MAXIMUM CREDIBLE FAULT TESTING FOR GOULD J10 RELAY

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT UNIT 2

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Maximum Credible Fault Testing for Gould J10 Relay

Background

The Gould J10 relay is seismically qualified in accordance with IEEE344-1975 and environmentally qualified in accordance with 10CFR50.49 for class 1E application. This qualification is consistent with the basis of the plant. For details and references, refer to calculation 12177-EQS-92.

General

This procedure only covers the testing of Gould J10 relay for the maximum credible fault. The maximum current the relay can pull is limited due to the internal resistance of the relay. The maximum credible voltage is limited from the regulating sources upstream and finally the EPA's. The EPA over voltage trip points are set at 132 volts. However, due to the cable voltage drops, the maximum voltage at the MSIV panels would be approximately 119 volts.

Objective

The objective of this test is to justify that upon an injection of current higher than the rating of the coil and contacts, the isolation between coil and contacts is maintained and that there is no spurious signals transmitted across to the other side. Since the actual installation of these relays uses a metallic barrier between the coil and the contacts, this barrier will be used in the testing.

Test Setup	Initials	Date
1. The test setup shall be in accordance with the schematic shown in figure 1.	DR	2/3/87
2. The voltage source shall be greater than 119V.	DR	2/3/87
3. The current signal shall be greater than 15 amperes for the contacts.	DR	2/3/87
4. The coil testing shall be based on the maximum withstand voltage of the devices, i.e., 1000 volts which is higher than the maximum credible voltage in the system. However, this is required to inject currents greater than the nominal rating of the relay.	DR	2/3/87

Procedure	Initials	Date

The testing will be performed in two steps.

Step 1 Contact Testing

In accordance with figure 1, voltage is to be applied to coil and the contacts. The contact side shall be provided with a current signal of greater than 15 amperes. This can be achieved by inserting a resistor in series with the contacts. The resistor size in indicated as 6 ohms, however, availability of resistors may dictate the exact size. The current shall be injected into the contacts for a period of 10 minutes or until such time when the contacts are no longer functional. During this time, the current and voltage on the coil side shall be continuously or manually recorded. This data will provide information on any spurious signals transmitted across the barrier. DR 2/3/87

Step 2 Coil Testing

Upon completion of step 1, it will be necessary to replace the contact block on the relay. For this step, the resistance in the contact circuit should be increased such that the contacts draw a nominal current within its rating of approximately 10 ampere. The coil shall be applied with gradually increasing voltage up to a 1000 volts. Again as in step 1, the test shall be continued for 30 minutes or until such time when the relay coil is no longer functional. The status and contact parameter will be observed for spurious signals in this step. DR 2/3/87

Acceptance

The relay will be considered as an acceptable isolation device if steps 1 and 2 of this procedure do not show any spurious signals propogated across the barrier. It should, however, be noted that contact status change when the relay coil is no longer functional is an acceptable change of status.

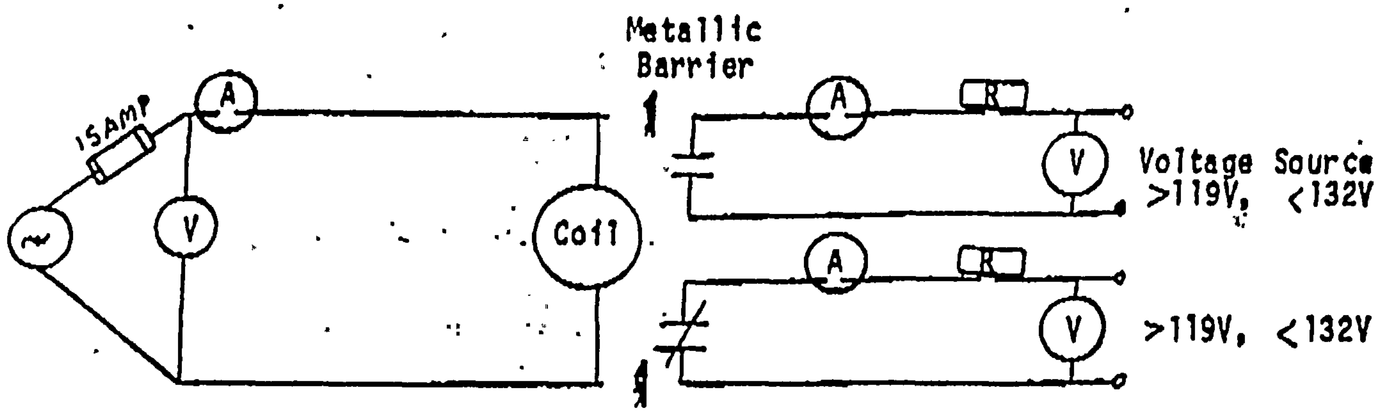

Figure 1

(A) Ammeter

(V) Voltmeter

[R] Resistor ≃ 6 OHMS for Step 1
≃ 12 OHMS for Step 2

(~) Source Voltage source for Step 1
Current source for Step 2 (Higher Voltage)

CAUTION: Voltages and currents applied to the relay are extremely excessive as compared to the nominal rating. Therefore, appropriate precautions are necessary.

