MARKED-UP CURRENT TECHNICAL SPECIFICATIONS

TABLE 3.3-3 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
7. Loss of Power (4.16 kV Emergency Bus Undervoltage)					
a. First Level				1, 2, 3, 4	
1) Diesel Start (Relays)	~~1/Bus~~	~~1/Bus~~	~~1/Bus~~		~~16~~
2) Initiation of Load Shed (Relays)	2/Bus	2/Bus	2/Bus		15
b. Second Level				1, 2, 3, 4	
1) Undervoltage Relays	2/Bus	2/Bus	2/Bus		15
2) Timers to Start Diesel	1/Bus	1/Bus	1/Bus		16
3) Timers to Shed Load	1/Bus	1/Bus	1/Bus		16
8. Engineered Safety Features Actuation System Interlocks					
a. Pressurizer Pressure, P-11	3	2	2	1, 2, 3	21
b. DELETED					
c. Reactor Trip, P-4	2	2	2	1, 2, 3	23
a) Loss of Voltage	2/Bus	1/Bus	1/Bus		36
b) Low Voltage	2/Bus	1/Bus	1/Bus		36
3) Timers to Start Diesel					
a) Loss of Voltage	1/Bus	1/Bus	1/Bus		16
b) Low Voltage	1/Bus	1/Bus	1/Bus		16
4) Timers to Shed Load	1/Bus	1/Bus	1/Bus		16

TABLE 3.3-3 (Continued)

ACTION STATEMENTS (Continued)

ACTION 21 - With less than the Minimum Number of Channels OPERABLE, within 1 hour determine by observation of the associated permissive annunciator window(s) that the interlock is in its required state for the existing plant condition, or apply Specification 3.0.3.

ACTION 22 - With the number of OPERABLE Channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 6 hours or be in at least HOT STANDBY within the next 6 hours and in at least HOT SHUTDOWN within the following 6 hours; however, one channel may be bypassed for up to 4 hours for surveillance testing per Specification 4.3.2.1 provided the other channel is OPERABLE.

ACTION 23 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

ACTION 24 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or declare the associated pump or valve inoperable and take the ACTION required by Specification 3.7.1.5 or 3.7.1.2 as applicable.

ACTION 25 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 6 hours or be in at least HOT STANDBY within the next 6 hours; however, one channel may be bypassed for up to 4 hours for surveillance testing per Specification 4.3.2.1 provided the other channel is OPERABLE.

ACTION 29 - With the number of OPERABLE channels less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided that within 6 hours, for the affected RCS Loop Delta-T channel(s), either:

a. The Trip Time Delay threshold power level for zero seconds time delay is adjusted to 0% RTP, or
b. With the number of OPERABLE channels one less than the Total Number of Channels, the affected Steam Generator Water Level-Low-Low channels are placed in the tripped condition.

ACTION 35 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided the following conditions are satisfied:

a. The inoperable channel is placed in the trip condition within 6 hours, and
b. The Minimum Channels OPERABLE requirement is met; however, the inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels per Specification 4.3.2.1.

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ACTION 36 - With the number of OPERABLE Channels less than the Total Number of Channels, declare the affected Emergency Diesel Generator(s) inoperable and comply with the ACTION statements of Specification 3.8.1.1; however, one channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.2.1.

TABLE 3 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUES
7. Loss of Power (4.16 kV Emergency Bus Undervoltage)		
a. First Level		
1) Diesel Start		
a. Loss of Voltage	≥ 0 volts with a ≤ 0.8 second time delay and	≥ 0 volts with a ≤ 0.8 second time delay and
b. Low Voltage	≥ 2583 volts with a ≤ 10 second time delay One relay	≥ 2583 volts with ≤ 10 second time delay One relay
2) Initiation of Load Shed	≥ 0 volts with a ≤ 4 second time delay and ≥ 2583 volts with a ≤ 25 second time delay with one relay ≥ 2870 volts, instantaneous	≥ 0 volts with a ≤ 4 second time delay and ≥ 2583 volts with a ≤ 25 second time delay with one relay ≥ 2870 volts, instantaneous
b. Second Level		
1) Diesel Start	≥ 3785 volts with a ≤ 10 second time delay	≥ 3785 volts with a ≤ 10 second time delay
2) Initiation of Load Shed	≥ 3785 volts with a ≤ 20 second time delay	≥ 3785 volts with a ≤ 20 second time delay
8. Engineered Safety Features Actuation System Interlocks		
a. Pressurizer Pressure, P-11	≤ 1915 psig	≤ 1917.5 psig
b. DELETED		
c. Reactor Trip, P-4	N.A.	N.A.

