## Access Floor Systems (Raised Floors)

### Access floor performance requirements

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.

### 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 w/ 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.

## 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 a 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.

### Cable tray 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.

### Under floor cable tray

The preferred distribution design for communications cabling routing in the Data Center is via overhead cable runway. If communications cabling is to be placed under the access floor, it shall be installed in under-floor cable trays. These trays shall be of the wire basket type, and placed in such a way as to not block air flow. The under floor cable trays may be installed in multiple layers to provide additional capacity. Adjacent sections of cable tray must be bonded together. The cable tray must be bonded to

the Data Center signal reference grid. The maximum recommended depth of the wire basket tray is 150 mm (4 in). The preferred make and manufacture of the under-floor cable tray is Cablofil systems or equivalent.

Planning of under floor pathways for communications cabling shall be kept to a minimum as most shall cabling will be overhead. These pathways shall be coordinated with mechanical & electrical engineers that are designing plumbing, air ducts, power, and fire protection systems. Plan telecommunications cabling to minimize blockage of airflow and to maintain a separation of copper cabling from power cabling by 6 inches or greater when crossing conductors perpendicular, and 18" when run in parallel.

## Racks and Cabinets

### Standards

#### 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.

#### 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.

#### 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.

## LACCD Power Standards for Data Centers

#### Power strips

The typical configuration for power in cabinets is listed in the table below. The power strips shall be metered with LED readouts. The actual power strip configuration shall be determined by the equipment each rack or cabinet is intended to support, as well as local electrical standards.

High voltage power strips shall be installed at the rear of the cabinet or rack, usually mounted on the right side of the cabinet. Power strips shall be labeled with the PDU/panel identifier and circuit breaker number.

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

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

Specialty Server Cabinets (Blade or SAN) – up to 10.0 kW max power load – Fed from UPS

*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.*

- 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**
- 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

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

### Rack and cable placement

Cabinets and racks shall 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 shall 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.

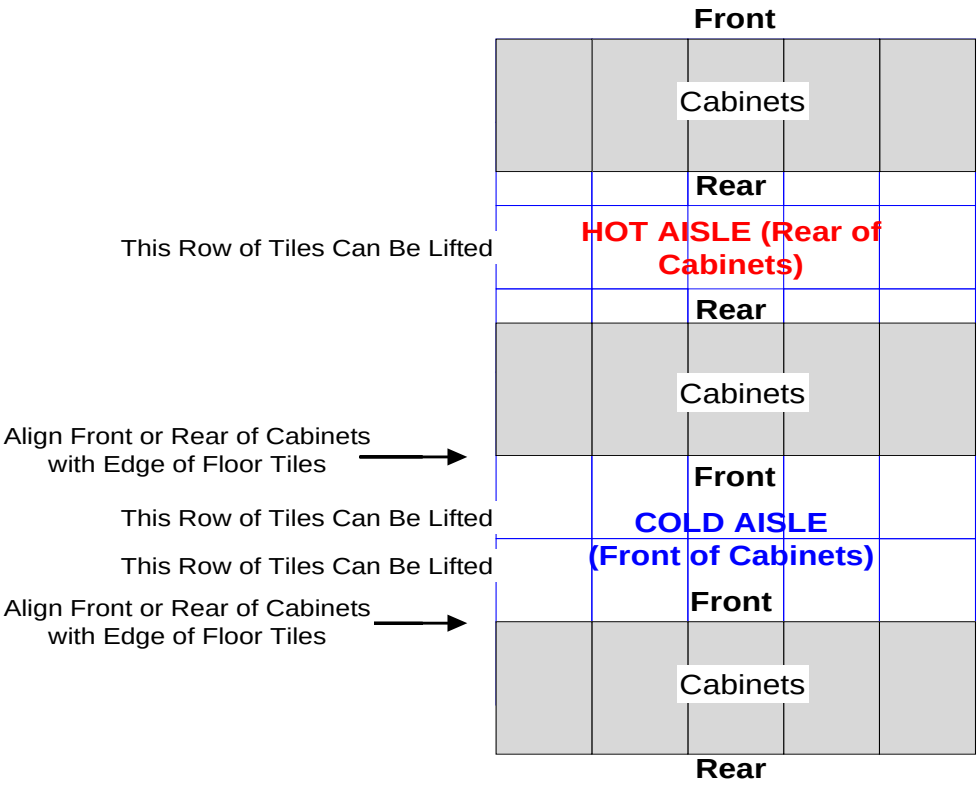


**Figure 4: Example of hot aisles, cold aisles and cabinet placement**

### 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.

### 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.

### Installation of racks and cabinets on access floors

Equipment racks mounted to the raised floor shall 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 shall be mounted to base-isolation platforms (WorkSafe Technologies ISO Base™ platform or equivalent).

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.

### 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.

## Mechanical Systems Requirements

### HVAC

Primary Data Centers, Automation will 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.

#### *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.

### *Operational parameters*

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

Temperature: 20° C (70° F) to 23° C (74° F)

- Normal set point 72°F
- Control ± 2°F

Relative Humidity: 45% to 55%

- Normal set point 50% RH
- Control ± 5%

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.

### *Positive pressure*

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

### *Air Filtration*

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

### *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 |

### 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.

### Leak detection system

A leak detection system consisting of both distributed-type cable sensors and point sensors shall 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.

### Building management system

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

### 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.

### 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.

### Fire protection systems

The following describes the various levels of fire protection that can 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.*

### 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.

### 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:

- A clean agent fire extinguishing system in the room, and under the raised floor (if applicable)
- 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.

### Data Tape Storage Rooms

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.

### Hand held fire extinguishers

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

## Electrical Systems Requirements

### 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.

### 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 gasoline.

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.

### 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. Detailed specifications can be found in Appendix A of this document.

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 pieces, 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

### 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.

### 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.

## IV. Exceptions or Waiver Requirements

Requests for exceptions to this standard shall be submitted to the LACCD DTC/ISSTC.

## V. Compliance

All components installed as part of a newly constructed or renovated Data Center must meet or exceed LACCD standards. The LACCD DTS committee can assist clients with procuring the correct system based on business requirements, user population and specific requests.

## VI. References

## VII. Glossary

## VIII. Document History

# Appendix A

GUIDE SPECIFICATIONS FOR

**12kW-60kW UPS & Power Distribution System**

GENERAL UPS

SUMMARY UPS

This specification 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 pieces, 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 deep, 42U high equipment racks.

In addition, this specification describes the design of the automated UPS maintenance bypass system and its operation with the rack mounted power distribution unit, hereafter referred to as the RPM or Rack Power Module. A parallel bus bar system housed in a standard EIA-310-D enclosure, rack level power management products, and connectivity solutions including complete PowerXpert system management solutions.

The UPS and associated equipment shall operate in conjunction with a primary power supply and an output distribution system to provide quality uninterrupted power and distribution for mission critical, electronic equipment loads.

