

S-18
50-348/364 - CIVP
2/12/92

Staff Exh. 18

DOLKATED
USNRC

'92 MAR 13 P12:08

Bechtel Eastern Power Corporation

Engineers — Constructors

15740 Shady Grove Road
Gaithersburg, Maryland 20877-1454
301-258-3000



OFFICE OF SECRETARY
DUCKETING & SERVICE
BRANCH

JUL 21 1987

In reply refer to AP-13169

Mr. W. G. Hairston, III
Alabama Power Company
600 North 18th Street
Post Office Box 2641
Birmingham, Alabama 35291-0400

Dear Mr. Hairston:

Joseph M. Farley Nuclear Plant Units 1 & 2
Bechtel Job 7597-011
EQ Solenoid Valve Splices - Justification for
Continued Operation
Bechtel File E-91
AP-13169

In a telephone call on July 21, 1987 APCo (Mr. J. E. Garlington) requested Bechtel provide justification of continued operation for EQ solenoid valves which are deenergized to perform their accident mitigation function, and for EQ solenoid valve coil pigtail splices (terminations) located in the Main Steam Valve Room.

The requested justification for continued operation is attached.

If you have any questions or comments, please contact us.

Yours very truly,

K. C. Gandhi
K. C. Gandhi
Project Engineer

KCG/AJD/DGB:rah
Enclosures

As stated above

- cc J. R. Crane, w/1
- J. D. Woodard, w/1
- J. E. Garlington, w/1
- R. G. Berryhill, w/1

NUCLEAR REGULATORY COMMISSION

Docket No. _____ Official Exh. No. 18
In the matter of ALABAMA POWER CO.
Staff INDEXED 2/13/92
Re: _____ RECEIVED 3/13/92
Intervenor _____ REJECTED _____
Conf'g Offr _____
Contractor _____ DATE 7-21-87
Other _____ Witness _____
Reporter J. Carter

Attachment 1 to AP-13169

Subject: Evaluation of potential deficiencies in pigtail splices (terminations) used for Safety Related Pilot Solenoid Valves in the scope of the Environmental Qualification program.

1.0 Introduction:

An evaluation has been performed to address two potential concerns. These concerns are:

- a. The safety function and associated position indication of air operated valves with pilot solenoid valves that are deenergized by the automatic actuation signal (e.g. Safety Injection, Containment Isolation, etc.) The applicable solenoid valves are listed in Appendix A.
- b. The safety function and associated position indication of air operated valves with pilot solenoid valves that are located in the main steam valve room and are energized on the automatic actuation signal (Steam Line Isolation). The applicable solenoid valves are listed in Appendix A.

2.0 Analysis

- a. Air operated valves with pilot solenoid valves that are deenergized by the automatic isolation signal.

A typical schematic of a safety related air operated valve which has its pilot solenoid deenergized following an automatic actuation signal (see Figure 1) shows that both current paths to the solenoid are interrupted. The direct path (path 1) is interrupted by the control switch contact 1A and the seal-in path (path 2) is interrupted by the contact of the automatic actuation signal (1-K605 contact 9-10, which opens). As a result no current path can be established regardless of the condition of the solenoid pigtail splices (terminations). It is noted that no other splices are present in the conduit system that contains the solenoid pigtail splices.

Since a current path cannot be established the solenoid will remain deenergized. Further, any postulated fault (e.g. short circuit) at the splice cannot affect the function of the position indication circuit since there is no potential available.

- b. Pigtail (splices/terminations) for solenoids that are energized on receipt of automatic suppression signal and are physically located in the Main Steam Valve Room:

A typical arrangement used for providing electrical conduit and junction boxes necessary for terminating the control wiring to the environmentally qualified solenoid valves located in the main steam valve room is shown in Figure 2. The solenoid valve coil is provided with qualified pigtail conductors which in some instances may not be of sufficient length to reach the solenoid valve junction box for termination to the qualified field control wiring. It is suspected that in these cases, qualified single conductor #12 AWG (Cable Code J02, JA2) was spliced/terminated using a detail similar to Figure 3. The splice (termination) to the coil pigtails is contained in a conduit or small junction box located in the conduit run between the solenoid valve junction box and the solenoid valve body conduit entrance. As shown in Figure 2, the solenoid pigtail conductor, the pigtail splice (termination) when used, and the field control cable and terminal block terminations are enclosed in the conduit and junction box raceway system.