NOTE 1: Time constants utilized in the lead-lag compensator for Steam Pressure - Low are τ_1 = 50 seconds and τ_2 = 5 seconds.

NOTE 2: Steam Generator Water Level Low-Low Trip Time Delay

$TD = B1(P)^3 + B2(P)^2 + B3(P) + B4$

Where: P = RCS Loop ΔT Equivalent to Power (%RTP), P ≤ 50% RTP

TD = Time delay for Steam Generator Water Level Low-Low (in seconds)

B1 = -0.007128

B2 = +0.8099

B3 = -31.40

B4 = +464.1

NOTE 3: Time constants utilized in the rate-lag compensator for Negative Steam Line Pressure Rate-High are τ_3 = 50 seconds and τ_4 = 50 seconds.

Unit 1 - Amendment No. 97, 121, 89, 85, 9, 103, 122
Unit 2 - Amendment No. 36, 71, 83, 85, 1, 102, 120

TABLE 4.3-2 (Continued)
ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL OPERATIONAL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	ACTUATION LOGIC TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
6. Auxiliary Feedwater (Continued)								
d. Undervoltage - RCP	N.A.	R24	N.A.	R24	N.A.	N.A.	N.A.	1
e. Safety Injection	See Item 1. above for all Safety Injection Surveillance Requirements.							
7. Loss of Power								
a. 4.16 kV Emergency Bus Level 1	N.A.	R	N.A.	R	N.A.	N.A.	N.A.	1, 2, 3, 4
b. 4.16 kV Emergency Bus Level 2	N.A.	R	N.A.	R	N.A.	N.A.	N.A.	1, 2, 3, 4
8. Engineered Safety Feature Actuation System Interlocks								
a. Pressurizer Pressure, P-11	N.A.	R24	Q	N.A.	N.A.	N.A.	N.A.	1, 2, 3
b. DELETED								
c. Reactor Trip, P-4	N.A.	N.A.	N.A.	R24	N.A.	N.A.	N.A.	1, 2, 3

TABLE NOTATIONS

(1) Each train shall be tested at least every 62 days on a STAGGERED TEST BASIS.
(2) For the Containment Ventilation Exhaust Radiation - High monitor only, a CHANNEL FUNCTIONAL TEST shall be performed at least once every 31 days.
(3) Trip function automatically blocked above P-11 (Pressurizer Pressure Interlock) setpoint and is automatically blocked below P-11 when Safety Injection on Steam Line Pressure-Low is not blocked.
(4) Deleted.
(5) For Mode 3, the Trip Time Delay associated with the Steam Generator Water Level-Low-Low channel must be less than or equal to 464.1 seconds.

REACTOR PROTECTION SYSTEM and ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION (Continued)

ESF response times specified in Table 3.3-5, which include sequential operation of the RWST and VCT valves (Table Notations 4 and 5), are based on values assumed in the non-LOCA safety analyses. These analyses take credit for injection of borated water from the RWST. Injection of borated water is assumed not to occur until the VCT charging pump suction isolation valves are closed following opening of the RWST charging pump suction isolation valves. When the sequential operation of the RWST and VCT valves is not included in the response times (Table Notation 7), the values specified are based on the LOCA analyses. The LOCA analyses takes credit for injection flow regardless of the source. Verification of the response times specified in Table 3.3-5 will assure that the assumptions used for the LOCA and non-LOCA analyses with respect to the operation of the VCT and RWST valves are valid.