All programming and miscellaneous components for a fully operational system as described in this specification shall be available as part of the System.

STANDARDS

UL 1778 (Underwriters Laboratories) – Standard for Uninterruptible Power Supply Equipment. Product safety requirements for the United States.

CSA C22.2 No 107.1(Canadian Standards Association) – Commercial and Industrial Power Supplies. Product safety requirements for Canada.

IEC 62040-1-1 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 1-1: General and safety requirements for UPS used in operator access areas.

IEC 62040-1-2 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 1-2: General and safety requirements for UPS used in restricted access locations.

IEC 62040-3 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements.

CISPR 22: FCC Rules and Regulations 47, Part 15, Class A (Federal Communications Commission) – Radio Frequency Devices.

Where applicable, the UPS shall also be designed in accordance with publications from the following organizations and committees

IEEE 587 (ANSI C62.41) Category A & B (International Electrical and Electronics Engineers) – Recommended practices on surge voltages in low voltage power circuits.

NFPA 70E®: Standard for Electrical Safety in the Workplace®

NEMA - National Electrical Manufacturers Association

OSHA - Occupational Safety and Health Administration

MIL-HDBK-217E (Military Handbook) – Reliability prediction of electronics equipment

IEEE 519-1992 Standard Practices and Requirements for Harmonic Control in Electrical Power Systems.

ISO 9001

ISO 14001

UPS MODES OF OPERATION

Normal: Utilizing commercial AC power, the critical load shall be continuously supplied regulated and protected AC power. The system shall power the load while regulating both voltage and frequency inside the acceptable limits of the connected load equipment. The system shall derive power from the commercial AC source and shall supply DC power to the Inverter in conjunction with charging the battery.

Battery: Upon failure of the commercial AC power, the critical load shall continue to be supplied AC power by the system, which shall obtain power from the batteries without any operator intervention. Continuous operation of the critical load shall never be jeopardized during the failure or restoration of the commercial AC source.

Charger: Upon restoration of the commercial AC or back-up generation source, the charger shall recharge the batteries and simultaneously supply power to the input power converter (rectifier) which provides power to the Inverter. This shall be an automatic function and shall cause no interruption to the critical load.

Static Bypass: Each UPS power module shall incorporate a continuous duty static bypass to provide transfer of critical load from the inverter output to the bypass source. This transfer, along with its retransfer, shall take have no effect on the operation of the critical load. In the event of an emergency, this transfer shall be an automatic function.

Maintenance Bypass: Each UPS module shall be equipped with an intelligent automated internal make-before-break maintenance bypass to isolate the UPS during routine maintenance and service of the UPS.

SUBMITTALS

Proposal Submittals:

Bid requirement bill of materials.

Product catalog sheets or equipment brochures.

Product guide specifications.

System single-line operation diagram.

Installation information, including weights and dimensions.

Information about terminal locations for power and control connections.

Drawings and details for requested optional accessories.

Delivery Submittals:

Installation and user manual including:

Instructions for storage, handling, examination, preparation, installation, and start-up of UPS.

Instructions for operating the system.

Equipment drawings

Interconnection Drawings

Battery Wiring Diagram

UPS One-Line Drawings

Equipment Outline Drawings

Accessory Wiring Diagrams

PRODUCT

DESIGN REQUIREMENTS

The UPS shall be sized for _____ kW load (_____ kVA).

The UPS battery shall be sized for _____ minutes runtime at a Power Factor of_____ for a _____ kW load.

SYSTEM CHARACTERISTICS

System Capacity: The system shall be rated for full kW output in the following configurations

12 kW/kVA – using one (1) 12kW UPS system

12 kW/kVA (N+1) – using two (2) 12kW UPS systems

24 kW/kVA - using two (2) 12kW UPS systems

24 kW/kVA (N+1) – using three (3) 12kW UPS systems

36 kW/kVA - using three (3) 12kW UPS systems

36 kW/kVA (N+1) – using four (4) 12kW UPS systems

48 kW/kVA - using four (4) 12kW UPS systems

48 kW/kVA (N+1) – using five (5) 12kW UPS systems

60kW/kVA - using five (5) 12kW UPS systems

60 kW/kVA (N+1) – using six (6) 12kW UPS systems

All N+1 configurations will include fully isolated and redundant logic controls, electronics modules, battery systems, static switch assemblies, and automatic maintenance bypass.

Input Specifications:

AC Input Nominal Voltage: 208Y/120V, 3 Phase, 4 wire, 60 Hz.

AC Input Voltage Window: 180vac to 255vac without using stored energy mode.

Maximum Frequency Range: 45-65Hz before switching to battery operation

Input Power Factor:

> .97 with active PFC IT loads

> .99 operating from IGBT based input power converter

Input Current Distortion (*with no additional passive filter)*

< 6% typical with active power factor corrected (PFC) IT loads

< 5% operating from input power converter, with PFC and Non-PFC loads.

Current inrush: No transformer magnetizing inrush in standard UPS

From start or retransfer from battery: Shall not exceed connected load inrush

Output Specifications:

AC Output: 208Y/120V, 3 Phase, 4 wire, 60 Hz.

AC Output Voltage Distortion: Max. 3% @ 100% Linear Load.

AC Output Voltage Window: Selectable

Conformance to ITIC curve, 187 to 229V L to L

Typical per ITE Power supply regulation window: 180 to 229V L to L

Voltage Transient Response:

Normal operation: +/- 1% maximum for 100% load step

Reserve energy mode: +/- 6% maximum for 100% load step

Voltage Transient Recovery within <60 milliseconds

Output Voltage Harmonic Distortion: Stored energy or inverter operation

<3% THD maximum and 1% single harmonic for a 100% linear load

<5% THD maximum for a 100% non-linear load

Phase Angle Displacement:

120 degrees $^{+}/_{-}$ 1 degree for balanced load

120 degrees $^{+}/_{-}$ 1 degrees for 50% imbalanced load

120 degrees $^{+}/_{-}$ 3 degrees for 100% imbalanced load

Overload Rating

Normal Operation

125% for one minute

110% for ten minutes

105% continuous

Bypass Operation

125% continuous

1000% for 500 milliseconds

System AC-AC Efficiency: >96.5% at 100% load

Output Power Factor Rating: 0.9lead to 0.7 lag

The UPS output shall not require derating for purely resistive or power factor corrected loads (PF of 1). The output kW and kVA ratings of the UPS shall be equal. For loads exhibiting a power factor of .9 leading to .7 lagging no derating of the UPS shall be required.

Environmental

Storage Ambient Temperature: -40°F to 158°F (-40°C to 70°C)

Operating Ambient Temperature: +32°F to 104°F (0°C to 40°C). (25°C is ideal for most battery types)

Relative Humidity: 0 to 95% Non-condensing

Altitude: Maximum installation with no derating of the UPS output shall be 3300 feet (1000m) above sea level.

