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EVALUATION OF WELDED SHUT CLASS 1E

LIMITORQUE LIMIT SWITCHES USED

FOR UNIT 2 COMPUTER INPUTS

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EVALUATION OF WELDED SHUT CLASS 1E
LIMITORQUE LIMIT SWITCHES USED
FOR UNIT 2 COMPUTER INPUTS

1.0 SCOPE

The purpose of this SEA is to evaluate the impact of a welded shut limit switch from Class 1E Limitorque motor operators on the operation of the Class 1E valve. SEA-EE-183 determined that closed Limitorque computer input limit switches could weld shut for impressed voltage faults.

2.0 CONCLUSIONS AND RECOMMENDATIONS

2.1 CONCLUSIONS

Analysis of the Unit 2 Class 1E motor-operated valves shows that these valves, except for Main Steam Line Drain Isolation Valves HV-B21-2F016 and HV-B21-2F019 and the Reactor Water Cleanup Isolation Valves HV-G33-2F001 and HV-G33-2F004, will meet their minimum performance requirements even if the computer input limit switches should weld shut. This conclusion is based upon an evaluation that shows:

-- The valves change position and meet their minimum performance requirements before the computer input limit switches are exposed to potential contact welding, i.e. the valve limit switches are normally open and they close when the valve changes position to its isolation position.

OR

-- The valves are in affiliated (associated) circuits and contacts from these devices are not used in Class 1E circuits, i.e. operation of the valve is not required for design basis event conditions.

In the event computer input limit switches for HV-G33-2F001, HV-G33-2F004, HV-B21-2F016 and HV-B21-2F019 weld shut, the limit switch main drive shafts could perhaps break loose internal to the valves causing the valves to jam, thus potentially preventing full closure of the valves. More than likely the welded shut limit switches would cause damage to the limit switch gearing, but would not prevent the subject valves from closing.

2.2 RECOMMENDATION

To assure that the HV-G33-2F001, HV-G33-2F004, HV-B21-2F016 and HV-B21-1F019 valves meet their minimum performance requirements with impressed voltage faults on their computer input cables, the computer input limit switches should be rewired such that these valves change position and meet their minimum performance requirements before the computer input switches are exposed to potential welding. The



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rewired valve limit switches should be normally open and closed only when the valves are 100% closed (i.e. switch closed when the valves closed in the primary containment isolation position). This action is being tracked by NCR 87-0021.



In order to preclude the need for future engineering analysis and maintain compliance with Regulatory Guide 1.75, Qualified Electrical Isolators, capable of withstanding 120V AC and 250V DC, should be installed for newly engineered digital computer inputs developed from Class 1E Limitorque limit switches. This recommendation is in-line with NPE-Electrical Group strategy of eliminating potential pitfalls for maintaining compliance to the plant licensing commitments.

3.0 INPUTS AND ASSUMPTIONS

3.1 INPUTS

At Susquehanna SES, computer input circuits are non-class 1E even though these inputs are developed from Class 1E motor-operated valves.

Regulatory Guide 1.75 which endorses IEEE 384-1974 allows the connection of these low-energy non-class 1E circuits to Class 1E devices provided an analysis has been performed to demonstrate that the Class 1E circuits are not degraded below an acceptable level for faults on the non-class 1E circuits.

Computer cables are routed in non-class 1E raceways which also contain 120V AC, 125V DC and 250V DC cables. Potential damage to cables in non-class 1E raceways may cause accidental imposition of 120 volts AC or 250 volts DC on computer input wire(s), and through these wires to the Class 1E device(s).

As discussed in SEA-EE-183, open contacts of Limitorque limit switches can withstand impressed voltages of 120 VAC and 250 VDC across the contacts. However, if 120 VAC or 250 VDC were impressed on closed contacts of the limit switches, the contacts could weld shut if sufficient current flowed for a sufficient duration.

This study is limited to Unit 2 digital computer inputs developed from Class 1E Limitorque motor-operators.

3.2 ASSUMPTIONS

The study was based on as-built drawings and the documents issued as of the date of task initiation.

Affiliated circuits in this study were treated the same as Class 1E circuits.

A change in state of a computer input contact while there is an impressed voltage was not considered. Only the contact in the open or closed position was analyzed.

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4.0 METHODS

The Susquehanna SES Unit 2 I/O Specification Listing - Digital Real was reviewed to identify the computer inputs developed from Limatorque motor-operators equipped with Limatorque limit switches.

The Susquehanna SES Motor-Operator Valve (MOV) Index dated October 17, 1989 and system drawings were reviewed to determine which MOVs are safety-related Class 1E valves.

Evaluation of the impact of welded-shut Limatorque limit switches used for computer inputs was performed to assure that these devices can perform their safety-related functions with welded computer input limit switches.