TEST SUMMARY

The testing of the Gould J10 relay was performed in accordance with the test procedure established "Maximum Credible Fault Testing for Gould J10 Relay." The purpose of this testing was to establish the acceptability of the J10 as an isolator.

This test showed that the relay exhibited performance in accordance with the established acceptance criteria. There were no spurious signals observed when higher than established maximum credible faults, i.e., voltage/current, were applied in the forward and the transverse modes.

At the completion of the contact testing, there was no degradation of the contacts. The contacts were injected with a current of greater than 15 amperes for a period of 10 minutes. The voltage and current of the coil were monitored manually and no significant change was observed from the start to finish of this step. The contact resistance did not change appreciably as shown in the enclosed data.

For step 2 of the procedure, the same relay and contact block was used. The resistance in the contact circuit was increased to lower the current to within the contact rating of 10 amperes. It should also be noted that in actual practice, the contacts would not draw more than approximately 1 ampere due to the additional impedance of other devices in series with the contact. The coil was applied with a nominal voltage, i.e.; 120 vac. The coil current was observed at this time. The coil voltage was gradually increased exceeding the maximum credible voltage and the next data point was taken at 240 vac. The current through the coil gradually increased during this process. The voltage was further increased to 360 vac and data noted. After the data was recorded, the relay coil broke down and the coil current dropped to zero. At this time, the contacts changed status. The coil current draw was 9.3 amperes at the time of the last data reading.

Therefore, it can be concluded that as the voltage was increased, the relay coil drew more current than its rating. The continued increase in current resulted in the coil failure at which time, the coil burned and de-energized the coil. The contact status changed upon this de-energization. During this entire procedure, the contacts were monitored and spurious signals were not observed.

It must be acknowledged that this testing subjected the test specimen to both voltage and current which far exceeded the maximum credible faults for which this relay is expected to operate. As shown in calculation 12177-EQS-92, the maximum credible voltage is limited to 119 vac by redundant Class 1E electrical protection assemblies. The maximum credible current is limited to 15 amps by redundant Class IE fuses. The testing performed exceeded both of these maximum credible faults and has proven that the J10 relay is an acceptable isolation device since neither excessive voltage nor excessive current propagated from coil to contact nor from contact to coil. Additionally, the testing performed has shown that when applying faults in excess of the maximum credible faults, the relay failure simulates a de-energized relay which when used in its specific application at NMP2 in a fail-safe, de-energize to trip application assures circuit safety is maintained.

Based on this testing and the information provided in 12177-EQS-92, the Gould J10 relays are acceptable as an isolation device.

LIST OF INSTRUMENTS USED*

EQUIPMENT	RANGE	FUNCTION	CALIBRATION DUE DATE
DRANETZ POLYMTR #5111	0-150 Volts 0-100 amps	Monitor Contact Voltage & Current	3/12/87
DRANETZ POLYMTR #2021	0-15 amps 0-150 volts	Monitor Contact Voltage & Current	6/17/87
DRANETZ POLYMTR #2004	0-15 amps 0-600 volts	Monitor Coil Voltage & Current	3/27/87
STATES LOAD BANK #12997	amps	Current Source With Resistor	N/A
STATES LOAD BANK #12995	amps	Current Source With Resistor	N/A
FLUKE MULTIMETER #2205	0-200 volts	Resistance	7/21/87
IMPERVITRAN XFMR	115:575V	Higher Voltage Supply for Coil	N/A

* For all Dranetz Polymtrs, accuracy is shown below:

Scale	Value
0-150 volts	±0.4 volts at 124 volts
0-100 amps	±0.18 amps at 50 amps
0-15 amps	±0.046 amps at 14 amps
0-1.5 amps	±0.0046 amps

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DATA

STEP 1 - CONTACT TESTING

	START	END
Contact Resistance	0.15 ohms	0.09 ohms
'A' Contact Current	15.12 amps	15.13 amps
Coil Voltage	120.3 volts	120.5 volts
Coil Current	0.133 amps	0.132 amps
'B' Contact Current	0.00	0.00
'B' Contact Voltage	125.4 volts	126.4 volts
Coil Voltage	120.7 volts	120.5 volts
Coil Current	0.133 amps	0.131 amps

STEP 2 - COIL TESTING

COIL VOLTAGE	COIL CURRENT	'B' CONTACT CURRENT	'A' CONTACT CURRENT
120 volts	0.135 amps	0	9.73 amps
240 volts	0.94 amps	0	9.6 amps
360 volts	9.3 amps	0 to 9.8 amps	9.5 to 0 amps

Test was discontinued since the relay coil showed open circuit and contacts changed status.