Table 8.3-12—Class 1E Uninterruptible Power Supply System Failure Modes and Effects Analysis Sheet 1 of 2

Item No.	Component Identification	Function	Failure Mode	Failure Mechanism	Effect on System Safety-related Function	Method of Failure Detection	Remarks
1	EPSS 480 Vac load center 31BMB, 32BMB, 33BMB, or 34BMB.	AC input power for EUPS battery charger 31BTP02, 32BTP02, 33BTP02 or 34BTP02.	Loss of voltage.	Load center fault or failure such as short.-circuit.	None. Safety-related function is maintained by redundant divisions.	Battery charger power failure alarm in the MCR.	a. EUPS Battery BTD01 automatically supplies power to its assigned loads without interruption for a minimum of two hours. b. Respective division battery charger BTP01 is manually placed in service.
2	Division 1 or division 4 480 Vac load center 31BMC, or 34BMC.	AC input power for division 1 or division 4 battery charger 31BTP01 or 34BTP01.	Loss of voltage.	Load center fault or failure such as short.-circuit.	None. Safety-related function is maintained by redundant divisions.	Battery charger power failure alarm in the MCR.	a. UPS Battery BTD01 automatically supplies power to its assigned loads without interruption for a minimum of two hours. b. Respective division battery charger BTP02 is manually placed in service.
3	Division 2 or division 3 480 Vac load center bus 32BMA, or 33BMA.	AC input power for division 2 or division 3 battery charger 32BTP01 or 33BTP01.	Loss of voltage.	Load center fault or failure such as short.-circuit.	None. Safety-related function is maintained by redundant divisions.	Battery charger power failure alarm in the MCR.	a. UPS Battery BTD01 automatically supplies power to its assigned loads without interruption for a minimum of two hours. b. Respective division battery charger BTP02 is manually placed in service.
4	Battery Chargers 31BTP01, 31BTP02, 32BTP01, 32BTP02, 33BTP01, 33BTP02, 34BTP01, or 34BTP02.	Supply division 250 Vdc distribution bus BUC while maintaining battery 31BTD01, 32BTD01, 33BTD01, or 34BTD01 charged.	Battery charger failure.	Battery charger fault resulting in loss of output.	None. Safety-related function is maintained by redundant divisions.	BDT01 Battery charger DC output failure alarm in the MCR.	a. Battery BTD01 automatically supplies power to it assigned loads without interruption for a minimum of two hours. b. Respective division standby battery charger is manually placed in service.
5	EUPS battery output fused disconnect switch.	Provides continuity or point of isolation from the battery to the EUPS 250 Vdc BUC switchboard.	Device failure.	Isolation device fault resulting in no battery output to the EUPS 250 Vdc BUC switchboard.	None. Safety-related function is maintained by redundant divisions.	BTD01 battery protective device open alarm in the MCR.	In service battery charger will maintain power to respective division EUPS loads. However, this is interruptible power and will be lost if there is a loss of power in the respective division.
6	EUPS 250 Vdc battery 31BTD01, 32BDT01, 33BDT01 or 34BDT01.	Supplies EUPS 250 Vdc bus 31BUC, 32BUC, 33BUC or 34BUC.	Loss of power from battery.	Battery fault resulting in low or no output.	None. Safety-related function is maintained by redundant divisions.	Degraded battery performance detected during normal surveillance testing; low voltage detected with BUC or battery undervoltage alarm.	In service battery charger will maintain power to respective division EUPS loads. However, this is interruptible power and will be lost if there is a loss of power in the respective division.
7	EUPS 250 Vdc switchboard 31BUC, 32BUC, 33BUC, or 34BUC.	Supplies 250 Vdc to various loads including the EUPS inverter BRU01.	Ground fault.	Grounding of either the positive or negative leg.	None.	EUPS DC system ground alarm in MCR.	EUPS is operated as ungrounded system so ground fault on one polarity does not result in protective tripping of equipment or prevent operation of supplied equipment.

Table 8.3-12—Class 1E Uninterruptible Power Supply System Failure Modes and Effects Analysis Sheet 2 of 2

Item No.	Component Identification	Function	Failure Mode	Failure Mechanism	Effect on System Safety-related Function	Method of Failure Detection	Remarks
8	EUPS 250 Vdc Switchboard 31BUC, 32BUC, 33BUC, or 34BUC.	Supplies 250 Vdc to various loads including the EUPS inverter BUR01.	Bus failure.	Bus fault, including short-circuit.	None. Safety-related function is maintained by redundant divisions.	BUC bus undervoltage alarm in MCR.	a. The parallel DC/DC converters supplied from the respective BRA bus will maintain power to the I&C equipment during normal operation. b. Inverter BRU01 will transfer to the bypass source, which maintains power to the I&C system.
9	EUPS 480 Vac inverter 31BRU01, 32BRU01, 33BRU01 or 34BRU01.	Supplies 480 Vac MCC 31BRA, 32BRA, 33BRA or 34BRA.	Inverter failure.	No output or inverter malfunction.	None. Safety-related function is maintained by redundant divisions.	Alarm in the MCR indicating bypass source supplying load.	a. EUPS loads are automatically transferred in a make-before-break transfer by static bypass switch to bypass source BNB02. b. If static bypass source is not available the I&C loads remain powered from the parallel DC/DC converters and EPSS switchgear and load center control power remains available from the BUC switchboard.
10	480 Vac MCC 31BRA, 32BRA, 33BRA or 34BRA.	Supplies 480 Vac to various loads including /DC converters for power supply of safety-related I&C cabinets.	MCC failure.	MCC bus failure, including short.-circuit.	None. Safety-related function is maintained by redundant divisions.	Alarm in the MCR.	a. Source breaker of the affected MCC operates to clear the faulted MCC, de-energizing affected loads. b. Safety-related I&C loads of the division remain powered from the parallel DC/DC converters. EPSS control power of the division remains available since it is supplied directly from BUC DC switchboard.
11	480 Vac to 24 Vdc converters 31BRW10, 31BRW12, 31BRW16, 32BRW30, 32BRW32, 32BRW36, 33BRW50, 33BRW52, 33BRW56, 34BRW70, 34BRW72 or 34BRW76.	Supplies 24 Vdc power to safety-related I&C cabinets.	Loss of output power.	AC/DC converter failure.	None.	Routine monitoring.	Parallel 250 Vdc to 24 Vdc converter maintains power for safety-related I&C cabinets without interruption.
12	250 Vdc to 24 Vdc converters 31BUW11, 31BUW13, 31BUW16, 32BUW31, 32BUW33, 32BUW36, 33BUW51, 33BUW53, 33BUW56, 34BUW71, 34BUW73 or 34BUW76.	Supplies 24 Vdc power to safety-related Vdc I&C cabinets.	Loss of output power.	DC/DC converter failure.	None.	Routine monitoring.	Parallel 480 Vac to 24 Vdc converter maintains power for safety-related I&C cabinets without interruption.

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