SECTION 263323.11 - CENTRAL BATTERY EQUIPMENT FOR EMERGENCY LIGHTING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY

This Section is limited to separately enclosed, prepackaged, combination power conversion units and battery packs furnished by a single manufacturer and NRTL listed as integrated units; it does not include separate power conversion units and battery packs furnished by different manufacturers and intended to be field assembled. This Section is also limited to central battery and power conversion equipment used exclusively for emergency lighting systems and NRTL listed or labeled to UL 924.

* + - * 1. Section Includes:

Interruptible (slow-transfer) central battery equipment.

Interruptible (fast-transfer) central battery equipment.

Uninterruptible (UPS-type) central battery equipment.

Enclosures.

Optional and accessory features.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. DDC: Direct digital control.
				2. IBC: International Building Code.
				3. Interruptible: As used in the Section Text, an off-line, passive-standby or line-interactive, inverter-only unit, with an intentional interruption of power to the load until an internal transfer switch picks up and transfers the load to the unit's inverter and internal battery source on loss of the "normal" source, and then retransfers to the "normal" source when it is restored. Transfer time can be "slow" (up to approximately 1 second) or "fast" (2-4 ms or 40-50 ms, depending on manufacturer).
				4. LED: Light-emitting diode.
				5. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
				6. NiCd: Nickel cadmium.
				7. OCPD: Overcurrent protective device.
				8. PC: Personal computer.
				9. PWM: Pulse-width modulated.
				10. TDD: Total demand (harmonic current) distortion (also listed as "THD" in catalog data by manufacturers).
				11. THD(V): Total harmonic voltage demand.
				12. Uninterruptible: As used in the Section Text, an on-line, double-conversion (rectifier/inverter) unit, with no interruption of power to the load on interruption and restoration of the "normal" source.
				13. UPS: Uninterruptible power supply.
				14. VRLA: Valve-regulated lead acid.
			1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type and rating of central battery equipment unit.

Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, shipping splits, and furnished options, specialties, and accessories.

* + - * 1. Shop Drawings: For each type and rating of central battery equipment unit.

Include plans, elevations, sections, and mounting details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, ventilation requirements, method of field assembly, components, and location and size of each field connection.

Include system one-line diagram, internal and interconnecting wiring; and diagrams for power, signal, and control wiring.

Include elevation, details, and legends of control and indication displays.

Include -circuit current (withstand) rating of unit.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space. See "Installation Considerations" Article in the Evaluations for additional guidance on when to retain below.

* + - * 1. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around central battery equipment. Show central battery equipment layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

Coordinate "Qualification Data" paragraph below and as may be supplemented in "Quality Assurance" Article.

* + - * 1. Qualification Data: For [**Installer and**]testing agency.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 260548.16 "Seismic Controls for Electrical Systems." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: For central battery equipment, accessories, and components, from manufacturer.

Certificate of compliance.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain "Product Certificates" paragraph below to require submittal of product certificates from manufacturers.

* + - * 1. Product Certificates: For each type of central battery equipment.

Harmonic contributions are normally only a concern with large, on-line, double-conversion, central battery equipment with unfiltered inputs and solid-state rectifiers (e.g., SCRs). Retain "Harmonic Analysis Study and Report" paragraph below if an analysis is required from central battery equipment manufacturer. Ensure that the information necessary for manufacturer to perform the analysis is included in the Construction Documents, including specified TDD and THD(V) limits. Coordinate with "Harmonic Analysis Study" Article; see "System Stability" and "Harmonic Distortion" articles in the Evaluations and see the Drawing Coordination Checklist for additional information.

* + - * 1. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze [**possible**] [**designated**] operating scenarios, including recommendations for input filtering of central battery equipment to limit TDD and THD(V) to specified levels.
				2. Source quality-control reports.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Sample Warranty: For special warranty.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For central battery equipment to include in emergency, operation, and maintenance manuals.
				2. Manufacturer's written instructions for testing central battery equipment.

Retain first subparagraph below if circuit breakers are specified in central battery equipment.

* + - * 1. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
				2. Manufacturer's written instructions for selecting and setting field-adjustable controls and status and alarm points.
			1. MAINTENANCE MATERIAL SUBMITTALS

Revise this article to include extra materials that Owner may require and that may fail more frequently due to continual use. Coordinate extra materials with features retained in Part 2.

Coordinate quantity of fuses with Section 262813 "Fuses" for required space in spare-fuse cabinet.

* + - * 1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Director’s Representative.

Fuses: One for every 10 of each type and rating, but no fewer than <**Insert quantity**> of each type.

Output Circuit Breakers: One for every 10 of each type and rating, but no fewer than <**Insert quantity**> of each type.

Output Circuit Breaker Open/Tripped Alarm Contacts: One for every 10 supplied, but no fewer than <**Insert quantity**> of each type.

Cabinet Ventilation Filters: One complete set.

Circuit Board: One spare circuit board for each critical circuit.

<**Insert extra material**>.

* + - 1. QUALITY ASSURANCE
				1. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

Retain "Testing Agency Qualifications" paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article.

* + - * 1. Testing Agency Qualifications: Member company of NETA or an NRTL[**acceptable to authorities having jurisdiction**].

Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

* + - * 1. Equipment Qualifications For Products Other Than Those Specified:

At the time of submission provide written notice to the Director of the intent to propose an “or equal” for products other than those specified. Make the “or equal” submission in a timely manner to allow the Director sufficient time to review the proposed product, perform inspections and witness test demonstrations.

If products other than those specified are proposed for use furnish the name, address, and telephone numbers of at least 5 comparable installations that can prove the proposed products have performed satisfactorily for 3 years. Certify in writing that the Director's Representative of the 5 comparable installations will allow inspection of their installation by the Director's Representative and the Company Field Advisor.

Make arrangements with the Director's Representative of 2 installations (selected by the Director) for inspection of the installations by the Director's Representative. Also obtain the services of the Company Field Advisor for the proposed products to be present. Notify the Director a minimum of 3 weeks prior to the availability of the installations for the inspection, and provide at least one alternative date for each inspection.

Only references from the actual Director or Director's Representative (Security Supervisor, Maintenance Supervisor, etc.) will be accepted. References from dealers, system installers or others, who are not the actual Director's Representative of the proposed products, are not acceptable.

Verify the accuracy of all references submitted prior to submission and certify in writing that the accuracy of the information has been confirmed.

The product manufacturer shall have test facilities available that can demonstrate that the proposed products meet the contract requirements.

Make arrangements with the test facility for the Director's Representative to witness test demonstrations. Also obtain the services of the Company Field Advisor for the proposed product to be present at the test facility. Notify the Director a minimum of 3 weeks prior to the availability of the test facility, and provide at least one alternative date for the testing.

Provide written certification from the manufacturer that the proposed products are compatible for use with all other equipment proposed for use for this system and meet all contract requirements.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Deliver equipment in fully enclosed vehicles.
				2. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.
			2. FIELD CONDITIONS

Revise "Environmental Limitations" paragraph below to specify unusual environmental or service conditions. Coordinate with manufacturers' standard environmental ratings in Part 2, because unusual conditions may require considerable derating of equipment ratings and reduced life expectancy, especially for batteries.

* + - * 1. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

Subparagraphs below are examples only, which should be revised to include actual Project conditions if applicable.

Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.

Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.

Humidity: More than 95 percent (condensing).

Altitude: Exceeding 3300 feet.

<**Insert unusual service condition**>.

Retain "Interruption of Existing Electrical Distribution Systems" paragraph below if interruption of existing electrical distribution systems is required to install central battery equipment.

* + - * 1. Interruption of Existing Electrical Distribution Systems: Do not interrupt electrical distribution systems within facilities occupied by Director’s Representative or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

Notify [**Architect**] [**Construction Manager**] [**Director’s Representative**] no fewer than [**two**] <**Insert number**> days in advance of proposed interruption of electrical systems.

Indicate method of providing temporary electrical service.

Do not proceed with interruption of electrical systems without [**Architect's**] [**Construction Manager's**] [**Director’s Representative**] written permission.

Comply with NFPA 70E.

Dimensions of larger central battery equipment, especially units with multiple battery enclosures and other devices, or various options, can vary in size between manufacturers. Retain "Product Selection for Restricted Space" paragraph below if installation space for battery equipment is limited; indicate maximum dimensions on Drawings.

* + - * 1. Product Selection for Restricted Space: Drawings indicate maximum dimensions for central battery equipment, including clearances between central battery equipment and adjacent surfaces and other items.
			1. COORDINATION

Retain this article if required for battery equipment.

* + - * 1. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.
			1. WARRANTY

When warranties are required, verify with Owner's counsel that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace central battery equipment that fails in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.

Numerous manufacturers may offer extended warranties for power conversion equipment, if retaining factory startup services in "Startup Service" Article.

Warranty Period: Include the following warranty periods, from date of Substantial Completion:

Central Battery Equipment (excluding Batteries): [**One**] [**Two**] <**Insert number**> year(s).

Retain subparagraphs below to match battery types retained in this Section. See the Alternative Battery Types for Central Battery Equipment Table in the Evaluations for typical warranty periods for battery types listed in this Section. Verify, with manufacturers, availability of warranties.

Standard VRLA Batteries:

Full Warranty: [**One**] <**Insert number**> year(s).

Pro Rata: [**Nine**] <**Insert number**> years.

Premium VRLA Batteries:

Full Warranty: [**One**] <**Insert number**> year(s).

