

Western Michigan University – Campus Planning, Design & Construction

Design Guidelines for Facilities Construction:

DESIGN GUIDELINE DG16-3 Alternative Power Systems

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Generators General:

Generators shall be sized to support the calculated load and at least an additional 30%.

Generators shall be sized so that the nominal base generator load is at least 30% of the generator rating.

Generators shall be sized to service an area rather than just a building.

Generators shall be by Cummins Onan only.

Provide a 120volt 20A circuit convenience outlet in addition to any outlet required for the block heater.

The battery charger shall be mounted next to the ATS within the building. Size the wire from the charger to the battery for the distance.

Prime Mover:

Engines shall be natural gas when available. Diesel engines should not be a first choice.

Provide an appropriately sized block heater.

Extend the oil pan drain so that it is external of the enclosure.

Enclosure:

Where installed outside the generator shall be contained within a sound attenuating enclosure.

The enclosure shall be a Quiet site level II enclosure

Where used motorized dampers shall be connected to open when the generator starts.

Exhaust:

Generator exhaust shall have a vertical discharge only with a premium grade rain cap.

The muffler shall be for critical location.

Control System:

Generator shall have electronic control system.

The generator control (run, e-stop) shall not be mounted higher than 6'-0" above grade directly in front of the controls. A raised metal platform may need to be built around the unit to facilitate this requirement. This should only be a problem with diesel units that are mounted over a sub base tank.

Lonworks FT10 communications shall be provided between all system components: generator(s), transfer switch(es), annunciator, and modlon gateway device.

Three relays for user specified operation shall be included in the generator.

Provide an Echelon LPR lonworks router to interface the generator system to the building automation lonworks system.

Annunciator:

The annunciator shall communicate to the system devices with lonworks FT10 via twisted pair.

Battery Charger:

SCR Battery Float Charger 10 Amp

Provide 12 hour timer for manual equalization charge

Shall have metering for DC voltage and AC ammeter with 2% accuracy

Charger shall have monitoring contacts and indicator lights for: loss of AC power, Low battery voltage, and high battery voltage.

Power ON indicator lamp.

Fuse protection shall be provided to protect the charger.

Transfer Switches:

Switches shall be four pole types.

Circuit breaker type switches shall not be used

Closed transition switches shall be used.

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The transfer switch shall adjust the speed of the generator prior to initiating a closed transition switch operation when both sources are available.

Switch shall have Level 2 control.

Switch enclosure shall be suitable for the environment it is installed within.

A security key, digital display, Lonworks communications, load monitoring, relay signal module, and digital bar graph meters shall be included.

Terminal lugs shall be provided for connections.

Where an elevator is supplied via a generator a pre transfer signal shall be connected to the elevator.

Monitoring and control wiring shall be connected between the ATS remote test and a relay contact on the building substation meter. A separate input shall be provided to the substation meter to indicate when the ATS is connected to the emergency source.

ATS shall include power metering capabilities for KW, KWHr, and amperage.

Provide an empty (Spare) ¾" raceway from the generator control to the ATS.

Provide at least four #16 THHN spare control wires between the ATS and generator control within the same raceway for the generator start signal.

Switches installed for optional loads where emergency loads are supplied by the same generator shall have load shedding ability, which can drive the optional loads switch to the neutral position.

Load Banking:

The generator shall be load banked in accordance with NFPA standards at initial startup.

Provisions shall be made in the emergency distribution system to connect a load bank device without taking the emergency system offline. This connection shall be via a circuit breaker and 400 cam lock terminals provided with caps when not in use. This circuit breaker needs to be sized to allow additional load so that the generator is fully loaded by the load bank and the emergency base loads. For example: A building has 2 ATS's with a combined actual load of 200kw on a 400kw generator, which would require a breaker capable of supply 200kw at the system voltage.

Extended Paralleling Systems:

When an emergency has a system capacity of at least ____Kw, extended paralleling shall be considered. The cost effectiveness of such an installation shall be evaluated and provided to the University.

When ever possible a natural gas system shall be used for Extended Paralleling.