The design basis accident environmental and flooding effects postulated to occur in the main steam valve room are addressed in FSAR Appendix 3K.4.1.1.8 and 3K.4.1.2.7. As shown in U-416797C and U-416798B, all environmentally qualified solenoid valves in system N11, N12, and N13 which are required to be energized for accident mitigation and their associated junction boxes (condulets), conduit and fittings are located above the maximum postulated flood level of

elevation 130' 5". As shown in FSAR Appendix 3K, Figures E-1A and E2, the postulated worst case temperature and pressure transient conditions predicted for a steam or feedwater line rupture are mitigated in less than two seconds with resulting predicted steady state temperature of 212 °F and pressure of 15.8 psia.

The materials and construction of the subject splices at Farley Nuclear Plant are expected to be able to withstand the conditions previously described as discussed below.

Okonite T-95 tape is rated for continuous use at 90 °C (194 °F) and emergency use at 130 °C (266 °F). Okonite product data sheet indicates that T-95 can be used at 130 °C emergency duty for five 100 hour cycles without loss of physical and electrical integrity. The solenoid coil circuit carries less than 0.5 ampere and conductor/splice is likely to run well below 90 °C limit.

Okonite test report NQRN-3 Rev. 1 documents acceptable qualification tests performed on 5 KV in-line splices using T-95 tape for insulation and T-35 tape for jacket. Splices were subjected to LOCA/HELB temperatures in excess of 308 °F for 10 hours.

Wyle test report 77859-02 tested V-configuration splices with T-95 tape for insulation & T-35 tape for jacket with no insulation tape in the crotch. All specimens except one passed LOCA/HELB test with peak temperature of 360 °F. The failure of the specimen was attributed to likely flashover to enclosure ground due to accumulation of chemical spray at bottom of test enclosure.

3.0 Conclusion:

- a. Air operated valves with pilot solenoid valves that are deenergized by the automatic isolation signal.

The solenoid coil will remain deenergized and the position indication will function as designed on an automatic actuation signal regardless of the condition of the pigtail solenoid splice (termination).

- b. Pigtail splices (terminations) for solenoids that are energized on receipt of an automatic actuation signal and are physically located in the Main Steam Valve Room:

As indicated above, the T-95 tape has been qualified to more severe environmental temperature than anticipated to occur in the design basis condition for the main steam valve room. From qualification testing a similar V-splice conductor configuration, the only failure mode observed was due to an assumed flashover between the crotch of the splice and ground during LOCA/HELB testing where the test specimen was exposed to chemical sprays. Due to the enclosed configuration of the V-splice located in main steam valve room at Farley Nuclear Plant Units 1 and 2, and the short duration and nature of the worst case anticipated transient conditions, it is very unlikely that sufficient moisture would exist to cause a failure of the splice during accident mitigation. Therefore the required energized state of the solenoids and the function of the position indication will be maintained.



