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263000-H: SUPPLEMENTAL ENGINE-GENERATOR SYSTEMS

Related Sections

Basis Guideline: 263000 – "Engine-Generator Systems"
260913-H – "Electrical Power Monitoring"
263010-H – "Supplemental Paralleling Gear"
1.0 – "Supplemental Codes and Regulatory Agencies"
5.11 – "Fire Command Center"

For an explanation of the use of these guidelines, see "Design Guidelines for UMHHC Facilities"
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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 16231 in regards to Engine-Generator Systems. Those UMAEC design guidelines are located on 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:

Generator Design shall incorporate all of the Codes and Standards noted in SID-F-HSID-F-H, plus the requirements of OSHA (MIOSHA), and NFPA 110 "The 2007 Minimum Design Standards for Healthcare Facilities in Michigan ". A copy of this publication can be obtained from State of Michigan Department of Community Health web site at: http://www.michigan.gov/mdch/0,1607,7-132-27417_27656---,00.html

Generator installations shall meet all OSHA (MIOSHA), and NFPA 110 requirements.

Generator design shall comply with U of M AEC Special Building AreaSBA – -JSpecial Building AreaSBA – -J – ('Fire Command Center)'., located at http://www.plantext.bf.umich.edu/desguide/sba/sba_j.pdf.

General:

Generators shall be installed in dedicated rooms, preferably at grade level for ease of installation, maintenance, and possible future changeouts. If at grade is not possible, select a location to addresses

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these same accessibility needs. A below grade location is the least preferred location for flooding reasons.

Place room in building at a location as far as possible from noise-sensitive sections of the facility. For the same noise reasons construct slab and room to isolate vibration and noise from building occupants.

If multiple units will be installed, install the paralleling gear in an adjacent room with a viewing window in between to observe generator operation from paralleling room.

All power needed for maintenance and operation of the generators, associated fuel systems, battery and charging systems, ventilation and associated controls, etc. shall be served from a dedicated, emergency power source.

Provide needed interfaces to complete Joint Commissions report, data connections, and programming needed for the operation of the Eaton power monitoring system.

All control panels, and like devices needing periodic monitoring, adjustment, and/or repairs shall be placed for easy access from grade. For devices, other than control panel and circuit breakers, where this may not be possible the devices shall be accessible from a step ladderladder of not more than 8-feet.

Provide fan cooled units in lieu of radiators.

PACKAGED ENGINE GENERATOR SYSTEMS

The engine generator system shall consist of a ,brushless; rotating field alternator driven by a diesel or natural gas fueled (do we want to say natural gas here? We may want a paragraph much lower noting natural gas only in certain situations) engine. An integral or field mountable control panel shall control all aspects of the unit and provide both local and remote control. The control panel shall provide local and remote annunciation of standard operating conditions and alarms. The unit shall have a UL 2200 listing and shall be certified by the EPA as conforming to Tier 1 non-road emissions regulations. The control panel shall also provide a charger for the battery.

An integral or field mountable control panel shall locally control and monitor all aspects of the unit. The control panel shall provide local and remote annunciation of standard operating conditions and alarms. It shall also allow this same functionality at a remote location (At paralleling gear and/or at remote internet connected computers?)

The alternator shall comply with NEMA MG1, IEEE and ANSI standards for temperature rise and motor starting. It shall be capable of sustaining short-circuit currents of 300% of the normal rated current for 10 seconds. It shall provide no-load to full-load regulation of +/-2% or less.

As a general rule, a diesel driven generator with independent cooling system shall be used for 500 kW generator units and up. Natural gas driven generators may be considered for units less than 500 kW.

The unit shall provide 60 Hz power at 1800 RPM and be listed for standby power for legally required and optional health care and related loads.

In general, specify 480/277V, three-phase generators. Coordinate with FP&D design manager and obtain his/her approval before specifying 208/120V and medium voltage generators.

Size the generator set for 125 % of the projected demand load and starting KVA. The generator shall be sized to power rated to pick-up 100% full rated loads in one step.

