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February 9, 1996

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CALLAWAY PLANT
DOCKET NUMBER 50-483
PRESSURE LOCKING AND THERMAL BINDING OF
SAFETY-RELATED POWER-OPERATED GATE VALVES

References: 1) Generic Letter 95-07 dated August 17, 1995
2) ULNRC-3277, dated October 10, 1995

Generic Letter 95-07 requested that licensees provide information concerning pressure locking and thermal binding of safety-related power-operated gate valves within 60 and 180 days of the generic letter date. Our 60 day response was transmitted to NRC as Reference 2.

The attachment to this letter contains our 180 day response. If you have any questions concerning this information, please contact us.

Very truly yours,

Donald F. Schnell

Donald F. Schnell

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Attachments

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STATE OF MISSOURI)
) S S
CITY OF ST. LOUIS)

Donald F. Schnell, of lawful age, being first duly sworn upon oath says that he is Senior Vice President-Nuclear and an officer of Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Donald F. Schnell
Donald F. Schnell
Senior Vice President
Nuclear

SUBSCRIBED and sworn to before me this ninth day of February, 1996.

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UNION ELECTRIC - CALLAWAY PLANT
EVALUATION OF SAFETY-RELATED POWER OPERATED GATE VALVES FOR PRESSURE LOCKING AND THERMAL BINDING

INTRODUCTION

This document includes the evaluations and actions implemented at the Callaway Plant to address NRC Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves." The potential for gate valves to pressure lock or thermally bind has been discussed in numerous industry documents for over 10 years. Pressure locking or thermal binding can cause a power operated valve to fail to open, resulting in an inability of the associated safety train or system to perform its safety function. The concern raised by the NRC is that pressure locking and thermal binding represent potential common-cause failure modes that can render redundant trains of safety-related systems, or multiple safety systems incapable of performing their safety function. The basic phenomena are described herein.

A comprehensive review of safety-related power operated gate valves installed at the Callaway Nuclear Plant has been performed to determine if any are susceptible to pressure locking or thermal binding. Attachment 2 lists the 80 motor operated, 4 air operated, and 8 hydraulically operated gate valves included in this review. Pressure locking and thermal binding are concerns for gate valves required to open during accident conditions. Since the Callaway Plant safe shutdown design basis is Hot Standby, valves required to operate for station blackout, ATWS, attaining Cold Shutdown, or other similar commitments are not considered to be within the scope of Generic Letter 95-07. Actions will be taken for those valves within this group identified as susceptible to pressure locking or thermal binding. With the completion of this evaluation and any recommended actions, the requirements of NRC Generic Letter 95-07 will be satisfied.

PRESSURE LOCKING

Pressure locking can occur in double disk and flexible wedge gate valves when the valve bonnet becomes water solid and pressurized so that the actuator is not capable of overcoming the additional thrust requirements resulting from the differential pressure created across both valve disks by the pressurized fluid. Bonnet pressures associated with pressure locking may be in excess of normal system operating pressures. High pressure within the valve bonnet can be developed by two mechanisms:

1. A normally closed valve can experience minor leakage from the higher pressure side past the seat and into the bonnet. Over time, the bonnet can become pressurized from this water source. When the system is rapidly depressurized, such as due to a Loss of Coolant Accident (LOCA), the pressure could remain trapped in the bonnet if the seats are assumed to be leak tight.

2. A closed valve with a water solid bonnet is heated by hot fluid introduced on one side or by a significant increase in ambient temperature. If the seats are tight in both directions, high pressure can develop in the bonnet due to the thermal expansion of the trapped water.

THERMAL BINDING

Thermal binding only affects wedge type gate valves. Solid wedge gate valves are typically associated with thermal binding, although flexible wedge valves which experience significant temperature changes or operate with high upstream and downstream temperature differences may also bind. Thermal binding is the result of differential thermal expansion/contraction which causes seats on the valve body to exert high clamping forces on the disk, such that friction forces resisting valve opening are increased.

Temperature changes associated with ambient conditions are not large enough to cause thermal binding. Thermal binding is aggravated by high closing forces, and is made less likely by motor operator designs equipped with compensating spring packs, which limit closing forces.

EVALUATION METHOD

All safety-related air, motor, and hydraulically operated gate valves listed in Attachment 2 were initially reviewed using the following criteria.

