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Place: Surge Suppression Incorporated Laboratory

Abstract: The utilization of Shielded Isolation Transformer in industrial settings does have certain valuable benefits in specific identifiable situations. The assumption by many is that one of the particular benefits is that of protection against transient voltage spikes and surges. The testing of this single phase 120/240 Shielded Isolation transformer manufactured by Hammond will illustrate the fallacy of that notion and the need for implementing surge protective devices on the input of isolation transformer.

Hammond Manufacturing Single phase shielded isolation transformer

The A3 Ringwave and the B3/C1 Combo wave tests were injected
at 90 Degrees on the sinewave
Measurements were taken from 0 Degrees to the peak of the surge
The A1 Ringwave was injected at 270 Degrees on the sinewave
Measurements were taken from point of injection to peak of the surge

		A1	A3	B3
Threshold SPD	L-N		1136	801
	L-G		371	312
	N-G		228	295
Frequency Attenuation SPD	L-N	25	226	790
	L-G	27		346
	N-G	23		215
Transformer Only	L-N	2594	7250	8990
	L-G	346	859	1400
	N-G	331	791	1250
Frequency Attenuation SPD on Txfr Output	L - N	170	306	422

Observations:

Tests were conducted first with the SPD units in place in front of the isolation transformer. There was some concern that the unit could be damage in some manner if it was subjected to multiple impulses without adequate protection in place. The final tests conducted were with the SPD on the output of the transformer. After initial Line to Neutral it was discovered that Line to Ground mode had been damaged, there was no output voltage on this mode of operation. Further testing ceased at this point.

Note – the increase in output measured surge voltage on the Line – Neutral testing without an SPD installed. This type of transformer design, appears to be no benefit to the user for preventing downstream disruption and damage to connected loads on the differential (L-N) mode. There is some benefit in the Common mode arena, but very little.

Note – With either the Frequency attenuation unit or the Threshold clamping unit significant protection is obtained in either mode on the B3/C1 combination wave tests.

Note – to prevent software disruption and other related phenomenon the Frequency Attenuation unit provided the greatest overall benefit.

Note – while the SPD on the output of the transformer was able to demonstrate marked reduction of the residual voltage from the B3/C1 test, the other – typically more prevalent voltage aberrations were less attenuated.

Recommendation: In applications of marginal criticality where shielded isolation transformers are implemented for high frequency noise attenuation, the application of SPD units on the input to the transformer provide remarkable benefit for the connected loads and the protection of the transformer. In applications of high criticality where shielded isolation transformers are implemented for high frequency noise attenuation, the application of SPD units on the input and output of the transformer should be considered.

Test Bench showing Surge Generator, Digital Storage Oscilloscope and Isolation Transformer.

Below - Test graphs of B3 test without SPD and expanded resulting wave shape and A1 test results with Frequency attenuation SPD.