CALCULATION SHEET

SEPC-2706 Rev. 2/1

JOB NO.	CALC. NO.	REV. NO.	SHEET
ORIGINATOR	DATE	CHECKED	DATE

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

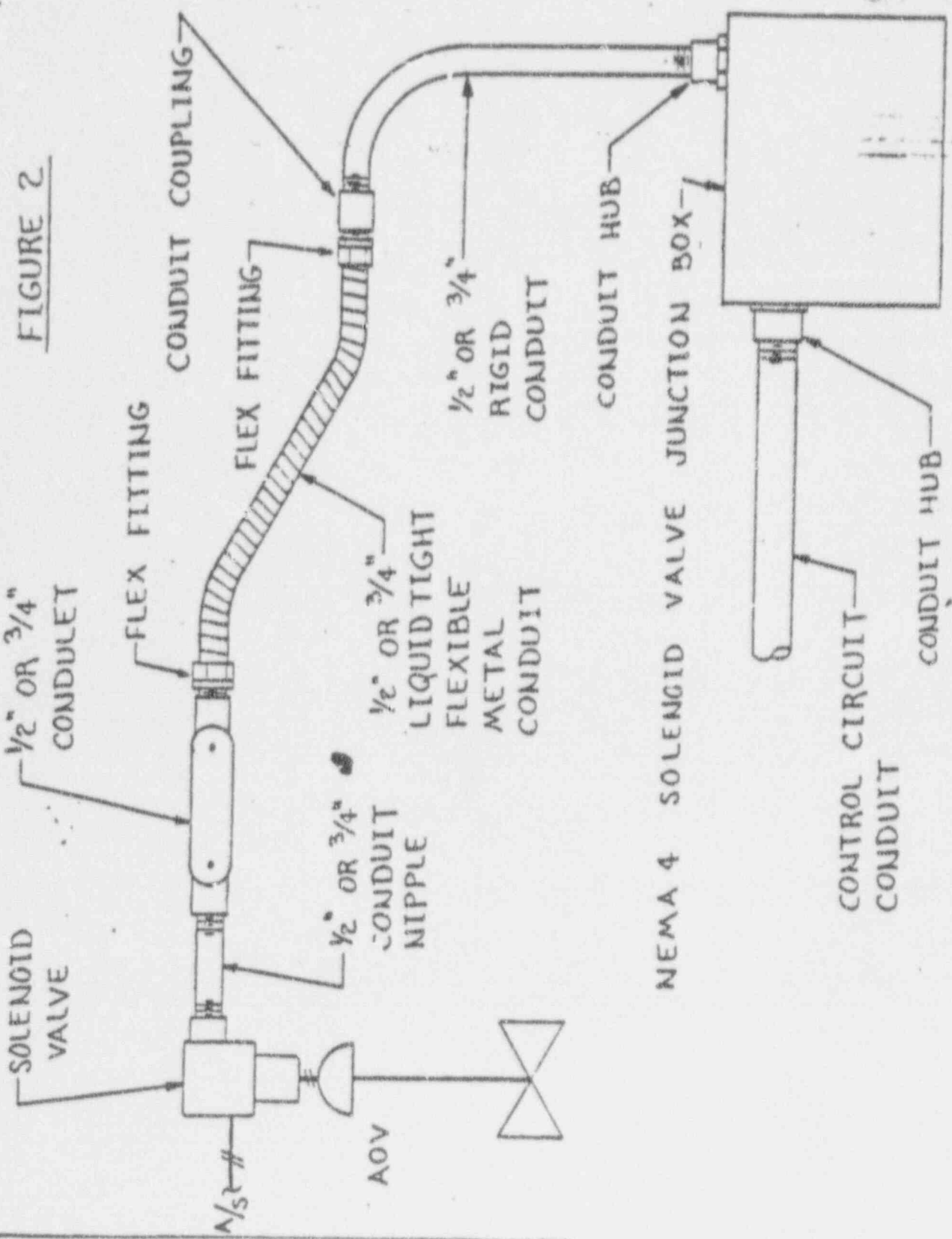


FIGURE 2

NEMA 4 SOLENOID VALVE JUNCTION BOX

CONTROL CIRCUIT CONDUIT

SOLENOID VALVE



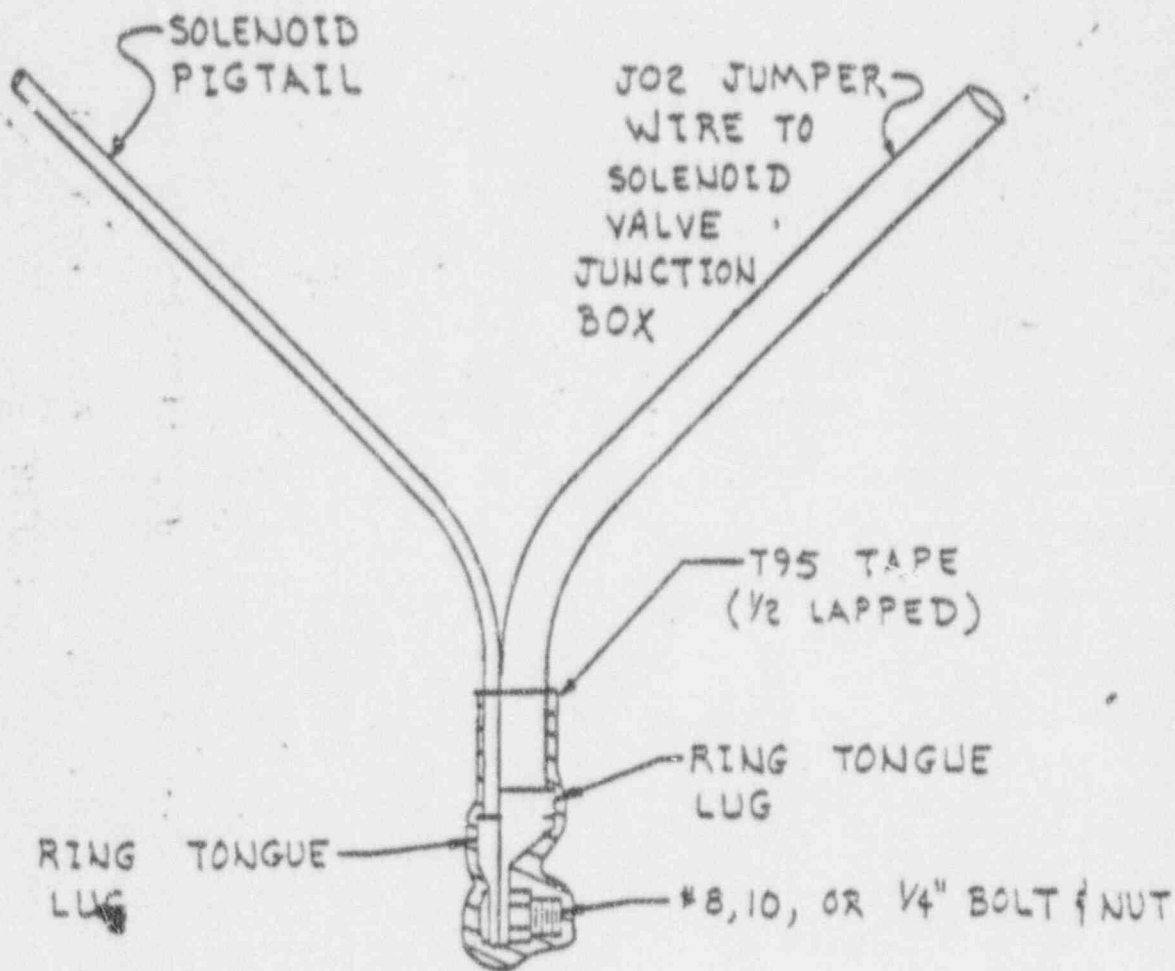
CALCULATION SHEET

SSPC-176 Rev. 5/95

JOB NO.	CALC. NO.	REV. NO.	SHEET
ORIGINATOR	DATE	CHECKED	DATE

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

FIGURE 3



APPENDIX A

EQ SOLENOID DATA

11

PLANT ID NO.	MANUFACTURER & MODEL	SERVICE	SCHEME NO	AUTO ACTUATION SIGNAL	VALVE POSITION FOLLOWING THE AUTO ACT. SIG.	SOLENOID STATUS FOLLOWING AUTO ACT. SIG.	REMARKS
		<u>REACTOR COOLANT SYSTEM - PRESSURIZER</u>					
WIBSDV 004T	ASCO, WPS21654V	PRESS RELIEF TANK TO REAC MAKE-UP WATER SUPPLY ISOLATE BY 004T	177313	CIA	CLOSED	DEENERGIZED	
WIBSDV 0443AA 0443BB	ASCO, WPS21670T	PRESS TANK RELIEF VALVE	077301	HIGH PRESSURE	OPEN	ENERGIZED	
WIBSDV 0443AA 0443AB	ASCO, WPS21670T	PRESS TANK RELIEF VALVE	077301	HIGH PRESSURIZER PRESSURE	OPEN	ENERGIZED	