INPUT POWER CONVERTER

The input power converter for each 12kW system is housed within the removable electronics module. This electronics module shall also contain the system control logic, continuous duty static switch and continuous duty inverter. The input power converter shall constantly receive power from the mains

input to the system, to provide the necessary UPS power for precise regulation of the DC link voltage to the inverter and battery charger, therefore maintaining regulated output power.

Input Current Total Harmonic Distortion: The input current $THD_I$ shall be actively controlled by the input power converter while operating from the converter. The input THD shall be less than 6% at full system load.

Magnetization Inrush Current: If provided with an optional isolation transformer or PDU/System Bypass, system inrush shall be limited to 8 times the nominal input current of the transformer.

Input Current Limit:

The input converter shall control and limit the input current draw from utility to 130% of the UPS output. During conditions where input current limit is active, the UPS shall be able to support 100% load, charge batteries at 10% of the UPS output rating, and provide voltage regulation with mains deviation of up to +22%/ -10% of the nominal input voltage.

Redundancy: When installing systems in a parallel redundant (PR) configuration, the system shall include redundant input converters, each with semiconductor fusing, and logic controlled contactors to remove a failed module from the power bus.

Battery management system: The UPS shall contain a battery management system with the following features:

Battery Recharge: The battery management system shall provide a three-step charging process. These periods shall be recognized as constant current, constant voltage and rest. After recharging batteries to full capacity, UPS shall isolate the charging circuit from the battery. Continual float charging of the battery shall not be allowed, therefore reducing the possibility of positive grid corrosion, and increasing expected battery life.

Battery Runtime Monitoring: The battery management system shall monitor battery and provide status to end user of battery run time via front panel, serial/network communications, or both. Run time calculations to be based on load demand and analysis of battery health.

Battery Health Monitoring: UPS shall continuously monitor battery health and the UPS will provide warnings visually, audibly and/or via serial/network communications when battery capacity falls below 80% of original capacity. Battery testing may also be user initiated via the front panel or serial communications.

Parallel connected systems shall independently monitor their battery voltage during discharge. Each system shall communicate with other systems on the parallel bus, sending information about current battery conditions (voltage). Each UPS shall be able to adjust output load based upon its own battery voltage, therefore systems with incorrectly connected, weak or failed batteries shall assume less load ensuring maximum runtime out of the connected battery. Adjusting output loading based on battery voltage shall not allow a UPS inverter to exceed more than 100% of its rated capacity.

The battery charging circuit shall remain active when in any normal mode of operation or while in static bypass mode.

Back-feed Protection: Each UPS shall provide a UL1778 approved back-feed protection scheme.

OUTPUT INVERTER

The UPS output inverter shall be used to regulate the output voltage to operate in conjunction with the connected IT load equipment. The output inverter shall use IGBT driven power converters, operating at high frequency to limit the effects of step loads and reduce the operating audible noise from the system. In both double conversion operation and battery operation, the output inverters shall create an output voltage independent of the mains input voltage. Input voltage anomalies such as brown-outs, spikes, surges, sags, and outages shall not affect the continued operation of the critical load.

Overload Capability: The output inverter shall be capable of supporting 300% overload for a short period, in attempt to clear any short-circuit on the output. The UPS inverter shall remain operational for one (1) minute if a steady-state overload condition of up to 125% is seen on the output of the system. If the overload persists past the outlined time limitation, the critical load will be automatically switched to the static bypass output of the UPS. In the event the static switch exceeds its overload capability, the UPS shall activate the automated maintenance bypass to continue to support the overload until activation of an overcurrent protection device, or the overload condition is removed from the system.

Inverter Output Isolation: The output inverter shall be provided with a semi conductor fuse and output mechanical contactor to provide overcurrent protection and physical isolation of the inverter from the critical bus. This feature allows a failed inverter to remove itself from the critical bus while not affecting the operation of other parallel systems supporting the loads.Battery Protection: Each UPS shall be capable of controlling battery discharge depth, with the additional feature of removing all DC power draw from the battery in case of an extended input power outage. This will ensure that the batteries will not be deeply discharged which could cause damage to the battery.

Redundancy: When installing systems in a parallel redundant (PR) configuration, the UPS shall be configured with redundant output inverters, each independently controlled from fully isolated logic control systems. The inverters shall be able to share output even if intra-module communication is lost between individual UPS modules. All UPS inverters shall utilize high speed semiconductor fusing, and logic controlled contactors to remove a failed inverter from the critical bus without effecting the output of the other modules on the bus.

STATIC BYPASS

Each UPS system shall include a hot swappable static bypass switch. Static bypass operation will be based upon the system configuration, stand-alone single module (SA), parallel capacity system (PC), or parallel redundant system (PR). When deployed as a SA or PC UPS system, overloads exceeding the rating of the inverter, load fault, or internal failures shall automatically transfer the critical load to the commercial AC power. If a PR system is in overload the system will automatically determine if all available systems are capable of handling the overload, and if so the system will remain in normal operation. If the overload or load fault exceeds the capability of all connected systems each modules internal static bypass switch shall automatically transfer the critical load to the commercial AC power. If an internal failure occurs on a PR system, the system affected by the fault will automatically remove

itself from the critical output bus, ensuring the critical load is protected by the remaining systems operating in normal operation, with no transfer to static bypass initiated. If a mode change to static bypass was the result of an overload or load fault, the system shall automatically return to normal operation once the condition is has cleared. No-break transfer between operating modes shall be capable of being initiated manually from the front display of any parallel connected system. Each UPS shall constantly monitor the bypass input source voltage, and inhibit potentially unsuccessful transfers to static bypass from taking place.

The design of the static switch power path shall consist of Silicon Controlled Rectifiers (SCR) with a continuous duty rating of 125% of the UPS output rating.

Automatic Transfers: An automatic transfer of load to static bypass shall take place whenever the load on the critical bus exceeds the overload rating of the UPS. Automatic transfers of the critical load from static bypass back to normal operation shall take place when the overload condition is removed from the critical bus output of the system. Automatic transfers of load to static bypass shall also take place if for any reason the UPS cannot support the critical bus.

Manual Transfers: Manually initiated transfers to and from static bypass shall be initiated through the UPS display interface. All parallel connected systems shall transfer to static bypass simultaneously upon request from one system display.

Overloads: The static bypass shall be rated and capable of handling overloads equal to or less than 125% of the rated system output continuously. For instantaneous overloads caused by inrush current from magnetic devices, or short circuit conditions, the static bypass shall be capable of sustaining overloads of 1000% of system capacity.

Redundancy: The static bypass switch shall be incorporated into each UPS Module, so PR systems will include redundancy in the Static switch function.

Modular Design: The static switch assembly shall be incorporated in the electronics module therefore reducing mean time to repair (MTTR).