For slave relays in the ESF actuation system circuit that are Potter & Brumfield type MDR relays, the SLAVE RELAY TEST is performed on a refueling frequency. The test frequency is based on relay reliability assessments presented in WCAP-13878, "Reliability Assessment of Potter and Brumfield MDR Series Relays," WCAP-13900, "Extension of Slave Relay Surveillance Test Intervals," and WCAP-14117, "Reliability Assessment of Potter and Brumfield MDR Series Relays." These reliability assessments are relay specific and apply only to Potter and Brumfield MDR series relays. Note that for normally energized applications, the relays may have to be replaced periodically in accordance with the guidance given in WCAP-13878 for MDR relays.

Undervoltage protection will generate a loss of power diesel generator start in the event a loss of voltage or degraded voltage condition occurs. The diesel generators provide a source of emergency power when offsite power is either unavailable or is insufficiently stable to allow safe unit operation. The first level undervoltage relays (FLURs) detect the loss of bus voltage (less than 69% bus voltage). The second level undervoltage relays (SLURs) provide a second level of undervoltage protection which protects all Class 1E loads from short or long term degradation in the offsite power system. The SLUR allowable value is the minimum steady state voltage needed on the 4160 volt vital bus to ensure adequate voltage is available for safety related equipment at the 4160 volt, 480 volt, and 120 volt levels.

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The undervoltage protection design is comprised of a first level and a second level set of undervoltage relays and timers. The first level undervoltage relays (FLURs) provide a first level of undervoltage protection that has a low voltage and a loss of voltage detection scheme. Each scheme contains two undervoltage relays. The low voltage detection scheme initiates a diesel generator start after one time delay and initiates a load shed after a second time delay. The loss of voltage relay initiates a diesel generator start after a short time delay. The second level undervoltage relays (SLURs) provide a second level of undervoltage protection that has two undervoltage relays. The second level of undervoltage protection will initiate a diesel generator start after a time delay and if the undervoltage persists it will initiate load shed and transfer to the diesel generator. The SLUR allowable value ensures that the SLUR will allow operation only at voltages that are at or above the minimum steady voltage needed on the 4160 volt vital bus to ensure adequate voltage is available for safety related equipment at the 4160 volt, 480 volt and 120 volt levels. Each of the undervoltage protective schemes (FLUR-low voltage, FLUR-loss of voltage, and SLUR) is implemented utilizing two undervoltage relays per bus. Each of these relays senses the 4.16 kV bus voltage via a potential transformer (PT). Due to different loads connected to these PTs, different voltages will be sensed at the undervoltage relays for a given 4.16 kV bus voltage. In order to implement a consistent set of trip setpoint and allowable value voltages at the 4.16 kV bus level, separate relay level setpoint and allowable values were determined for undervoltage relays connected to lightly loaded and heavily loaded PTs.

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TABLE 3.3-3 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
7. Loss of Power (4.16 kV Emergency Bus Undervoltage)					
a. First Level				1, 2, 3, 4	
1) Diesel Start Relays					
a) Loss of Voltage	2/Bus	1/Bus	1/Bus		36
b) Low Voltage	2/Bus	1/Bus	1/Bus		36
2) Initiation of Load Shed Relays	2/Bus	2/Bus	2/Bus		15
3) Timers to Start Diesel					
a) Loss of Voltage	1/Bus	1/Bus	1/Bus		16
b) Low Voltage	1/Bus	1/Bus	1/Bus		16
4) Timers to Shed Load	1/Bus	1/Bus	1/Bus		16
b. Second Level				1, 2, 3, 4	
1) Undervoltage Relays	2/Bus	2/Bus	2/Bus		15
2) Timers to Start Diesel	1/Bus	1/Bus	1/Bus		16
3) Timers to Shed Load	1/Bus	1/Bus	1/Bus		16
8. Engineered Safety Features Actuation System Interlocks					
a. Pressurizer Pressure, P-11	3	2	2	1, 2, 3	21
b. DELETED					
c. Reactor Trip, P-4	2	2	2	1, 2, 3	23

TABLE 3.3-3 (Continued)

ACTION STATEMENTS (Continued)

ACTION 21 - With less than the Minimum Number of Channels OPERABLE, within 1 hour determine by observation of the associated permissive annunciator window(s) that the interlock is in its required state for the existing plant condition, or apply Specification 3.0.3.