Include all code required emergency loads including Critical, Life Safety and equipment load in your projected (current and anticipated future) loads calculations. Carefully evaluate mechanical equipment load and provide emergency power back up for the critical mechanical equipment such as heating system pumps, condensate return pumps, sewage ejector pumps, building pneumatic control air compressors, etc… to avoid building freeze-up or flooding due to power outage.

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Single generator sets larger than 2MW shall not be specified for UMHHC projects.

Provide backup data to support basic design decisions related to selection of emergency power system components and sizing of generators, fuel storage tank(s), ATS's, and associated distribution gear. Calculations may be performed manually or by computer programs.

If one generator is used to supply both emergency and non-emergency (legally required or optional standby) loads, design shall call for multiple transfer switches to meet code.

A 4-pole transfer switch shall be used on systems where the building's main breaker contains ground fault protection, or where one generator serves multiple buildings.

A generator circuit breaker shall be provided with each generator set. The circuit breaker may shall typically be internally or remotely mounted mountedas required.

Provide hospital grade critical silencers (We should talk. These may only be required on outdoor units) on the generator exhaust.

Provide unit with suitable spring-type vibration isolators and mounted on structural steel base. Concrete slab supporting base shall be reinforced concrete, and this support slab shall be isolated from room slab and rest of building.

The generator sets, fuel storage tanks, and associated Automatic Transfer Switches shall be a standard product of the same generator manufacturer.

Generators that are supported with sub base fuel tank shall be equipped with mezzanine to allow personnel to service generator.

For I-2 occupancies, the generator shall be installed indoors where possible. For off-site buildings, the generator may be installed outdoors. The design professional shall coordinate the generator location with the UMHHC design manager and receive approval during the programming phase of the project.

Contact FP&D to determine if generator needs to be connected to power monitoring system.

OUTDOOR GENERATOR REQUIREMENTS

Generator sets located outdoors shall be provided with an outdoor-rated enclosure. The enclosure shall also contain an integral double-wall fuel tank where specified. Engine block heaters shall be provided on all outdoor located generator sets. Provide required working clearances around the generator. Locate outdoor generators so that the required minimum distance between the generator and the building is met.

Special care shall be taken in locating the outdoor generators to avoid installations that would detract from the building aesthetics. Project architect shall be responsible to provide aesthetically pleasing screen wall to hide outdoor generator installation from public view. Electrical engineer shall coordinate with the project architect and the civil engineer and ensure that a proper screen wall is on architectural and civil drawings.

Coordinate with the FP&D design manager and submit plans to the University of Michigan Exterior Element Review Committee (EERV) for outdoor generator installation. Outdoor Generator installation shall incorporate EERV review comments and requirements.

Outdoor enclosures shall provide ide proper clearances for servicing generator and proper sound reduction that follows local sound pollution ordinances.

INDOOR GENERATOR REQUIEMENTS

For indoor installations, generator(s) shall be located in a room designed for the purpose. The generator sets shall be isolated from other areas as required in the code for the isolation of hazards. The generator

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set should be installed close to the normal electric service. Allow a minimum of three feet around the generator set for service and to ensure free flow of cooling air.

An adequate supply of combustion air and cooling air shall be provided for the emergency generator room. Manufacturer's recommendations for air supply and exhaust shall be determined and facilities designed according to these recommendations. Supply air shall be taken from outdoors or from indoor areas having normal ambient. PIf necessary, provide a heat source, such as a unit heater to keep room at normal room temperature of 40°F minimum.

Exhaust generator into an upright stack well above ground level, not into an area well or underground pit. Location of exhaust outlet shall not be located where it would affect building occupants.

Indicate on drawings or specifications which contractor furnishes and which contractor installs the miscellaneous items for a complete generator installation. The mechanical engineer shall be responsible for sizing and routing of the exhaust, venting, and fuel piping; electrical engineer shall coordinate these with the mechanical engineer and ensure that they are on the mechanical drawings.

When removing an existing generator or installing a new one, make sure to note any access conflicts that the contractor should be aware of such as door frames, walls, or louvers that must be removed and reinstalled. The project architect is responsible for showing extent of architectural demolition and new work required for generator installation. Electrical engineer shall coordinate with the project architect and ensure that required architectural demolition and new work are on architectural drawings.

