



A Custom-Engineered Replacement for Liquid Power Fuses Protecting Indoor Potential Transformers

S&C Featured Solution: S&C's Power Systems Solutions

Location: Southern United States

Customer Challenge

A generation and transmission utility in the southern U.S. had a number of 18-kV and 24-kV generating stations in which 1940s-vintage S&C Type RR Potential Transformer Protective Combinations were applied to protect indoor potential transformers serving metering and other loads.

These long-obsolete devices—installed in asbestos-wall potential transformer cubicles—feature a ½-ampere S&C Type DLC Liquid Power Fuse in series with 90- or 120-ohm S&C Type RR Wire-Wound Current-Limiting Resistors that limit the extremely high 200- to 300-kA available fault current on the generator bus to a definitive low level.

Because the S&C Type DLC Liquid Power Fuse is no longer manufactured, and no conventional current-limiting fuse available today can handle such high fault currents at these voltages, the utility asked S&C to provide a functional equivalent.

The requirements were formidable. The replacement fuse would need to be capable of:

- Interrupting the very low currents limited by the resistors and neutral grounding transformer
- Handling the high-frequency transient recovery voltage experienced under certain ground fault conditions
- Matching the time-current characteristics of the S&C Type DLC Liquid Power Fuse
- Quickly retrofitting in the existing resisted power fuse mountings with a minimum of rework to eliminate disruption of the asbestos environment

An asbestos-wall cubicle houses a potential transformer, which is connected to the isolated phase bus of the generator.



S&C Type RR Potential Transformer Protective Combination installed in potential transformer cubicle. The potential transformer (not visible) is located at the bottom of the cubicle. The S&C Type DLC Liquid Power Fuse has been removed from the mounting in this photo.





S&C Solution

S&C's Power Systems Solutions engineers performed a site walk-down at several generating stations to determine the generator and potential transformer ratings and to assess the physical constraints. Transient analysis studies were then prepared to determine the proper testing parameters for the replacement fuse.

Based on these findings, S&C developed a special solid-material Type LPF-20R Fuse Unit with time-current characteristics closely matching those of the Type DLC Liquid Power Fuse. Performance of the LPF-20R Fuse Unit was verified through rigorous testing in S&C's Electrical Laboratory using a test circuit closely matching that of the customer's generating stations.

To make field retrofit quick and easy, S&C's engineering team designed unique adjustable end-fittings for the LPF-20R Fuse Unit. The replacement

fuse neatly fits in the upper and lower contact assemblies of the restored power fuse mounting without modification, as shown below. The existing series-connected current-limiting resistors are unaffected by the retrofit.

Like the Type DLC Liquid Power Fuse it replaces, the LPF-20R Fuse Unit does not vent ionized gases when it operates...of particular importance in this application because the potential transformer is located directly below the fuse in the cubicle.

Results

Prototype replacement fuses were delivered to the utility in just three months. And the entire project was completed in only six months. S&C may be able to design replacements for the liquid power fuses on your system; contact your nearest S&C Sales Office for details.

25-kV S&C Type RR Potential Transformer Protective Combination with original 25-kV, 1/2-A Standard Speed, Size 4 Type DLC Liquid Power Fuse.



25-kV S&C Type RR Potential Transformer Protective Combination retrofitted with 25-kV, 1/2-A Standard Speed, LPF-20R Fuse Unit.

