

2.5.2 Class 1E Uninterruptible Power Supply

Design Description

1.0 System Description

The Class 1E uninterruptible power supply (EUPS) system provides Class 1E power to safety-related, dc loads, and uninterruptible ac power to safety-related and select non-safety-related loads during normal and abnormal operations.

2.0 Arrangement

2.1 The functional arrangement of EUPS is as described in the Design Description of Section 2.5.2, Tables 2.5.2-1—Class 1E Uninterruptible Power Supply System Electrical Equipment Location and 2.5.2-2—Class 1E Uninterruptible Power Supply Electrical Equipment Design, and as shown in Figure 2.5.2-1—Class 1E Uninterruptible Power Supply System Functional Arrangement.

2.2 Deleted.

2.3 Deleted.

2.4 Deleted.

3.0 Mechanical Design Features

3.1 Equipment listed as Class 1E in Table 2.5.2-2 are qualified as Seismic Category I and can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays, and Controls

4.1 Displays listed in Table 2.5.2-2 are indicated on the PICS operator workstations in the main control room (MCR) and the remote shutdown station (RSS).

5.0 Electrical Design Features

5.1 Physical separation exists between Class 1E EUPS equipment listed in Table 2.5. 2-2 and non-Class 1E equipment.

5.2 Non-safety-related loads connected to the EUPS are electrically isolated from the EUPS by an isolation device.

5.3 Without an alternate feed installed, independence is maintained between the EUPS divisions.

5.4 With the alternate feed installed from EPSS division 1 to division 2, independence is maintained between the load group created by EUPS divisions 1 and 2, and the load group created by divisions 3 and 4. EUPS divisions 3 and 4 are independent of each other.

- 5.5 With the alternate feed installed from EPSS division 2 to division 1; independence is maintained between the load group created by EUPS divisions 1 and 2, and the load group created by divisions 3 and 4. EUPS divisions 3 and 4 are independent of each other.
- 5.6 With the alternate feed installed from EPSS division 3 to division 4; independence is maintained between the load group created by EUPS divisions 3 and 4, and the load group created by divisions 1 and 2. EUPS divisions 1 and 2 are independent of each other.
- 5.7 With the alternate feed installed from EPSS division 4 to division 3; independence is maintained between the load group created by EUPS divisions 3 and 4, and the load group created by divisions 1 and 2. EUPS divisions 1 and 2 are independent of each other.
- 5.8 Deleted.
- 5.9 Deleted.
- 5.10 EUPS switchboards, MCCs, transformers, panelboards, and converters, listed in Table 2.5.2-2, and their feeder and load breakers are sized to supply their load requirements.
- 5.11 EUPS cables and buses are sized to supply their assigned load requirements.
- 5.12 Each EUPS battery is able to provide power for starting and operating design loads for a minimum of two hours when the ac supply to the battery charger is lost.
- 5.13 Each EUPS battery charger supplies assigned EUPS loads while maintaining the respective EUPS battery charged.
- 5.14 The EUPS inverters are sized to power the design EUPS loads on the respective supplied MCC.
- 5.15 EUPS operating voltage remains within the terminal voltage range of the supplied safety-related equipment during the battery duty cycle.
- 5.16 EUPS switchboards, MCCs, transformers and panelboards listed in Table 2.5.2-2 are rated to withstand fault currents for the time required to clear the fault from its power source.
- 5.17 The feeder and load circuit breakers for EUPS switchboards, MCCs and panelboards are rated to interrupt fault currents.
- 5.18 EUPS interrupting devices (e.g., circuit breakers and fuses) are coordinated so that the circuit interrupting device closest to the fault opens before other devices.
- 5.19 Harmonic distortion does not prevent Class 1E buses from performing safety functions.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.5.2-3 lists the EUPS ITAAC.