1. Valves having only a safety-related passive function (pressure boundary) were eliminated. This included valves that are normally open and have an open safety position and valves which are normally closed and have a closed safety position. Mispositioning was assumed to represent a single active failure, and was not considered to be a common cause failure mode.

2. Valves that do not have a safety function to open were eliminated. Pressure locking and thermal binding affects valves which must open. As such, valves with a safety function to close are not susceptible to these concerns.

3. Valves that have a safety function to open in response to station blackout, cold shutdown or other similar commitments are not considered to be within the scope of Generic Letter 95-07.

Valves eliminated by the above criteria are so noted in the remarks column of Attachment 2. No additional review is provided as part of Union Electric's response to Generic Letter 95-07.

Twenty nine valves not eliminated by the foregoing criteria were evaluated in detail. All of these valves were screened and categorized using the criteria developed by the Westinghouse Owners Group (WOG) included as Attachment 3. In determining potential operating scenarios, evaluations performed in developing differential pressures for GL 89-10 were utilized. Other sources include flow diagrams, system descriptions, the Callaway Final Safety Analysis Report, previous valve safety classification analyses, and previous analyses for pressure locking and thermal binding.

Other Westinghouse 4 loop plants with similar designs (Wolf Creek, Commanche Peak, Byron, Braidwood, and Vogtle) were contacted and the lists of potentially susceptible valves compared to ensure that all conditions and valves were considered.

For purposes of screening for thermal binding, the following values were used when considering 'significant' temperature changes. The basis for these values are calculations and testing performed by Westinghouse for the WOG. This basis is documented in letter ESBU/WOG-95-387, dated December 6, 1995.

1. Thermal binding was not considered if ambient or fluid temperature is always less than 200 °F.

2. Above 200 °F, for solid wedge gate valves, only temperature changes greater than 50 °F were considered significant.

3. Above 200 °F, for flexible wedge gate valves, only temperature changes greater than 100 °F were considered significant.

<u>EVALUATION RESULTS</u>

The screening and categorization process identified 6 of the 29 valves as potentially susceptible to pressure locking or thermal binding. The 6 valves are summarized in the table below and discussed in detail in the following pages of this submittal.

Valve ID	Description	Callaway Actions and Justification
EJHV8811A/B	Containment Recirculation Sump to Residual Heat Removal (RHR) Pump Suction	Potentially susceptible to thermally induced pressure locking. Currently, air quantity trapped in bonnet is verified during inservice testing. Modification planned to add air pipe to ensure air cushion will always be present.
EJFCV0610 & EJFCV0611	RHR Minimum Flow Control	Potentially susceptible to thermal binding. Operability evaluation concluded that when required to open for its safety function, the valve would not thermally bind. Additionally, the valves were modified to close on limit. The contacts are set to stop the motor approximately 1/2" before the disk contacts the seat.
ENHV0001/7	Containment Recirculation Sump to Containment Spray Pump Suction	Potentially susceptible to thermally induced pressure locking. Currently, air quantity trapped in bonnet is verified during inservice testing. Modification planned to add air pipe to ensure air cushion will always be present.

Detailed discussions for the following 3 valves, which are opened when transferring the plant to hot leg recirculation, are also included in the following pages of this submittal. Some plants have identified these valves as susceptible to pressure locking. However, testing performed for the WOG on similar valves indicates that these valves will not pressure lock. These valves are included since they were initially determined to be potentially susceptible to pressure locking.

Valve ID	Description	Callaway Actions and Justification
EJHV8840	RHR to Hot Leg Injection Isolation	Originally identified as potentially susceptible to pressure locking. Pressure source was assumed leakage past two RCS check valves. Testing performed for the WOG indicates that the bonnet, if pressurized, will relieve pressure prior to the time the valve is required to open.
EMHV8802A/B	Safety Injection to Hot Leg Injection Isolation	Originally identified as potentially susceptible to pressure locking. Pressure source was assumed leakage past two RCS check valves. Testing performed for the WOG indicates that the bonnets, if pressurized, will relieve pressure prior to the time the valves are required to open.

EJFCV0610 & 0611, RHR PUMP MINIMUM FLOW CONTROL VALVE

EJFCV0610 & 0611 are 3" flexible wedge gate valves, equipped with SMB-000 operators which are setup to close on limit. The limit switch is set 1/2" above the hard seat. The valves are located in the auxiliary building in the recirculation flow line for the residual heat removal (RHR) pump. The maximum post accident temperature for these valves is 109 °F.

