

Notification 200842716

Note - This POD SHALL address all breakers with this design.

PROMPT OPERABLE / DETERMINATION TEMPLATE
(Refer to SOL13-KV-52)

PART 1: DEGRADED, NONCONFORMING/UNANALYZED CONDITION

A. Describe the as-found condition and the equipment affected, assuring that the problem and scope have been clearly identified.

On 3/13/10 2P026 was started and breaker 2A0605 tripped immediately after operating successfully since Dec 2009. Subsequent trouble shooting found that if one of 4 Breaker closed indicating lights is removed, the breaker does not trip. It was suspected that the trip coil in new breaker is being tripped by the current going through the breaker closed indicating lights.

The breaker was recently changed to a Vacuum style circuit breaker Squared HE by MLF (with ECR) along with 12 other breakers on 2A06 during the recent 2016 bus outage.

During troubleshooting it was noted that the resistors for the TS bulb and the CS bulb had cracks. Debris was also noted in the sockets.

B. If it is confirmed at this stage that no degraded, nonconforming or unanalyzed condition exists, record as such and provide justification.

PART 2: SPECIFIC SAFETY FUNCTION(S) OF THE AFFECTED SSC
All 4KV breakers on bus 2A06 are required to interrupt the current flow on a valid trip signal and, conversely, to energize the load and allow it to start and run in the absence of such a trip. The original failed breaker 2A0605 was associated with Component Cooling Water Pump 2P026. The other breakers in 2A06 are associated with various safety related components. The safety related functions of these components are discussed in the following UFSAR sections:

The applicable specified safety functions of Component Cooling Water Pumps 2P025 and 2P026 are described in UFSAR 9.2.2.1.

The applicable specified safety functions of Auxiliary Feed Water Pump 2P504 is described in UFSAR 10.4.9

The applicable specified safety functions of Containment Spray Pump 2P013 is described in UFSAR 6.2.2.

The applicable specified safety functions of Low Pressure Safety Injection Pump 2P016 is described in UFSAR 6.3.2.2.2.

The applicable specified safety functions of High pressure Safety Injection Pumps 2P019 and 2P018 are described in UFSAR 6.3.2.2.3

The applicable specified safety functions of Salt water Pumps 2P113 and 2P114 are described in UFSAR 9.2.1.

The applicable specified safety functions of Auxiliary Building Emergency Chiller E335 are described in UFSAR 9.1.

The applicable specified safety functions of Emergency Diesel Generator 2G003, Unit Aux transformer 2XU1, Reserve Auxiliary Transformer 2XR2 and Load Center Transformers 2B06X and 2B26A are described in UFSAR 8.3..

PART 3: BASIS FOR DETERMINING IMPACT ON SPECIFIC SAFETY FUNCTION(S)

A. Technical Basis

Under normal conditions, in the absence of trip signals, this breaker is expected to remain closed to allow the pump to run.

Maintenance inspected the installed light bulbs of 2A0605 breaker control circuit and resistance of the ceramic resistors for TC close and the CS start lights as well as the variable resistors for the CR lights. None of the light bulbs or the resistances were found to be abnormal.

TS: 2.04kohms

CS: 2.00kohms

CR lights were 1546 ohms and 1245 ohms.

Maintenance then isolated the lights from the control circuit to determine if there was potential for a trip circuit contact that had failed and was increasing the trip current which could cause the trip coil (TC) to operate. There is no indication that this has happened. Currently, the data is pointing to the fact that with 4 lights in the control circuit, the breaker trip coil is near the trip set

point.

The following chart summarizes the differences in the "old" (ABB) and "new" (NLI Square D) breaker:

Square D

Component	Voltage (V)	Current (A)	Operating time
Close coil	90-130	0.7	15 ms
Trip coil	70-140	0.7	15 ms
Spring charging motor	90-130	2.5	5-10 sec.s

ABB

Component	Voltage (V)	Current (A)	Operating time
Close coil	90-130	5.0	75 ms
Trip coil	70-140	5.0	75 ms
Spring charging motor	90-130	10.0	2 seconds

a. Vendor data shows the breaker is required to trip at a nominal 70 vdc. Discussions with the vendor revealed the vendor verifies the breaker will trip at 65 vdc. Neither the vendor nor SONGS previously tested for minimum voltage and current needed to energize the trip coil. Tests performed on 3/23/10 per (b)(6) of NLI, recorded a minimum trip of ~35.0 volts and 0.320A on one breaker in their facility.

b. Measurements taken on the 2A0605 breaker and the breaker intended for cubicle 2A0610, show that the minimum pickup voltage is ~33.5 volts.

c. Measurements taken on the 2A0605 breaker show that the following current and voltage is present on the trip coil with

- Four lights 33.3 Volts and 0.170 Amps
- Three Lights: 27.9 Volts and 0.145 Amps (TS bulb out)
28.5 Volts and 0.146 Amps (CS bulb out)
24 Volts and 0.131 Amps (CR64 bulb out)

c. Two lights 19.4/18.1 Volts and 0.110/0.100 Amps (before/after adjusting RG and RL resistors)

d. Measurements taken on four red light circuit 2A0603 for AFW Pump 2P504 are as follows:

Trip Coil Resistance with the bkr closed 130.6 ohm
Trip Coil Voltage with the bkr closed 32.9 Vdc
Control Circuit Voltage with the bkr open 131.5 Vdc

Using conservative values of 139.5 volts (battery on equalize) and 132 volts (battery on float) calculated values with the battery on equalize and float charge are:

Four lights	0.200A and 0.188 A
Three lights	0.157A and 0.118 A
Two lights	0.100A [.041+.057] and 0.094A [.04+.054]
One light at Swgr	0.043A and 0.040A

These calculated values are within 10% of the measured values

(Lower voltages reduce the current threshold for tripping. If the breaker trips at a value of 45 volts, the current needed to trip the breaker would be 45 Volts/179 ohms = 0.251A)

After replacing the ceramic resistors in the red lights of the TS and CS for breaker 2A0605, the breaker did NOT trip with the design four lights in service. These readings indicate that the problem with 2A0605 tripping was due to deficiencies in the TS and CS ceramic 2K ohm resistors.

Phone conversations with (b)(6) of NLI on 3/23/10 offered the following related information:

1. The seismic qualification test was not done with any voltage applied to the trip coil.
2. In a second conversation (b)(6) reported that he had applied 34 Vdc to the trip coil and the breaker tripped.

With the NLI Vacuum Breakers in service with voltage applied to the trip coil, there is no qualified test report to justify OPERABILITY. NLI only tested the circuit with no continuous voltage applied to the trip coil.

All NLI breakers on bus 2A06 were declared inoperable, except EDG breaker 2A0613 (its red status lights are wired to the negative bus via a 152a contact). A new IN200845084 was written and compliance was notified.

The decision was made to reinstall ITE breakers to all 2A06 positions excepting:

2A0613 EDG Output breaker (no status lights are wired to its trip coil) and

2A0670 480V 2B06 and 2B26 transformer Feeder Breaker (which

will have its two red status lights on 2A06 switchgear disabled by design change that will remove the bulbs from their respective sockets, E.D. 30229 Note 8), both of which will continue to use NLI Vacuum Breakers in a configuration supported by NLI Qualification Report 8023-302 2A-M14, Rev 1.

B. Status (As Found)

- Specified Safety Function(s) Satisfied
- x Specified Safety Function(s) NOT Satisfied

PART 4: CONTINUED DEGRADATION

This is not a continued degradation issue.

PART 5: COMPENSATORY MEASURES

The "old" style breaker is being installed in the 2F026 circuit (and subsequently in most other locations in 2A06 as noted above). The suspect resistors have been replaced. Testing performed in the evening of 3/23/10 on the two removed resistors showed that the resistors, when tested out of the socket did not show any tendency to short. It was not possible to test them in a configuration that mimicked the socket connection.

PART 6: EXTENT OF CONDITION (Required for Inoperable)

This change affects the following Unit 2 Train B 1E 4kv bus breakers with status lights wired to the breaker trip coil:

Drawing	System	Component	Supply Breaker
[with four red lights]			
E.D.30703	CCW	P026	2A0605
E.D.30725	CCW	P025	2A0606
E.D.30725	SWC	P114	2A0611
E.D.31105	APW	P504	2A0602
E.D.30724	SWC	P113	2A0610*

* has the original ITE Brown Koveri breaker

[with three red lights]

E.D.30665	HPSI	P018	2A0609
E.D.30644	HPSI	P019	2A0608
E.D.30642	LPST	P016	2A0607
E.D.30685	CS	P012	2A0604

[with two red lights]

E.D.30228	UAT	Supply breaker	2A0616
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E.D.30225 RAT Supply breaker 2A0618
E.D.30226 Tie Breaker 2A0619
E.D.31357 Chiller E335 2A0612
E.D.30229 2B06/2B26 480v Transformers 2A0620 (see Note 1)

(with no red lights)

E.D.30332 EDG 2G003 Output Breaker 2A0610

Note 1: Breaker 2A0620 will have its red lights disabled making it a "no red light to the trip coil" configuration. The B06/B26 feeder breaker is now operable because the red lights connected to the trip coil have been removed and any elevated temperatures experienced by the trip coil due to previous indicating light currents are bounded by the case or the 4 red light breakers continuing to function since being placed in service for last several months.

Note 2: All in service breakers listed above with red lights connected to the trip coil, will be returned to ITE type air circuit breakers.

Note 3: With actions in note 1 and 2 above complete, there no longer is a U2 Train B. Bus 2A06 4kV breaker degraded or non conforming condition.

EOC Created (YES or NO)? No

Describe "other train/other unit" findings" (if performed):
U2 Train A, U3 Train A and U3 Train B 1E 4kV Buses are not affected. The other train/other unit 1E safety related 4kV breakers continue to be ITE air circuit breakers. Two non-safety related containment chillers (with two indicating lights), one on each unit's A08 bus, have NLI/Square D vacuum breakers. The containment chiller is NOT credited in the NPSAR for accident mitigation.

POD prepared By (b)(6) 3/24/2010 with SME
assistance from (b)(6)

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POD approved by (b)(6)
Peer Checked by (b)(6)