Table 2.5.2-1—EUPS Electrical Equipment Location
Sheet 1 of 2

Description	Tag Number ⁽¹⁾	Location
Battery Charger	31BTP01	Division 1 Safeguard Building
Battery Charger	31BTP02	Division 1 Safeguard Building
Battery Charger	32BTP01	Division 2 Safeguard Building
Battery Charger	32BTP02	Division 2 Safeguard Building
Battery Charger	33BTP01	Division 3 Safeguard Building
Battery Charger	33BTP02	Division 3 Safeguard Building
Battery Charger	34BTP01	Division 4 Safeguard Building
Battery Charger	34BTP02	Division 4 Safeguard Building
Battery	31BTD01	Division 1 Safeguard Building
Battery	32BTD01	Division 2 Safeguard Building
Battery	33BTD01	Division 3 Safeguard Building
Battery	34BTD01	Division 4 Safeguard Building
Inverter	31BRU01	Division 1 Safeguard Building
Inverter	32BRU01	Division 2 Safeguard Building
Inverter	33BRU01	Division 3 Safeguard Building
Inverter	34BRU01	Division 4 Safeguard Building
Switchboard	31BUC	Division 1 Safeguard Building
Switchboard	32BUC	Division 2 Safeguard Building
Switchboard	33BUC	Division 3 Safeguard Building
Switchboard	34BUC	Division 4 Safeguard Building
Motor Control Center	31BRA	Division 1 Safeguard Building
Motor Control Center	32BRA	Division 2 Safeguard Building
Motor Control Center	33BRA	Division 3 Safeguard Building
Motor Control Center	34BRA	Division 4 Safeguard Building
Transformer	31BGT01	Division 1 Safeguard Building
Transformer	32BGT01	Division 2 Safeguard Building
Transformer	33BGT01	Division 3 Safeguard Building
Transformer	34BGT01	Division 4 Safeguard Building
120 Vac Panelboard	31BGA01	Division 1 Safeguard Building
120 Vac Panelboard	32BGA01	Division 2 Safeguard Building
120 Vac Panelboard	33BGA01	Division 3 Safeguard Building
120 Vac Panelboard	34BGA01	Division 4 Safeguard Building

Table 2.5.2-1—EUPS Electrical Equipment Location
Sheet 2 of 2

Description	Tag Number⁽¹⁾	Location
AC/DC Converter	31BRW10	Division 1 Safeguard Building
DC/DC Converter	31BUW11	Division 1 Safeguard Building
AC/DC Converter	31BRW12	Division 1 Safeguard Building
DC/DC Converter	31BUW13	Division 1 Safeguard Building
AC/DC Converter	31BRW16	Division 1 Diesel Building
DC/DC Converter	31BUW16	Division 1 Diesel Building
AC/DC Converter	32BRW30	Division 2 Safeguard Building
DC/DC Converter	32BUW31	Division 2 Safeguard Building
AC/DC Converter	32BRW32	Division 2 Safeguard Building
DC/DC Converter	32BUW33	Division 2 Safeguard Building
AC/DC Converter	32BRW36	Division 2 Diesel Building
DC/DC Converter	32BUW36	Division 2 Diesel Building
AC/DC Converter	33BRW50	Division 3 Safeguard Building
DC/DC Converter	33BUW51	Division 3 Safeguard Building
AC/DC Converter	33BRW52	Division 3 Safeguard Building
DC/DC Converter	33BUW53	Division 3 Safeguard Building
AC/DC Converter	33BRW56	Division 3 Diesel Building
DC/DC Converter	33BUW56	Division 3 Diesel Building
AC/DC Converter	34BRW70	Division 4 Safeguard Building
DC/DC Converter	34BUW71	Division 4 Safeguard Building
AC/DC Converter	34BRW72	Division 4 Safeguard Building
DC/DC Converter	34BUW73	Division 4 Safeguard Building
AC/DC Converter	34BRW76	Division 4 Diesel Building
DC/DC Converter	34BUW76	Division 4 Diesel Building