Pro Rata: [**19**] <**Insert number**> years.

NiCd, Wet-Cell Batteries:

Full Warranty: [**Five**] <**Insert number**> years.

Pro Rata: [**15**] <**Insert number**> years.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures.

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Seismic Performance" paragraph below with "Seismic Qualification Data" paragraph in "Informational Submittals" Article for projects requiring seismic design; however, several listed manufacturers do not currently offer seismic certificates and some do not test wall-mounted controllers for their ability to "withstand" a seismic event. Delete paragraph if performance requirements are indicated on Drawings. Verify availability of seismic testing and certification with manufacturers. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Verify requirements of authorities having jurisdiction. Coordinate requirements with structural engineer. See "Seismic Considerations" Article in the Evaluations.

* + - * 1. Seismic Performance: Central battery equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated central battery equipment shall be tested and certified by an NRTL as meeting ICC-ES AC 156 test procedure requirements.

Retain subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."

For each central battery equipment unit, indicate on Drawings, in tables on Drawings, or in the Section Text, input and output voltages, equipment ratings and type, accessories, short-circuit current rating (or available short-circuit currents), and enclosure type if not specified in the Section Text. See "Sample Schedule" Article in the Evaluations for selection considerations.

Not all features, accessories, and options in this article are available for every rating, with every enclosure type, and from every listed manufacturer. Verify availability and unique characteristics with manufacturers. Indicate on Drawings, or in schedules, those features and accessories that apply to each central battery equipment unit.

* + - 1. INTERRUPTIBLE (SLOW-TRANSFER) CENTRAL BATTERY EQUIPMENT

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=7606) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Chloride; Signify North America Corp](http://www.specagent.com/Lookup?uid=123457165328).

[Dual-Lite](http://www.specagent.com/Lookup?uid=123457165332).

[Emergi-Lite; a Thomas & Betts brand](http://www.specagent.com/Lookup?uid=123457165337).

Or equal.

* + - * 1. General Requirements for Interruptible (Slow-Transfer) Central Battery Equipment:

See Editing Instructions No. 2 and No. 4 and "Industry Standards" Article in the Evaluations for a discussion of testing laboratory listing/labeling of central battery equipment. Some authorities having jurisdiction may require specific local approvals (e.g., the New York Department of Buildings). Insert additional or replacement standards or approvals in subparagraphs below.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

NRTL Compliance: Fabricate and label central battery equipment to comply with UL 924.

Comply with the IBC, NFPA 70, and NFPA 101.

Source Limitations: Obtain central battery equipment, including batteries, overcurrent protective devices, components, and accessories, from single source from single manufacturer.

* + - * 1. Performance Requirements:

Central battery equipment for emergency lighting is categorized by the speed at which power is restored to the load. Retain subparagraphs below that describe basic type of unit required. HID and some other light sources are unsuitable for emergency lighting systems served with passive-standby (off-line) type systems, especially slow-transfer types. See Editing Instruction No. 3 in the Evaluations for a discussion of transfer time; consult manufacturers for suitable light sources to use.

Slow-Transfer Central Battery Equipment: Passive-standby (off-line) system. Automatically sense loss of normal alternating-current (ac) supply and use an electromechanical transfer switch to transfer loads. Transfer in one second or less from normal supply to battery-inverter supply.

Automatic Operation:

Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, bypassing inverter, with battery connected in parallel via rectifier/charger output.

Abnormal Supply Conditions: If normal ac supply deviates from specified voltage, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.

If normal power fails, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.

If a fault occurs in system when being supplied by inverter and current flows in excess of the overload rating of inverter, inverter automatically protects itself against damage from overloads and short circuits by shutting down.

When normal ac power is restored at input supply terminals of unit, controls automatically retransfer the load back to the normal ac supply, with a momentary loss of power to the load. Rectifier/charger then recharges battery.

If normal power failure is prolonged (more than 90 minutes), integral low-voltage battery protective circuit disconnects battery and prevents battery from damage due to deep discharge.

If battery becomes discharged, and when normal ac supply is again available, rectifier/charger recharges battery. When battery is fully charged, rectifier/charger automatically shifts to float-charge mode.

If battery is disconnected, and normal ac power is available, central battery equipment continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.

* + - * 1. Unit Operating Requirements:

See "Ratings" Article in the Evaluations on how to indicate central battery equipment ratings. The Section Text defaults to indicating ratings information (e.g., input/output voltage levels, wattages, etc.) on the Drawings or in tables (see "Sample Schedule" Article in the Evaluations); however, for single units, the Section Text can be revised to incorporate this information.

Increases in technology are allowing manufacture of central battery equipment with greater tolerance to system anomalies and better operating performance. Most listed manufacturers offer central battery equipment that tolerates the greater operational variances, or they offer the higher levels of performance included in subparagraphs below. Consult manufacturers if Project system conditions fall outside the selected parameters in first three subparagraphs because corrective actions or additional modifications may be required before central battery equipment can be applied. In "Input AC Voltage Tolerance" subparagraph below, voltage tolerance is more a factor of voltage limitations for industrial control devices (e.g., magnetic contactors) in central battery equipment and not the central battery equipment power converter, which can usually tolerate greater voltage variations.

Input AC Voltage Tolerance: Plus 10 and minus [**15**] <**Insert number**> percent of central battery equipment input voltage rating.

Input Frequency Tolerance: Plus or minus [**3**] [**5**] <**Insert number**> percent of central battery equipment frequency rating.

Synchronizing Slew Rate: [**1**] <**Insert number**> Hz per second, maximum.

For off-line units, the only losses when operating on normal power (i.e., in standby or bypass mode) are the internal bus impedances, the battery charger operating in float-charge mode, and any line-conditioning equipment (e.g., isolation transformers) provided by some listed manufacturers, to reduce incoming power anomalies.

Minimum Off-Line Efficiency: [**95**] [**99**] <**Insert number**> percent at 60 Hz, full load.

Minimum Displacement Primary-Side Power Factor: [**96**] [**98**] <**Insert number**> percent under any load or operating condition.

Central battery equipment is available that is suitable for use under environmental conditions different than those indicated in first four rating subparagraphs below; however, derating or special modifications, or both, may be required. For central battery equipment, where converter, battery charger, and batteries are in the same enclosure or same room, the determining factor for ambient operating and storage temperature ranges normally defaults to those specified for the batteries because they are more restrictive. Coordinate with "Field Conditions" Article, and consult manufacturers for required modifications or derating, or both, to accommodate unusual service conditions. See Editing Instruction No. 6 and "Batteries" and "Equipment Rooms" articles in the Evaluations for additional discussions on this subject.

Ambient Temperature Rating (Other Than Batteries): Not less than 68 deg F and not exceeding 86 deg F.

Ambient Storage Temperature Rating (Other Than Batteries): Not less than minus 4 deg F and not exceeding 158 deg F.

Ambient Temperature Rating (Batteries): Not less than 32 deg F and not exceeding 104 deg F.

Fully charged batteries are normally stored for up to six months at ambient temperatures of not more than 25 deg C; for each 9 deg C rise above 25 deg C, storage time should be reduced by half.

Ambient Storage Temperature Rating (Batteries): Not less than 0 deg F and not exceeding 104 deg F.

Humidity Rating: Less than 95 percent (noncondensing).

Altitude Rating: Not exceeding 3300 feet.

Off-Line Overload Capability: [**1.1**] [**1.5**] times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.

* + - * 1. Inverter and Controls Logic: Microprocessor based, isolated from all power circuits; provides complete self-diagnostics, periodic automatic testing and reporting; with alarms.
				2. Controls and Indication:

Coordinate local control and indication requirements with Owner or end users. Operator stations and digital displays are not typically available on slow-transfer central battery equipment; status and alarm displays and output signals vary considerably among central battery equipment manufacturers.

Status Indication: Door-mounted, labeled LED indicators or digital screen displaying the following conditions:

Normal power available.

Status of system.

Battery charging status.

On battery power.

System fault.

External fault.

<**Insert condition**>.

Coordinate Project-specific display, alarms, metering, interfaces, and other controls and indication features with manufacturers, because standard and optional features vary considerably among manufacturers.

Remote Signal Interfaces:

Remote Indication Interface: A minimum of [**one**] <**Insert number**> programmable (Form C) dry-circuit relay output(s) (120-V ac, 2 A) for remote indication of the following:

Fault or status indication.

On bypass.

Low battery.

<**Insert indication**>.

Communications interfaces are not typically available on small units below 500 W; some manufacturers only offer these interfaces as added-cost options. Retain "Communications Interface" subparagraph below if remote programming, monitoring, or both, are required for central battery equipment. Coordinate with manufacturers what is available to suit Project requirements.

Communications Interface: Factory-installed hardware and software to enable a remote PC to program central battery equipment and monitor and display status and alarms.

Communications Ports: [**RS-232**] [**RS-485**] <**Insert port type**>.

Retain "Compliance with ASHRAE 135" subparagraph below for DDC system for HVAC control network. Revise as required for other network protocols. See "Optional Features and Accessories" Article in the Evaluations for discussion of communication network options.

Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications and shall be able to communicate directly via DDC system for HVAC RS-485 serial networks and Ethernet 10Base-T networks as a native device.

* + - * 1. Self-Protection and Reliability Features:

Coordinate Project-specific self-protection and reliability features with manufacturers, because standard and optional features vary considerably among manufacturers.