SAFETY RELATED FUNCTION

During normal operation, these valves are open. They provide RHR pump protection by ensuring RHR pump discharge flow is greater than pump minimum flow requirements. These valves automatically close when RHR discharge flow reaches approximately 1600 gpm, and automatically open when flow drops to approximately 800 gpm.

EVALUATION DISCUSSION

EJFCV0610 & 0611 are not exposed to high pressure, therefore pressure locking from exposure to a high pressure source is not applicable. Pressure locking due to heatup following closure is also not a concern since the only case where the valves may be closed and the system heated up, is during a normal plant startup. No cases of pressure locking at Callaway Plant have occurred for these valves during a startup, but if locking were to occur under these conditions, no safety concern would exist. Therefore, these valves are not susceptible to pressure locking.

Additionally, a modification was implemented which soft seats the valve using the limit switch. The limit switch contacts are set to stop the motor after flow has been stopped, but ~1/2" before the disc contacts the seat. Based on the modification, these valves are not susceptible to thermal binding. The method of closing these valves also eliminates the possibility for pressure locking since the seats are not leak tight.

CONCLUSION

EJFCV0610 & 0611 are not susceptible to pressure locking or thermal binding.

EJHV8811A & B, CONTAINMENT RECIRC SUMP TO RHR PUMP SUCTION

EJHV8811A & B are 14" flexible wedge gate valves equipped with SB-1 operators that have spring compensators. The valves are set up to close on torque. These valves isolate the containment recirculation sump from the RHR pump suction. They are located inside encapsulations in the auxiliary building.

SAFETY RELATED FUNCTION

During normal operation, these valves are closed. Following a design basis accident, these valves are required to open when transferring ECCS from the injection phase to cold leg recirculation. Once opened, the valves remain open.

EVALUATION DISCUSSION

EJHV8811A & B are not susceptible to thermal binding. They are closed at ambient conditions and opened post-accident at, or slightly above ambient temperature.

These valves have been considered susceptible to thermally induced pressure locking based on the following scenario. The valve bonnets are assumed to be water solid at ambient temperature. After an accident occurs, the containment recirculation sumps fill with hot water (250 °F maximum) which warms the valve and the water contained in the bonnet. At assumed bonnet pressurization rates of 20-30 psi per °F, pressure locking could occur. However, recent test results indicate that this pressurization rate is not realistic.

At Callaway, these valves are normally stroked once every refueling outage to satisfy ASME Section XI testing requirements (Ref. OSP-EF-V002A). Procedurally, prior to stroke testing, the RHR system is drained. These valves are closed at ambient conditions with no water present in the bonnet. Leakage past the seat into the bonnet is not anticipated because of the low driving head (RWST static head) in the line. Since some air is always present in the valve bonnet, these valves are not susceptible to pressure locking.

In addition, Callaway procedurally quantified the amount of free volume in the valve bonnets. Results of the tests performed in Refuel 7 confirmed that the bonnets contained less than 50% by volume of water. This volume was present after 18 months of plant operation and represents the worst case conditions. Air quantification testing will also be performed during Refuel 8, scheduled for the fall of 1996.

In order to eliminate the need for continued testing while ensuring sufficient free volume will always be available, Union Electric plans to add 'air expansion pipes' to the valve bonnets. These expansion pipes, elevated above the valve bonnets, will be connected to the bonnet packing leakoff line with instrument tubing. The air cushion provided by these pipes will accommodate any thermal expansion of water, assuming the bonnet is water solid. EJ-HV-8811B will be modified during Refuel 9 (scheduled for the spring of 1998), and EJ-HV-8811A will be modified during Refuel 10 (scheduled for fall of 1999). This schedule coincides with the planned train work and will allow the modification to be designed and implemented within the normal refuel planning and scheduling process.

CONCLUSION

EJHV8811A & B are not susceptible to pressure locking or thermal binding. Previous tests have verified that sufficient free volume is present in the bonnet to preclude thermally induced pressure locking. Air quantification testing will continue to be performed to assure that sufficient free volume is present in the valve bonnets to prevent pressure locking.