1. Equipment tag numbers are provided for information only and are not part of the certified design.

**Table 2.5.2-2—EUPS Electrical Equipment Design
Sheet 1 of 2**

Description	Tag Number⁽¹⁾	IEEE Class 1E	MCR/RSS Displays
Battery Charger	31BTP01	Yes	Output Current / Output Current
Battery Charger	31BTP02	Yes	Output Current / Output Current
Battery Charger	32BTP01	Yes	Output Current / Output Current
Battery Charger	32BTP02	Yes	Output Current / Output Current
Battery Charger	33BTP01	Yes	Output Current / Output Current
Battery Charger	33BTP02	Yes	Output Current / Output Current
Battery Charger	34BTP01	Yes	Output Current / Output Current
Battery Charger	34BTP02	Yes	Output Current / Output Current
Battery	31BTD01	Yes	Battery Current / Battery Current
Battery	32BTD01	Yes	Battery Current / Battery Current
Battery	33BTD01	Yes	Battery Current / Battery Current
Battery	34BTD01	Yes	Battery Current / Battery Current
Inverter	31BRU01	Yes	N/A / N/A
Inverter	32BRU01	Yes	N/A / N/A
Inverter	33BRU01	Yes	N/A / N/A
Inverter	34BRU01	Yes	N/A / N/A
Switchboard	31BUC	Yes	Bus Voltage / Bus Voltage
Switchboard	32BUC	Yes	Bus Voltage / Bus Voltage
Switchboard	33BUC	Yes	Bus Voltage / Bus Voltage
Switchboard	34BUC	Yes	Bus Voltage / Bus Voltage
Motor Control Center	31BRA	Yes	Bus Voltage / Bus Voltage
Motor Control Center	32BRA	Yes	Bus Voltage / Bus Voltage
Motor Control Center	33BRA	Yes	Bus Voltage / Bus Voltage
Motor Control Center	34BRA	Yes	Bus Voltage / Bus Voltage
Transformer	31BGT01	Yes	N/A / N/A
Transformer	32BGT01	Yes	N/A / N/A
Transformer	33BGT01	Yes	N/A / N/A
Transformer	34BGT01	Yes	N/A / N/A
120 Vac Panelboard	31BGA01	Yes	N/A / N/A

**Table 2.5.2-2—EUPS Electrical Equipment Design
Sheet 2 of 2**

Description	Tag Number⁽¹⁾	IEEE Class 1E	MCR/RSS Displays
120 Vac Panelboard	32BGA01	Yes	N/A / N/A
120 Vac Panelboard	33BGA01	Yes	N/A / N/A
120 Vac Panelboard	34BGA01	Yes	N/A / N/A
AC/DC Converter	31BRW10	Yes	N/A / N/A
DC/DC Converter	31BUW11	Yes	N/A / N/A
AC/DC Converter	31BRW12	Yes	N/A / N/A
DC/DC Converter	31BUW13	Yes	N/A / N/A
AC/DC Converter	31BRW16	Yes	N/A / N/A
DC/DC Converter	31BUW16	Yes	N/A / N/A
AC/DC Converter	32BRW30	Yes	N/A / N/A
DC/DC Converter	32BUW31	Yes	N/A / N/A
AC/DC Converter	32BRW32	Yes	N/A / N/A
DC/DC Converter	32BUW33	Yes	N/A / N/A
AC/DC Converter	32BRW36	Yes	N/A / N/A
DC/DC Converter	32BUW36	Yes	N/A / N/A
AC/DC Converter	33BRW50	Yes	N/A / N/A
DC/DC Converter	33BUW51	Yes	N/A / N/A
AC/DC Converter	33BRW52	Yes	N/A / N/A
DC/DC Converter	33BUW53	Yes	N/A / N/A
AC/DC Converter	33BRW56	Yes	N/A / N/A
DC/DC Converter	33BUW56	Yes	N/A / N/A
AC/DC Converter	34BRW70	Yes	N/A / N/A
DC/DC Converter	34BUW71	Yes	N/A / N/A
AC/DC Converter	34BRW72	Yes	N/A / N/A
DC/DC Converter	34BUW73	Yes	N/A / N/A
AC/DC Converter	34BRW76	Yes	N/A / N/A
DC/DC Converter	34BUW76	Yes	N/A / N/A

