

## 263353-H: SUPPLEMENTAL CENTRAL UPS SYSTEMS

### **Related Sections**

Basis Guideline: [263353](#) - "Central UPS Systems"

For an explanation of the use of these guidelines, see ["Design Guidelines for UMHHC Facilities"](#)

### **Applicability:**

The information expressed herein is unique to UMHHC owned, operated, and leased facilities, and are intended to supplement the University of Michigan's Architecture, Engineering, and Construction (UMAEC), design guidelines 16265 in regards to the UPS System. Those UMAEC design guidelines are located on the website <http://www.plantext.bf.umich.edu/for.archs/index.html>. All information presented in the referenced UMAEC guideline applies to UMHHC facilities, unless explicitly stated otherwise below. Where differences and/or conflicts exist between the supplemental information noted below, and the information in the UMAEC guideline, this supplementary information shall take precedence.

The Design Professional (A/E) shall adhere to UMHHC Design Guidelines for all work at UMHHC facilities. Any requested deviations from these guidelines, shall be sent, in writing, to UMHHC's Facilities Planning and Development (FP&D). Address the correspondence to the assigned FP&D design manager for the given project. The deviation shall not be incorporated into the construction documents until written approval of the deviation is received by the Design Professional.

The Design Professional is fully responsible for the professional quality, technical accuracy, code compliance, and overall coordination of the contract documents. Compliance with these guidelines shall not be construed so as to relieve the Design Professional of any of that responsibility.

### **Standards:**

Provide UPS power to protect mission critical loads such as computers, telecommunication equipment, invasive imaging equipment, or other expensive electronic equipment against unexpected power disruption that could cause injuries, fatalities, serious business disruption or data loss. The UPS installation shall conform with the latest versions of the following IEEE standards:

**IEEE SS-EN 50091-1-1 & 2** - General and safety requirements for UPS

**IEEE STD 1184-2006** - Guide for Batteries for Uninterruptible Power Supply Systems.

During the programming phase of new building design, the design professional(A/E) shall establish the need for UPS power in the building and provide recommendations in regards to the size and location of the UPS and associated systems. Examine each potential failure scenario, and evaluate the cost of remedy against the potential operational costs in your recommendations.

If it is determined that a new UPS will not be installed as a part of initial construction, the design professional (A/E) shall include space in strategic location within the building for future installation of UPS, generator(s), and associated gear, associated battery room, and dedicated HVAC equipment all sized for the projected UPS Load.

Prep the shell space as much as practically possible and install conduit/pipe/ducts stubbed into the space to accommodate the future UPS installation. Coordinate with structural engineers to ensure the shell space floor can structurally support the weight of the future UPS and associated equipment. Coordinate with all other trades and ensure that provisions are provided in the building utilities such as power, fire alarm, security system, plumbing system, BMS system, and HVAC system to support the future UPS and associated appurtenances

Select the UPS location so that the UPS system can be readily integrated into the building's infrastructure while maintaining sufficient physical separation between multiple UPSs.

### **General:**

The primary purpose of the UPS is to provide clean, uninterrupted power to computer and sensitive equipment. Ancillary gear, like HVAC equipment, normally is not protected by UPS. Data center air conditioning equipment shall be backed by generator power.

Design the UPS's to handle the load in the event of a power outage while the standby generators are coming online. The UPS shall also be designed to protect against spikes, surges and sags from utility power sources.

This document describes the recommended procedures to guide the Design Professional (A/E) in the development of design requirements and specifications for the installation of Uninterruptible Power Supply (UPS) devices in UMHC facilities.

Design a UPS system in conjunction with stand-by generator(s). The generator(s) are typically placed before the UPS to provide cover for lengthy outages.

UPS system design shall be scalable. Provide N+1 redundancy for reliability and future growth. For a data center with two independent utility sources, consider having both sources protected by UPSs in a system + system (S+S or 2(N+1)) design for a higher redundancy.

The UPS shall be sized for 150% of the anticipated initial and future loads. The UPS shall never be loaded more than 80% of its rated KW.

Where available, Utilize existing UPS systems to feed new loads. Before adding loads to existing UPS systems, verify available spare capacity in existing UPS by metering the existing load(s) on the UPS for a minimum of 24 hours to determine the existing peak demand.

### ***Uninterruptible Power Supplies Characteristics***

1. Uninterruptible power supplies (UPS) shall be on-line type, double conversion with integral sine-wave inverter, filters, battery bank and charging system.
2. The inverter shall be of a sine-wave design. Square-wave, pseudo-wave, rectangular-wave and modified sine/square-wave designs are not acceptable.
3. Provide surge protection, noise filter, and output isolation transformer in the design of the UPS system for true power conditioning.
4. Standby type UPS designs do not provide the power conditioning for protection of sensitive loads and are not desirable and shall not be specified for UMHC projects without prior approval from the FP&D design manager.
5. The UPS shall provide power from the batteries and inverter in the event of a power failure.
6. Design of the UPS system shall include an isolation transformer in the output circuit to mitigate the common mode disturbances and provide a clean (ultra-quiet) ground reference to protect the connected sensitive electronic loads from common mode noise.
7. The UPS shall sense and transfer power in 4-6ms.
8. Verify how the proposed UPS design responds to an instantaneous doubling of power draw ("step function"), simulating a module failure. With primary-side static transfer switches, it's important to look at how current rise is controlled, since the sudden current change created by switching can cause "saturation" in downstream transformers, resulting in unacceptable waveform distortion.
9. Provide provisions for fault alarm notification. UPS shall report all alarm conditions to the Building's Management System (BMS) panel. The mechanical engineer shall be responsible for incorporating the alarm conditions in the BMS system; electrical engineers shall coordinate these with the mechanical engineer and ensure that they are on the mechanical drawings.
10. UPS units offering front-only access are preferred.
11. The UPS shall be designed to provide regulated power (+/-10%) for all anticipated initial and future loads.