NOTE: SOLENOID VALVES ENCLOSED BY A BOX ARE ENERGIZED BY THE AUTO ACTUATION SIGNAL

PLANT ID NO	MANUFACTURER & MODEL	SERVICE	SCHEMATIC NO	AUTO ACTUATING SIGNAL	VALVE POSITION FOLLOWING THE AUTO ACT. SIG.	SOLENOID SIGNALS FOLLOWING AUTO ACT. SIG.	REMARKS
		<u>FEEDWATER CONTROL SYSTEM</u>					
NECIESV 0478A 0478B	ASCO RV-206-301-20	MAIN FEED WATER CONTROL VALVE FCV 478	177913	SI & FI	CLOSED	DEENERGIZED	ONE OF THE TWO SOLENOIDS REQUIRED TO BE DEENERGIZED FOR VALVE TO CLOSE BOTH COILS ENERGIZED
NECIESV 0488A 0488B	ASCO RV-206-301-20	MAIN FEED WATER CONTROL VALVE FCV 488	177846	SI & FI	CLOSED	DEENERGIZED	— " —
NECIESV 0478A 0478B	ASCO RV-206-301-20	MAIN FEED WATER CONTROL VALVE FCV 478	177914	SI & FI	CLOSED	DEENERGIZED	— " —
NECIESV 0477A 0477B	ASCO RV-206-301-40	MAIN FEED WATER BYPASS VALVE FCV 477	177915	SI & FI	CLOSED	DEENERGIZED	— " —
NECIESV 0478A 0478B	ASCO RV-206-301-20	MAIN FEED WATER BYPASS VALVE FCV 488	177916	SI & FI	CLOSED	DEENERGIZED	— " —
NECIESV 0477A 0477B	ASCO RV-206-301-40	MAIN FEED WATER BYPASS VALVE FCV 477	177917	SI & FI	CLOSED	DEENERGIZED	— " —
FI - Feedwater Isolation Signal (HI-HI Steam Generator Level)							

PLANT ID NO	MANUFACTURER # MODEL	SERVICE	NAME NO	AUTO ACTUATION SIGNAL	VALVE POSITION FOLLOWING THE AUTO ACT. SIG.	SOLENOID STATUS FOLLOWING AUTO ACT. SIG.	REMARKS
		<u>LIMB WASTE DISPOSAL SYSTEM</u>					
Q14115V 2376	ASCO WPSMAY4V	Containment Sump Discharge Valve. NV 3376	177362	CIA	CLOSED	DEENERGIZED	
Q14115V 1005A 1005B	ASCO D08-381-4RT	Reactor Coolant Drain Tank Pump Discharge Valve LCV 1005	177208	CIA	CLOSED	DEENERGIZED	
Q14115V 712B	ASCO WPSMAY4V	Reactor Coolant Drain Tank Inlet NV 712B	177389	CIA	CLOSED	DEENERGIZED	
		<u>MAIN STEAM</u>					
Q14115V 3561A	ASCO WPS16R36V	Main Steam Isolation Valve. NV 3561A	177863	SLI	CLOSED	ENERGIZED	
Q14115V 3561B	ASCO WPS16R36V	Main Steam Isolation Valve. NV 3561B	177863	SLI	CLOSED	ENERGIZED	
Q14115V 3561C	ASCO WPS16R36V	Main Steam Isolation Valve. NV 3561C	177863	SLI	CLOSED	ENERGIZED	

SLI- STEAM LINE ISOLATION SIGNAL

PLANT ID NO	MANUFACTURER & MODEL	SERVICE	SCHEME NO	AUTO RECUINTION SIGNAL	VALVE POSITION FOLLOWING THE AUTO ACT. SIG.	SOLENOID STATUS FIELD AUTO ACT. SIG.	REMARKS
		<u>MAIN STEAM ... CONT.</u>					
QIN115V 3370A	ASCO NFB016R36V	MAIN STEAM ISOLATION VALVE HV 3370A	177047	SLI	CLOSED	ENERGIZED	
QIN115V 3370B	ASCO NFB016R36V	MAIN STEAM ISOLATION VALVE HV 3370B	177047	SLI	CLOSED	ENERGIZED	
QIN115V 3370C	ASCO NFB016R36V	MAIN STEAM ISOLATION VALVE HV 3370C	177047	SLI	CLOSED	ENERGIZED	
QIN115V 3360A	ASCO NFB016R36V	MAIN STEAM ISOLATION BYPASS VALVE HV 3360A	177044	SLI	CLOSED	DEENERGIZED	
QIN115V 3360B	ASCO NFB016R36V	MAIN STEAM ISOLATION BYPASS VALVE HV 3360B	177044	SLI	CLOSED	DEENERGIZED	
QIN115V 3360C	ASCO NFB016R36V	MAIN STEAM ISOLATION BYPASS VALVE HV 3360C	177044	SLI	CLOSED	DEENERGIZED	
QIN115V 3976A	ASCO NFB016R36V	MAIN STEAM ISOLATION BYPASS VALVE HV 3976A	177046	SLI	CLOSED	DEENERGIZED	
QIN115V 3976B	ASCO NFB016R36V	MAIN STEAM ISOLATION BYPASS VALVE HV 3976B	177046	SLI	CLOSED	DEENERGIZED	