1. Equipment tag numbers are provided for information only and are not part of the certified design.

Table 2.5.2-3—Class 1E Uninterruptible Power Supply System ITAAC
Sheet 1 of 6

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The functional arrangement of the EUPS is as described in the Design Description of Section 2.5.2, Tables 2.5.2-1 and 2.5.2-2, and as shown on Figure 2.5.2-1.	An inspection of the as-built EUPS functional arrangement will be performed.	The EUPS conforms to the functional arrangement as described in the Design Description of Section 2.5.2, Tables 2.5.2-1 and 2.5.2-2, and as shown on Figure 2.5.2-1.
2.2	Deleted.	Deleted.	Deleted.
2.3	Deleted.	Deleted.	Deleted.
2.4	Deleted.	Deleted.	Deleted.
3.1	Equipment listed as Class 1E in Table 2.5.2-2 are qualified as Seismic Category I and can withstand seismic design basis loads without loss of safety function.	<ul style="list-style-type: none"> a. Type tests, analyses, or a combination of type tests and analyses will be performed on the equipment identified as Seismic Category I in Table 2.5.2-2 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements. b. An inspection will be performed of the as-built equipment identified as Seismic Category I in Table 2.5.2-2 to verify that the equipment, including anchorage, are installed per the approved design requirements. 	<ul style="list-style-type: none"> a. Test/analysis reports conclude that the equipment identified as Seismic Category I in Table 2.5.2-2 can withstand seismic design basis loads without a loss of the function listed in Table 2.5.2-2 including the time required to perform the listed function. b. Inspection reports conclude that the equipment identified as Seismic Category I in Table 2.5.2-2, including anchorage, are installed per the approved design requirements.

Table 2.5.2-3—Class 1E Uninterruptible Power Supply System ITAAC
Sheet 2 of 6

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.1	Displays listed in Table 2.5.2-2 are indicated on the PICS operator workstations in the MCR and the RSS.	a. Tests will be performed to verify that the displays listed in Table 2.5.2-2 are indicated on the PICS operator workstations in the MCR by using test input signals to PICS. b. Tests will be performed to verify that the displays listed in Table 2.5.2-2 are indicated on the PICS operator workstations in the RSS by using test input signals inputs to PICS.	a. Displays listed in Table 2.5.2-2 are indicated on the PICS operator workstations in the MCR. b. Displays listed in Table 2.5.2-2 are indicated on the PICS operator workstations in the RSS.
5.1	Physical separation exists between Class 1E EUPS equipment listed in Table 2.5.2-2 and non-Class 1E equipment.	An inspection will be performed to verify that as-built Class 1E EUPS equipment is physically separated from as-built non-Class 1E equipment.	The Class 1E EUPS equipment listed in Table 2.5.2-2 is separated from non-Class 1E equipment by at least 3 ft horizontally and at least 5 ft vertically.
5.2	Non-safety-related loads connected to the EUPS are electrically isolated from the EUPS by an isolation device.	a. Type tests, analyses, or a combination of type tests and analyses of the isolation devices will be performed. b. An inspection will be performed of the as-built non-safety-related loads connected to the EUPS.	a. The isolation devices used between the EUPS and non-safety-related loads are qualified to provide electrical isolation. b. A qualified electrical isolation device exists between non-safety-related loads connected to the EUPS and the EUPS.
5.3	Without an alternate feed installed, independence is maintained between the EUPS divisions.	Testing will be performed by providing a test input signal in each EUPS division, one division at a time.	Without an alternate feed installed, the test input signal exists only in the EUPS division under test, when a test input signal is applied in each EUPS division.

