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To: US Nuclear Regulatory Commission
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From: Tracy Bolt
AZZ | NLI Director of Quality Assurance

Part 21 Report No: P21-02152016, Rev. 3
Update** - Reference NRC Notification Event Number: **51923

Subject: Notification of 10CFR Part 21 condition, Masterpact Breaker Fail to Close

Pursuant to 10CFR 21.21 (d) (3) (ii), AZZ|NLI is providing written notification of the identification of a potential defect or failure to comply.

On the basis of our evaluation, it has been determined that there is sufficient information to determine if the subject condition is left uncorrected could potentially create a Substantial Safety Hazard or could create a Technical Specification Safety Limit violation as it relates to the subject plant applications. The plants will need to evaluate their application to determine if the identified condition could have an impact to the plant operation.

The following information is required per 10CFR 21.21 (d) (4).

(i) Name and address of the individual or individuals informing the Commission.

Tracy Bolt, Director of Quality Assurance
Nuclear Logistics, Inc
7410 Pebble Drive
Ft. Worth, TX 76118

(ii) Identification of the facility, activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.

Masterpact NT and NW style Electrically/Remotely operated circuit breakers.
A potential issue of failure to reclose following a command to open electrically has been identified. The failure to reclose electrically/remotely may occur when a close signal of greater than 200mS is applied while the breaker is charging the closing springs and/or a breaker open signal from the shunt trip is received while the close circuit is still energized.

Note: The closing springs electrically charge automatically each time after the breaker closes. This identified condition is not applicable to manual only circuit breakers.

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(iii) Identification of the firm constructing or supplying the basic component which fails to comply or contains a defect.

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Fort Worth, Texas 76118

(iv) Nature of defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

Possible "failure to close" condition of Masterpact breakers NT and NW style, that are being used with specific logic schemes that are subjected to "anti-pump" conditions during normal operation or are having the close command maintained for greater than 200mS while the closing springs are being charged, have a higher susceptibility to not return to the ready to close position after the close signal has been removed.

Testing by Schneider Electric confirmed that the condition may exist if the breaker has a standing close signal during the few seconds of charging the closing springs following an electrical command to close.

PSEG reported approximately 14 instances with different breakers in different cubicles where they initiated an electric close command, and the breakers failed to close.

NLI inspected three of the breakers (all NWs) that were returned by PSEG and could not fully replicate the problem as described by the plant. NLI was only able to repeat the failure to close when performing an "anti-pump" test. The failure to close was intermittent, but could be duplicated. When the anti-pump condition was not present, NLI could not duplicate a failure to close. Visual inspections of the tested breakers did not reveal any visible damage to the breaker linkages, latches, shunt close or shunt trip assemblies.

Schneider Electric (SE) performed testing of three Masterpact NW08 breakers (operated to beyond design life) and duplicated the fail to close condition as described by the plant. It was determined that a standing close signal with a trip/open signal applied is determined to be one root cause of the fail to close issue. The SE testing confirms that the presence of this condition can cause the breaker anti-pump latch to receive excessive forward pressure. When the nose of the latch impacts the close coil plunger, it will "rock" up in the rear, catching on the top of the mechanism plate. Once the close voltage is removed, and the plunger retracts, the latch may or may not let go. If the latch does not release, then application of the close coil voltage will simply activate the close coil plunger and without the latch underneath the plunger, the breaker will not close.

PSEG performed extensive troubleshooting at the Hope Creek plant and discovered that all of the affected breakers were in an anti-pump condition when the breakers failed to close.

The anti-pump condition is present when the close signal remains present after closing and during the time that the breaker receives a command to open electrically.

Possible scenarios for the circuit breaker to be more susceptible to the condition:

- The closing circuit is continually energized during charge and or open operations.
- Anti-Pump condition is present.
- The breaker receives a command to open electrically before or at the same time the close command is initiated.
- A remote closing action by an operator that may hold the close signal for a duration longer than 200 mS which would extend into the charging cycle.
- A logic scheme that would have a component controlling the close circuit that would apply the voltage to the close coil for a duration longer than 200mS which would extend into the charging cycle.

(v) The date on which the information of such defect or failure to comply was obtained.

Revision 2 of this notification was submitted based on the information gathered on 5/10/2016 after additional testing by the request Riverbend was performed. The additional testing was requested following the notification that was provided to the plants listed below, in the original issue of this letter in February 2016.

The evaluation of the condition was originally completed in September of 2012. The issue was originally determined at that time to not be a reportable condition based on the breaker not containing a defect and the condition was believed to be attributed to the specific logic scheme at the plant. To date, this issue has only been reported to NLI from the following plants, PSEG Hope Creek, River Bend Station and St. Lucie. No other plants have reported this specific fail to close condition. NLI was in direct communication with the plants when this issue was first being evaluated and the failure analysis were being conducted.

(vi) In the case of a basic component which contains a defect or fails to comply, the number and location of these components in use at, supplied for being supplied for, or may be supplied for, manufactured or being manufactured for one or more facilities or activities subject to the regulations in this part.

Plants which have been supplied the Masterpact circuit breakers.