ACTION 22 - With the number of OPERABLE Channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 6 hours or be in at least HOT STANDBY within the next 6 hours and in at least HOT SHUTDOWN within the following 6 hours; however, one channel may be bypassed for up to 4 hours for surveillance testing per Specification 4.3.2.1 provided the other channel is OPERABLE.

ACTION 23 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

ACTION 24 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or declare the associated pump or valve inoperable and take the ACTION required by Specification 3.7.1.5 or 3.7.1.2 as applicable.

ACTION 25 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 6 hours or be in at least HOT STANDBY within the next 6 hours; however, one channel may be bypassed for up to 4 hours for surveillance testing per Specification 4.3.2.1 provided the other channel is OPERABLE.

ACTION 29 - With the number of OPERABLE channels less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided that within 6 hours, for the affected RCS Loop Delta-T channel(s), either:

a. The Trip Time Delay threshold power level for zero seconds time delay is adjusted to 0% RTP, or
b. With the number of OPERABLE channels one less than the Total Number of Channels, the affected Steam Generator Water Level-Low-Low channels are placed in the tripped condition.

ACTION 35 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided the following conditions are satisfied:

a. The inoperable channel is placed in the trip condition within 6 hours, and
b. The Minimum Channels OPERABLE requirement is met; however, the inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels per Specification 4.3.2.1.

ACTION 36 - With the number of OPERABLE Channels less than the Total Number of Channels, declare the affected Emergency Diesel Generator(s) inoperable and comply with the ACTION statements of Specification 3.8.1.1; however, one channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.2.1.

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUES
7. Loss of Power (4.16 kV Emergency Bus Undervoltage)		
a. First Level		
1) Diesel Start		
a) Loss of Voltage	1040 volts with a 0.69 second time delay	≥ 993 volts with a ≤ 0.75 second time delay
b) Low Voltage	3172 volts with a 1.89 second time delay	≥ 3126 volts with ≤ 1.95 second time delay
2) Initiation of Load Shed	3172 volts with a 3.89 second time delay	3126 to 3218 volts with a 3.83 to 3.95 second time delay
b. Second Level		
1) Diesel Start	3790 volts with a 9.89 second time delay	≥ 3753 volts with a ≤ 9.95 second time delay
2) Initiation of Load Shed	3790 volts with a 19.89 second time delay	3753 to 3815 volts with a 19.83 to 19.95 second time delay
8. Engineered Safety Features Actuation System Interlocks		
a. Pressurizer Pressure, P-11	≤ 1915 psig	≤ 1917.5 psig
b. DELETED		
c. Reactor Trip, P-4	N.A.	N.A.

NOTE 1: Time constants utilized in the lead-lag compensator for Steam Pressure - Low are τ_1 = 50 seconds and τ_2 = 5 seconds.

NOTE 2: Steam Generator Water Level Low-Low Trip Time Delay

$TD = B1(P)^3 + B2(P)^2 + B3(P) + B4$

Where: P = RCS Loop ΔT Equivalent to Power (%RTP), P ≤ 50% RTP

TD = Time delay for Steam Generator Water Level Low-Low (in seconds)

B1 = -0.007128

B2 = +0.8099

B3 = -31.40

B4 = +464.1

NOTE 3: Time constants utilized in the rate-lag compensator for Negative Steam Line Pressure Rate-High are τ_3 = 50 seconds and τ_4 = 50 seconds.