Table 2.5.2-3—Class 1E Uninterruptible Power Supply System ITAAC
Sheet 3 of 6

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
5.4	With the alternate feed installed from EPSS division 1 to division 2, independence is maintained between the load group created by EUPS divisions 1 and 2, and the load group created by divisions 3 and 4. EUPS divisions 3 and 4 are independent of each other.	Testing will be performed by providing a test input signal in each EPSS division, one division at a time, while the alternate feed is installed from EPSS division 1 to division 2.	<ul style="list-style-type: none"> a. A test input signal exists only in the load group created by Class 1E divisions 1 and 2 when the test input signal is provided in Class 1E division 1 or 2. b. A test input signal exists only in the division under test when the test input signal is provided in Class 1E division 3 or 4.
5.5	With the alternate feed installed from EPSS division 2 to division 1, independence is maintained between the load group created by EUPS divisions 1 and 2, and the load group created by divisions 3 and 4. EUPS divisions 3 and 4 are independent of each other.	Testing will be performed by providing a test input signal in each EPSS division, one division at a time, while the alternate feed is installed from EPSS division 2 to division 1.	<ul style="list-style-type: none"> a. A test input signal exists only in the load group created by Class 1E divisions 1 and 2 when the test input signal is provided in Class 1E division 1 or 2. b. A test input signal exists only in the division under test when the test input signal is provided in Class 1E division 3 or 4.
5.6	With the alternate feed installed from EPSS division 3 to division 4, independence is maintained between the load group created by EUPS divisions 3 and 4, and the load group created by divisions 1 and 2. EUPS divisions 1 and 2 are independent of each other.	Testing will be performed by providing a test input signal in each EPSS division, one division at a time, while the alternate feed is installed from EPSS division 3 to division 4.	<ul style="list-style-type: none"> a. A test input signal exists only in the load group created by Class 1E divisions 3 and 4 when the test input signal is provided in Class 1E division 3 or 4. b. A test input signal exists only in the division under test when the test input signal is provided in Class 1E division 1 or 2.

**Table 2.5.2-3—Class 1E Uninterruptible Power Supply System ITAAC
Sheet 4 of 6**

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
5.7	With the alternate feed installed from EPSS division 4 to division 3, independence is maintained between the load group created by EUPS divisions 3 and 4, and the load group created by divisions 1 and 2. EUPS divisions 1 and 2 are independent of each other.	Testing will be performed by providing a test input signal in each EPSS division, one division at a time, while the alternate feed is installed from EPSS division 4 to division 3.	<ul style="list-style-type: none"> a. A test input signal exists only in the load group created by Class 1E divisions 3 and 4 when the test input signal is provided in Class 1E division 3 or 4. b. A test input signal exists only in the division under test when the test input signal is provided in Class 1E division 1 or 2.
5.8	Deleted.	Deleted.	Deleted.
5.9	Deleted.	Deleted.	Deleted.
5.10	EUPS switchboards, MCCs, transformers, panelboards, and converters, listed in Table 2.5.2-2 and their feeder breakers and load breakers, are sized to supply their load requirements.	An inspection and analysis will be performed to verify as-built EUPS switchboards, MCCs, transformers, panelboards, and converters, listed in Table 2.5.2-2, and their feeder breakers and load breakers are sized to supply their load requirements.	An equipment sizing analysis concludes that ratings for EUPS switchboards, MCCs, transformers, panelboards, and converters, listed in Table 2.5.2-2, and their feeder breakers and load breakers are greater than their analyzed load requirements.
5.11	EUPS cables and buses are sized to supply their assigned load requirements.	An inspection and analysis will be performed to verify as-built EUPS cables and buses are sized to supply their assigned load requirements.	An equipment sizing analysis concludes EUPS cables and buses are sized to supply analyzed load requirements.