Input transient protection by means of SPDs to provide protection against damage from supply voltage surges as defined in IEEE C62.45, Category B and C.

Integral, programmable, self-diagnostic and self-test circuitry; with alarms and logging.

Battery deep-discharge and self-discharge protection; with alarms.

Battery self-test circuitry; with alarms and logging.

<**Insert feature**>.

Not all manufacturers offer options in "Integral Input Disconnecting Means and OCPD" paragraph below. Coordinate with manufacturers for available options. Coordinate selection of the disconnecting means and OCPD with short-circuit current (withstand) ratings required for Project. See Editing Instruction No. 7 and "Selecting and Setting Protective Devices" Article in the Evaluations for additional information.

* + - * 1. Integral Input Disconnecting Means and OCPD: [**Thermal-magnetic circuit breaker, complying with UL 489**] [**None**] <**Insert disconnecting means**>.

Retain "Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating" subparagraph below if all central battery equipment on a project requires the same short-circuit current rating. Delete subparagraph if short-circuit ratings vary for individual units, and indicate the ratings on Drawings.

Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating: [**5**] [**10**] [**22**] [**65**] <**Insert value**> kA.

Inverters are used in all central battery equipment, but they vary considerably in type and function between manufacturers. Coordinate with manufacturers for available features and functions, and revise "Inverter" paragraph below to suit Project. See "Power Conversion" Article in the Evaluations for additional information on inverters.

* + - * 1. Inverter:

Some listed manufacturers only offer square-wave, non-PWM-type inverters with their small slow-transfer units; coordinate with manufacturers if this is a concern. Revise language below if retaining square-wave inverters.

Description: Solid-state, high-frequency, PWM type, with the following operational features:

Automatically regulate output voltage to within plus or minus [**3**] [**5**] percent, for all load ranges and for maximum 25 percent step-load changes; regulation may increase to [**8**] <**Insert number**> percent for 100 percent step-load changes.

Automatically regulate output frequency to within plus or minus [**1**] <**Insert number**> Hz, from no load to full load, at unity power factor, over the operating range of battery voltage.

See Editing Instruction No. 5 in the Evaluations for additional discussions on TDD levels when using PWM-type inverters.

Output Voltage Waveform: Sine wave with maximum [**3**] [**5**] <**Insert number**> percent TDD throughout battery operating-voltage range, for 100 percent linear load.

Load Power Factor: [**0.5**] <**Insert number**> lead to [**0.5**] <**Insert number**> lag.

Inverter Overload Capability: [**115**] <**Insert number**> percent for 10 minutes; 150 percent surge for [**10**] <**Insert number**> seconds.

Some manufacturers of single-conversion, slow-transfer units do not provide rectifiers/battery chargers, but rather use the inverter to charge the batteries during normal power operations and to serve the load. Then, the power flow is reversed to serve the load from the batteries during loss of normal power. Coordinate with manufacturers for available features and functions, and revise "Rectifier/Battery Charger" paragraph below to suit Project.

* + - * 1. Rectifier/Battery Charger:

Description: Solid state, variable rate, temperature compensated; automatically maintains batteries in fully charged condition when normal power is available.

Listed manufacturers normally offer, as standard, a maximum battery recharge time of 24 hours from maximum discharge to a fully recharged state; however, some manufacturers offer a faster recharge rate as an added-cost option.

Maximum Battery Recharge Time from Fully Discharged State: [**24**] <**Insert number**> hours.

Low-voltage disconnect circuit reduces battery discharge during extended power outages, monitors battery voltage, and disconnects inverter when battery voltage drops to no less than 85.7 percent of nominal voltage.

* + - * 1. Batteries:

Retain one of three options in "Description" subparagraph below. Standard VRLA batteries are the type most frequently offered by manufacturers as a standard, with other types offered only as an added-cost option. Coordinate with "Special Warranty" paragraph in "Warranty" Article. See "Batteries" Article in the Evaluations for a discussion on types of storage batteries.

Description: [**Standard VRLA**] [**Premium VRLA**] [**NiCd, wet-cell**] batteries.

The IBC, NFPA 70, and NFPA 101 require a minimum of 90 minutes of run time; however, some manufacturers offer longer run times as an added-cost option.

Capable of sustaining full-capacity output of inverter unit for minimum of [**90 minutes**] <**Insert duration**>.

Battery Disconnect and OCPD: Manufacturer's standard.

* + - * 1. Maintenance Bypass Systems:

Maintenance Bypass Mode:

See "Maintenance Bypass Systems" Article in the Evaluations for a discussion on this feature. Retain one of first two subparagraphs below, or retain both if both are required for greater bypass and isolation capabilities for single units or if both are required for separate central battery equipment. If specifying more than one unit, indicate on Drawings where each type is required.

Internal; manual operation only; bypasses central battery equipment power circuits (inverter and transfer switch); requires local operator selection at central battery equipment. Transfer and retransfer shall be [**make-before-break, without disrupting power to the load or causing system instabilities**] [**break-before-make, with temporary disrupting power to the load**].

External; manual operation only; bypasses central battery equipment completely; requires local operator selection at external switch enclosure remote from central battery equipment. Transfer and retransfer shall be [**make-before-break, without disrupting power to the load or causing system instabilities**] [**break-before-make, with disrupting power to the load**].

Bypass Overload Capability: [**1.5**] <**Insert number**> times the base load current.

* + - * 1. Integral Output Disconnecting Means and OCPD:

Coordinate Project-specific output OCPDs with manufacturers, because standard and optional features vary considerably among manufacturers. Retain subparagraphs below as required to suit Project. For a single unit, with single-output OCPD, "Single-Output OCPD" subparagraph below can be revised to include size and type; or, consider scheduling output OCPDs on Drawings for coordination with feeder and branch circuit wiring sizes. Most authorities having jurisdiction require schedules of loads on branch circuits to be indicated on Drawings. See "Selecting and Setting Protective Devices" Article in the Evaluations for additional information.

Single-Output OCPD: [**As scheduled on Drawings**] [**Fuses**] [**Thermal-magnetic circuit breaker, complying with UL 489**] <**Insert disconnecting means**>; manufacturer's standard ratings based on unit output ratings.

Manufacturers normally offer multiple-output OCPDs as a standard option for other than extremely small unit ratings, with multiple choices of types and features. "Multiple-Output OCPDs" subparagraph below includes those most commonly encountered; retain or revise as required to suit Project.

Multiple-Output OCPDs: Thermal-magnetic circuit breakers, complying with UL 489; voltage rating matching unit output voltage rating; 20 A, single pole.

Normally Closed/On: [**2**] <**Insert number**>[**; with trip alarm**].

Normally Open/Off: [**2**] <**Insert number**>[**; with trip alarm**][**; with time delay**].

<**Insert output OCPD option**>.

* + - 1. INTERRUPTIBLE (FAST-TRANSFER) CENTRAL BATTERY EQUIPMENT

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=7607) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Chloride; Signify North America Corp](http://www.specagent.com/Lookup?uid=123457165339).

[Dual-Lite](http://www.specagent.com/Lookup?uid=123457165343).

[Emergi-Lite; a Thomas & Betts brand](http://www.specagent.com/Lookup?uid=123457165349).

Or equal.

* + - * 1. General Requirements for Interruptible (Fast-Transfer) Central Battery Equipment:

See Editing Instructions No. 2 and No. 4 and "Industry Standards" Article in the Evaluations for a discussion of testing laboratory listing of central battery equipment. Some authorities having jurisdiction may require specific local approvals (e.g., the New York Department of Buildings). Insert additional or replacement standards or approvals in subparagraphs below.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Besides UL 924, some manufacturers advertise that their fast-transfer-type central battery equipment complies with UL 1778; however, many manufacturers of fast-transfer equipment do not list their equipment to this standard, and compliance with UL 1778 is not required for UL 924 compliance. Coordinate with manufacturers, and retain option in "NRTL Compliance" subparagraph below if applicable.

NRTL Compliance: Fabricate and label central battery equipment to comply with UL 924[**and UL 1778**].

Comply with the IBC, NFPA 70, and NFPA 101.

NEMA PE 1 applies to passive-standby, line-interactive, and double-conversion-type UPSs, including some fast-transfer-type central battery equipment. Some manufacturers advertise their fast-transfer equipment as complying with this standard; however, compliance with NEMA PE 1 is not required for UL 924 compliance. Retain subparagraph below if applicable.

Comply with NEMA PE 1.

* + - * 1. Performance Requirements:

Central battery equipment for emergency lighting is categorized by the speed at which power is restored to the load. Retain subparagraphs below that describe basic type of unit required. HID and some other light sources may not be suitable for emergency lighting systems served with some fast-transfer systems, especially some passive standby units. See Editing Instruction No. 3 in the Evaluations for a discussion of transfer time; consult manufacturers for suitable light sources to use.

Listed manufacturers are neither consistent nor uniform in designating whether their respective fast-transfer units are passive standby or line-interactive type, and transfer times can vary just as inconsistently between types. Consult manufacturers for both type and transfer speed, and retain appropriate options in "Fast-Transfer Central Battery Equipment" subparagraph below to match required functions.

Fast-Transfer Central Battery Equipment: [**Passive standby (off-line)**] [**Line-interactive (on-line)**] system. Automatically sense loss of normal ac supply and use a solid-state static switch to transfer load. Transfer in [**2-4**] [**40-50**] <**Insert values**> ms or less from normal supply to battery-inverter supply.

Automatic Operation:

Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, bypassing inverter, with battery connected in parallel via rectifier/charger output.

