

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 insufficiently stable to allow safe unit operation. Undervoltage protection will generate an LOP start if a loss of voltage or degraded voltage condition occurs in the switchyard. There are two LOP start signals, one for each 4.16 kV vital bus.

There is one undervoltage relay per phase connected in a two-out-of-three logic scheme on the 4160 V essential bus. For an actual loss of voltage to the bus, the normal incoming breaker is tripped, the 4160 volt essential bus is load shed, and the diesel generator breaker is closed provided the diesel generating unit has attained at least 95% speed.

There is one degraded voltage relay per phase connected in a two-out-of-three logic scheme. Once the undervoltage is detected, two time delay relays begin timing to verify the event is sustained. If the first timer completes its cycle, an alarm will be initiated in the control room. The second time delay relay is provided to allow additional time following the first time delay for the operators to improve voltage. If the undervoltage condition is still present when the second timing cycle is complete, the normal and standby incoming circuit breakers are tripped. The LOP start actuation is described in UFSAR, Section 8.3 (Ref. 1).

Trip Setpoints and Allowable Values

The NOMINAL TRIP SETPOINTS used in the relays are based on the analytical limits presented in UFSAR, Chapter 15 (Ref. 2). The selection of these NOMINAL TRIP SETPOINTS is such that adequate protection is provided when all sensor and processing time delays are taken into account.

The actual as-left setpoint of 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.

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.

BASES

BACKGROUND (continued)

Allowable Values and NOMINAL TRIP SETPOINTS are specified for each Function in the LCO. The NOMINAL TRIP 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. A relay shall be OPERABLE if the point at which the relay trips is found equal to or more conservative than the Allowable Value. If the point at which the relay trips is found outside of the NOMINAL TRIP SETPOINT calibration tolerance band in a conservative direction, the relaying shall be checked to verify that it will not render the offsite power system INOPERABLE due to premature actuation. If the trip setpoint is found outside of the NOMINAL TRIP SETPOINT calibration tolerance band, the setpoint shall be re-adjusted. In the event a relay's trip setpoint is found less conservative than the Allowable Value, or the transmitter, instrument loop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that relay must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected. Each Allowable Value and NOMINAL 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 in setpoint calculations (Ref. 3).

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 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.

BASES

APPLICABLE SAFETY ANALYSIS (continued)

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 (Ref. 4).

LCO

The LCO for LOP DG start instrumentation requires that three channels per bus of both the loss of voltage and degraded voltage 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 three 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

A channel shall be OPERABLE if the point at which the relay trips is found equal to or more conservative than the Allowable Value. If the point at which the channel trips is found outside of the NOMINAL TRIP SETPOINT calibration tolerance band in a conservative direction, the channel shall be checked to verify that it will not render the offsite power system INOPERABLE due to premature actuation. If the trip setpoint is found outside of the NOMINAL TRIP SETPOINT calibration tolerance band, the setpoint shall be re-adjusted. In the event a relay's trip setpoint is found less conservative than the Allowable Value, or the transmitter, instrument loop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that relay must be declared inoperable and the LCO Condition(s) entered for the protection Function(s) affected.

Because the required channels are specified on a per bus basis, the Condition may be entered separately for each bus as appropriate.

BASES

ACTIONS (continued)

A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in the LCO. The Completion Time(s) of the inoperable channel(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A applies to the LOP DG start Function with one loss of voltage or degraded voltage channel per bus inoperable.

If one channel is inoperable, Required Action A.1 requires that channel to be placed in trip within 6 hours. With a channel in trip, the LOP DG start instrumentation channels are configured to provide a one-out-of-two logic to initiate a trip of the incoming offsite power.

The specified Completion Time is reasonable considering the Function remains fully OPERABLE on every bus and the low probability of an event occurring during these intervals.

B.1

Condition B applies when more than one loss of voltage or more than one degraded voltage channel on a single bus is inoperable.

Required Action B.1 requires restoring all but one channel to OPERABLE status. The 1 hour Completion Time should allow ample time to repair most failures and takes into account the low probability of an event requiring an LOP start occurring during this interval.

C.1

Condition C applies to each of the LOP DG start Functions when the Required Action and associated Completion Time for Condition A or B are not met.

In these circumstances the Conditions specified in LCO 3.8.1, "AC Sources-Operating," or LCO 3.8.2, "AC Sources—Shutdown," for the DG made inoperable by failure of the LOP DG start instrumentation are required to be entered immediately. The actions of those LCOs provide for adequate compensatory actions to assure unit safety.

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.5.1

SR 3.3.5.1 is the performance of a TADOT. The test checks trip devices that provide actuation signals directly, bypassing the analog process control equipment. For these tests, the relay NOMINAL TRIP SETPOINTS are verified and adjusted as necessary. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Testing consists of voltage sensor relay testing only. Actuation of load shedding and time delay timers is not required.

SR 3.3.5.2

SR 3.3.5.2 is the performance of a CHANNEL CALIBRATION.

The setpoints, as well as the response to a loss of voltage and a degraded voltage test, shall include a single point verification that the trip occurs within the required time delay, as shown in Reference 1.

CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

If plant conditions warrant, the definition of NOMINAL TRIP SETPOINT provides an option for setting a trip setpoint in plant hardware outside the NOMINAL TRIP SETPOINT calibration tolerance band as long as the trip setpoint is conservative with respect to the NOMINAL TRIP SETPOINT. Application of that provision to this SR could result in premature separation of safety related equipment from offsite power during switchyard voltage fluctuations. Consequently, this SR has been modified by a Note stating that a NOMINAL TRIP SETPOINT shall be set within the channel's calibration tolerance band.

REFERENCES

1. UFSAR, Section 8.3.
2. UFSAR, Chapter 15.
3. Loss of Voltage Relay Setting Calculation, MCC-1381.05-00-0094.
4. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).