

Westinghouse Instrumentation and Control

Rod Control System Battery Backup Power Supply Enhancement Kit

Background

Several reactor trips attributed to lightning strikes have occurred in plants with the Westinghouse Solid State Rod Control System (SSRCS.) NRC Information Notice 85-86 notified all nuclear power plants of potential lightning induced problems with the SSRCS. In response, Westinghouse has developed a modification kit that includes a battery backup system for the (+)24 VDC power supplies.

Description

The power supply enhancement kit replaces the +24 VDC Rod Control Power Cabinet Power Supplies. This kit alleviates the Rod Control System susceptibility to a common mode shut-down due to the failure of the power supplies or tripping of the over-voltage protectors from a lightning strike. The over-voltage protectors are also susceptible to noise generated by other plant components such as chattering relays etc. The common mode shut-downs cause a loss of power to the +24 VDC bus. The loss of +24 VDC bus allows the rods to be released to drop into the reactor core and tripping the plant. This design adds back-up batteries to maintain the +24 VDC bus and timed reset power supplies to power the +24 VDC bus and eliminates plant trips. This design also addresses the Rod Ratchetting issue as described in Westinghouse Nuclear Safety Advisory Letter NSAL-96-002.

Benefits

Built-In Redundancy

This design provides a backup battery bank for each power supply PS1 and PS2. Each battery bank is redundant to the other battery bank. Upon failure of a power supply, the redundant power supply assumes the entire load. If both power supplies PS1 and PS2 are tripped or failed, these battery banks supply power to the +24 volts bus for at least one hour under full load.

Timed Reset of Power Supplies

The timed reset feature provides a reset for power supplies PS1 and PS2 after a shut-down of the output of the power supplies. This feature

eliminates manual reset of the power supplies after they are tripped.

Annunciation of Power Supplies Malfunction

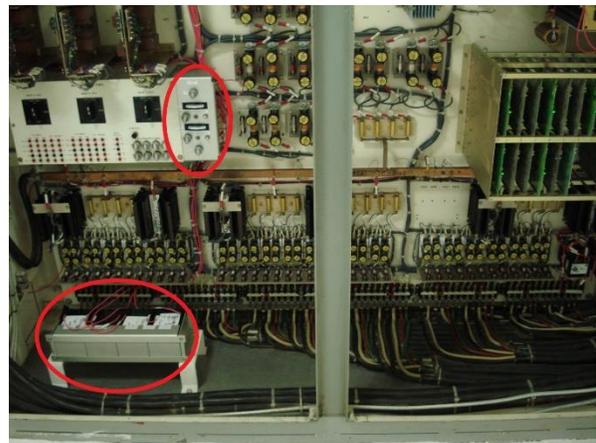
The design of this kit provides annunciation of the malfunction of the power supplies.

Built-In Testing and Monitoring of Battery Banks

The kit provides meter and load on monitoring panel to test battery banks and monitor battery voltage under full load condition.

Auto Charging of Battery Banks

The battery banks are continuously trickle charged by the power supply PS1 and PS2.



Top Circle: Battery Backup Power Supplies Test Panel

Bottom Circle: Backup Batteries for + 24 VDC Power Supplies

Experience

The kit has been installed in all Power Cabinets in four operating units (two plant sites), where they have operated successfully for more than 20 years.