System Protection:

Back-feed protection: As a requirement of UL1778, back-feed protection in the static bypass circuit shall also be incorporated in the system design. Back-feed protection shall be a function of a mechanical contactor in series with the bypass SCR(s). The back-feed contactor shall open immediately upon sensing a condition where back-feeding of the static switch by any source connected to the critical output bus of the system is occurring. Shorted SCRs in the static bypass assembly will cause the back-feed protection to activate.

Parallel connected system protection: Parallel connected systems shall include a redundant communication method for detecting if a single UPS module has initiated a transfer to bypass, which will

cause all systems to transfer to static bypass mode. This communication method is used in event the primary communication between parallel connected modules fails.

MAINTENANCE BYPASS

Each 12kW UPS system shall include an automated internal maintenance bypass, which will allow hot-swappable replacement of logic control, input converter (rectifier), output converter (inverter), battery modules and static bypass switch. Parallel connected UPS modules shall be capable of full removal and replacement if necessary. Maintenance bypass operation will be based upon the system configuration, stand-alone single module (SA), parallel capacity system (PC), or parallel redundant system (PR). When deployed as a SA or PC UPS system, conditions requiring maintenance bypass operation shall force all connected systems to the maintenance bypass mode. This shall be an automated process, with activation coming from either a command from the front panel, or when a display panel RJ45 connector is unplugged from the electronics module. Overloads exceeding the rating of the static switch shall automatically transfer the critical load through the maintenance bypass to the commercial AC power. PR systems can be commanded to maintenance bypass through the front panel, however automated transfer to maintenance bypass by unplugging one display will be inhibited as long as it does not force other connected systems into an overload condition. If a front display is unplugged in PR configuration, the UPS module will take itself off-line allowing all other connected systems to support the critical load in normal operation. Overloads of the static bypass on PR systems will automatically transfer the critical load to the commercial AC power. If an internal failure occurs on a PR system, the system affected by the fault will automatically remove itself from the critical output bus, ensuring the critical load is protected by the remaining systems operating in normal operation, with no transfer to static or maintenance bypass initiated. Each UPS shall constantly monitor the maintenance bypass input source voltage, and inhibit potentially unsuccessful transfers to maintenance bypass from taking place.

OUTPUT POWER DISTIBUTION

Each 12kW UPS module shall provide power to an output connector on the rear of the UPS chassis. This connector shall be protected by a properly sized breaker (50A), limiting the output of each UPS module to its rating. This output connector shall be wired internally so that anytime it is attached to the parallel bus system; the connector shall be supported by all UPS modules on the parallel bus. The connector shall be capable of supporting loads connected to it even in event the electronics and battery modules are removed. This connector shall also be designed so that the internal UPS electronics module will support the loads on the output connector in event of a parallel bus failure. The output connector shall be monitored by the UPS controls per the information in section 2.8.c.d.

DISPLAY AND CONTROLS

System control and information network interconnections

Any UPS installed as a parallel system shall connect to a digital monitoring network so information about system voltage, current and power measurements can be accessed from any system display. This network shall not be needed to ensure proper system synchronization or load balancing control for each

module on the output power bus. This network will allow accumulated or single system information to be displayed on any system display. The network will also allow for full system operating mode changes to be controlled from any display. Each UPS shall also be capable of individual module control though its own independent display.

Each UPS module installed in parallel shall include a digital monitoring network card, using industry standard control area network (CAN) architecture. This control architecture allows systems to operate in electrically noisy environments with extremely high reliability. This network allows accumulation of information between systems and mode control selection for all connected systems. The digital networking card will require a tool to install securely in each UPS module.

Cabling for the UPS monitoring network shall consist of interconnecting cable (Category 6) segments secured at each UPS with an interlocked 8P8C modular plug (RJ45). All information network interconnections shall be made on independent control area network (CAN) cards, which are inserted in an independently controlled and powered communication slot on each UPS module. Each of these interconnection cables shall serve as the physical layer for the UPS information network. This network cable shall be included by the manufacturer with every control area network card purchased. And shall not require tools to install.

A secondary independent control network shall be connected to each UPS module to allow system mode control changes in case of failure on the digital monitoring network. This network will ensure that if any UPS, in a parallel connected system, is in the bypass operating mode that all systems on the parallel output power bus must also be in that same operating mode. This redundancy is used to ensure that even in event of the primary digital network failure that no unsafe conditions exist for personnel working on the upstream electrical system.

The secondary control network consists of a non-shielded twisted pair cable that shall daisy chain between paralleled UPS modules. The twisted pair cables shall come assembled with a two pin female connector, used to plug into a male connector header located on the back chassis of each UPS module. These male pins shall be recessed into the chassis to prevent damage during shipping or use. Each UPS module shall have two connection points that shall not be located on the network communication card and shall be isolated from the card. UPS modules in the bottom-most and top-most positions shall only have one cable connection. Any UPS modules located in-between two other modules will have two connected cables, one to the module below and one to the module above the said module. This twisted pair cable shall be included by the manufacturer with every control area network card purchased, and will not require tools to install.

The length of all the interconnecting cable segments for each network shall be approximately 45 centimeters.

UPS performance with loss of control wiring interconnections

With the complete loss of digital network communications all UPS modules shall have the capability to support the critical load up to their rated load, with no reduction in system operational capability.

With the complete loss of the digital and analog network communications, all UPS modules shall have the capability to support the critical load up to their rated load; however capability to switch modes to static bypass will be inhibited.

With the complete loss of one or both of the UPS conmunication networks, each UPS module shall have the capability to detect an internal failure and remove itself from the paralleled UPS bus.

Control in this method eliminates the need for system wide synchronization control signals, therefore eliminating any possibility of a synchronization control failure causing the entire system to go off line or remove power from the critical load.

It shall not be possible for a failure in the controls of one UPS power module to propagate a failure into other UPS power modules.

Front Panel Display: The UPS shall include a front panel display consisting of a graphical LCD display with backlight, four status LED's, and a four-key keypad. The LCD shall display a mimic screen of power flow through the UPS system when programmed for this function. The keypad keys shall be menu driven per the function being performed.

Graphical LCD display: Includes basic language (English and local selectable languages), display of unit function and operating parameters. It shall be used to signify the operating state of the UPS, for indicating alarms, for changing operations control parameters and set points. The graphical display shall have a real time clock which will stamp events with event type and time information, reviewable in the logged data menus.

Local language packages available:

English, Spanish, French, German, Portuguese (Standard)

English, Finnish, Norwegian, Swedish, Russian

English, Hungarian, Polish, Romanian, Czech, Danish

English, Greek, Turkish, Bulgarian

English, Korean

English, Chinese

Four status LED's, which indicate:

Alarms, with a red LED

On Battery, with a yellow LED

On Bypass, with a yellow LED

Power On, with a green LED

Four-Key Multifunction Keypad: UPS shall have keypad to allow user to:

Adjust UPS parameters

View UPS metered data

View all parallel UPS systems metered data

View alarm and inverter logs

Change UPS operational modes of the individual module

Change operational modes of all parallel connected systems

Turn the UPS on and off

Turn all parallel connected systems on or off

Metered Data: The following metered data, shall be available on the alphanumeric display:

Input:

Voltage Line to Neutral

Voltage Line to Line

Frequency

Battery:

Voltage

Current

Runtime

Output:

Voltage Line to Neutral

Voltage Line to Line

Current

Frequency

Power kW

Power kVA

Power factor (pf)

Parallel System:

kW [by unit]

kW [Parallel total]

Load Receptacle:

Voltage Line to Line

Frequency

Power kW

Power kVA

Current

Event log: The display unit shall allow the user to display a time and date stamped log of the 100 most recent status and alarm events. Each event will be time stamped with Year, Month, Day, Hour, Minute, Second of occurring event.