TABLE 4.3-2 (Continued)
ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION
SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL OPERATIONAL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	ACTUATION LOGIC TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
6. Auxiliary Feedwater (Continued)								
d. Undervoltage - RCP	N.A.	R24	N.A.	R24	N.A.	N.A.	N.A.	1
e. Safety Injection	See Item 1. above for all Safety Injection Surveillance Requirements.							
7. Loss of Power								
a. 4.16 kV Emergency Bus Level 1	N.A.	R24	N.A.	R24	N.A.	N.A.	N.A.	1, 2, 3, 4
b. 4.16 kV Emergency Bus Level 2	N.A.	R24	N.A.	R24	N.A.	N.A.	N.A.	1, 2, 3, 4
8. Engineered Safety Feature Actuation System Interlocks								
a. Pressurizer Pressure, P-11	N.A.	R24	Q	N.A.	N.A.	N.A.	N.A.	1, 2, 3
b. DELETED								
c. Reactor Trip, P-4	N.A.	N.A.	N.A.	R24	N.A.	N.A.	N.A.	1, 2, 3

TABLE NOTATIONS

(1) Each train shall be tested at least every 62 days on a STAGGERED TEST BASIS.
(2) For the Containment Ventilation Exhaust Radiation - High monitor only, a CHANNEL FUNCTIONAL TEST shall be performed at least once every 31 days.
(3) Trip function automatically blocked above P-11 (Pressurizer Pressure Interlock) setpoint and is automatically blocked below P-11 when Safety Injection on Steam Line Pressure-Low is not blocked.
(4) Deleted.
(5) For Mode 3, the Trip Time Delay associated with the Steam Generator Water Level-Low-Low channel must be less than or equal to 464.1 seconds.

REACTOR PROTECTION SYSTEM and ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION (Continued)

ESF response times specified in Table 3.3-5, which include sequential operation of the RWST and VCT valves (Table Notations 4 and 5), are based on values assumed in the non-LOCA safety analyses. These analyses take credit for injection of borated water from the RWST. Injection of borated water is assumed not to occur until the VCT charging pump suction isolation valves are closed following opening of the RWST charging pump suction isolation valves. When the sequential operation of the RWST and VCT valves is not included in the response times (Table Notation 7), the values specified are based on the LOCA analyses. The LOCA analyses takes credit for injection flow regardless of the source. Verification of the response times specified in Table 3.3-5 will assure that the assumptions used for the LOCA and non-LOCA analyses with respect to the operation of the VCT and RWST valves are valid.

For slave relays in the ESF actuation system circuit that are Potter & Brumfield type MDR relays, the SLAVE RELAY TEST is performed on a refueling frequency. The test frequency is based on relay reliability assessments presented in WCAP-13878, "Reliability Assessment of Potter and Brumfield MDR Series Relays," WCAP-13900, "Extension of Slave Relay Surveillance Test Intervals," and WCAP-14117, "Reliability Assessment of Potter and Brumfield MDR Series Relays." These reliability assessments are relay specific and apply only to Potter and Brumfield MDR series relays. Note that for normally energized applications, the relays may have to be replaced periodically in accordance with the guidance given in WCAP-13878 for MDR relays.

Undervoltage protection will generate a loss of power diesel generator start in the event a loss of voltage or degraded voltage condition occurs. The diesel generators provide a source of emergency power when offsite power is either unavailable or is insufficiently stable to allow safe unit operation. The undervoltage protection design is comprised of a first level and a second level set of undervoltage relays and timers. The first level undervoltage relays (FLURs) provide a first level of undervoltage protection that has a low voltage and a loss of voltage detection scheme. Each scheme contains two undervoltage relays. The low voltage detection scheme initiates a diesel generator start after one time delay and initiates a load shed after a second time delay. The loss of voltage relay initiates a diesel generator start after a short time delay. The second level undervoltage relays (SLURs) provide a second level of undervoltage protection that has two undervoltage relays. The second level of undervoltage protection will initiate a diesel generator start after a time delay and if the undervoltage persists it will initiate load shed and transfer to the diesel generator. The SLUR allowable value ensures that the SLUR will allow operation only at voltages that are at or above the minimum steady voltage needed on the 4160 volt vital bus to ensure adequate voltage is available for safety related equipment at the 4160 volt, 480 volt and 120 volt levels. Each of the undervoltage protective schemes (FLUR-low voltage, FLUR-loss of voltage, and SLUR) is implemented utilizing two undervoltage relays per bus. Each of these relays senses the 4.16 kV bus voltage via a potential transformer (PT). Due to different loads connected to these PTs, different voltages will be sensed at the undervoltage relays for a given 4.16 kV bus voltage. In order to implement a consistent set of trip setpoint and allowable value voltages at the 4.16 kV bus level, separate relay level setpoint and allowable values were determined for undervoltage relays connected to lightly loaded and heavily loaded PTs.