In order to eliminate the need for continued testing while ensuring this free volume will always be present, the valves will be modified by the addition of air expansion pipes in Refuels 9 and 10. If additional information becomes available such that the planned modification will not be implemented, notification with justification will be provided to the staff.

ENHV0001 & 7, CTMT RECIRC SUMP TO CTMT SPRAY PUMP SUCTION

ENHV0001 & 7 are 12" flexible wedge gate valves equipped with SMB-00 operators which are setup to close on torque. These valves isolate the containment recirculation sump from the containment spray pump suction. They are located inside encapsulations in the auxiliary building.

SAFETY RELATED FUNCTION

During normal operation, ENHV0001 & 7 are closed. Following a design basis accident, these valves are required to open when transferring containment spray from the injection phase to recirculation phase. Once opened, the valves remain open.

EVALUATION DISCUSSION

ENHV0001 & 7 are not susceptible to thermal binding since they are closed at ambient conditions and opened post-accident at, or slightly above ambient temperature.

These valves have been considered susceptible to thermally induced pressure locking based on the following scenario. The valve bonnets are assumed to be water solid at ambient temperature. After an accident occurs, the containment recirculation sumps fill with hot water (250 °F maximum) which warms the valve and the water contained in the bonnet. At assumed bonnet pressurization rates of 20-30 psi per degree F, pressure locking could occur. However, recent test results indicate this pressurization rate is not realistic.

At Callaway, these valves are normally stroked once every refueling outage to satisfy ASME Section XI testing requirements (Ref. OSP-EN-00002). Procedurally, prior to stroke testing, the containment spray system is drained. These valves are closed at ambient conditions with no water present in the bonnet. Leakage past the seat into the bonnet is not anticipated because of the low driving head (RWST static head), and the presence of a check valve in the line. Since some air is always present in the valve bonnet, these valves are not susceptible to pressure locking.

Union Electric procedurally quantifies the amount of free volume in the valve bonnets. Air quantification testing is scheduled to be performed in Refuel 8. In order to eliminate the need for continued testing while ensuring that sufficient free volume will always be available, Union Electric plans to add 'air expansion pipes' to the valve bonnets. These expansion pipes, elevated above the valve bonnets, will be connected to the bonnet packing leakoff line with instrument tubing. The air cushion provided by

these pipes will accommodate any thermal expansion of water assuming the valve bonnet is water solid. ENHV0007 will be modified during Refuel 9 (which is scheduled for the spring of 1998), and ENHV0001 will be modified during Refuel 10 (which is scheduled for fall of 1999). This schedule coincides with the planned train work and will allow the modification to be designed and implemented within the normal refuel planning and scheduling process.

CONCLUSION

ENHV0001 & 7 are not susceptible to pressure locking or thermal binding. Testing has been performed to verify that sufficient free volume is present in the bonnet to preclude thermally induced pressure locking. Testing will continue to be performed to assure that sufficient free volume is present in the valve bonnets to prevent pressure locking.

In order to eliminate the need for continued testing while ensuring this free volume will always be present, the valves will be modified by the addition of air expansion pipes in refueling outages 9 and 10. If additional information becomes available such that the planned modification will not be implemented, notification with justification will be provided to the staff.

EJHV8840, RHR TO HOT LEG RECIRCULATION

EJHV8840 is a 10" flexible wedge gate valve, equipped with an SBD-3 operator that has a spring compensator. The valve is setup to close on torque. The valve is located in the auxiliary building and isolates the RHR pumps from the hot leg recirculation line. The maximum post accident temperature for this valve is 107 °F.

SAFETY RELATED FUNCTION

During normal operation, EJHV8840 is closed with power removed. The valve remains closed for the cold leg recirculation phase of a LOCA response, and is opened 13 hours later during the hot leg recirculation phase of a LOCA response.

EVALUATION DISCUSSION

EJHV8840 is not exposed to high temperature when closed, or post accident prior to opening the valve. Additionally, the valve operator is equipped with a spring compensator which reduces the wedging forces during closing. Thus, thermal binding is not a concern.

This valve is normally closed, and is isolated from the reactor coolant system (RCS) by two check valves in series. Since a small amount of check valve leakage is allowed, the potential exists for the downstream side of the valve to be exposed to RCS pressure. Leakage past the valve seat could result in the bonnet reaching RCS pressure.