If diesel is used for an extended paralleling fuel source the tank shall have sufficient capacity to supply the full load for a minimum of 48 hours.

Fuel:

Installing contractor shall be responsible for fuel expenses and other expendable items used prior to turn over to the University.

Diesel units shall be turned over with a full tank of fuel.

All diesel fuel tanks shall be of the sub base type and of double wall construction.

Emergency Distribution:

Separate transfer switches shall be used to separate life safety emergency loads and optional emergency loads.

For smaller emergency systems the generator shall have a main breaker rated for its capacity, which supplies an emergency distribution panel to protect the ATS's appropriately.

Manuals:

Provide three complete sets of printed manuals. This should include: installation, operators, parts, and service for each component of the system (i.e. battery charger, annunciator, prime mover, alternator, control system, transfer switch, and any communication devices).

Warranty:

Generator systems shall have a five year warranty to cover materials and labor to repair defective items.

Warranty repairs shall be done at a time least disruptive to University activities.

1. GENERAL DESIGN REQUIREMENTS

For guidelines and requirements applicable to all of Division 16 sections, see DG16-0.

This Guideline addresses alternative power systems, such as emergency generators & their transfer switches, uninterruptible power systems, and battery power systems.

When required by code, WMU request or project program these guidelines will be used.

Generators General:

Generators shall be sized to support the calculated load and at least an additional 30%.

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Generators shall be sized so that the nominal base generator load is at least 30% of the generator rating.

Generators shall be sized to service an area rather than just a building.

Generators shall be by Cummins Onan only.

Provide a 120volt 20A circuit convenience outlet in addition to any outlet required for the block heater.

The battery charger shall be mounted next to the ATS within the building. Size the wire from the charger to the battery for the distance.

Prime Mover:

Engines shall be natural gas when available. Diesel engines should not be a first choice.

Provide an appropriately sized block heater.

Extend the oil pan drain so that it is external of the enclosure.

Enclosure:

Where installed outside the generator shall be contained within a sound attenuating enclosure.

The enclosure shall be a Quiet site level II enclosure

Where used motorized dampers shall be connected to open when the generator starts.

Exhaust:

Generator exhaust shall have a vertical discharge only with a premium grade rain cap.

The muffler shall be for critical location.

Control System:

Generator shall have electronic control system.

The generator control (run, e-stop) shall not be mounted higher than 6'-0" above grade directly in front of the controls. A raised metal platform may need to be built around the unit to facilitate this requirement. This should only be a problem with diesel units that are mounted over a sub base tank.

Lonworks FT10 communications shall be provided between all system components: generator(s), transfer switch(es), annunciator, and modlon gateway device.

Three relays for user specified operation shall be included in the generator.

Provide an Echelon LPR Lonworks router to interface the generator system to the building automation lonworks system.

Annunciator:

The annunciator shall communicate to the system devices with lonworks FT10 via twisted pair.

Battery Charger:

SCR Battery Float Charger 10 Amp

Provide 12 hour timer for manual equalization charge

Shall have metering for DC voltage and AC ammeter with 2% accuracy

Charger shall have monitoring contacts and indicator lights for: loss of AC power, Low battery voltage, and high battery voltage.

Power ON indicator lamp.

Fuse protection shall be provided to protect the charger.

Transfer Switches:

Switches shall be four pole types.

Circuit breaker type switches shall not be used

Closed transition switches shall be used.

The transfer switch shall adjust the speed of the generator prior to initiating a closed transition switch operation when both sources are available.

Switch shall have Level 2 control.

Switch enclosure shall be suitable for the environment it is installed within.

A security key, digital display, lonworks communications, load monitoring, relay signal module, and digital bar graph meters shall be included.

Terminal lugs shall be provided for connections.

Where an elevator is supplied via a generator a pre transfer signal shall be connected to the elevator.

Monitoring and control wiring shall be connected between the ATS remote test and a relay contact on the building substation meter. A separate input shall be provided to the substation meter to indicate when the ATS is connected to the emergency source.