Attachment D
PG&E Letter DCL-98-153

MARKED-UP IMPROVED TECHNICAL SPECIFICATIONS

3.3 INSTRUMENTATION

3.3.5 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

LCO 3.3.5 One channel per bus of the loss of voltage DG start Function and two channels for initiation of load shed Function and two channels per bus of the degraded voltage Function with one timer per bus for DG start and initiation of load shed Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4,
When associated DG is required to be OPERABLE by LCO 3.8.2, "AC Sources – Shutdown."

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one or more channels per bus inoperable.	A.1 ----------NOTE---------- One channel may be bypassed for up to 2 hours for surveillance testing. ---------- Declare the associated DG inoperable and enter the applicable Condition(s) and Required Action(s).	Immediately

Two channels per bus, one of the loss of voltage DG start Function, one of the low voltage DG start Function and load shed Function,

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.5.1	Not used	
SR 3.3.5.2	Perform TADOT. Specified in Table 3.3.5-1.	18 months
SR 3.3.5.3	Perform CHANNEL CALIBRATION with [ ] Trip Setpoint and Allowable Value as follows:	18 months

a. Loss of voltage Diesel Start Trip Setpoint and Allowable Value ≥ 0 V with a time delay of ≤ 0.8 second and ≥ 2583 V with a ≤ 10 second time delay.

Loss of voltage initiation of load shed with one relay Trip Setpoint and Allowable Value ≥ 0 V with a time delay of ≤ 4 seconds and ≥ 2583 V with a time delay ≤ 25 seconds and with one relay ≥ 2870, instantaneous.

b. Degraded voltage Diesel Start Trip Setpoint and Allowable Value ≥ 3785 V with a time delay of ≤ 10 seconds.

Degraded voltage initiation of Load Shed Trip Setpoint and Allowable Value ≥ 3785 V with a time delay of ≤ 20 seconds.

Table 3.3.5-1
LOP DG Start Instrumentation Trip Setpoints and Allowable Values

FUNCTIONAL UNIT	TRIP SETPOINT	ALLOWABLE VALUE
First Level -Loss of Voltage - Diesel Start Voltage Relay: Time Delay:	 1040 volts 0.69 seconds	 ≥ 993 volts ≤ 0.75 seconds
First Level -Low Voltage - Diesel Start Voltage Relay: Time Delay:	 3172 volts 1.89 seconds	 ≥ 3126 volts ≤ 1.95 seconds
First Level -Initiation of Load Shed Voltage Relay: Time Delay:	 3172 volts 3.89 seconds	 3126 to 3218 volts 3.83 to 3.95 seconds
Second Level -Diesel Start Voltage Relay: Time Delay:	 3790 volts 9.89 seconds	 ≥ 3753 volts ≤ 9.95 seconds
Second Level -Initiation of Load Shed Voltage Relay: Time Delay:	 3790 volts 19.89 seconds	 3753 to 3815 volts 19.83 to 19.95 seconds

B 3.3 INSTRUMENTATION

B 3.3.5 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

BASES

BACKGROUND

The DGs provide a source of emergency power when offsite power is either unavailable or is degraded below a point that would allow safe unit operation. Undervoltage protection will generate an LOP start if a loss of voltage or degraded voltage condition occurs on the 4.16kV vital bus. There are three LOP start signals, one for each 4.16 kV vital bus.

