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Upgrading ATRs Diesel Generator Control Panels

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Idaho National Laboratory

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Background

At the Advanced Test Reactor (ATR) the diesel generator plays an important role as it supplies power to the facility in an emergency. The control panels house the switchgear components that help protect, monitor, and control the generator. Many of the components in the control panels are outdated and in need of replacement. The objective of this project was to design the wiring and layout of the new components that would improve the overall performance and reliability of the generator.

Kilowatt Meter

One of the upgrades made was the change from a power factor meter to an analog kilowatt meter. The analog





kilowatt meter is an important part of the monitoring process as it monitors the real power of the generator and the rate of change when unloading the generator. By monitoring these values, it ensures that the generator is not mechanically overloaded, and can be safely unloaded without stressing the system.

Figure 2: Analog Kilowatt Meter

Figure 1: Control Panels 118 (left side panel) and 119 (right side panel)

Over/Under Frequency Relay

The Over and Under Frequency relays are being replaced by a singular frequency relay that will perform the same task. The job of the over/under frequency relay is to monitor the frequency of the generator to ensure it remains as close to 60 Hz as possible. The relay has two setpoints, one for underfrequency at 59 Hz and one for overfrequency at 61 Hz. If the relay detects that either of these values is met for a certain amount of time, then it will take the appropriate action, such as shutting down the generator, to prevent things like overspeed that can extremely damage the system.







Figure 3: Outdated Frequency Relays (Over Frequency left) (Under frequency right)



Figure 4: Updated Over/Under Frequency Relay

<image><image>

Conclusion

The Emergency Stop Button ensures quick shutdown of the generator during emergencies. Before 1994, an engine selector switch (ESS) failed at initiating an emergency shut down, prompting a jumper wire fix that unintentionally disabled the ability of an emergency stop. In 2021, a generator breaker failure caused a fire; operators couldn't use the ESS to shut down, requiring manual shutdown in a smoke-filled area. A new emergency stop button on the control panel would reinstate the emergency shutdown capability without the failure risk.

Along with general maintenance, upgrading components is a vital part of ensuring the optimal performance and efficiency of a generator. By upgrading components such as the kilowatt meter, frequency relay, and emergency stop button, you also improve things such as the lifespan, safety, and reliability of the generator.



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