Indoor generators to be located in adjacent room of paralleling gear. Provide vision panel between spaces.

Provide a remote emergency stop pushbutton near egress door of indoor generators.

PARALLELING GENERATOR SYSTEMS

The paralleling generator system shall consist of engine generator sets, fuel storage tanks, generator controls, automatic transfer switches, paralleling gear, and distribution switchgear integrated into the emergency power system.

When paralleling multiple generator sets, the smallest generator shall be sized for 125% of the projected Critical, Life Safety, and all necessary Equipment loads to maintain building operations.

All paralleled generators are to be supplied with the same size and same pitch.

Refer to Supplemental Paralleling Gear section 16315-H for additional requirements. Coordinate and specify generator sets, fuel storage tanks, ATS's, and paralleling gears packaged by the same manufacturer.

DIESEL FUEL STORAGE TANKS SYSTEMS (Ask Adam which codes should additional be referenced). (Also, are day tanks and fuel recirculation requirements addressed – I did not see them in my quick scan of the tank section?)

Refer to Mechanical Division 1521-23.

TANK SIZING:

The required tank capacity should be calculated based on published engine consumption data and a specified minimum run time. For inpatient and outpatient surgical buildings, provide 72 hours of run time fuel supply for UMHHC facilities per the State of Michigan requirements. Greater capacities may be merited in certain circumstances based on generator service, geographical consideration, historical outages and extended fuel delivery times.

For other types of building provide storage capacity as noted in program statement

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VEHICLE IMPACT PROTECTION:

Guard posts or other approved barrier protection shall be provided to protect the above ground fuel storage tank(s) from vehicle impact. Guard posts, if used, shall be installed according to the following specifications:

1. The posts shall be steel pipe not less than 4 inches in diameter and concrete filled.
2. The posts shall be spaced a minimum of 4 feet apart.
3. The posts shall be set not less than 3 feet deep in a concrete footing not less than 15 inches in diameter.
4. The top of the posts shall not be less than 3 feet above the grade upon which the tank sits.
5. The posts shall not be located less than 5 feet from the tank.

OVERFILL PREVENTION*:*

Aboveground tanks shall not be filled in excess of 90% of their capacity. An overfill prevention system shall be provided for each tank. During tank filling operation, the system shall:
Provide an independent means of notifying the person filling the tank that the fluid level has reached 85% of tank capacity by providing an audible or visual alarm signal. The tank shall also be provided with a tank level gauge marked at 85% of the tank capacity.

Automatically shut off the flow of fuel to the tank when the quantity of liquid in the tank reaches 90% of tank capacity. For rigid hose fuel-delivery systems, an approved means shall be provided to empty the fill hose into the tank after the automatic shutoff device is activated.

ANTI-SIPHON DEVICES*:*

Approved anti-siphon devices shall be installed in each external pipe connected to the tank when the pipe extends below the level of the top of the tank.

TANK OPENINGS*:*

Tank openings in aboveground tanks shall be through the top only.

TANK TYPE*:*

In general, UMHHC prefers above ground, concrete encased fiber glass tanks. Steel tanks are not preferred except for subbase tanks.

Unless otherwise approved by UMHHC FPD, all generator tanks 1,000 gallons and less shall be subbase-type aboveground storage tanks (ASTs). Generator fuel storage systems with capacities greater than 1,000 gallons shall utilize underground/aboveground storage tanks (USTs). Above ground storage tanks are preferred whenever possible and practical.

SPILL PLANS*:*

Federal EPA rules (Title 40 of the Code of Federal Regulations, Part 112) require preparation of a Spill Prevention, Control and Countermeasure (SPCC) plan for single aboveground tanks with a capacity greater than 1,320 gallons or multiple tanks with an aggregate capacity greater than this limit.

SUBBASE TANKS*:*

Subbase tanks shall be rectangular double-wall design (secondary containment), consisting of a single-wall inner steel tank constructed inside a steel secondary tank. Subbase tanks are designed for installation below the generator set between the foundation pad and are generally confined within the frame supports. Larger capacity tanks may extend beyond the footprint of the generator. Outdoor generators with subbase tanks should be equipped with a weatherproof enclosure to minimize entry of rainwater and debris on the tank top. Single-wall subbase tanks are not allowed. Subbase AST tanks shall include the following minimum features:

1. Tank construction shall be heavy-gauge welded steel, 10 Gauge (minimum) on primary inner tank, secondary outer tank walls & bottom. An air gap (1/2” minimum) shall be provided below the bottom of the tank and the concrete support pad.

