WHITE PAPER

Switchgear Solutions:
Beyond the Standard

Testing Beyond the Standard:
Transient Recovery Voltages for Medium Voltage Switchgear

System parameters like capacitance and inductance can have adverse effects on the performance of load switching mechanisms. Highly capacitive and inductive loads cause transient recovery voltage (TRV) during load switching beyond the values determined by the IEEE C37.74 standard. Systems experiencing such loads are subject to failures in equipment that do not exceed the standard and can result in outages, equipment damage and loss of revenue.

TRV appears across the terminals of a switching device after current interruption. It consists of TRV peak value (kV), time to TRV peak (µSec) and a resulting rate of rise (kV/µSec).

In general, the larger the rate of rise, the more difficult the load current is to break without causing a voltage restrike across the open contacts. A typical waveform is shown below in *Figure 1*.

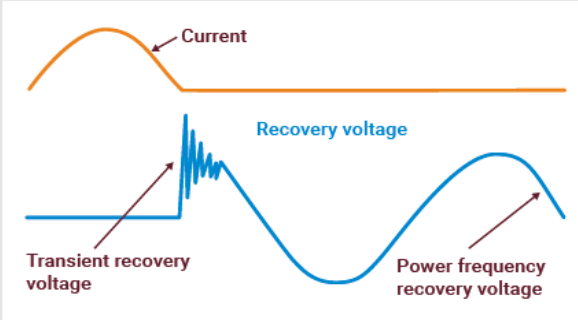

Figure 1

$$\text{Rate of Rise} = \frac{\text{TRV Peak Value}}{\text{Time to TRV Peak}}$$

TVR Testing and Results

G&W designed and tested the linear puffer mechanisms to provide a reliable solution capable of withstanding the worst case TRVs. The mechanisms are rated for over 15 (15x) the TRVs provided per the standard. The highest rate of rise in the standard is found in IEEE C37.74, with value 0.04194 kV/µSec. G&W's mechanism is rated for 0.60185 kV/µSec, or over 15.5 times the standard. See Table 2 for details.

In addition to the TRV testing above the standard, the mechanisms have been tested to break loads up to 3,000A. The mechanism was subjected to 1,200 operations at load current followed by 10 operations each at varying levels from 600 up to 3,000A for a total of 1,270 operations. The test resulted in a fully functional mechanism and proceeded to pass all production tests per the ANSI/IEEE 37.74 after the high-current operations.

The G&W linear puffer mechanism is best in class, with the capability of interrupting TRVs and load break currents. This robust switch instills confidence to handle the worst of conditions.

RATED MAXIMUM VOLTAGE	38 kV	
Load Switching per IEEE C37.74-2003	Voltage Peak	13 kV
	Time to Peak	310 µSec
	Rate of Rise	**0.04194** kV/µSec
Load Switching per G&W LP Mechanisms	Voltage Peak	65 kV
	Time to Peak	108 µSec
	Rate of Rise	**0.60185** kV/µSec

Table 2

G&W
Engineered to order. Built to last.