**Table 2.5.2-3—Class 1E Uninterruptible Power Supply System ITAAC
Sheet 5 of 6**

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
5.12	Each EUPS battery is able to provide power for starting and operating design loads for a minimum of two hours when the ac supply to the battery charger is lost.	<ul style="list-style-type: none"> a. An analysis will be performed to determine if each as-built EUPS battery is able to provide power for starting and operating analyzed design loads for a minimum time of two hours while battery terminal voltage remains above minimum voltage required for the design loads. b. A battery discharge test will be performed to verify the capacity of each EUPS battery is equal to or greater than the analyzed battery design duty cycle. 	<ul style="list-style-type: none"> a. An analysis concludes each EUPS battery is able to provide power for starting and operating analyzed design loads for a minimum time of two hours while battery terminal voltage remains above minimum voltage required for the design loads. b. The capacity of each EUPS battery is equal to or greater than the analyzed battery design duty cycle.
5.13	Each EUPS battery charger supplies assigned EUPS loads while maintaining the respective EUPS battery charged.	<ul style="list-style-type: none"> a. An analysis will be performed to determine if each as-built EUPS battery charger rating is greater than the analyzed load requirements. b. A battery charger capacity test will be performed to verify each EUPS battery charger can maintain an output current that can supply the assigned EUPS loads while maintaining the respective EUPS battery charged. 	<ul style="list-style-type: none"> a. An analysis concludes each EUPS battery charger rating is greater than the analyzed load requirements. b. Each EUPS battery charger can maintain an output current that can supply the assigned EUPS loads while maintaining the respective EUPS battery charged.
5.14	The EUPS inverters are sized to power the design EUPS loads on the respective supplied MCC.	An inspection and analysis will be performed to verify as-built EUPS inverters are sized to power the design EUPS loads on the respective supplied MCC.	An equipment sizing analysis concludes each EUPS inverter rating is greater than the analyzed load requirements.

Table 2.5.2-3—Class 1E Uninterruptible Power Supply System ITAAC
Sheet 6 of 6

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
5.15	EUPS operating voltage remains within the terminal voltage range of the supplied safety-related equipment during the battery duty cycle.	A test will be performed to verify that EUPS operating voltage remains within the terminal voltage range of the supplied safety-related equipment during the battery duty cycle.	EUPS battery terminal voltage remains greater than minimum required terminal voltage after a period of no less than two hours with a discharge rate that is equal to or greater than the battery design duty cycle capacity.
5.16	EUPS switchboards, MCCs, transformers and panelboards listed in Table 2.5.2-2 are rated to withstand fault currents for the time required to clear the fault from its power source.	An inspection and analysis will be performed to verify as-built EUPS switchboards, MCCs, transformers, and panelboards, listed in Table 2.5.2-2, are rated to withstand fault currents for the time required to clear the fault from its power source.	A short-circuit analysis concludes that current capability for EUPS switchboards, MCCs, transformers, and panelboards, listed in Table 2.5.2-2, is greater than the analyzed fault currents for the time required to clear the fault from its power source as determined by circuit interrupting device coordination analysis.
5.17	The feeder and load circuit breakers for EUPS switchboards, MCCs, and panelboards are rated to interrupt fault currents.	An inspection and analysis will be performed to verify as-built feeder and load circuit breakers for EUPS switchboards, MCCs, and panelboards are rated to interrupt fault currents.	A short-circuit analysis concludes that current interrupting capability for EUPS switchboards, MCCs, and panelboards feeder and load circuit breakers, is greater than the analyzed fault currents.
5.18	EUPS interrupting devices (e.g., circuit breakers and fuses) are coordinated so that the circuit interrupting device closest to the fault opens before other devices.	An inspection and analysis will be performed to verify as-built EUPS interrupting devices (e.g., circuit breakers and fuses) are coordinated so that the circuit interrupting device closest to the fault opens before other devices.	An equipment protection and coordination analysis concludes that the EUPS interrupting devices (e.g., circuit breakers and fuses) are coordinated so that the circuit interrupting device closest to the fault opens before other devices.
5.19	Harmonic distortion does not prevent Class 1E buses from performing safety functions.	An analysis will be performed to verify that harmonic distortion does not prevent as-built Class 1E buses from performing safety functions.	An analysis of the Class 1E buses concludes that total harmonic distortion does not exceed 5 percent voltage distortion on the Class 1E buses.