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Three undervoltage relays are provided on each 4160 Class 1E vital bus for detecting sustained degraded voltage condition or a loss of bus voltage. A relay will generate an LOP signal (first level undervoltage type relay setpoint) if the voltage is below 75% for a short time . The DG start relays (one per bus) have an inverse time characteristic and will generate an LOP signal with a ≤0.8 sec time delay at ≥ 0 volts and at ≤ 10 seconds for ≥ 2583 volts. In addition, the circuit breakers for all loads, except the 4160-480 V load center transformers, are opened automatically by a similar set of first level undervoltage relays. Each of the vital 4160 kV buses has a separate pair of these relays. The relays have a two-out-of-two logic arrangement for each bus to prevent inadvertent tripping of operating loads during a loss of voltage either from a single failure in the potential circuits or from human error. One relay trips instantaneously at ≥ 2870 volts. The second of the two relays has an inverse time characteristic and a delay of ≤ 4 seconds at no voltage and a ≤ 25 second delay with ≥ 2583 volts to prevent loss of operating loads during transient voltage dips, and to permit the offsite power sources to pick up the load. The LOP start actuation is described in FSAR, Section 8.3 (Ref. 1).

3790

Should there be a degraded voltage condition, where the voltage of the vital 4160 kV buses remains at approximately 3785 kV or below, but above the setpoints of the first level undervoltage relays, the following second level undervoltage actions occur automatically:

approximately 9.89

(1) After a ≤ 10 second time delay, the respective diesel generators will start.

approximately 19.89

(2) After a ≤ 20 second time delay, if the undervoltage condition persists, the circuit breakers for all loads to the respective vital 4160 kV buses, except the 4160-480 V load center transformer, are opened and sequentially loaded on the DG.

Each vital 4160 kV bus has two second level undervoltage relays and one associated timer to initiate each of the above actions (1) and (2) (one timer for each action).

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(continued)

Inserts for ITS page B 3.3-123

Insert C

On a loss of power from the main generator, the 500kV system or on a 4kV auxiliary bus undervoltage condition, any 4kV bus fed from the auxiliary transformer will be automatically transferred to the startup transformer feeder. If the transfer is unsuccessful or there is a loss of voltage or an undervoltage condition on the startup feeder, the DG will be started and brought to a suitable condition for loading. If the undervoltage condition persists, the loads will be shed and transferred to the DG. The starting of the DG and the initiation of load shed occurs via the first or second level undervoltage relays.

Four first level undervoltage relays are provided on each 4160 kV Class I E vital bus for detecting loss of voltage and low voltage conditions and initiating a DG start and load shedding. There are two low voltage relays and two loss of voltage relays per bus. The relays have instantaneous time characteristics, so separate timers are provided to complete the LOP functions. Upon detecting a low voltage condition representing about 76% (relay setpoint of 3172V) bus voltage by either of the two relays, a LOP signal is generated after a time delay of 1.89 seconds to initiate DG start. If the undervoltage condition exists for 3.89 seconds, indicating the transfer of loads has not been successful, both relays (two-out-of-two logic) must operate to permit the load shed function initiation and transfer of loads to the DG. As a backup to the low voltage relays, the loss of voltage relays perform the same function of DG start and load transfer to the startup feeder, except the relay setpoints are 1040V with a time delay of 0.69 seconds. The time delays are provided to prevent loss of operating loads during transient voltage dips and to permit the startup feeder to pick up the loads. The LOP start actuation is described in the FSAR Section 8.3 (Ref. 1).

Insert D

Each of the undervoltage protective schemes (FLUR-low voltage, FLUR-loss of voltage, and SLUR) is implemented utilizing two undervoltage relays per bus. Each of these relays senses the 4.16 kV bus voltage via a potential transformer (PT). Due to different loads connected to these PTs, different voltages will be sensed at the undervoltage relays for a given 4.16 kV bus voltage. In order to implement a consistent set of trip setpoint and allowable value voltages at the 4.16 kV bus level, separate relay level setpoint and allowable values were determined for undervoltage relays connected to lightly loaded and heavily loaded PTs.

