

2.5.2 Class 1E Uninterruptible Power Supply

1.0 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 equipment is shown in Figure 2.5.2-1—Class 1E Uninterruptible Power Supply System Functional Arrangement.

2.2 Equipment identified as Class 1E in Table 2.5.2-2—Class 1E Uninterruptible Power Supply Electrical Equipment Design are located as listed in Table 2.5.2-1—Class 1E Uninterruptible Power Supply System Electrical Equipment Location.

2.3 There are four EUPS divisions.

3.0 Mechanical Design Features, Electrical and Seismic Classifications

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, Alarms, Displays and Controls

4.1 Displays listed in Table 2.5.2-2 are retrievable in the main control room (MCR) and the remote shutdown station (RSS) as listed in Table 2.5.2-2.

5.0 Electrical Considerations

5.1 Physical separation exists between EUPS Class 1E equipment listed in Table 2.5.2-2 and non-Class 1E equipment.

5.2 Non-safety-related loads connected to the EUPS (e.g., post accident monitoring and special emergency lighting) are separated by a Class 1E isolation device.

5.3 Without an emergency power supply system (EPSS) alternate feed installed, independence is maintained between the four 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 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 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 divisions 1 and 2. EUPS divisions 1 and 2 are independent of each other.

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- 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 divisions 1 and 2. EUPS divisions 1 and 2 are independent of each other.
- 5.8 EUPS Class 1E cables and cable raceways are marked according to their respective division color-code.
- 5.9 Physical separation or electrical isolation exists between Class 1E divisions and between Class 1E divisions and non-Class 1E cables.
- 5.10 EUPS switchboards, MCCs, transformers, panelboards, and converters as listed in Table 2.5.2-2 and their feeder breakers 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.
- 6.0 Inspection, Tests, Analyses and Acceptance Criteria**
- 6.1 Table 2.5.2-3—Class 1E Uninterruptible Power Supply Inspections, Tests, Analyses, and Acceptance Criteria, provides the ITAAC for the EUPS.

Table 2.5.2-1—Class 1E Uninterruptible Power Supply System Electrical Equipment Location (2 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment 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

Table 2.5.2-1—Class 1E Uninterruptible Power Supply System Electrical Equipment Location (2 Sheets)

Equipment Description	Equipment Tag Number (1)	Equipment Location
120 Vac Panelboard	34BGA01	Division 4 Safeguard Building
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—Class 1E Uninterruptible Power Supply Electrical Equipment Design (3 Sheets)

Equipment Description	Equipment 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

Table 2.5.2-2—Class 1E Uninterruptible Power Supply Electrical Equipment Design (3 Sheets)

Equipment Description	Equipment Tag Number (1)	IEEE Class 1E	MCR/RSS Displays
120 Vac Panelboard	31BGA01	Yes	N/A / N/A
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

Table 2.5.2-2—Class 1E Uninterruptible Power Supply Electrical Equipment Design (3 Sheets)

Equipment Description	Equipment Tag Number (1)	IEEE Class 1E	MCR/RSS Displays
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 Inspections, Tests, Analyses, and Acceptance Criteria (4 Sheets)

	Commitment	Inspection, Test or Analysis	Acceptance Criteria
2.1	The functional arrangement of the EUPS is as shown on Figure 2.5.2-1.	An inspection will be performed.	The as-built EUPS conforms to the functional arrangement as shown in Figure 2.5.2-1.
2.2	Equipment identified as Class 1E in Table 2.5.2-2 is located as listed in Table 2.5.2-1.	An inspection will be performed.	The equipment listed as Class 1E in Table 2.5.2-2 is located as indicated in Table 2.5.2-1.
2.3	There are four EUPS divisions.	An inspection will be performed.	The EUPS has four divisions.
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. An inspection will be performed. b. Type testing, analysis, or a combination of type testing and analysis will be performed. 	<ul style="list-style-type: none"> a. A report exists and concludes that the equipment designated as Class 1E in Table 2.5.2-2 is installed as designed. b. A report exists and concludes that the equipment listed as Class 1E in Table 2.5.2-2 can withstand seismic design basis loads without loss of safety function.
4.1	Displays listed in Table 2.5.2-2 are retrievable in the MCR and RSS as listed in Table 2.5.2-2.	An inspection will be performed.	<p>Displays listed in Table 2.5.2-2 as being retrieved in the MCR can be retrieved in the MCR.</p> <p>Displays listed in Table 2.5.2-2 as being retrieved in the RSS can be retrieved in the RSS.</p>
5.1	Physical separation exists between EUPS Class 1E equipment listed in Table 2.5.2-2 and non-Class 1E equipment.	An inspection will be performed.	There is physical separation between EUPS Class 1E equipment listed in Table 2.5.2-2 and non-Class 1E equipment.