Plant Name	Notes
PSEG Hope Creek	Issue Identified for NW style
River Bend	Issue identified for NT style
Callaway	This issue has not been identified however, the potential should be evaluated.
St. Lucie	This issue has been identified.
Turkey Point	This issue has not been identified however, the potential should be evaluated.
Beaver Valley	This issue has not been identified however, the potential should be evaluated.
Davis Besse	This issue has not been identified however, the potential should be evaluated.
Three Mile Island	This issue has not been identified however, the potential should be evaluated.
Calvert Cliffs	This issue has not been identified however, the potential should be evaluated.
Hatch	This issue has not been identified however, the potential should be evaluated.

STP	This issue has not been identified however, the potential should be evaluated.
SONGS	This issue has not been identified however, the potential should be evaluated.
KHNP Ulchin	This issue has not been identified however, the potential should be evaluated.
KHNP Kori	This issue has not been identified however, the potential should be evaluated.
Duke Oconee	This issue has not been identified however, the potential should be evaluated.
Duke McGuire	Non-safety (not supplied by NLI), This issue has not been identified.
Browns Ferry	This issue has not been identified however, the potential should be evaluated.
Fort Calhoun	This issue has not been identified however, the potential should be evaluated.
Wolf Creek	This issue has not been identified however, the potential should be evaluated.
Seabrook	This issue has not been identified however, the potential should be evaluated.

(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.

NLI originally created a technical bulletin to address the issue and recommendations. However, since new information has been recently identified, NLI TB-12-007 has been revised. The solution for this potential problem is to replace the XF (shunt close assembly) with the XFCOM shunt close assembly.
The part numbers are:
S47323 (100-130VAC/DC)
S47324 (200-240VAC/DC)
Additional details regarding the replacement device are contained in the NLI technical bulletin TB-12-007.

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.

The permanent solution to correct the possible failure to close event has been identified above.

Advice for plants with breakers currently installed:
Evaluate the applications where the breakers may be potentially subjected to an Anti-Pump condition or where the close coil will be energized for greater than 200mS while the closing springs are being charged.

The circuit breaker will continue to operate if this condition is present however there may need to be human interaction with the circuit breaker by manually pressing the trip/open button on the front of the circuit breaker to free the mechanism.

Please contact NLI with any questions or comments.

Sincerely,

Tracy Bolt
Director of Quality Assurance

Technical Bulletin

TB-12-007, Revision 3

Masterpact Breakers Fail To Close

TB-12-007, Rev. 3
September 2016

Technical Bulletin

TB-12-007, Revision 3

Masterpact Breakers Fail To Close

This technical bulletin has been prepared in accordance with NLI Quality Assurance Program

Prepared by: Jim Hootman date: 9/22/16

Verified by: Chris Trimble date: 9/22/16

Approved by: Tracy Bolt date: 9/22/16

REVISION HISTORY

Revision	Description	Date
0	Original Issue	4/13/2015
1	Provided Clarification for the Issue Description	3/17/2016
2	Added options for use as is or replace coils	9/09/2016
3	Correction to the identified issue and recommendation. The document has been revised in its entirety, no revision bars were used.	9/22/2016

1.0 Issue Description

A potential issue of failure to reclose has been identified with the Masterpact breaker (NT and NW type). The failure to reclose may occur when a close signal of >200mS is applied while the breaker is charging the closing springs and/or a breaker trip signal from the shunt trip is received while the close circuit is still energized.

Potential Causes

a) The action of maintaining a close signal of >200mS while the breaker is charging the closing springs has the potential to cause the internal close/trip mechanism to bind, preventing the breaker from being ready to close on the next valid close command.

b) The action of maintaining a close signal of >200mS and an open signal is introduced to the Shunt trip device causing the breaker to open (anti-pump condition), has the potential to cause the internal close/trip mechanism to bind, preventing the breaker from being ready to close on the next valid close command.

Possible scenarios for the circuit breaker to be more susceptible to the condition:

- The closing circuit is continually energized during charge and open operations.
- Anti-Pump condition is present.
- The breaker receives a command to open electrically before or at the same time the close command is initiated.
- A remote closing action by an operator that may hold the close signal for a duration longer than 200 mS which would extend into the charging cycle.
- A logic scheme that would have a component controlling the close circuit that would apply the voltage to the close coil for a duration longer than 200mS which would extend into the charging cycle.

2.0 RECOMMENDATION

NLI and Schneider Electric originally provided a solution to have the continuous power dropped out of the close circuit once the breaker closed. This method was to utilize one of the spare normally closed OF auxiliary contacts contained within the circuit breaker. This contact can be connected in series with the close circuit between the power source and the close coil/module. Although highly reliable in normal circumstances, this method was demonstrated that when forced into a condition with the trip signal and close signal being applied at the same time, the breaker still had the potential to fail to close.

In lieu of utilizing a spare OF auxiliary contact, NLI and Schneider Electric performed extensive testing on an optional XFCOM coil which releases the plunger after close signal is applied without any inherent auxiliary contact delay. Note: The close signal must be removed and reapplied to re-activate the close coil.

Based on the evaluations and additional testing performed, NLI and Schneider Electric recommends the following:

1. Replace the XF (shunt close assembly) with the XFCOM shunt close assembly.
   The Square D part numbers are:
   S47323 (100-130VAC/DC)
   S47324 (200-240VAC/DC)
   These coils have been qualified for EMI/RFI by NLI, and qualification traceability can be performed for individual plants.
   Contact NLI if this option is prefered.

Typical Wiring Drawing for
MN/XFCOM device