BASES

BACKGROUND (continued)

Trip Setpoints and Allowable Values

The Trip Setpoints used in the relays are based on the analytical limits presented in FSAR, Chapter 15 (Ref. 2). The selection of these Trip Setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. has an allowable range specified as the

The ~~actual nominal~~ Trip Setpoint ~~entered into the relays is normally still more conservative than that required by the~~ Allowable Value. If the measured setpoint ~~does not exceed~~ the Allowable Value, the relay is considered OPERABLE. is within

Setpoints adjusted in accordance with the Allowable Value ensure that the consequences of accidents will be acceptable, providing the unit is operated from within the LCOs at the onset of the accident and that the equipment functions as designed. is within

Allowable Values and/or Trip Setpoints are specified for each Function in the LCO. Nominal Trip Setpoints are also specified in the ~~unit specific~~ setpoint calculations. The nominal setpoints are selected to ensure that the setpoint measured by the surveillance procedure ~~does not exceed~~ the Allowable Value if the relay is performing as required. If the measured setpoint ~~does not exceed~~ the Allowable Value, the relay is considered OPERABLE. Operation with a Trip Setpoint ~~less conservative than the nominal Trip Setpoint, but~~ within the Allowable Value is acceptable provided that operation and testing is consistent with the assumptions of the ~~unit specific~~ setpoint calculation. Each Allowable Value and/or Trip Setpoint specified is more conservative than the analytical limit assumed in the transient and accident analyses in order to account for instrument uncertainties appropriate to the trip function. These uncertainties are defined WCAP-11082, Rev. ~~2~~ 5 " Westinghouse Setpoint Methodology for Protection Systems Diablo Canyon Stations ~~Eagle 21 Version~~ " (Ref. 3).

is within

24 Month Fuel Cycle Evaluation

APPLICABLE SAFETY ANALYSES

The LOP DG start instrumentation is required for the Engineered Safety Features (ESF) Systems to function in any accident with a loss of offsite power. Its design basis is that of the ESF Actuation System (ESFAS).

Accident analyses credit the loading of the DG based on the loss of offsite power during a loss of coolant accident (LOCA). The actual DG start has historically been associated with the ESFAS actuation. The DG loading has been included in the delay time associated with each safety system component requiring DG supplied power following a loss of offsite power. The analyses assume a non- mechanistic DG loading, which does not explicitly

(continued)

two channels per bus, one of the loss of voltage DG start Function, one of the low voltage DG start Function and load shed Function,

BASES

APPLICABLE SAFETY ANALYSES (continued)

account for each individual component of loss of power detection and subsequent actions.

The required channels of LOP DG start instrumentation, in conjunction with the ESF systems powered from the DGs, provide unit protection in the event of any of the analyzed accidents discussed in Reference 2, in which a loss of offsite power is assumed.

The delay times assumed in the safety analysis for the ESF equipment include the 10 second DG start delay, and the appropriate sequencing delay, if applicable. The response times for ESFAS actuated equipment in LCO 3.3.2, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," include the appropriate DG loading and sequencing delay.

The LOP DG start instrumentation channels satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The LCO for LOP DG start instrumentation requires that one channel per bus of loss of voltage and two channels per bus for initiation of load shed and two channels per bus of degraded voltage with one timer per bus for DG start and initiation of load shed Functions shall be OPERABLE in MODES 1, 2, 3, and 4 when the LOP DG start instrumentation supports safety systems associated with the ESFAS. In MODES 5 and 6, the channels must be OPERABLE whenever the associated DG is required to be OPERABLE to ensure that the automatic start of the DG is available when needed. Loss of the LOP DG Start Instrumentation Function could result in the delay of safety systems initiation when required. This could lead to unacceptable consequences during accidents. During the loss of offsite power the DG powers the motor driven auxiliary feedwater pumps. Failure of these pumps to start would leave only one turbine driven pump, as well as an increased potential for a loss of decay heat removal through the secondary system.

APPLICABILITY

The LOP DG Start Instrumentation Functions are required in MODES 1, 2, 3, and 4 because ESF Functions are designed to provide protection in these MODES. Actuation in MODE 5 or 6 is required whenever the required DG must be OPERABLE so that it can perform its function on an LOP or degraded power to the vital bus.

ACTIONS

In the event a channel's Trip Setpoint is found nonconservative with respect to the Allowable Value, or the channel is found

(continued)