Abnormal Supply Conditions: If normal ac supply deviates from specified voltage, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.

If normal power fails, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.

If a fault occurs in system when being supplied by inverter and current flows in excess of the overload rating of inverter, inverter automatically protects itself against damage from overloads and short circuits by shutting down.

When normal ac power is restored at input supply terminals of unit, controls automatically retransfer the load back to the normal ac supply, with a momentary loss of power to the load. Rectifier/charger then recharges battery.

If normal power failure is prolonged (more than 90 minutes), integral low-voltage battery protective circuit disconnects battery and prevents battery from damage due to deep discharge.

If battery becomes discharged, and when normal ac supply is again available, rectifier/charger recharges battery. When battery is fully charged, rectifier/charger automatically shifts to float-charge mode.

If battery is disconnected, and normal ac power is available, central battery equipment continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.

* + - * 1. Unit Operating Requirements:

See "Ratings" Article in the Evaluations on how to indicate central battery equipment ratings. The Section Text defaults to indicating ratings information (e.g., input/output voltage levels, wattages, etc.) on the Drawings or in tables (see "Sample Schedule" Article in the Evaluations); however, for single units, the Section Text can be revised to incorporate this information.

Increases in technology are allowing manufacture of central battery equipment with greater tolerance to system anomalies and better operating performance. Most listed manufacturers offer central battery equipment that tolerates the greater operational variances, or they offer the higher levels of performance included in subparagraphs below. Consult manufacturers if Project system conditions fall outside the selected parameters in first three subparagraphs because corrective actions or additional modifications may be required before central battery equipment can be applied. In "Input AC Voltage Tolerance" subparagraph below, voltage tolerance is more a factor of voltage limitations for industrial control devices (e.g., magnetic contactors) in central battery equipment and not the central battery equipment power converter, which can usually tolerate greater voltage variations.

Input AC Voltage Tolerance: Plus 10 and minus [**15**] <**Insert number**> percent of central battery equipment input voltage rating.

Input Frequency Tolerance: Plus or minus [**3**] [**5**] <**Insert number**> percent of central battery equipment frequency rating.

Synchronizing Slew Rate: [**1**] <**Insert number**> Hz per second, maximum.

For most off-line units, the only losses when operating on normal power (i.e., in standby or bypass mode) are the internal bus impedances, the battery charger operating in float-charge mode, and any line-conditioning equipment (e.g., isolation transformers) provided by some listed manufacturers, to reduce incoming power anomalies. Units with integral transformers or similar equipment, to provide input line power conditioning, may have lower efficiencies than those listed below.

Minimum Off-Line Efficiency: [**95**] [**99**] <**Insert number**> percent at 60 Hz, full load.

Minimum Displacement Primary-Side Power Factor: [**96**] [**98**] <**Insert number**> percent under any load or operating condition.

Central battery equipment is available that is suitable for use under environmental conditions different than those indicated in first four rating subparagraphs below; however, derating or special modifications, or both, may be required. For central battery equipment, where converter, battery charger, and batteries are in the same enclosure or same room, the determining factor for ambient operating and storage temperature ranges normally defaults to those specified for the batteries because they are more restrictive. Coordinate with "Field Conditions" Article, and consult manufacturers for required modifications or derating, or both, to accommodate unusual service conditions. See Editing Instruction No. 6 and "Batteries" and "Equipment Rooms" articles in the Evaluations for additional discussions on this subject.

Ambient Temperature Rating (Other Than Batteries): Not less than 68 deg F and not exceeding 86 deg F.

Ambient Storage Temperature Rating (Other Than Batteries): Not less than minus 4 deg F and not exceeding 158 deg F.

Ambient Temperature Rating (Batteries): Not less than 32 deg F and not exceeding 104 deg F.

Fully charged batteries are normally stored for up to six months at ambient temperatures of not more than 25 deg C; for each 9 deg C rise above 25 deg C, storage time should be reduced by half.

Ambient Storage Temperature Rating (Batteries): Not less than 0 deg F and not exceeding 104 deg F.

Humidity Rating: Less than 95 percent (noncondensing).

Altitude Rating: Not exceeding 3300 feet.

Off-Line Overload Capability: [**1.1**] [**1.5**] times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.

* + - * 1. Inverter and Controls Logic: Microprocessor based, isolated from all power circuits; provides complete self-diagnostics, periodic automatic testing and reporting; with alarms.
				2. Controls and Indication:

Coordinate local control and indication requirements with Owner or end users. Operator stations and status and alarm displays vary considerably among central battery equipment manufacturers. Most of the indications included in "Status Indication" subparagraph below can be and are accomplished by listed manufacturers through digital displays in their panel-mounted operator stations; therefore, some listed manufacturers do not offer LED indicators in larger units. Additionally, some listed manufacturers offer only limited LED indicators and do not offer digital displays for smaller, simpler units.

Status Indication: Door-mounted, labeled LED indicators or digital screen displaying the following conditions:

Normal power available.

Status of system.

Battery charging status.

On battery power.

System fault.

External fault.

<**Insert condition**>.

Retain "Panel-Mounted Operator Station" subparagraph below for all but the smallest units; verify with manufacturers that digital displays are available for unit sizes specified or scheduled on Drawings. Coordinate Project-specific display, alarms, metering, interfaces, and other controls and indication features with manufacturers, because standard and optional features vary considerably among manufacturers.

Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

Keypad: In addition to required programming and control keys, include the following:

Keys for METER, CONTROL, PROGRAM, and CLEAR modes.

Security Access: Provide electronic security access to controls through identification and password with at least two levels of access: View only; and view, operate, and service.

Control Authority: Supports at least three conditions: Off, local manual control at unit and local automatic control at unit.

<**Insert feature**>.

Digital Display: Plain-English language messages on a digital display; provide the following historical logging information and displays:

Real-time clock with current time and date.

Tests and Events Logs: Record and store up to [**25**] [**50**] <**Insert number**> tests and events.

Dates.

Times.

Durations.

Output voltage and currents.

<**Insert event**>.

Alarm Logs: Record and store up to [**25**] [**50**] <**Insert number**> alarms.

Dates.

Times.

Alarm type.

<**Insert event**>.

Metering Functions: Display central battery equipment metering parameters including, but not limited to, the following:

Input and output voltage (V ac) and output current (A ac).

Battery voltage (V dc) and current (A ac).

Fault or alarming status (code).

Power output (VA).

Inverter load (W).

Ambient temperature (deg F).

System run time (cumulative days).

Inverter run time (cumulative minutes).

<**Insert parameter**>.

Alarm Functions: Digital display mounted flush in unit door and connected to display central battery equipment parameters including, but not limited to, the following:

High/low battery charge voltage.

High/low input voltage.

Battery nearing low-voltage condition.

Battery low voltage.

High ambient temperature.

Inverter fault.

Output fault.

Output overload.

<**Insert parameter**>.

<**Insert information or display**>.

Remote Signal Interfaces:

Remote Indication Interface: A minimum of [**one**] <**Insert number**> programmable (Form C) dry-circuit relay output(s) (120-V ac, 2 A) for remote indication of the following:

Fault or status indication.

On bypass.

Low battery.

<**Insert indication**>.

Communications interfaces are not typically available on small units below 500 W; some manufacturers only offer these interfaces as added-cost options. Retain "Communications Interface" subparagraph below if remote programming, monitoring, or both, are required for central battery equipment. Coordinate with manufacturers what is available to suit Project requirements.

Communications Interface: Factory-installed hardware and software to enable a remote PC to program central battery equipment and monitor and display status and alarms.

Communications Ports: [**RS-232**] [**RS-485**] <**Insert port type**>.

Retain "Network Communications Ports" subparagraph below if the Internet or a local network is used to monitor and program central battery equipment.

Network Communications Ports: [**Ethernet**] [**and**] [**RS-232**] [**RS-485**] <**Insert port type**>.

Retain "Compliance with ASHRAE 135" subparagraph below for DDC system for HVAC control network. Revise as required for other network protocols. See "Optional Features and Accessories" Article in the Evaluations for discussion of communication network options.

Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via DDC system for HVAC RS-485 serial networks and Ethernet 10Base-T networks as a native device.

* + - * 1. Self-Protection and Reliability Features:

Coordinate Project-specific self-protection and reliability features with manufacturers, because standard and optional features vary considerably among manufacturers.

Input transient protection by means of surge suppressors to provide protection against damage from supply voltage surges as defined in IEEE C62.45, Category B and C.

Integral, programmable, self-diagnostic and self-test circuitry; with alarms and logging.

Battery deep-discharge and self-discharge protection; with alarms.

Battery self-test circuitry; with alarms and logging.

<**Insert feature**>.

Not all manufacturers offer options in "Integral Input Disconnecting Means and OCPD" paragraph below. Coordinate with manufacturers for available options. Coordinate selection of the disconnecting means and OCPD with short-circuit current (withstand) ratings required for Project. See Editing Instruction No. 7 and "Selecting and Setting Protective Devices" Article in the Evaluations for additional information.

* + - * 1. Integral Input Disconnecting Means and OCPD: [**Thermal-magnetic circuit breaker, complying with UL 489**] [**None**] <**Insert disconnecting means**>.

Retain "Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating" subparagraph below if all central battery equipment on a project requires the same short-circuit current rating. Delete subparagraph if short-circuit ratings vary for individual units, and indicate the ratings on Drawings.

Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating: [**5**] [**10**] [**22**] [**65**] <**Insert value**> kA.

Inverters are used in all central battery equipment, but they vary considerably in type and function between manufacturers. Coordinate with manufacturers for available features and functions, and revise "Inverter" paragraph below to suit Project. See "Power Conversion" Article in the Evaluations for additional information on inverters.

* + - * 1. Inverter:

Description: Solid-state, high-frequency, PWM type, with the following operational features:

Automatically regulate output voltage to within plus or minus [**3**] [**5**] percent, for all load ranges and for maximum 25 percent step-load changes; regulation may increase to [**8**] <**Insert number**> percent for 100 percent step-load changes.

Automatically regulate output frequency to within plus or minus [**1**] <**Insert number**> Hz, from no load to full load, at unity power factor, over the operating range of battery voltage.

See Editing Instruction No. 5 in the Evaluations for additional discussions on TDD levels when using PWM-type inverters.

Output Voltage Waveform: Sine wave with maximum [**3**] [**5**] <**Insert number**> percent TDD throughout battery operating-voltage range, for 100 percent linear load.

Inverter Overload Capability: [**115**] <**Insert number**> percent for 10 minutes; 150 percent surge for [**10**] <**Insert number**> seconds.

Load Power Factor: [**0.5**] <**Insert number**> lead to [**0.5**] <**Insert number**> lag.

Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.

Some manufacturers of single-conversion, fast-transfer units do not provide rectifiers/battery chargers, but rather use the inverter to charge the batteries during normal power operations and to serve the load. Then, the power flow is reversed to serve the load from the batteries during loss of normal power. Coordinate with manufacturers for available features and functions, and revise "Rectifier/Battery Charger" paragraph below to suit Project. See "Power Conversion" Article in the Evaluations for additional information on rectifiers/battery chargers.

* + - * 1. Rectifier/Battery Charger:

Description: Solid state, variable rate, temperature compensated; automatically maintains batteries in fully charged condition when normal power is available.

Listed manufacturers normally offer, as standard, a maximum battery recharge time of 24 hours from maximum discharge to a fully recharged state; however, some manufacturers offer a faster recharge rate as an added-cost option.

Maximum Battery Recharge Time from Fully Discharged State: [**24**] <**Insert number**> hours.

Low-voltage disconnect circuit reduces battery discharge during extended power outages, monitors battery voltage, and disconnects inverter when battery voltage drops to no less than 85.7 percent of nominal voltage.

* + - * 1. Batteries:

Retain one of three options in "Description" subparagraph below. Standard VRLA batteries are the type most frequently offered by manufacturers as a standard, with other types offered only as an added-cost option. Coordinate with "Special Warranty" paragraph in "Warranty" Article. See "Batteries" Article in the Evaluations for a discussion on types of storage batteries.

Description: [**Standard VRLA**] [**Premium VRLA**] [**NiCd, wet-cell**] batteries.

NFPA 70 and NFPA 101 require a minimum of 90 minutes of run time; however, some manufacturers offer longer run times as an added-cost option.

Capable of sustaining full-capacity output of inverter unit for minimum of [**90 minutes**] <**Insert duration**>.

Battery Disconnect and OCPD: Manufacturer's standard.

* + - * 1. Maintenance Bypass Systems:

Maintenance Bypass Mode:

See "Maintenance Bypass Systems" Article in the Evaluations for a discussion on this feature. Retain one of first two subparagraphs below, or retain both if both are required for greater bypass and isolation capabilities for single units or if both are required for separate central battery equipment. Indicate on Drawings where each type is required.

Internal; manual operation only; bypasses central battery equipment power circuits (inverter and static transfer switch); requires local operator selection at central battery equipment. Transfer and retransfer shall be [**make-before-break, without disrupting power to the load or causing system instabilities**] [**break-before-make, with temporary disrupting power to the load**].

External; manual operation only; bypasses central battery equipment completely; requires local operator selection at external switch enclosure remote from central battery equipment. Transfer and retransfer shall be [**make-before-break, without disrupting power to the load or causing system instabilities**] [**break-before-make, with disrupting power to the load**].

Bypass Overload Capability: [**1.5**] <**Insert number**> times the base load current.

* + - * 1. Integral Output Disconnecting Means and OCPD:

Coordinate Project-specific output OCPDs with manufacturers, because standard and optional features vary considerably among manufacturers. Retain subparagraphs below as required to suit Project. For a single unit, with single-output OCPD, "Single-Output OCPD" subparagraph below can be revised to include size and type; or, consider scheduling output OCPDs on Drawings for coordination with feeder and branch circuit wiring sizes. Most authorities having jurisdiction require schedules of loads on branch circuits to be indicated on Drawings. See "Selecting and Setting Protective Devices" Article in the Evaluations for additional information.

Single-Output OCPD: [**As scheduled on Drawings**] [**Fuses**] [**Thermal-magnetic circuit breaker, complying with UL 489**] <**Insert disconnecting means**>; manufacturer's standard ratings based on unit output ratings.

Manufacturers normally offer multiple-output OCPDs as a standard option for other than extremely small unit ratings, with multiple choices of types and features. "Multiple-Output OCPDs" subparagraph below includes those most commonly encountered; retain as required to suit Project.

Multiple-Output OCPDs: Thermal-magnetic circuit breakers, complying with UL 489; voltage rating matching unit output voltage rating; 20 A, single pole.

Normally Closed: [**2**] <**Insert number**>[**; with trip alarm**][**; with time delay**].

Normally Open: [**2**] <**Insert number**>[**; with trip alarm**].

<**Insert output OCPD option**>.

* + - 1. UNINTERRUPTIBLE (UPS-TYPE) CENTRAL BATTERY EQUIPMENT

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=7608) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[ABB, Electrification Products Division](http://www.specagent.com/Lookup?uid=123457165356).

Eaton.

Exide Power Systems Div. ESB Inc.

Or equal.

* + - * 1. General Requirements for Central Battery Equipment:

See Editing Instructions No. 2 and No. 4 and "Industry Standards" Article in the Evaluations for a discussion of testing laboratory listing of central battery equipment. Some authorities having jurisdiction may require specific local approvals (e.g., the New York Department of Buildings). Insert additional or replacement standards or approvals in subparagraphs below.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Besides UL 924, some manufacturers list their "uninterruptable," or UPS-type, central battery equipment to UL 1778; however, not all manufacturers do and compliance with UL 1778 is not required for UL 924 compliance. Coordinate with manufacturers, and retain option in "NRTL Compliance" subparagraph below if applicable.

NRTL Compliance: Fabricate and label central battery equipment to comply with UL 924[**and UL 1778**].

Comply with the IBC, NFPA 70, and NFPA 101.

NEMA PE 1 applies to passive-standby, line-interactive, and double-conversion-type UPSs, including UPS-type central battery equipment; however, not all manufacturers list their equipment to this standard, and compliance with NEMA PE 1 is not required for UL 924 compliance. Retain subparagraph below if applicable.

Comply with NEMA PE 1.

* + - * 1. Performance Requirements for UPS-Type Central Battery Equipment:

Central battery equipment for emergency lighting is categorized by the speed at which power is restored to the load. Retain subparagraphs below that describe basic type of unit required. UPS-type central battery equipment is normally suitable for use with any light source used for emergency lighting, including HID and other light sources not typically suitable for emergency lighting systems served with slow-transfer systems and some fast-transfer systems. See Editing Instruction No. 3 in the Evaluations for a discussion of transfer time.

Type: On-line, double conversion.

Continuously provide uninterrupted ac power to connected emergency electrical lighting system.

Automatic Operation:

Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, through rectifier and inverter, with battery connected in parallel with rectifier output.

Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, battery supplies constant, regulated, inverter ac power output to the load without switching or disturbance.

If normal power fails, battery continues to supply regulated ac power through the inverter to the load without switching or disturbance.

When power is restored at normal supply terminals of system, controls automatically synchronize inverter with the external source before transferring the load. Rectifier then supplies power to the load through the inverter and simultaneously recharges battery.

If battery becomes discharged and normal supply is available, rectifier charges battery. When battery is fully charged, rectifier automatically shifts to float-charge mode.

If any element in the rectifier/inverter string fails and power is available at normal supply terminals of system, static transfer switch transfers the load to normal ac supply circuit without disturbance or interruption of supply.

If a fault occurs in system supplied by the inverter output, and current flows in excess of the overload rating of the inverter, static transfer switch operates to bypass fault current to normal ac supply circuit for fault clearing.

When fault has cleared, static transfer switch returns the load to inverter output.

If battery is disconnected, inverter continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.

Manual Operation:

Revise functional descriptions in first two subparagraphs below to suit Project.

Turning inverter off causes static transfer switch to transfer the load directly to normal ac supply circuit without disturbance or interruption.

Turning inverter on causes static transfer switch to transfer the load to inverter.

Noise levels are not usually an issue with off-line units and may only be an issue with larger UPS-type equipment. Insert noise values in "Maximum Acoustical Noise" subparagraph below that are consistent with rated capacity of UPS units specified in this Section. See Editing Instruction No. 8 in the Evaluations for additional information on audible noise and for the Nominal Overall UPS Audible Noise Ratings Table.

Maximum Acoustical Noise: <**Insert value**> dB, "A" weighting, emanating from any UPS component under any condition of normal operation, measured [**39 inches**] <**Insert dimension**> from nearest surface of component enclosure.