PLANT ID NO	MANUFACTURER & MODEL	SERVICE	SCHEM. NO	AUTO ACTIVATION SIGNAL	VALVE POSITION FOLLOWING THE STATUS FOLLOWING AUTO ACT. SGA	REMARKS
QIN115V3228C	ASCO NP8320A196E	MAIN STEAM ... CONT MAIN STEAM ISOLATING BYPASS VALVE BY 3228C <u>AUXILIARY FEED WATER</u>	177168	SLI	CLOSED	DEENERGIZED
QIN1235V3228AA	ASCO NP8320A196E	TD AFW PUMP DISCHARGE HV 3228A	177590	SG LOW-LOW LEVEL & W/V ON RCP BUSES	OPEN	ENERGIZED
QIN1235V3228AB	ASCO NP8320A196E	TD AFW PUMP DISCHARGE HV 3228A	177590	(MANUAL)		ENERGIZED TO CLOSE DEENERGIZED TO MOD
QIN1235V3228BA	ASCO NP8320A196E	TD AFW PUMP DISCHARGE HV 3228B	177590	SG LOW-LOW LEVEL & W/V ON RCP BUSES	OPEN	ENERGIZED
QIN1235V3228BB	ASCO NP8320A196E	TD AFW PUMP DISCHARGE HV 3228B	177590	(MANUAL)		ENERGIZED TO CLOSE DEENERGIZED TO MOD
QIN1235V3228CA	ASCO NP8320A196E	TD IAFW PUMP DISCHARGE HV 3228C	177590	SG LOW-LOW LEVEL & W/V ON RCP BUSES	OPEN	ENERGIZED
QIN1235V3228CB	ASCO NP8320A196E	TD AFW PUMP DISCHARGE HV 3228C	177590	(MANUAL)		ENERGIZED TO CLOSE DEENERGIZED TO MOD
QIN1235V3235A	ASCO NP8321A2V	STEAM TO TD AFW PUMP HV 3235A	177188	SG LOW-LOW LEVEL & W/V ON RCP BUSES	OPEN	ENERGIZED
QIN1235V3235B	ASCO NP8321A2V	STEAM TO TD AFW PUMP HV 3235B	177189	SG LOW-LOW LEVEL & W/V ON RCP BUSES	OPEN	ENERGIZED
QIN1235V3235A	ASCO NP8320A186V	STEAM TO TD AFW PUMP HV 3235A	177857	CIA	CLOSED	DEENERGIZED
QIN1235V3235B	ASCO NP8320A186V	STEAM TO TD AFW PUMP HV 3235B	177857	CIA	CLOSED	DEENERGIZED

PLANT ID NO	MANUFACTURER & MODEL	SERVICE	ACCUM. TAG	AUTO ACTUATION SIGNAL	VALVE POSITION FOLLOWING THE AUTO ACT. SIG.	SOLENOID STATUS FOLLOWING AUTO ACT. SIG.	REMARKS
		<u>Aux Feed Water ... Cont.</u>					
Q1H235V 317CA	ASCO NFB320A196R	MB AFW PUMP DISCHARGE RV 327C	17791	VARIOUS	OPEN	ENERGIZED	
Q1H235V 317CB	ASCO NFB320A196R	MB AFW PUMP DISCHARGE RV 327C	17791	(MANUAL)			ENERGIZED TO CLOSE DEENERGIZED TO MOD.
Q1H235V 317CC	ASCO NFB320A174E	MB AFW PUMP DISCHARGE RV 327C	17791	VARIOUS	OPEN	ENERGIZED	
		<u>Chemical Injection System</u>					
Q1H235V 317CA	ASCO NFB316A194V	Injection to Steam Gener RV 317CA	177373	CIA	CLOSED	DEENERGIZED	
Q1H235V 317CB	ASCO NFB316A194V	Injection to Steam Gener RV 317CB	177373	CIA	CLOSED	DEENERGIZED	
Q1H235V 317CC	ASCO NFB316A194V	Injection to Steam Gener RV 317CC	177373	CIA	CLOSED	DEENERGIZED	