The system shall be capable of displaying the following system status information:

System Normal

High Efficiency Power: %

Battery Resting

Battery Floating

UPS in Parallel mode

Parallel Unit Number

Units on Parallel Bus

Units on Load

The system control functions shall have the following capability

Go to Normal Mode

Go to Bypass Mode

Turn UPS On/Off

Turn system UPS On/Off

Start Battery Test

Start Display Test

The following system information shall be available from the front display

UPS Type

UPS Part Number

UPS Serial Number

UPS Firmware Revision

UPS Display Firmware Revision

UPS CAN Bridge Firmware Revision

Alarms and system information: The display unit shall allow the user to display a log of all active alarms. The following minimum set of alarm conditions shall be available:

On Battery

Battery Low

On Bypass

Bypass Unavailable

Battery Breaker Open

Battery Connection

Overload

Over-temperature

Site Wiring Fault

The UPS does not provide the expected backup time

Power is not available at the UPS output receptacle

The UPS does not start

The UPS does not turn off

The UPS operates normally, but some or all of the protected equipment is not on

Battery test failed

Battery test pending

Battery test did not run

Battery test aborted

The UPS does not transfer to Bypass mode

Check Parallel Board

Abnormal output voltage at startup

Selective Trip

Redundancy Loss Due to Overload

Configuration Error and the UPS does not start.

System Configuration: The following shall be configurable from the display unit:

Set Date and Time

Display Contrast

Change Language

Relay Configuration

Signal Inputs

Serial Port Configuration

Parallel Operation Settings

Modem Configuration

Battery Setup

Power Strategy

Start Screen

User Password

Audible Alarms

Unsynchronized Transfer to Bypass

Transfer to Bypass When Overload

Automatic Start Delay

Control Commands from X−Slot 1

Control Commands from X−Slot2

X−Slot Signal Input Activation Delay

Site Wiring Fault Notice

Input Range

Reset Custom Event Settings

REPO Configuration

Communication Interface Board: A communication interface board shall provide the following communication ports which can be used simultaneously:

Communication Card Slots:

Each UPS shall provide (2) communication slots in the back of the system allowing for additional connectivity options, including SNMP/Web, AS/400 relays, Modbus, etc

Serial communications (via RS-232) with manufacturer-supplied power management software package RS232 Serial Port #1

REPO Input, N/O and N/C connections for connection to isolated contact on room EPO switch:

Each module in a PC or PR configuration shall require a separate EPO connection, ensuring failure of one EPO connection does not cause entire system shutdown.

Two programmable signal inputs shall be programmable for the following system control:

ABM Resting (Charger disable)

Remote ON/OFF

Remote Go To Normal

Force UPS to Static Bypass (External Bypass Interface)

External Battery Breaker Status (Disconnect notice)

Summary alarm relay output

BATTERY

The UPS battery shall be of modular construction made up of user replaceable, hot swappable, battery modules with approved over-current protection. Each UPS module shall contain a minimum of two parallel battery strings therefore reducing the chance of a single battery failure causing complete loss of runtime. Each 12kW UPS in a parallel capacity (PC) or parallel redundant (PR) configuration shall have independent battery systems, with independent battery breakers therefore reducing any chance of a single point of failure in the DC bus.

The battery jars housed within each removable battery module shall be of the Valve Regulated Lead Acid (VRLA) type. The battery case shall be made of flame retardant material rated as UL94-V0.

The UPS shall incorporate a battery management system to automatically monitor the health of the battery system. This UPS shall notify the user via the front panel and serial/network communications in the event that a failed or weak battery is found.

Each 12kW UPS module shall have an independent 70A DC breaker for isolation of all internal and external battery modules to the DC bus. The UPS module shall notify the user if the DC breaker is in the off position.

ACCESSORIES

PARALLELING BUS SYSTEM

A parallel bus bar system shall be available in a standard EIA-310-D four post 19" IT enclosure measuring 42 inches (1050mm) deep, 80 inches (2030mm) tall (42U) and 24 inches (600mm) wide. The parallel bus shall be rated for a maximum of 60kW N+1 of output power, allowing up to six (6) UPS modules to be connected to it in one enclosure. The enclosure shall include full length side panels, castors and split rear door. Cable entry into the enclosure shall be capable from top, bottom or sides without effecting front or rear door operation. The parallel bus shall include a 6U high power wiring area with multiple conduit landing areas appropriate for installation in raised or non-raised floor applications. The parallel bus shall include both input and output bussing systems with fully rated power connections located in the wiring area. The parallel bus system shall include UL approved touch safe connectors, for easy installation and/or removal (hot swap) of individual UPS modules while power is still applied to the critical output bus. UPS system installation procedures shall be capable of being completed by the user or other designated personnel.

Input Specifications:

Maximum continuous input current rating shall be 180A @ 208Vac

Maximum input OCP protection per NEC 80% deratings shall be 225A

Input lugs shall be compression type.

Output Specifications:

Maximum continuous output current rating shall be 167A @ 208Vac, (60kVA)

Maximum output OCP protection per NEC 80% deratings shall be 225A

Output lugs shall be compression type.

POWER DISTRIBUTION SYSTEM

The UPS module output connector on the rear of the UPS chassis shall be designed to interface to a rack mounted power distributions system. Each rack mounted power distribution system (when installed on paralleled UPS modules), shall be protected by all systems on the AC output bus. This power distribution system shall be modular and scalable in relationship to the upstream UPS system modules.