Table 2.5.2-3—Class 1E Uninterruptible Power Supply Inspections, Tests, Analyses, and Acceptance Criteria (4 Sheets)

	Commitment	Inspection, Test or Analysis	Acceptance Criteria
5.2	Non-Safety-related loads connected to the EUPS (e.g., post accident monitoring and special emergency lighting) are separated by a Class 1E isolation device.	An inspection will be performed.	EUPS Class 1E and non-Class 1E equipment are separated by a Class 1E isolation device.
5.3	Without an EPSS alternate feed installed, independence is maintained between the four EUPS divisions.	Testing will be performed by providing a test signal in each Class 1E division, one division at a time.	Without an alternate feed installed, the test signal exists only in the EUPS division under test when a test signal is applied in each EPSS division.
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 divisions 3 and 4. EUPS divisions 3 and 4 are independent of each other.	Testing will be performed by providing a test signal in each Class 1E division; one division at a time while the alternate feed is installed from EPSS division 1 to division 2.	A test signal exists only in the load group created by Class 1E divisions 1 and 2 when the test signal is provided in Class 1E division 1 or 2. A test signal exists only in the division under test when the test 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 divisions 3 and 4. EUPS divisions 3 and 4 are independent of each other.	Testing will be performed by providing a test signal in each Class 1E division; one division at a time while the alternate feed is installed from EPSS division 2 to division 1.	A test signal exists only in the load group created by Class 1E divisions 1 and 2 when the test signal is provided in Class 1E division 1 or 2. A test signal exists only in the division under test when the test signal is provided in Class 1E division 3 or 4.

Table 2.5.2-3—Class 1E Uninterruptible Power Supply Inspections, Tests, Analyses, and Acceptance Criteria (4 Sheets)

	Commitment	Inspection, Test or Analysis	Acceptance Criteria
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 divisions 1 and 2. EUPS divisions 1 and 2 are independent of each other.	Testing will be performed by providing a test signal in each Class 1E division; one division at a time while the alternate feed is installed from EPSS division 3 to division 4.	A test signal exists only in the load group created by Class 1E divisions 3 and 4 when the test signal is provided in Class 1E division 3 or 4. A test signal exists only in the division under test when the test signal is provided in Class 1E division 1 or 2.
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 divisions 1 and 2. EUPS divisions 1 and 2 are independent of each other.	Testing will be performed by providing a test signal in each Class 1E division; one division at a time while the alternate feed is installed from EPSS division 4 to division 3.	A test signal exists only in the load group created by Class 1E divisions 3 and 4 when the test signal is provided in Class 1E division 3 or 4. A test signal exists only in the division under test when the test signal is provided in Class 1E division 1 or 2.
5.8	EUPS Class 1E cables and cable raceways are marked according to their respective division color-code.	See Tier 1 Section 2.5.1.5.9.	See Tier 1 Section 2.5.1.5.9.
5.9	Physical separation or electrical isolation exists between Class 1E divisions and between Class 1E equipment and non-Class 1E cables.	See Tier 1 Section 2.5.1.5.10.	See Tier 1 Section 2.5.1.5.10.
5.10	EUPS switchboards, MCCs, transformers, panelboards, and converters as listed in Table 2.5.2-2 and their feeder breakers and load breakers are sized to supply their load requirements.	An inspection will be performed.	The EUPS switchboards, MCCs, transformers, panelboards, and converters as listed in Table 2.5.2-2 and their feeder breakers and load breakers are sized to supply their load requirements.

Table 2.5.2-3—Class 1E Uninterruptible Power Supply Inspections, Tests, Analyses, and Acceptance Criteria (4 Sheets)

	Commitment	Inspection, Test or Analysis	Acceptance Criteria
5.11	EUPS cables and buses are sized to supply their assigned load requirements.	An inspection will be performed.	The as-built 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.	A test will be performed.	Each EUPS battery can supply design loads for a minimum time of two hours while battery terminal voltage remains above minimum voltage required for the design loads.
5.13	Each EUPS battery charger supplies assigned EUPS loads while maintaining the respective EUPS battery charged.	A test will be performed.	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.	A test will be performed.	Each EUPS inverter is sized to power the design EUPS loads on the respective supplied MCC.