ATS shall include power metering capabilities for KW, KWHr, and amperage.

Provide an empty (Spare) ¾” raceway from the generator control to the ATS.

Provide at least four #16 THHN spare control wires between the ATS and generator control within the same raceway for the generator start signal.

Switches installed for optional loads where emergency loads are supplied by the same generator shall have load shedding ability, which can drive the optional loads switch to the neutral position.

Load Banking:

The generator shall be load banked in accordance with NFPA standards at initial startup.

Provisions shall be made in the emergency distribution system to connect a load bank device without taking the emergency system offline. This connection shall be via a circuit breaker and 400 cam lock terminals provided with caps when not in use. This circuit breaker needs to be sized to allow additional load so that the generator is fully loaded by the load bank and the emergency base loads. For example: A building has 2 ATS's with a combined actual load of 200kw on a 400kw generator, which would require a breaker capable of supply 200kw at the system voltage.

Extended Paralleling Systems:

When an emergency has a system capacity of at least ____Kw, extended paralleling shall be considered. The cost effectiveness of such an installation shall be evaluated and provided to the University.

When ever possible a natural gas system shall be used for Extended Paralleling.

If diesel is used for an extended paralleling fuel source the tank shall have sufficient capacity to supply the full load for a minimum of 48 hours.

Fuel:

Installing contractor shall be responsible for fuel expenses and other expendable items used prior to turn over to the University.

Diesel units shall be turned over with a full tank of fuel.

All diesel fuel tanks shall be of the sub base type and of double wall construction.

Emergency Distribution:

Separate transfer switches shall be used to separate life safety emergency loads and optional emergency loads.

For smaller emergency systems the generator shall have a main breaker rated for its capacity, which supplies an emergency distribution panel to protect the ATS's appropriately.

Manuals:

Provide three complete sets of printed manuals. This should include: installation, operators, parts, and service for each component of the system (i.e. battery charger, annunciator, prime mover, alternator, control system, transfer switch, and any communication devices).

Warranty:

Generator systems shall have a five year warranty to cover materials and labor to repair defective items.

Warranty repairs shall be done at a time least disruptive to University activities.

2. GENERATORS & TRANSFER SWITCHES

Generators General:

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Battery Charger:

SCR Battery Float Charger 10 Amp

Provide 12 hour timer for manual equalization charge

Shall have metering for DC voltage and AC ammeter with 2% accuracy

Charger shall have monitoring contacts and indicator lights for: loss of AC power, Low battery voltage, and high battery voltage.

An additional indicator shall show power on.

Fuse protection shall be provided to protect the charger.

Transfer Switches:

Switches shall be four pole types.

Circuit breaker type switches shall not be used

Closed transition switches shall be used.

Switch shall have Level 2 control.

Switch enclosure shall be suitable for the environment it is installed within.

A security key, digital display, lonworks communications, load monitoring, relay signal module, and digital bar graph meters shall be included.

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All diesel fuel tanks shall be of the sub base type and of double wall construction.

Warranty:

Generator systems shall have a five year warranty to cover materials and labor to repair defective items.

Warranty repairs shall be done at a time least disruptive to University activities.

3. UNINTERRUPTIBLE POWER SYSTEMS

4. BATTERY POWER SYSTEMS

4.1 Battery Operated Emergency Light Units

4.1.1 *General*

Comply with NFPA 70 "National Electric Code" and NFPA 101, "Life Safety Code".

Comply with requirements of UL 924 "Emergency Lighting and Power Equipment".
Emergency lighting fixtures shall be UL listed and labeled.

Submittals:

Submit manufacturer's technical product data for each type of emergency lighting unit specified. Assemble in "Lighting Fixture" booklet with a separate sheet for each fixture, arranged in unit "type", alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet.

Provide installation instructions written by manufacturers for all specified products.

4.1.2 *Products*

Emergency Light Sets:

The following features apply to emergency light sets:

Battery:

Sealed, maintenance free, lead-acid type with 10 year nominal life.

Charger:

Minimum two-rate, fully automatic, solid-state type, with sealed transfer relay.