* + - * 1. Unit Operating Requirements:

See "Ratings" Article in the Evaluations on how to indicate central battery equipment ratings. The Section Text defaults to indicating ratings information (e.g., input/output voltage levels, wattages, etc.) on the Drawings or in tables (see "Sample Schedule" Article in the Evaluations); however, for single units, the Section Text can be revised to incorporate this information.

Increases in technology are allowing manufacture of central battery equipment with greater tolerance to system anomalies and better operating performance. Most listed manufacturers offer central battery equipment that tolerates the greater operational variances, or they offer the higher levels of performance included in subparagraphs below. Consult manufacturers if Project system conditions fall outside the selected parameters in first three subparagraphs because corrective actions or additional modifications may be required before central battery equipment can be applied. In "Input AC Voltage Tolerance" subparagraph below, voltage tolerance is more a factor of voltage limitations for industrial control devices (e.g., magnetic contactors) in central battery equipment and not the central battery equipment power converter, which can usually tolerate greater voltage variations.

Input AC Voltage Tolerance: Plus 10 and minus [**15**] <**Insert number**> percent of central battery equipment input voltage rating.

Input Frequency Tolerance: Plus or minus [**3**] [**5**] <**Insert number**> percent of central battery equipment frequency rating.

Synchronizing Slew Rate: [**1**] <**Insert number**> Hz per second, maximum.

Units with integral transformers or similar equipment, to provide input line power conditioning, may have lower efficiencies than those listed below; consult manufacturers for values to use if additional line conditioning is applied.

Minimum Off-Line Efficiency: [**95**] [**99**] <**Insert number**> percent at 60 Hz, full load.

Minimum Displacement Primary-Side Power Factor: [**96**] [**98**] <**Insert number**> percent under any load or operating condition.

Central battery equipment is available that is suitable for use under environmental conditions different than those indicated in first four rating subparagraphs below; however, derating or special modifications, or both, may be required. For central battery equipment, where converter, battery charger, and batteries are in the same enclosure or same room, the determining factor for ambient operating and storage temperature ranges normally defaults to those specified for the batteries because they are more restrictive. Coordinate with "Field Conditions" Article, and consult manufacturers for required modifications or derating, or both, to accommodate unusual service conditions. See Editing Instruction No. 6 and "Batteries" and "Equipment Rooms" articles in the Evaluations for additional discussions on this subject.

Ambient Temperature Rating (Other Than Batteries): Not less than 68 deg F and not exceeding 86 deg F.

Ambient Storage Temperature Rating (Other Than Batteries): Not less than minus 4 deg F and not exceeding 158 deg F.

Ambient Temperature Rating (Batteries): Not less than 32 deg F and not exceeding 104 deg F.

Fully charged batteries are normally stored for up to six months at ambient temperatures of not more than 25 deg C; for each 9 deg C rise above 25 deg C, storage time should be reduced by half.

Ambient Storage Temperature Rating (Batteries): Not less than 0 deg F and not exceeding 104 deg F.

Humidity Rating: Less than 95 percent (noncondensing).

Altitude Rating: Not exceeding 3300 feet.

Off-Line Overload Capability: [**1.1**] [**1.5**] times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.

* + - * 1. Inverter and Controls Logic: Microprocessor based, isolated from all power circuits; provides complete self-diagnostics, periodic automatic testing and reporting; with alarms.
				2. Controls and Indication:

Coordinate local control and indication requirements with Owner or end users. Operator stations and status and alarm displays vary considerably among central battery equipment manufacturers. Most of the indications included in "Status Indication" subparagraph below can be and are accomplished by listed manufacturers through digital displays in their panel-mounted operator stations; therefore, some listed manufacturers do not offer LED indicators in larger units. Additionally, some listed manufacturers offer only limited LED indicators and do not offer digital displays for smaller, simpler units.

Status Indication: Door-mounted, labeled LED indicators or digital screen displaying the following conditions:

Normal power available.

Status of system.

Battery charging status.

On battery power.

System fault.

External fault.

<**Insert condition**>.

Retain "Panel-Mounted Operator Station" subparagraph below for all but the smallest units; verify with manufacturers that digital displays are available for unit sizes specified or scheduled on Drawings. Coordinate Project-specific display, alarms, metering, interfaces, and other controls and indication features with manufacturers, because standard and optional features vary considerably among manufacturers.

Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

Keypad: In addition to required programming and control keys, include the following:

Keys for METER, CONTROL, PROGRAM, and CLEAR modes.

Security Access: Provide electronic security access to controls through identification and password with at least two levels of access: View only; and view, operate, and service.

Control Authority: Supports at least three conditions: Off, local manual control at unit and local automatic control at unit.

<**Insert feature**>.

Digital Display: Plain-English language messages on a digital display; provide the following historical logging information and displays:

Real-time clock with current time and date.

Tests and Events Logs: Record and store up to [**25**] [**50**] <**Insert number**> tests and events:

Dates.

Times.

Durations.

Output voltage and currents.

<**Insert event**>.

Alarm Logs: Record and store up to [**25**] [**50**] <**Insert number**> alarms:

Dates.

Times.

Alarm type.

<**Insert event**>.

Metering Functions: Display central battery equipment metering parameters including, but not limited to, the following:

Input and output voltage (V ac) and output current (A ac).

Battery voltage (V dc) and current (A ac).

Fault or alarming status (code).

Power output (VA).

Inverter load (W).

Ambient temperature (deg F).

System run time (cumulative days).

Inverter run time (cumulative minutes).

<**Insert parameter**>.

Alarm Functions: Digital display mounted flush in unit door and connected to display central battery equipment parameters including, but not limited to, the following:

High/low battery charge voltage.

High/low input voltage.

Battery nearing low-voltage condition.

Battery low voltage.

High ambient temperature.

Inverter fault.

Output fault.

Output overload.

<**Insert parameter**>.

<**Insert information or display**>.

Remote Signal Interfaces:

Remote Indication Interface: A minimum of [**one**] <**Insert number**> programmable (Form C) dry-circuit relay output(s) (120-V ac, 2 A) for remote indication of the following:

Fault or status indication.

On bypass.

Low battery.

<**Insert indication**>.

Communications interfaces are not typically available on small units below 500 W; some manufacturers only offer these interfaces as added-cost options, and some only offer limited monitoring without programming capabilities. Retain "Communications Interface" subparagraph below if remote programming, monitoring, or both, are required for central battery equipment. Coordinate with manufacturers what is available to suit Project requirements.

Communications Interface: Factory-installed hardware and software to enable a remote PC to monitor and display status and alarms[**and to program central battery equipment**].

Communications Ports: [**RS-232**] [**RS-485**] <**Insert port type**>.

Retain "Network Communications Ports" subparagraph below if the Internet or a local network is used to monitor and program central battery equipment.

Network Communications Ports: [**Ethernet**] [**and**] [**RS-232**] [**RS-485**] <**Insert port type**>.

Retain "Compliance with ASHRAE 135" subparagraph below for DDC system for HVAC control network. Revise as required for other network protocols. See "Optional Features and Accessories" article in the Evaluations for discussion of communication network options.

Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via DDC system for HVAC RS-485 serial networks and Ethernet 10Base-T networks as a native device.

* + - * 1. Self-Protection and Reliability Features:

Coordinate Project-specific self-protection and reliability features with manufacturers, because standard and optional features vary considerably among manufacturers.

Input transient protection by means of surge suppressors to provide protection against damage from supply voltage surges as defined in IEEE C62.45, Category B and C.

Integral, programmable, self-diagnostic and self-test circuitry; with alarms and logging.

Battery deep-discharge and self-discharge protection; with alarms.

Battery self-test circuitry; with alarms and logging.

<**Insert feature**>.

Not all manufacturers offer options in "Integral Input Disconnecting Means and OCPD" paragraph below. Coordinate with manufacturers for available options. Coordinate selection of the disconnecting means and OCPD with short-circuit current (withstand) ratings required for Project. See Editing Instruction No. 7 and "Selecting and Setting Protective Devices" Article in the Evaluations for additional information.

* + - * 1. Integral Input Disconnecting Means and OCPD: [**Thermal-magnetic circuit breaker, complying with UL 489**] [**None**] <**Insert disconnecting means**>.

Retain "Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating" subparagraph below if all central battery equipment on a project requires the same short-circuit current rating. Delete subparagraph if short-circuit ratings vary for individual units, and indicate the ratings on Drawings.

Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating: [**5**] [**10**] [**22**] [**65**] <**Insert value**> kA.

The rectifiers in many double-conversion, UPS-type units are used to charge and protect the batteries as well as to feed direct-current (dc) voltage to the inverters; however, some manufacturers advertise separate chargers with their double-conversion units. Coordinate with manufacturers for available features and functions, and revise "Rectifier" paragraph below to suit Project. See "Power Conversion" Article in the Evaluations for additional information on rectifiers.

* + - * 1. Rectifier:

Description: Solid state, with the following operational features:

Automatically convert incoming ac voltage to regulated dc bus voltage, with less than [**2**] <**Insert number**> percent rms ripple voltage with inverter fully loaded and batteries disconnected.

Rectified Efficiency: Not less than [**97**] <**Insert number**> percent.

Retain first subparagraph below if Project includes a standby generator to back up the facility normal power system, the central battery system is served from the backed up system, the central battery system constitutes a large percentage of the total load on the generator, and the effects of harmonic distortion on the generator's operation is a concern. Coordinate with "Line Conditioning and Filtering" paragraph.

Generator compatible.

<**Insert feature**>.