PLANT ID NO	MANUFACTURER A MODEL	SERVICE	SCHEM NO	AUTO ACTUATION SIGNAL	VALVE POSITION FOLLOWING THE AUTO ACT. SIG. ANTO ACT. SIG.	REMARKS
Q1P15W 3103	ASCO NP0320A104V	<u>SAMPLING SYSTEM</u> Pressurizer Liquid RV 3103	111571	CIA & PEN. ROOM HI PRESSURE	CLOSED DEENERGIZED	
Q1P15W 3105	ASCO NP0320A104V	Condenser Hot Leg RV 3105	111571	CIA & PEN. ROOM HI PRESSURE	CLOSED DEENERGIZED	
Q1P15W 3106	ASCO NP0320A104V	Accumulator Sample RV 3106	111598	CIA	CLOSED DEENERGIZED	
Q1P15W 3111A	ASCO NP0320A104V	Steam Gen Bleeddown RV 3111A	111509	VARIOUS	CLOSED DEENERGIZED	
Q1P15W 3111B	ASCO NP0320A104V	Steam Gen Bleeddown RV 3111B	111505	VARIOUS	CLOSED DEENERGIZED	
Q1P15W 3111C	ASCO NP0320A104V	Steam Gen Bleeddown RV 3111C	111413	VARIOUS	CLOSED DEENERGIZED	
Q1P15W 3180A	ASCO NP0320A104V	Steam Gen Bleeddown RV 3180A	111509	VARIOUS	CLOSED DEENERGIZED	
Q1P15W 3180B	ASCO NP0320A104V	Steam Gen Bleeddown RV 3180B	111509	VARIOUS	CLOSED DEENERGIZED	

Q1P15W 3103

PLANT ID NO	MANUFACTURER IN SYMBOL	SERVICE	SCHEMATIC NO	AUTO ACTUATION SIGNAL	VALVE POSITION FOLLOWING THE AUTO ACT. SIGN.	SOLENOID STATUS FOLLOW AUTO ACT. SIG.	REMARKS
Q1P155V 3100C	ASCO MPB320A184V	STEAM BURN BLOWDOWN HV 3100C	177413	VARIOUS	CLOSED	DEENERGIZED	
Q1P155V 3101A	ASCO MPB320A184V	STEAM BURN BLOWDOWN HV 3101A	177465	VARIOUS	CLOSED	DEENERGIZED	
Q1P155V 3101B	ASCO MPB320A184V	STEAM BURN BLOWDOWN HV 3101B	177465	VARIOUS	CLOSED	DEENERGIZED	
Q1P155V 3101C	ASCO MPB320A184V	STEAM BURN BLOWDOWN HV 3101C	177465	VARIOUS	CLOSED	DEENERGIZED	
Q1P155V 3101	ASCO MPB320A184V	Press Steam Sample HV 3101	177371	CIA & PEN. ROOM HI PRESSURE	CLOSED	DEENERGIZED	
Q1P155V 3101	ASCO MPB320A184V	Reactor Hot Leg HV 3101	177340	PEN. ROOM HI PRESSURE	CLOSED	DEENERGIZED	
Q1P155V 3102	ASCO MPB320A184V	Reactor Hot Leg HV 3102	177340	PEN. ROOM HI PRESSURE	CLOSED	DEENERGIZED	
Q1P155V 3103	ASCO MPB320A184V	Reactor Hot Leg HV 3103	177371	CIA	CLOSED	DEENERGIZED	

PLANT ID AND E MODEL	MANUFACTURER E MODEL	SERVICE	SCHEM NO	AUTO ACTUATION SIGNAL	VALVE POSITION FOLLOWING THE AUTO ACT. SIG.	SOLENOID STATUS FOLLOWING AUTO ACT. SIG.	REMARKS
01P1454 3184	ASCO MP3366784	<u>Component Cooling Water</u> REG. COOL. PUMP CONTROL RV 3184	177855	CIB & HI PRESSURE	CLOSED	ENERGIZED	
01P1454 3443	ASCO MP3366784	ACCESS LET DOWN ME CONTROL ASSEM RV 3443	177374	CIA	CLOSED	DEENERGIZED	