The only safety function of this valve is to align the plant for hot leg recirculation. PRA analysis results show no effect on core damage frequency due to failure of EJHV8840 to open. If this valve fails to open, Callaway emergency operating procedures direct the operators to maintain injection through the cold legs. Also, since the transfer to hot leg recirculation is a manual process and the time to transfer is not critical, local operator action could be taken to manually open the valve.

Currently, quarterly temperature monitoring is performed to identify excessive RCS check valve leakage. If increasing pressure is identified, actions will be taken to relieve it.

As noted earlier, valve EJHV8840 is not required to open until 13 hours post accident. In the event that the bonnet were pressurized, sufficient time exists for that pressure to dissipate. Testing performed for the WOG indicates that valve

bonnets quickly depressurize. Therefore, this valve is not susceptible to pressure locking.

Since the valve is not exposed to high temperatures during normal or accident operations, the conditions needed to create thermally induced pressure locking are not present.

CONCLUSION

EJHV8840 is not susceptible to pressure locking or thermal binding. Any pressure in the bonnet will have sufficient time to dissipate prior to required valve operation.

EMHV8802A & B, SAFETY INJECTION TO HOT LEG RECIRCULATION

EMHV8802A & B are 3" flexible wedge gate valves, equipped with SBD-00 operators that have spring compensators. The valves are setup to close on torque. The valves are located in the auxiliary building and isolate the safety injection (SI) pumps from the hot leg recirculation line. The maximum post accident temperature for these valves is 107 °F.

SAFETY RELATED FUNCTION

During normal operations, EMHV8802A & B are closed with power removed. The valves remain closed for the cold leg recirculation phase of a LOCA response, and are opened 13 hours later during the hot leg recirculation phase of a LOCA response.

EVALUATION DISCUSSION

EMHV8802A & B are not exposed to hot conditions when closed, or post accident prior to opening the valve. Additionally, the valve operators are equipped with a spring compensator which reduces the wedging forces during closing. Thus, thermal binding is not a concern for these valves.

These valves are normally closed, and are isolated from the RCS by two check valves in series. Since a small amount of check valve leakage is allowed, the potential exists for the downstream side of the valves to be exposed to RCS pressure. Leakage past the valve seat could result in the bonnet reaching RCS pressure.

These valves only opening safety function is to align the plant for hot leg recirculation. PRA analysis results show no affect on core damage frequency due to failure of EMHV8802A & B to open. If these valves fail to open, Callaway emergency operating procedures direct the operators to maintain injection through the cold legs. Also, since the transfer to hot leg recirculation is a manual process and the time to transfer is not critical, local operator action could be taken to manually open the valve.

Currently, quarterly temperature monitoring is performed to identify excessive RCS check valve leakage. If increasing pressure is identified, actions will be taken to relieve it.

As noted earlier, EMHV8802A & B are not required to open until 13 hours post accident. In the event that the bonnet was pressurized, sufficient time exists for that pressure to dissipate. Testing performed for the WOG indicates that valve bonnets quickly depressurize. This testing included a valve that

is the same model as EMHV8802A/B. Therefore, these valves are not susceptible to pressure locking from RCS check valve leakage.

Also, these valves are stroke tested quarterly to satisfy the Inservice Testing (IST) program. If check valve leakage from the RCS were present, the stroke test would exercise the valves under the same conditions that would exist when the valves are required to open.

Since these valves are not exposed to high temperatures during normal or accident operations, the conditions needed to create thermally induced pressure locking are not present.

CONCLUSION

EMHV8802A & B are not susceptible to pressure locking or thermal binding.

