



14685 WEST 105TH STREET, LENEXA, KANSAS 66215-2003

o 913-888-2630 | d 913-956-3160 | f 913-312-3582

sorinc.com

February 23, 2018

Attn: Document Control Desk
US Nuclear Regulatory Commission
Washington, DC 20555-0001

Reference: NUCLEAR REGULATORY COMMISSION INSPECTION REPORT OF SOR INC. NO. 99900824/2017-201, AND NOTICE OF NONCONFORMANCE, dated December 1, 2017

Subject: Reply to a Notice of Nonconformance 99900824/2017-201-01

SOR Inc. is providing the enclosed response to the Notice of Nonconformance 99900824/2017-201-01. Details regarding the corrective actions and the targeted completion date are provided in the attachment to this letter.

If you should have any questions please contact me at (913) 956-3160 or by email: mdirks@sorinc.com.

Sincerely,
SOR Inc.

A handwritten signature in cursive script that reads 'Melanie Dirks'.

Melanie Dirks
Director of Quality

Enclosure

c: Terry Jackson	US NRC
Aaron Armstrong	US NRC
Mike Waters	SOR
Bert Benton	SOR
Mike Bequette	SOR

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Reasons for Noncompliances

Response to Nonconformance 99900824/2017-201-01, Item 1:

"SOR failed to analyze how the current-carrying switch terminal and current-carrying conductor temperature rise would impact the qualified life of safety-related switches. Additionally, they failed to provide an adequate technical justification for activation energies used in the aging effects calculations."

The subject qualification report 9058-102 is a generic report used to qualify an entire product line of nuclear qualified pressure, vacuum, and temperature switches. The intent was to qualify to a high level to encompass as many applications as possible. These switches are mechanical on-off devices that do not require power to operate. Heat rise will only occur if switch contacts are closed and there is enough current running through the switch to create a rise in temperature in the current carrying wires and switches. Since the end use application will vary for every application, the intent of 9058-102, Section 9 was to characterize the worst case heat rise data for the condition where there is current running through the switch and present this data so that the aging effect could be calculated for each unique situation.

SOR's understanding of the NRC's concerns in the subject nonconformance is that even though this information is presented in the report, that it may be missed by the end user or that they may not take this effect into account for their aging calculations. For this reason, SOR will for conservatism, treat this as a reported deviation. In addition, SOR has performed the calculations for bounding conditions and will present this in the report 9058-102.

Effects of current load on the qualified life of switches are referenced in section 9, assuming 119.257°F ambient temperature. The assumption will be that the switch is continuously closed and the closed circuit has an electrical load.

In addition, technical evaluation for activation energies has been added to report 9058-102 revision 3.

Response to Nonconformance 99900824/2017-201-01, Item 2:

"SOR failed to demonstrate that safety-related temperature, pressure, and vacuum switches could perform their safety function at the bounding conditions of the adjustable ranges for pressure and temperature. "

SOR performed a review and analysis of this subject. There were no reportable findings as a result of this review. Justification for the bounding conditions has been added to the report 9058-102. This will be based on a combination of test and analysis.

Response to Nonconformance 99900824/2017-201-01, Item 3:

"SOR failed to document how test anomalies affected the qualification of switches; particularly anomalies associated with hydrostatic pressure tests, repeatability tests, and pre-seismic test deviations. Specifically, SOR failed to evaluate anomalies with qualified switches against acceptance criteria to determine if the anomalies could invalidate the qualification."

All anomalies that were not previously addressed in the report 9058-102 have been added to the report and the evaluations will be documented which determined their effect on qualification.

Hydrostatic Pressure Tests

All issues associated with hydrostatic testing in report 9058-102 will be addressed as an NOA. SOR's evaluation of the anomaly concluded that there was no effect on qualification.

Repeatability

All issues associated with repeatability in report 9058-102 will be addressed in NOAs.

The following changes will be made to the qualification:

Temperature Switches will be changed from 1% to 1.5% repeatability
Vacuum Switches will be changed from 1% to 1.5% repeatability for post LOCA

Since SOR promotes the switches as 1% devices and since the report implies 1% is an acceptance criteria, SOR has reported this as a deviation.