12. Contacts and computer interface ports shall be provided to allow the UPS to be monitored remotely.
13. Provide internal maintenance bypass to allow isolating the UPS for maintenance. The bypass mode kicks in automatically when the batteries run out, go bad or some other UPS failure occurs. Install "full wrap-around bypass."
14. All UPS installations shall also be provided with a maintained contact style external bypass switch to allow removal and servicing of the UPS.

#### ***UPS Battery and Battery Room Requirements***

1. The UPS batteries shall be sized to provide battery backup for a period of no less than 15 minutes. Longer battery times may be required for some installations. The design professional (A/E) shall coordinate with FPD design manager to determine battery back up time required at the initial programming phase of the project.
2. Wet Cell type batteries to be installed in areas such as I-2 occupancies where high power reliability is required. A dedicated battery room is required for wet cell battery applications.
3. Wet Cell battery racks shall not be higher than two-tiers with adequate space between racks for ease of maintenance.
4. Provide spill containment in the battery room. Provide trays and absorptive pillows under the battery rack as a minimum.
5. All electrical devices including lighting fixtures installed in the battery room shall be enclosed and mounted a minimum of 18" below ceiling. Pay special attention to areas where ceiling beams create pockets in the ceiling where hydrogen can collect.
6. All electrical devices in the ceiling shall be explosion proof.
7. All equipment on emergency power including emergency lighting, fire alarm, controls, and communication items installed within the battery room shall be explosion proof.
8. Wet cell battery rooms shall be continuously vented. The mechanical engineer shall be responsible for sizing and routing of the exhaust fans and related ductwork, electrical engineer shall coordinate these with the mechanical engineer and ensure that they are on the mechanical drawings.
9. The mechanical engineer shall be responsible for providing any emergency shower inside the battery room; electrical engineer shall coordinate these with the mechanical engineer and ensure that they are on the mechanical drawings.
10. Provide a local hydrogen detection system for monitoring hydrogen concentration inside the wet cell battery room for local and remote alarm annunciation. The Hydrogen Detection control panel shall report alarm conditions to the Building's Management System (BMS) panel. The mechanical engineer shall be responsible for incorporating the alarm conditions in the BMS system; - electrical engineer shall coordinate these with the mechanical engineer and ensure that they are on the mechanical drawings.
11. All raceways installed in the battery room shall be sealed. Provide conduit seal off at each conduit penetrating the battery room walls.
12. In areas with non mission critical loads, the maintenance-free, "sealed-cell", Valve Regulated Lead Acid (VRLA) batteries will be considered. Design professionals (A/E) shall coordinate and secure prior approval from the FP&D design manager at the programming phase of the project before specifying UPS's with VRLA batteries.
13. VRLA can be installed in a normal, occupied environment as they don't emit explosive hydrogen gas like flooded lead acid "wet cells" do. Therefore, VRLA batteries do not need to be installed in dedicated battery rooms.

#### **CONSTRUCTION DRAWINGS:**

Electrical construction drawings shall show all necessary plans and details for the complete installation of the UPS system and associated battery room and distribution switchgear. The electrical construction drawings shall be designed so that the contractor is able to use the proper combination of materials, techniques, and manpower to accomplish the overall installation.

Show feeders information including number of conductors, size of each conductor, and conduit sizes on the one-line diagram and/or in a separate feeder schedule. Show routing of power and control conduits on plans.

Drawings shall show UPS installation details and wiring block diagrams. Provide electrical construction details on drawings to specify electrical construction requirements. Provide plan view, elevation and/or detail drawings to cover all UPS, battery room, and associated gear. Provide cross sections and details as needed.

Show battery room grounding details.

The electrical drawings shall be coordinated and actively cross checked with the drawings of all other disciplines. Design Professional (A/E) may be asked to provide a 1/4" scale drawing of UPS and battery rooms, showing both mechanical and electrical work, to ensure that coordination is being achieved. Ductwork, piping, and raceways not serving the space which is considered by code officials to be foreign to the UPS and battery rooms may not be installed in the space.

### **SPECIFICATION REQUIREMENTS:**

Design professional (A/E) is responsible for providing specifications meeting UMHC requirements for each piece of electrical equipment used in the project.

The designer shall prepare supplementary material when the UMHC/UMAEC design guidelines are not sufficient to adequately define the electrical work. If the resultant supplementary material is not extensive, it may be inserted at appropriate locations into the master specification section; otherwise, as many new sections as necessary shall be developed in the same format as the master specifications.

Specifications shall be checked carefully with the drawings to be sure that everything required by the drawings is included, and that the inapplicable matters are not included in the specifications.

Trade names or other indications tending to identify a product of an individual manufacturer shall not be used on any project, unless specifically approved by UMHC FP&D, and except as follows:

- Where necessary to identify existing equipment.
- Where an existing system is to be extended and competitive manufacturers cannot meet performance requirements.
- Where required by a public utility or municipal system as a condition of its services.