Inverters are used in all central battery equipment, but they vary considerably in type and function between manufacturers. Coordinate with manufacturers for available features and functions, and revise "Inverter" paragraph below to suit Project. See "Power Conversion" Article in the Evaluations for additional information on inverters.

* + - * 1. Inverter:

Description: Solid-state, high-frequency, PWM type, with the following operational features:

Automatically regulate output voltage to within plus or minus [**3**] [**5**] percent, for all load ranges and for maximum 25 percent step-load changes; regulation may increase to [**8**] <**Insert number**> percent for 100 percent step-load changes, with recovery within [**3**] <**Insert number**> cycles.

Automatically regulate output frequency to within plus or minus [**0.05**] <**Insert number**> Hz, from no load to full load, at unity power factor, over the operating range of battery voltage.

See Editing Instruction No. 5 in the Evaluations for additional discussions on TDD levels when using PWM-type inverters.

Inverter Overload Capability: [**115**] <**Insert number**> percent for 10 minutes; 150 percent surge for [**10**] <**Insert number**> seconds.

Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.

Load Power Factor: [**0.5**] <**Insert number**> lead to [**0.5**] <**Insert number**> lag.

<**Insert feature**>.

Some listed manufacturers of double-conversion units provide a separate battery charger in addition to the rectifier to charge the batteries. "Battery Charger" paragraph below may be revised to further define the battery charging functions and protection if a separate charger is used for battery charging. Coordinate with manufacturers for available features and functions, and revise below to suit Project. See "Power Conversion" Article in the Evaluations for additional information on battery chargers.

* + - * 1. Battery Charger:

Description: Solid state, variable rate, temperature compensated; automatically maintains batteries in fully charged condition when normal power is available.

Listed manufacturers normally offer, as standard, a maximum battery recharge time of 24 hours from maximum discharge to a fully recharged state; however, some manufacturers offer a faster recharge rate as an added-cost option.

Maximum Battery Recharge Time from Fully Discharged State: [**24**] <**Insert number**> hours.

Low-voltage disconnect circuit reduces battery discharge during extended power outages, monitors battery voltage, and disconnects inverter when battery voltage drops to no less than 85.7 percent of nominal voltage.

* + - * 1. Batteries:

Retain one of three options in "Description" subparagraph below. Standard VRLA batteries are the type most frequently offered by manufacturers as a standard, with other types offered only as an added-cost option. Coordinate with "Special Warranty" paragraph in "Warranty" Article. See "Batteries" Article in the Evaluations for a discussion on types of storage batteries.

Description: [**Standard VRLA**] [**Premium VRLA**] [**NiCd, wet-cell**] batteries.

The IBC, NFPA 70, and NFPA 101 require a minimum of 90 minutes of run time; however, some manufacturers offer longer run times as an added-cost option.

Capable of sustaining full-capacity output of inverter unit for minimum of [**90 minutes**] <**Insert duration**>.

Battery Disconnect and OCPD: Manufacturer's standard.

* + - * 1. Line Conditioning and Filtering:

Input Line Conditioning:

If input current distortion due to harmonic generation in central battery equipment is a concern, consult manufacturers for options available to mitigate harmonic distortion (Note: This issue is normally only a concern when specifying large, on-line, double-conversion units). Options may include dc bus link reactors, isolation transformers, active and passive harmonic filters, and 12- or 18-pulse phase-shifting input transformers. Retain first or second subparagraph below if retaining "Harmonic Analysis Study and Report" paragraph in "Informational Submittals" Article, if a specific method of mitigation is not important, and if manufacturer is delegated responsibility to incorporate whatever mitigating means are necessary to comply with specified limitations. Otherwise, retain third subparagraph and insert specific requirements. See "Harmonic Distortion" Article in the Evaluations for additional guidance.

Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD at input terminals of [**all**] [**indicated**] central battery equipment to less than [**5**] [**10**] <**Insert number**> percent and THD(V) to [**3**] [**5**] <**Insert number**> percent.

Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD and THD(V) at the defined point of common coupling per [**IEEE 519**] <**Insert standard**>.

<**Insert requirements**>.

Output Voltage Waveform:

Retain first subparagraph below if a specific level is important, and if manufacturer is delegated responsibility to incorporate whatever means are necessary to comply with specified limitations. Otherwise, retain second subparagraph and insert specific requirements.

Sine wave with maximum [**3**] [**5**] <**Insert number**> percent TDD throughout battery operating-voltage range, for 100 percent linear load.

<**Insert requirements**>.

* + - * 1. Maintenance Bypass Systems:

Maintenance Bypass Mode:

See "Maintenance Bypass Systems" Article in the Evaluations for a discussion on this feature. Retain one of first two subparagraphs below, or retain both if both are required for greater bypass and isolation capabilities for single units or if both are required for separate central battery equipment. Indicate on Drawings where each type is required.

Internal; manual operation only; bypasses central battery equipment power circuits (inverter and static transfer switch); requires local operator selection at central battery equipment. Transfer and retransfer shall be [**make-before-break, without disrupting power to the load or causing system instabilities**] [**break-before-make, with temporary disrupting power to the load**].

External; manual operation only; bypasses central battery equipment completely; requires local operator selection at external switch enclosure remote from central battery equipment. Transfer and retransfer shall be [**make-before-break, without disrupting power to the load or causing system instabilities**] [**break-before-make, with disrupting power to the load**].

Bypass Overload Capability: [**1.5**] <**Insert number**> times the base load current.

* + - * 1. Integral Output Disconnecting Means and OCPD:

Coordinate Project-specific output OCPDs with manufacturers, because standard and optional features vary considerably among manufacturers. Retain subparagraphs below as required to suit Project. For a single unit, with single-output OCPD, "Single-Output OCPD" subparagraph below can be revised to include size and type; or, consider scheduling output OCPDs on Drawings for coordination with feeder and branch circuit wiring sizes. Most authorities having jurisdiction require schedules of loads on branch circuits to be indicated on Drawings. See "Selecting and Setting Protective Devices" Article in the Evaluations for additional information.

Single-Output OCPD: [**As scheduled on Drawings**] [**Fuses**] [**Thermal-magnetic circuit breaker, complying with UL 489**] <**Insert disconnecting means**>; manufacturer's standard ratings based on unit output ratings.

Manufacturers normally offer multiple-output OCPDs as a standard option for other than extremely small unit ratings, with multiple choices of types and features. "Multiple-Output OCPDs" subparagraph below includes those most commonly encountered; retain as required to suit Project.

Multiple-Output OCPDs: Thermal-magnetic circuit breakers, complying with UL 489; voltage rating matching unit output voltage rating; 20 A, single pole.

Normally Closed: [**2**] <**Insert number**>[**; with trip alarm**][**; with time delay**].

Normally Open: [**2**] <**Insert number**>[**; with trip alarm**].

<**Insert output OCPD option**>.

* + - 1. ENCLOSURES

See "Enclosures" Article in the Evaluations for a discussion of enclosure types. Coordinate "Central Battery Equipment Enclosures" paragraph below with Drawings by identifying the designated areas on plans or by including the required enclosure types. Enclosure materials and finishes may be added to the Section Text. Availability of some enclosure types is limited by type and rating of units; special accommodations and accessories (e.g., powered/filtered ventilation) may be required for some enclosure types. Consult manufacturers for availability of, and limitations on, enclosures other than NEMA 250, Type 1, and for enclosures requiring more than just front access for maintenance. Central battery equipment is not usually available in explosion-proof enclosures; however, some manufacturers advertise that such enclosures are available by special order.

Central battery inverters are available in multiple cabinets. Large units may use more than one cabinet to house batteries, electronics, and output equipment.

* + - * 1. Central Battery Equipment Enclosures: NEMA 250, to comply with environmental conditions at installed location.

Dry and Clean Indoor Locations: [**Type 1**] <**Insert type**> steel cabinets with access to components through hinged doors with flush tumbler lock and latch.

Finish: [**Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment**] <**Insert finish**>.

* + - 1. OPTIONAL AND ACCESSORY FEATURES

Optional and accessory feature types and quantities vary considerably among central battery equipment manufacturers, and may be very limited for small and lower-cost units. Consult manufacturers for availability and limitations. Features vary according to central battery equipment and luminaire characteristics and operating criteria. Retain applicable features in this article; insert others to suit Project. Indicate requirements for and quantities of optional features on Drawings if not included here. These features are normally added-cost items. See "Optional and Accessory Features" Article in the Evaluations for additional guidance, and consult manufacturers for availability of, and limitations on, other options and accessories.

* + - * 1. Factory-Installed Options and Accessories:

Multiple-Output Voltages: Supply unit branch circuits at different voltage levels if required. Transform voltages internally as required to produce indicated output voltages.

Split-Output Configuration: Divides output into normally on and normally off buses.

Auto-dialer.

Internal fax modem.

Audible alarm with silencer switch.

Retain "Remote Summary Alarm Panel" subparagraph below if optional system alarm monitoring by remote monitoring panel is required.

Remote Summary Alarm Panel: Labeled LEDs on panel faceplate shall indicate [**five**] <**Insert number**> basic status conditions. Audible signal indicates alarm conditions; silencing switch in face of panel silences signal without altering visual indication.

Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.

Maximum Distance from Main Unit: [**1000 feet**] <**Insert dimension**>.

Retain "Remote Meter Panel" subparagraph if system monitoring and control by a remote monitoring panel is required.

Remote Meter Panel: Match equipment requirements of remote monitoring, controlling, and programming of central battery equipment.

Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.

Maximum Distance from Main Unit: [**150 feet**] <**Insert dimension**>.

<**Insert option or accessory**>.

* + - 1. SOURCE QUALITY CONTROL

Retain "Testing Agency" paragraph below if required. Independent certification may be acceptable to authorities having jurisdiction without further monitoring of plant's quality-control and testing program by Owner.

* + - * 1. Testing Agency: [**Director’s Representative will engage**] [**Engage**] a qualified testing agency to evaluate central battery equipment fabricator's quality-control and testing methods.

Retain " and UL 1778" options in "Testing" and "Factory Tests" paragraphs below if retaining UL 1778 option in "NRTL Compliance" subparagraph in "Uninterruptible (UPS-Type) Central Battery Equipment" Article; however, UL 1778 is not required to comply with UL 924.

* + - * 1. Testing: Test and inspect central battery equipment according to UL 924[**and UL 1778**].

Retain "Factory Tests" paragraph below for factory-assembled central battery equipment. Factory tests are an added-cost option and may not be available from some manufacturers. Verify requirement with Owner.

See the reference standards listed in the Evaluations for other standards that are appropriate for Project.

* + - * 1. Factory Tests: Test and inspect assembled central battery equipment[**, by a qualified testing agency,**] according to UL 924[**and UL 1778**] <**Insert standards organization**>. Affix standards organization's label. Include the following:

Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.

Full-load test.

Transient-load response test.

Overload test.

Power failure test.

* + - * 1. Central battery equipment will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
1. EXECUTION
	* + 1. EXAMINATION

NECA 411 is a standard for receiving, storing, and installing UPSs. Retain first paragraph below if retaining "Uninterruptible (UPS-Type) Central Battery Equipment" Article.

* + - * 1. Receive, inspect, handle, and store central battery equipment according to NECA 411.

Large central battery equipment is very heavy, due primarily to the weight of batteries, and proper operation and longevity of this equipment usually depends on its environmental conditions. For additional information, see "Installation Considerations," "Equipment Rooms," and "Structural Considerations" articles in the Evaluations.

* + - * 1. Examine areas, surfaces, and substrates to receive central battery equipment, with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, <**Insert Project-specific conditions,**> and other conditions affecting performance of the Work.

Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.

* + - * 1. Examine equipment before installation. Reject equipment that is wet, moisture damaged, or mold damaged.
				2. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
				3. Proceed with installation only after unsatisfactory conditions have been corrected.

Retain "Harmonic Analysis Study" Article below if retaining "Harmonic Analysis Study and Report" paragraph in "Informational Submittals" Article.

* + - 1. HARMONIC ANALYSIS STUDY
				1. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze [**possible**] [**designated**] operating scenarios, including recommendations for central battery equipment input filtering to limit TDD and THD(V) to specified levels.
				2. Prepare a harmonic analysis study and report complying with IEEE 399 and with NETA Acceptance Testing Specification.
			2. INSTALLATION
				1. Coordinate layout and installation of central battery equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

NECA 411 is a standard for receiving, storing, and installing UPSs. Retain first paragraph below if retaining "Uninterruptible (UPS-Type) Central Battery Equipment" Article.

* + - * 1. Install central battery equipment and accessories according to NECA 411.
				2. Wall-Mounted Central Battery Equipment: Install central battery equipment on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.

Retain "Suspended-Mounted Central Battery Equipment" paragraph below for small central battery equipment supported from ceilings.

* + - * 1. Suspended-Mounted Central Battery Equipment: Suspend central battery equipment from structural ceiling components using hangers, clamps, and associated fittings, designed for types and sizes of units to be supported.

Retain "Floor-Mounted Central Battery Equipment" paragraph below for equipment supported on slabs-on-grade. If installing units on concrete bases, ensure that their disconnect operating handles are not higher than 79 inches above finished floor.

* + - * 1. Floor-Mounted Central Battery Equipment: Install central battery equipment on 4-inch nominal-thickness concrete base.

Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

Retain "Seismic Bracing" paragraph below if seismic controls are Project requirement. Coordinate with Drawings and Sections specifying vibration and seismic controls.

* + - * 1. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
				2. Comply with NECA 1.
				3. Wiring Methods:

Retain one of first three subparagraphs below.

Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters.

Install cables in raceways and cable trays except within consoles, cabinets, desks, counters, accessible ceiling spaces, and gypsum board partitions where unenclosed wiring method may be used.

Install conductors and cables concealed in accessible ceilings, walls, and floors where possible.

Conceal raceway and cables except in unfinished spaces.

Provide plenum-rated cable, where installed exposed or in open cable tray, within environmental airspaces, including plenum ceilings.

* + - * 1. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
			1. CONNECTIONS
				1. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams unless otherwise indicated.
				2. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.
			2. INSTALLATION OF CONTROL WIRING

Retain this article if applicable or if remote control or indication is required.

* + - * 1. Install wiring between central battery equipment and remote devices[**and facility's central-control system**].
				2. Bundle, train, and support wiring in enclosures.
			1. IDENTIFICATION
				1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
				2. Label central battery equipment with engraved nameplates.
				3. Label each separate cabinet, for multicabinet units.
				4. Label each enclosure-mounted control and pilot device.

If specific operational procedures are required in emergency situations, specify below. Show specific information to be included in framed instructions on Drawings; retain "Operating Instructions" paragraph below if required.

* + - * 1. Operating Instructions: Frame printed operating instructions for central battery equipment, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of central battery equipment units.
			1. FIELD QUALITY CONTROL

See Editing Instruction No. 10 in the Evaluations for guidance on the level of field quality control that is appropriate for Project. Retain "Testing Agency," "Manufacturer's Field Service," and "Perform tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" paragraph, or if retaining "Manufacturer's Field Service" or "Perform tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

* + - * 1. Testing Agency: [**Director’s Representative will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections. Due to the complexity of central battery equipment, it is advisable to require manufacturer's services for installations other than simple systems.

* + - * 1. Manufacturer's Field Service: Engage a Company Service Advisor to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform tests and inspections.

Retain "Acceptance Testing Preparation" and "Tests and Inspections" paragraphs below to describe tests and inspections to be performed.

* + - * 1. Acceptance Testing Preparation:

Inspect and Test Each Component:

Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.

Test insulation resistance for all external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.

Test continuity of each circuit.

* + - * 1. Tests and Inspections:

Inspect central battery equipment, wiring, components, connections, and equipment installation.[**Test and adjust components and equipment.**]

Test insulation resistance for all external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.

Test continuity of each circuit.

In first subparagraph below, the voltage variation is a functional issue. Where ASHRAE/IES 90.1 is Project's applicable energy code, further restrictions in voltage drop are required.

Verify that input voltages and frequencies at central battery equipment locations are within voltage and frequency limits specified in Part 2. If outside this range, notify [**Architect**] [**Construction Manager**] [**Director’s Representative**] before closing input OCPDs.

See Editing Instruction No. 9 in the Evaluations. Although NETA Acceptance Testing Specification does not specifically apply to central battery equipment for emergency lighting, its requirements for UPS equipment make it suitable and adaptable for use with this equipment.

Perform each visual and mechanical inspection and electrical test stated in manufacturer's written instructions and in NETA Acceptance Testing Specification, including specifically those for batteries, battery chargers, and UPS, regardless of the type of central battery equipment provided. Certify compliance with test parameters.

Perform a load-duration test at rated voltage and rated output current to verify the correct functional operation of the unit under full-load stable operating conditions for the minimum time limits required by UL 924. Monitor and record ambient temperature and temperatures within the unit.

Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

NETA Acceptance Testing Specification allows three methods to test and inspect bolted electrical connections for high resistance; the infrared (thermographic) method is the most thorough and costly. Retain first subparagraph below if this method is preferred.

Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of central battery equipment. Remove front panels so joints and connections are accessible to portable scanner.

Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of central battery equipment 11 months after date of Substantial Completion.

Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

* + - * 1. Central battery equipment will be considered defective if it does not pass tests and inspections.

Retain paragraph below if tests and inspections are performed by Contractor or manufacturer's field-service representative engaged by Contractor.

* + - * 1. Prepare test and inspection reports, including a certified report that identifies central battery equipment and describes all test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
			1. STARTUP SERVICE
				1. [**Engage a Company Service Advisor** **to perform**] [**Perform**] startup service.

Complete installation and startup checks according to manufacturer's written instructions.

<**Insert startup steps if any**>.

* + - 1. ADJUSTING

Retain applicable paragraphs below to correspond to selections made in Part 2.

* + - * 1. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

First two paragraphs below pertain primarily to central battery equipment with bypass systems. Retain if retaining "Maintenance Bypass Systems" Article.

* + - * 1. Set field-adjustable switches, auxiliary relays, and other adjustable parts.
				2. Adjust the trip settings of thermal-magnetic circuit breakers with adjustable, instantaneous-trip elements; install fuses if not factory installed.
				3. Set the automatic system test parameters.

Retain option in paragraph below unless settings are included on Drawings.

* + - 1. PROTECTION
				1. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
				2. Replace central battery equipment whose interiors have been exposed to water or other liquids prior to Substantial Completion.
			2. DEMONSTRATION
				1. [**Engage a Company Service Advisor** **to train**] [**Train**] Director’s Representative maintenance personnel to adjust, operate, and maintain central battery equipment, and to use and reprogram microprocessor-based control, monitoring, and display functions.

END OF SECTION 263323.11