5.0 RESULTS

Review of the Susquehanna SES Unit 2 I/O Specification Listing revealed that the number of computer points derived from Class 1E Limatorque limit switches is 40. Evaluation of welded contacts for each of these limit switches is provided.

The Class 1E Limatorque limit switches are part of motor-operated valves which are in one of the following groups:

1. Affiliated.
2. Require no automatic operation.
3. Require automatic closure.

The affiliated motor-operated valves, listed in Table 1, are powered from Class 1E sources. However, these valves and their limit switches are not used in Class 1E circuits. Operation of these valves is not required for design basis event conditions. Therefore, welding a computer input limit switch does not effect Class 1E circuits.

The Class 1E motor-operated valves which require no automatic operation are listed in Table 2. These valves have open limit switches for computer inputs during normal plant lineup. These limit switches are not exposed to potential welding. In the event the normal plant lineup is changed, the valves change to their new positions before the computer input limit switches are exposed to potential welding. Therefore, welding of the computer input limit switches does not prevent the motor-operated valves from meeting their minimum performance requirements.

In addition to the valves in Table 2, the Feedwater Inlet Stop Check Valves HV-B21-2F032A and HV-B21-2F032B motor operators, which are in the open position during normal plant operation, are not required to automatically operate for design base accidents. However, these motor operators have closed limit switches for computer inputs during normal plant operation. The Feedwater Inlet Stop Check Valves are motor assisted in order to provide these valves with closing capability for primary containment isolation leakage rate testing. In the event the limit switches weld shut, the Feedwater Inlet Stop Check Valves will not be

prevented from closing for design base accidents since these valves are check valves. Therefore, the welding of the computer input limit switches does not prevent HV-B21-2F032A and HV-B21-2F032B from meeting their minimum performance requirements.

The Class 1E valves which are required to operate for design base accidents are evaluated below:

The ESW Diesel "E" Cooler Supply Valves Nos. HV-01110E and HV-01120E are required to automatically close for certain DBA's when the Diesel Generator "E" is not aligned and is being tested. For this condition, the computer input limit switches are open and are not exposed to potential welding. If these valves receive an automatic close signal, the valve changes position before the computer input limit switches are exposed to potential welding. Therefore, the welding of these computer input limit switches does not prevent HV-01110E and HV-01120E from meeting their minimum performance requirements.

The Reactor Water Cleanup Isolation Valves HV-G33-2F001 and HV-G33-2F004 and the Main Steam Line Drain Isolation Valves HV-B21-2F016 and HV-B21-2F019 are required to automatically close for certain DBA's. However, the computer input limit switches from these valves are closed when these valves are open. In the event the computer input limit switches weld shut, the limit switch main drive shafts could perhaps break loose internal to the valves causing the valves to jam, thus potentially preventing full closure of the valves. Per Dan Warsing of Limitorque Corp., this is very unlikely. More than likely, the welded shut limit switch will cause damage to the limit switch gearing, but will not prevent the valves from closing.

To assure that the HV-G33-2F001, HV-G33-2F004, HV-B21-2F016 and HV-B21-2F019 valves meet their minimum performance requirements with impressed voltage faults on their computer input cables, the computer input limit switches should be rewired such that these valves change positions and meet their minimum performance requirements before the computer input switches are exposed to potential welding. The rewired valve limit switches should be normally open and closed only when the valves are 100% closed (i.e. switch closed when the valves closed in the primary containment isolation position). This action is being tracked by NCR 87-0021.

REFERENCES

- 6.1 IEEE 279-1971.
- 6.2 IEEE 384-1974.
- 6.3 Regulatory Guide 1.75, Rev. 0.
- 6.4 Susquehanna SES Unit 2 I/O Specification Listing dated Dec. 8, 1989.
- 6.5 Susquehanna SES Motor-Operator Valve Index dated Oct. 17, 1989.
- 6.6 SEA-EE-183, Rev. 0.
- 6.7 Susquehanna SES Design Description Manual Chapter 5, 15 and 31.



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TABLE 1

AFFILIATED MOTOR-OPERATED VALVES

HV-B21-2F001	HV-B31-2F023A	HV-B31-2F031B
HV-B21-2F002	HV-B31-2F023B	HV-B31-2F032A
HV-B21-2F005	HV-B31-2F031A	HV-B31-2F032B

TABLE 2

MOTOR-OPERATED VALVES
NO AUTOMATIC OPERATION

HV-01112A	HV-01122A	HV-01112E
HV-01112B	HV-01122B	HV-01122E
HV-01112C	HV-01122C	HV-B21-2F020
HV-01112D	HV-01122D	HV-G33-2F042
HV-01110A	HV-01120A	HV-G33-2F104
HV-01110B	HV-01120B	HV-24182A
HV-01110C	HV-01120C	HV-24182B
HV-01110D	HV-01120D	

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