RACK POWER MODULE (RPM)

For power distribution from the UPS modules to enclosure mounted power distribution units or directly to the loads, a 3U Rack Power Module (RPM) shall be available. Each RPM shall be capable of distributing power to single-phase loads, either line to line or line to neutral connected. The RPM shall also be capable of distributing three-phase power to any three-phase load equipment. Each RPM shall be capable of being plugged into the back of each UPS module, allowing power distribution growth at the same time as UPS power capacity growth. The cord connecting the RPM to the UPS module shall be rated for above floor wire routing only. Each RPM shall come with a standard four post rail mounting kit to ensure easy slide in installation into the rack or enclosure. RPM's shall be capable of mounting into the same enclose that houses the UPS modules, server equipment or EBM's, except enclosures configured with a 60kW N+1 UPS system will consume all 42U of available rack space. An optional wall mounting kit to mount the RPM vertically on the wall shall be available. Each cord shall be capable of being routed through the IT enclosures using tool-less mounting hardware, or bolt on hardware. The cords shall also be capable for routing above the enclosure using customer supplied standard wire routing trays. The RPM shall always have 12 breaker pole positions in any selectable configuration. The breaker poles shall be grouped in two groups of six poles to match available output receptacle plates. There shall always be two receptacle plates of the same or different types of receptacles available on the rear panel of the RPM. Output connections to the RPM shall be made though either NEMA or IEC type receptacles. Input and output current monitoring shall be provided by individual eight segment multi colored LED displays for each breaker pole as well as the three input phases. Percentage of capacity of all input and output currents shall be displayed at the same time on the front of the RPM. Each RPM shall be configurable with the following available features:

Physical attributes

3U (5.25 in), (130 mm) height

20 in, (507 mm) depth

17.4 in, (440 mm) width

32 to 54 lbs based on configuration options

Input type

Connection direct to UPS module connector (typical)

IEC309-60A five (5) wire (3P + N + G)

NEMA L21-30P

Hardwire (100A maximum), (3P + N + G)

Input cord lengths (not applicable to hardwire units)

Six (6) feet, (1.8 m)

Ten (10) feet, (3.05 m)

15 feet, (4.57 m)

20 feet, (6.1 m)

Output receptacle types / number per receptacle plate / Number per breaker

| | | | | | |
|---|---|---|---|---|---|
| L21-20R | | / | 2 | / | 1 |
| L21-30R | | / | 2 | / | 1 |
| L6-15R | / | 3 | / | 1 | |
| L6-20R | / | 3 | / | 1 | |
| L6-30R | / | 3 | / | 1 | |
| 5-15R | / | 6 | / | 1 | |
| 5-20R | / | 6 | / | 1 | |
| L14-20R | | / | 3 | / | 1 |
| L14-30R | | / | 3 | / | 1 |
| IEC320-C13 | / | 12 | / | 4 | |
| IEC320-C19 | / | 6 | / | 2 | |

Monitoring

True RMS monitoring of all input and output current

Percent ( %) load on all breakers (standard)

Percent ( %) load on input connector (standard)

LED indicator for power available to the system

LED indicator for overload alarm

Audible alarm indicator for overload

Individual branch circuit monitoring with network connection using hot swappable energy management card with following:

Web-enabled monitoring of power quality data

Data and event logging with time stamp

Power quality data via Modbus TCP

Customized email messaging for events notification

Real-time power monitoring

Standard SNMP MIB support

Support of environmental monitor probe

TVSS

Optional integrated TVSS shall be available with a minimum rating of 50kA

A visual TVSS indicator shall located on the front of the system with the following functions:

| | |
|---|---|
| TVSS indicator off: | TVSS not installed |
| TVSS indicator green: | TVSS installed and operationally OK |
| TVSS Indicator red: | TVSS damaged, needs replacement |

Cable Restraining

Each RPM distribution module shall come standard with a cable restraining system capable of holding connected equipment plugs from accidentally pulling out of the systems output receptacles.

ENCLOSURE MOUNTED POWER DISTRIBUTION UNITS (ePDU):

Distributing power within the IT enclosure shall be accomplished by enclosure (rack) mount power distribution units (ePDU). The ePDU units shall come in many sizes and input plug and output receptacle configurations for supporting the wide variety of IT load equipment power connections. Two (zero) 0U vertical ePDUs shall be capable of being installed in the back of the accompanying enclosure to consume no U space reserved for the IT equipment. One 1U and two 2U configurations shall be capable of installation in the U space on a rack meeting the EIA-310-D 19" specification. One U (1U) ePDUs shall also have available optional brackets for mounting the device in the zero U (0U) space. In this configuration up to three like or unlike 1U ePDU's can be mounted on each side of a 42U high enclosure (total 6 in 0U space rear of enclosure. Additional optional enclosure mounting brackets shall be available to mount more than six (6) of the 1U ePDUs in the rear of the cabinet, or more than two (2) of the 0U vertical ePDUs without effecting mounting space for the IT equipment.

Input Connection – All ePDU units used with the RPM power distribution system shall be connected via twist lock or strait blade connecters. Input plugs shall be offered for single phase and three-phase connections.

Output Connections - The outputs of the ePDU shall be distributed to receptacles capable of supplying power to cord connected equipment.

Power options- The ePDUs shall be capable of delivering the following power to the rack based on input connection used:

| | |
|---|---|
| 5-15P | 1.44kW |
| L6-20P | 3.33kW |
| L6-30P | 4.99kW |
| L14-30P | 4.99kW |
| L21-20P | 5.76kW |
| L21-30P | 8.65kW |

Metering, Monitoring and management options

Phase metering and local display of input current or branch circuit breakers shall be an option on the ePDUs, and is based on the model selected.

Remote monitoring via built in SNMP or serial communications of the phase metering shall be an option based on the ePDU model selected.

Individual outlet switching control shall be an option based on the ePDU model selected. Outlet switching can be done either via WEB/SNMP interface or via serial communication.

Agency

All ePDUs shall be listed to the 60950 agency specification though one of the following organizations:

| | |
|---|---|
| UL or ETL | North American Products |
| CE | International Products |

EXTENDED RUNTIME BATTERY

Extended runtime for the UPS shall be available as an option. These extended battery runtime modules (EBM) will come in a standard rack mount design, with capability to go into any EIA-310-D, or EIA-310-E four post 19" IT enclosure, with minimum depth of 30 inches. Each EBM shall be 3U (5.20 in / 132 mm ) in height, 26 in ( 660 mm) depth, and 17.2 in (437 mm) width. Each EBM shall come with a standard four post rail mounting kit to ensure easy slide in installation into the rack or enclosure. EBM's shall be capable of mounting into the same enclose that houses the UPS modules, server equipment or RPM's, except enclosures configured with a 60kW N+1 UPS system will consume all 42U of available rack space. Each EBM will include a cord assembly that allows plug in capability to the rear of the UPS system or other like EBMs. Each EBM shall include a matching input connector that allows easy tool-less "daisy chaining" of additional EBM modules by plugging them together. The DC output of each EBM shall be protected by an over-current protection device (breaker) with capability of being reset without tools. The cord length of the EBM will be 24" to allow easy installation above or below any UPS, or when connecting to parallel UPS systems. When connecting to parallel UPS systems the EBMs will be designed to go into standard racks to the left of the UPS cabinet. This configuration will allow use of the standard cable length, however in cases where additional cable length is needed; an optional 36" jumper shall be available. Up to four (4) Extended Battery Modules shall be capable to be added to the standard UPS system for increased battery runtime greater than 30 minutes.

INFORMATION TECHNOLOGY (IT) ENCLOSURE

IT enclosures shall be available for housing of customer supplied IT equipment. Enclosures shall meet the requirements of the 60950 agency specifications.