Operation:

Relay turns lamp on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamp operates for duration of outage, up to 1.5 hours. Lamp automatically disconnected from battery if voltage approaches deep-discharge level. When nominal voltage is restored, battery is automatically recharged within 16 hours and then floated on trickle charge.

Control Panel:

Control panel contains low-voltage disconnect switch, LED indicator light, test switch, and concealed terminals for remote lamp head connection.

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Surface-Mount Type with Lamp Heads:

Two integral lamp heads mounted on housing with 180-degree, 2-way locking swivel joints for aiming.

Finish:

Exposed parts shall be matte white.

Manufacturer:

Dual-Lite Inc. - Model EZ-2

Emergency Fluorescent Power Supply:

Internal Type:

Provide internal self contained, modular, battery-invertor unit, factory mounted within the fluorescent fixture body.

Arrange unit with test switch and LED indicator light, visible and accessible without entering ceiling space.

Battery:

Sealed, maintenance free, nickel-cadmium type, with normal 10 year life, minimum.

Charger:

Fully automatic, solid-state, constant current type.

Operation:

Relay turns two lamps on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. When normal voltage is restored, battery is automatically recharged.

Light Output:

Unit shall power one T-8 fluorescent lamp to a minimum of 1100 lumens output for a minimum of 1.5 hours.

External Type:

For designated fluorescent fixtures, provided under Division 16 Section "Lighting Fixtures", provide external self contained, modular, battery-invertor unit.

Arrange unit with test switch and LED indicator light, visible and accessible without entering ceiling space.

Battery:

Sealed, maintenance free, nickel-cadmium type, with normal 10 year life, minimum.

Charger:

Fully automatic, solid-state, constant current type.

Operation:

Relay turns two lamps on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. When normal voltage is restored, battery is automatically recharged.

Manufacturers:

Subject to compliance with the requirements, provide products by the following:

Bodine Co.
Chloride Systems
Dual-Lite, Inc.
Emergi-Lite, Inc.
Holophane Lighting
Lightalarms Electronics Corp.
Lithonia Lighting
Sure-Lites
Thomas Industries, Inc.

4.1.3 Installation

All emergency lights shall be provided and installed in accordance with the NEC. Provide at least one light, connected to the emergency system, in each mechanical room, electrical room, auditorium, theater, large lecture hall, and dining room.

In general, the night lights shall be on the emergency power system and utilized as emergency lights.

Units shall be mounted so that they may easily be removed for service. Wall shelves or brackets shall be designed in such a way that battery units are securely fastened to the mounting unit.

Set units plumb, square, and level with ceiling and walls and secure in accordance with manufacturer's written instructions and approved shop drawings. Conform to the requirements of NFPA 70.

Mounting heights specified or indicated are to bottom of fixture for suspended or ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures.

Recessed and semi-recessed fixtures may be supported from suspended ceiling support system if the ceiling system support rods or wires are not more than 6 inches from fixture corners. For fixtures smaller than the ceiling grid, install a minimum of four rods or wires per fixture and locate at corner of the ceiling grid in which the fixture is located. Do not support fixtures by ceiling acoustical panels. Where fixtures smaller than the ceiling grid are used, they are to be centered in the acoustical panel. Support fixtures independently with at least two 3/4-inch metal channels spanning and secured to the ceiling tees. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corner.

Lamp units in accordance with manufacturer's instructions. Make external wiring connections required for proper functioning.

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Coordinate non-current-carrying parts of equipment. Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

Tighten grounding connections to comply with tightening torques specified in UL 486A.

Clean emergency lighting fixtures of dirt and construction debris upon completion of installation.

Protect installed fixtures from damage during remainder of construction period.

Demonstration:

Upon completion of installation of emergency lighting fixtures apply normal power supply to demonstrate proper operation under normal conditions. Interrupt normal power supply to demonstrate proper transfer and operation under battery power. Operate under battery power for five minutes and then restore normal power supply to demonstrate proper retransfer and operation under normal power.

END OF SECTION