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2. Tank shall carry an Underwriters Laboratories Inc. UL 142 label. Fire-rated UL 2085 tanks may be substituted in special circumstances.
3. Subbase tanks shall be provided with the following top-mounted tank openings as a minimum:
    a. Primary Tank
        i. Fuel supply and fuel return openings (1” NPT minimum each)
        ii. Normal (primary) tank vent opening on primary tank (2” NPT minimum)
        iii. Emergency pressure-relief (secondary) vent opening sized per NFPA 30.
        iv. Opening for Low-level and high level fuel alarm switches (2” NPT minimum)
        v. Mechanical fuel gauge opening (1-1/2” NPT minimum)
        vi. Stick port opening (1-1/2” NPT minimum)
        vii. Tank fill bung (2” NPT minimum)
    b. Secondary Tank
        i. Monitoring port on interstice of secondary tank (2” NPT minimum)
        ii. Emergency pressure-relief (secondary) vent opening sized per NFPA 30. Note: Primary and emergency secondary tank vents shall be extended outside of the generator enclosure and terminated at a minimum height of twelve (12) feet above grade.
4. The top of the subbase tank shall include provisions for containment of minor leakage of engine fluids. A liquid-tight containment lip shall be formed with 1” or larger welded steel angle. The containment area should encompass as a minimum the subbase tank top below the engine and within the weather-proof enclosure.

FILL ASSEMBLY*:*

Locate the fuel fill station such that the delivery operator has direct access to the tank gauge. Provide a spill containment bucket that is accessible from outside the generator enclosure. Specify a cam-lock style tight-fill connection with an overfill prevention valve set to stop the flow of fuel when the tank reaches 95% of tank capacity.

TANK GAUGING*:*

A mechanical, direct reading, type of fuel level gauge indicator shall be provided in addition to any electronic monitoring system.

LEAK AND OVERFILL ALARMS*:*

1. A liquid sensor shall be mounted inside the secondary tank and wired to the major engine alarm.
2. A remote overfill alarm horn with an independent alarm silence switch shall be provided. The alarm shall be wired to sound at 90% of tank capacity.

SIGNAGE*:*

Tanks shall be labeled with fuel type and capacity. Labels shall be 2" white letters on black background and attached to the tank with adhesive.

Warning signs shall be installed to clearly identify hazards. The design of such signs shall be in accordance with the Fire Code. Conspicuous signs prohibiting simultaneous tank filling and fuel dispensing shall also be posted. Diesel fuel is classified as a Class II Combustible Liquid. Diesel fuel has the following NFPA 704 hazard ratings: Health: 1, Flammability: 2, Reactivity: 0 and Special Hazards: None (leave blank).

ACCESSORIES*:*

1. Emergency vent shall be sized by tank manufacturer per NFPA 30.
2. Dielectric couplings and/or flanged kits shall be provided at all copper to steel connections and as required to isolate the piping from the tank.

CONSTRUCTION DRAWINGS:

Electrical construction drawings shall show all necessary plans and details for the complete installation of the generator set(s), fuel storage tank(s) and associated fuel fill stations and spill containment facilities,

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ATS's, Paralleling Gear, and Generator 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 feeder 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 generator pad installation details and generator grounding details. Provide electrical construction details on drawings to specify electrical construction requirements. Provide plan view, elevation and/or detail drawings to cover all generator sets and associated gear. Provide cross sections and details as needed.

When ground fault protection is provided in the system, when-4-pole transfer switches are used, or when multiple loads are served from one emergency generator, note grounding requirements on the one-line diagram.

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 ¼" scale drawing of generator 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 generator room may not be installed in the space.

SPECIFICATION REQUIREMENTS:

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

The designer shall prepare supplementary material when the UMHHC/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 UMHHC 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.