General Requirements

The Enclosure shall be designed to provide a secure, managed environment for computer and networking equipment.

The Enclosure shall conform to EIA-310 Standard for Cabinets, Racks, Panel and Associated Equipment and accommodate industry standard 19" rack mount equipment.

The Enclosure shall be designed with four (4) adjustable vertical posts to allow installation of typical rack mount equipment.

The enclosure posts shall have adjustable top and bottom rails allowing front to back post relocation, as well as side to side post movement.

The standard enclosure shall be available with a vertical equipment mounting space of 42U (1U=1.75" or 44.45mm).

U space markings shall be on the front and rear of each rail to allow easy identification of rack U used when installing equipment.

Varying U heights, frame designs, door configurations and other cosmetic changes shall be available as options.

The enclosure shall have "Z" type rails front and rear to give additional strength in the vertical rail and for added equipment mounting surfaces.

The enclosure shall not require any horizontal bracing in the zero U mounting areas to meet the maximum weight ratings of the cabinet, and to comply to IBC zone 4 seismic certification. Areas in the zero U space and the U space outside the IT equipment mounting space shall be available for cable management and power distribution options.

Physical Requirements

Standard enclosure width shall be 600 mm (23.5”) for 19” enclosures for typical 24” floor tile width matching.

Standard enclosure depth shall be 42” (1050mm), for optimal 4 foot cold isle, 3 foot hot isle installations on typical raised floor tiles.

The enclosure of a 42U design shall have a maximum external height of 2030mm (80”) to allow passage through standard 81” or taller doorway without tipping.

The enclosure shall support a dynamic load (rolling on castors) of 909kG (2000 lbs.) total weight.

The enclosure shall support a static weight of 1451kG (3200 lbs).

Enclosure shall also be designed and manufactured to be used to house the UPS modules, rack power modules, enclosure power distribution units and extended runtime battery modules to provide a uniform and consistent appearance in a datacenter environment.

Equipment Access and Mounting

The enclosure shall provide 42U of equipment vertical mounting space.

The vertical mounting rails shall be adjustable to allow different mounting depths.

Front and rear doors of the enclosure shall be designed with quick release hinges allowing for easy detachment without the use of tools. Each enclosure shall come standard with key locking front and rear doors.

Optional side air flow panels shall be available which will allow baying enclosures together while blocking side to side air flow between adjacent enclosures. These panels shall include areas in the back of the rack allowing cables to pass between enclosures. Use of these panels will eliminate the need for side panels while maintaining proper front to rear air flow for high density computing requirements.

Seismic Floor Anchor Brackets.

An optional floor anchor bracket system shall be available to solidly connect each enclosure to the floor to provide IBC Zone 4 tested and certified safety.

Optional seismic rated floor stands shall be available to support enclosures populated with IT or UPS equipment. Floor Stands shall be available in custom heights to maintain a flush mount installation with the raised floor, and shall be designed in accordance to the equipment weight and contact points.

Cable management brackets and wire-ways

Optional tool-free or tools required cable management brackets shall be available for routing power and communication cables internal to the enclosure.

An optional top mounted cable tray shall be available for routing cables at the top of the enclosure down the row of IT enclosures. Optional tray top covers shall be available to meet any requirements of local electrical codes. Trays shall be available for both front and rear cable routing.

Additional enclosure options

The following is a list of other enclosure options:

Tool-free blacking panels

Rear door air flow assist fans

Enclosure bottom blowers

Universal mounting plates

Tool-free and tool required shelves

Heavy duty support rails

Enclosure baying kits

SOFTWARE AND CONNECTIVITY

The UPS manufacturer shall be capable of providing three separate levels of system management for the data center. The following is a list of levels and their functionality:

Basic single UPS system operation, management and graceful load shutdown software to be included with every UPS shipped

The included UPS software shall have automatic model detection of the manufacturer's current models of UPS systems as well as automatic detection for some competitive UPS models.

The software shall provide sequential shutdown to further help network administrators determine what sequence to shut down servers during an extended power outage.

The shutdown software shall be capable of being used completely unknown to the user at the display, for use on point of service or other public environments where not relevant to involve the user

The software shall automatically detect time used on battery and calculate the cost savings of the UPS by not subjecting the user to downtime.

Software Compatibility, the supplied with each UPS sold shall support graceful shutdown and remote monitoring for the following systems:

Microsoft: Windows 2000 (Server, Advanced Server, Professional) Windows XP Home Windows XP Professional, Windows 2003 Server (Web, Small Business), Windows 2003 Server (Standard, Enterprise), Windows 2003 Server R2 (Standard, Enterprise), Windows Vista (Ultimate, Home Premium, Business), Windows XP on 64-bit architecture

HP-UX: v. 10.20, 11.0, 11i (11.11) for PA-RISC, v. 11i v1.6 (11.22) for Itanium, v. 11 v. 2 (11.23) for Itanium

BM AIX: v. 4.3.2 for RISC, v. 4.3.3 for RISC and PowerPC 3, v. 5.1, 5.2, 5.3 for PowerPC 3, v. 5.3 for PowerPC 5

Mac OS v. 10.2.8, 10.3.x, 10.4.x

Red Hat 7.2, 8.0 9.0, Red Hat Enterprise Linux 3 and 4 (ES and AS),Red Hat Enterprise Linux 4 (ES, AS, and Desktop), Red Hat Enterprise Linux AS v. 2.1 and v. 3 2, Fedora Core 5

SCO Unix OpenServer v. 5.0.6, 5.0.7

SGI Irix (MIPS) v. 6.5.2.x

Sun Solaris v. 7, 8, 9, 10 for SPARC, v. 7, 8, 9, 10 for Intel

SuSE Linux v. 7.2, 8.0, 8.2, 9.0, 9.3, 10.0, SuSE Enterprise Linux Server 8 and 9

Novell NetWare v. 5.0, 5.1, 6.0, 6.5 (must upgrade to latest SP)

Optional data center, Windows®-based client/server software package (PowerVision) that provides real-time monitoring of critical power conditions for the entire enterprise down to a single channel or parameter of the UPS. It is specifically designed to support multiple UPS systems in the data center including:

Real-time, enterprise-wide monitoring analyzes critical power conditions and identifies problems

Drill-down monitoring of individual meter or status for the UPS isolates the issue and speeds diagnosis

Monitoring via client (local or remote), server or the Web (computer or PDA) provides easy "anywhere/anytime" access

Scalable architecture (single/multi server) allows network managers the flexibility to monitor power conditions from within each LAN or monitor multiple LANs from a centralized, master client

Alarm notification through alphanumeric paging and/or SMTP email speeds corrective action

Customizable alarms tailor notification to user needs

Powerful data collection, graphing and report writing toolset provides trend analysis and diagnosis of chronic power problems.