Pre-Seismic Anomaly on Model 9RT-B45-U8-C2A-JTTNO

The anomaly on the subject model was not adequately addressed. This will be addressed as an NOA. SOR found no effect on qualification for this model.

Review of Other Effects on Safety Related Components

Additional review has identified the following which were evaluated:

Thermal conduction test on direct mount temperature switches:

Reference the evaluation for Nonconformance 99900824/2017-201-01, Item 1 above. There will be a similar effect on qualified life due to the proximity of direct mount temperature switches to process temperatures which may be at an elevated temperature. As before, SOR collected data and reported it in 9058-102 for the benefit of the end user to determine any effects on qualified life. SOR has performed the actual calculations and presented the results in the test report 9058-102. In addition, for conservatism, SOR has reported this as a deviation.

Additional Unevaluated Anomalies

Additional unevaluated anomalies have been identified including Insulation Resistance and Contact Resistance. SOR found no reportable issues. These will be evaluated and documented on NOAs.

Acceptance Criteria Not Clearly Defined

The report 9058-102 will be revised to address acceptance criterion which was not adequately defined.

Effects for Uncertainties of M&TE on Qualification

Previously unaccounted for M&TE uncertainties will reduce qualification levels as follows:

Qualified Life – Due to un-accounted for inaccuracies of the temperature indicator used to monitor thermal aging, the qualified life will be revised from 20 years @ 120°F to 20 years @ 119.257°F service temperature.

LOCA, HELB1, & HELB2 – Due to the fact that NTS actual values for DBA autoclave pressure and temperature were not reported and are no longer available, it was necessary to reduce DBA profiles by an amount equal to the M&TE uncertainties. This data has been incorporated into 9058-102 revision 3.

These corrections to Qualified Life, LOCA, HELB1, & HELB2 have been reported as deviations.

The probable root cause of the inadequacies noted in the original qualification test report occurred in 1993 when formal procedures were not in place to perform an independent and effective engineering review. Further, half of the qualification testing was performed internally by SOR and the other half was performed externally by NTS.

Corrective Steps Taken and Results Achieved

SOR issued Corrective Action Report (CAR) 972 on October 18, 2017 and Corrective Action Report (CAR) 975 on October 20, 2017 to formally document the investigation and actions to be taken. In addition to performing an internal investigation, SOR contacted NTS requesting clarification to their original test report NTS Test Report 60162-93N.

Due to the scope of the investigation, it was determined that the duration of this evaluation would exceed the 60 days from date of discovery. SOR prepared and submitted an interim Part 21 report on December 15, 2017 describing the evaluation status to

date. All customer quotations and orders were suspended pending the completion of the evaluation of the original qualification data and records. SOR maintained open communications with customers during the entire evaluation process, assisting them with determining any safety concern with a particular model and/or application.

Shortly following the interim Part 21 notification, SOR drafted supplemental information to the part 21. SOR included this supplemental information to all customer inquiries in addition to the interim Part 21 report details.

On February 2, 2018, SOR completed their technical evaluation of the test report 9058-102 concluding that there were several reportable deviations to include in the updated notification.

Extent of Condition Review

As SOR Qualification Test Report 9058-102 was the basis for qualifying an entire product line of nuclear qualified pressure, vacuum, and temperature switches, it was necessary to perform a critical review of all factors of the original 1993 qualification records to evaluate and report any deviation from the design.

The technical evaluation encompassed the following elements:

Acceptance Criteria
Activation Energies
Aging (thermal conduction)
Aging (electrical load)
Anomalies
Contact Resistance
NTS LOCA values
NTS M&TE
NTS Uncertainties
Repeatability
Uncertainties

Corrective Steps to Avoid Noncompliances

After SOR Test Report 9058-102 Revision 1 was released in 1993, SOR's nuclear Quality program has continually made process improvements to ensure engineering independent verification wherever it is required. Presently, all internal nuclear analyses, test plans and test reports follow the SOR Engineering Test Reports procedure 095-041 and associated forms.

Corrective Action Completion Date

Revision 2 of qualification test report 9058-102 is 760 pages in length, and is currently in process of an update with the required changes, targeting publication by the end of February 2018. SOR continues to maintain open communications with customers, assisting them with determining any safety concern with a particular model and/or application. For the sake of expediency, SOR will publish the report to our FTP site once it becomes available and notify our customers accordingly.