Optional enterprise wide, Windows®-based client/server software package (Foreseer) that provides monitoring and management of the power through the entire power train including UPS and a variety of foundation equipment. This software shall have capability of data monitoring of any manufactures equipment which is equipped with data output capability. The software is highly customizable to fit the application. The advanced features of Foreseer include:

Unique graphical user interface and unparalleled performance analysis tools deliver the information needed to identify dangerous trends; execute corrective action; and, prevent failures.

Easily configurable for unique environments, regardless of the complexity, size, or number of distributed sites.

Monitoring of power over networks, modems, T1, or virtually any Ethernet or serial connection.

Advanced alarm management capabilities, including a stoplight color scheme and Alpha-numeric OutCall Paging™, ensure that the right personnel are automatically notified of alarms and potential problems.

Easy to set-up graphical views to accurately depict site. Authorized users, enterprise-wide, can personalize software views based on individual preference. The editor function includes extensive drawing capability and allows import of CAD files, logos, photographs and scanned images.

A variety of easy-to-use reports. Standard reports are included with each system and a Custom Report Generator produces management reports and other specific information whenever needed. Some of the available reports include: Load Analysis, Capacity Planning, Equipment Run Times and Alarm Reports.

Installation, service and support by Eaton Corporation, Worldwide Services Group. A range of installation packages are available to meet specific needs including complete, turn-key project management and on-site training.

Supported facilities equipment includes

Generators

Power metering systems

Uninterruptible power systems (UPSs)

Static switches

Security systems including WEB enabled cameras

Computer room air conditioners

Chillers

Leak detection systems

Fuel monitoring systems

Fire detection and suppression systems

Building automation systems (BMS)

Building management systems

Power distribution units (PDU)

Enclosure (rack) based power distribution units (ePDU)

Switch gear and automatic transfer switches (ATS)

DC power systems

Battery monitoring sensors

Power monitoring systems

UPS monitoring and management

Network management: An Ethernet WEB/SNMP network communication adaptor shall be available to allow one or more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments. SNMP information shall be available in the standard management information base (MIB) data, which can be used by network management software programs. SNMP information shall be provided in DOS and UNIX "tar" formats. The WEB/SNMP interface adaptor shall be a hot swappable card capable of being inserted into any open UPS communication slot.

Parallel connected UPS modules shall be able to be monitored from one WEB/SNMP card in any of the paralleled UPS communication slots. In this configuration all modules are monitored and managed as one UPS system. Individual UPS monitoring shall be capable by utilizing one communication card in each UPS in a parallel connected system.

Unattended shutdown shall be a function of the UPS reporting operating data to a network management device, so that IT systems can gracefully shut down. When utility AC is lost and the UPS is operating on battery, information sent about battery runtime is used to determine if and when the IT systems should start their automatic shutdown.

Each UPS system shall also be capable of using an RS232 port to communicate by means of serial communications to gracefully shut down one or more operating systems during operation on battery.

Isolated potential free contacts shall be available with an optional relay
interface board. This relay interface board shall come if two different models, one for low voltage/low current applications and the other for voltages up to 250Vac and currents up to 5A. Either relay interface board shall change relay states for UPS changes from the following list:

Normal Operation

Battery Operation

Bypass Operation

Common Fault

Low Battery

UPS Off.

EXECUTION

STANDARD EQUIPMENT WARRANTY

Standard equipment warranty shall be twelve (12) months from the date of purchase or eighteen (18) months from date of Product shipment, whichever occurs first.

FACTORY ASSISTED UPS STARTUP

If an optional factory assisted UPS start-up is requested, factory trained service personnel shall perform the following inspections, test procedures, and on-site training:

Unpack UPS and perform visual inspection

Install in to customer rack when applicable

Connect batteries

Power up the unit

If a PowerTrust service contract and appropriate connectivity parts are purchased and a customer supplied LAN cable and customer network/contact information is available, Eaton technician may install eNotify remote monitoring service

Train customer support staff on operation of the unit

Register the warranty if applicable

UNPACK

Unpack UPS and accessories.

VISUAL INSPECTION

Verify that all equipment and accessories listed in User Guide are included

Visually inspect all equipment and accessories for signs of damage and/or foreign materials

Observe type of ventilation, room cleanliness, use of proper signs and any safety-related items that may be noteworthy

INSTALL EXTENDED BATTERY MODULES (EBM) IN CUSTOMER RACK

Install EBM mounting rails in customer rack

Install EBM on mounting rails in rack

Install EBM front cover

INSTALL UPS IN CUSTOMER RACK

Install UPS mounting rails in customer rack

Install UPS on mounting rails in rack

Install UPS electronics module in UPS chassis

Install battery modules in UPS chassis

Install UPS front panel

Install Communications Terminal Block Connectors

Install CAN Bridge Cards, CAN Bridge Card Wiring, and Redundant Signal Wiring (parallel systems only)

Connect EBM to UPS (if applicable)

Connect UPS input and output power connectors

UNIT START UP

Switch on utility power at UPS connection point

Energize UPS and verify no alarms are present (or have been corrected and cleared)

Configure UPS. 5.3.1. Select appropriate display language

Set Date and Time

Set number of EBMs

If installed, check EPO function

Remove Utility power from UPS input. Verify transfer to battery power

Restore Utility power to UPS input. Verify transfer to utility power

System is now ready for customer to apply/energize load

ON-SITE OPERATIONAL TRAINING:

Prior to leaving the site, the Customer Support Engineer will familiarize customer personnel in the operation of the UPS. The familiarization takes 1 hour to 8 hours at Eaton's discretion, and depends on site personnel, equipment type and equipment availability. Basic operational training includes:

Key pad operation

LED indicator explanation

Start-up and shutdown procedures

System maintenance bypass operation information

Component familiarization

Alarm and notice familiarization.

MANUFACTURER FIELD SERVICE

Worldwide service: The UPS manufacturer shall have a worldwide service organization, consisting of factory trained field service personnel to perform start-up, preventative maintenance, and service of the UPS system and power equipment. The service organization shall offer 24 hours a day, 7 days a week, 365 days a year service support

Replacement parts: Parts shall be available through the worldwide service organization 24 hours a day, 7 days a week, and 365 days a year. The worldwide service organization shall be capable of shipping parts within 4 working hours or on the next available flight, so that the parts may be delivered to the customer site within 24 hours

MAINTENANCE CONTRACTS

A complete offering of preventative and full service maintenance contracts for the UPS system and the battery system shall be available. All contract work shall be performed by Eaton authorized trained service personnel

Contracts shall be available for both Monday through Friday, normal business hours next day response, and seven days a week, any hour with up to two (2) hour response time.

TRAINING

UPS service training: A UPS service training first responder course shall be available from the UPS manufacturer. The service training workshop shall include a combination of lecture and practical instruction with hands-on laboratory sessions. The service training workshop shall include instruction about safety procedures, UPS operational theory, sub-assembly identification and operation, system controls and adjustment, preventative maintenance, and troubleshooting.

End of Section 16611