	Callaway GL 95-07 Valve Data			
Valve ID	Noun Name	Remarks	Valve Manufacturer	Valve Type
ALHV0034	CST TO MD AFP B ISO	Safety Function to close only.	ANCHOR-DARLING	FW GATE
ALHV0035	CST TO MD AFP A ISO	Safety Function to close only.	ANCHOR-DARLING	FW GATE
ALHV0036	CST TO TD AFP ISO	Safety Function to close only.	ANCHOR-DARLING	FW GATE
BBHV0013	RCP A THRM BAR CCW RTN ISO	Safety Function to close only.	VELAN	FW GATE
BBHV0014	RCP B THRM BAR CCW RTN ISO	Safety Function to close only.	VELAN	FW GATE
BBHV0015	RCP C THRM BAR CCW RTN ISO	Safety Function to close only.	VELAN	FW GATE
BBHV0016	RCP D THRM BAR CCW RTN ISO	Safety Function to close only.	VELAN	FW GATE
BBHV8000A	PZR PORV BBPCV0455A INLET ISO		WESTINGHOUSE	FW GATE
BBHV8000B	PZR PORV BBPCV0456A INLET ISO		WESTINGHOUSE	FW GATE
BBHV8037A	PRT OUT TO CTMT NORM SMP ISO	Cold SD, N/A for GL 95-07	WESTINGHOUSE	FW GATE
BBHV8037B	PRT OUT TO CTMT NORM SMP ISO	Cold SD, N/A for GL 95-07	WESTINGHOUSE	FW GATE
BBPV8702A	RCS HL 1 TO RHR PMP SUCTION ISO	Cold SD, N/A for GL 95-07	WESTINGHOUSE	FW GATE
BBPV8702B	RCS HL 4 TO RHR PMP SUCTION ISO	Cold SD, N/A for GL 95-07	WESTINGHOUSE	FW GATE
BGHV8105	CHRGNG PMPS TO REGEN HX CTMT ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
BGHV8106	CHRGNG PMPS TO REGEN HX CTMT ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
BGLCV112B	VCT OUT UPSTRM ISO	Safety Function to close only.	WESTINGHOUSE	SW GATE
BGLCV112C	VCT OUT DNSTRM ISO	Safety Function to close only.	WESTINGHOUSE	SW GATE
BNHV0003	RWST TO CTMT SPRY PMP B	Normal line-up is open.	ANCHOR-DARLING	FW GATE
BNHV0004	RWST TO CTMT SPRY PMP A	Normal line-up is open.	ANCHOR-DARLING	FW GATE
BNHV8806A	SI PMP A SUCT FROM RWST ISO	Normal line-up is open.	WESTINGHOUSE	FW GATE
BNHV8806B	SI PMP B SUCT FROM RWST ISO	Normal line-up is open.	WESTINGHOUSE	FW GATE
BNHV8812A	RWST TO RHR PMP A SUCT ISO	Normal line-up is open.	WESTINGHOUSE	FW GATE
BNHV8812B	RWST TO RHR PMP B SUCT ISO	Normal line-up is open.	WESTINGHOUSE	FW GATE
BNLCV112D	CCP A SUCT FROM RWST ISO		WESTINGHOUSE	FW GATE
BNLCV112E	CCP B SUCT FROM RWST ISO		WESTINGHOUSE	FW GATE
EFHV0097	ESW PMP A DISCH RECIRC		VELAN	SW GATE
EFHV0098	ESW PMP B DISCH RECIRC		VELAN	SW GATE
EFPDV0019	ESW S-C STR A DRN DP CTRL VLV		VELAN	SW GATE
EFPDV0020	ESW S-C STR B DRN DP CTRL VLV		VELAN	SW GATE
EGHV0058	CCW TO CTMT OUTER ISO HV	Safety Function to close only.	ANCHOR-DARLING	PDG
EGHV0059	CCW FROM CTMT OUTER ISO	Safety Function to close only.	ANCHOR-DARLING	PDG
EGHV0060	CCW FROM RCS IN CTMT ISO	Safety Function to close only.	ANCHOR-DARLING	PDG
EGHV0061	CCW FROM RCP THERM BAR OUTER CTMT ISO	Safety Function to close only.	VELAN	PSG
EGHV0062	CCW FROM RCS IN CTMT ISO	Safety Function to close only.	VELAN	PSG
EGHV0071	CCW TO CTMT OUTER ISO	Passive Safety Function only.	ANCHOR-DARLING	FW GATE
EGHV0126	CCW TO CTMT BYP ISO	Passive Safety Function only.	ANCHOR-DARLING	FW GATE
EGHV0127	CCW TO CTMT BYP ISO	Passive Safety Function only.	ANCHOR-DARLING	PDG
EGHV0130	CCW FROM RCS CTMT EGHV0060 BYP ISO	Passive Safety Function only.	ANCHOR-DARLING	PDG
EGHV0131	CCW FROM CTMT EGHV0059 BYP ISO	Passive Safety Function only.	ANCHOR-DARLING	FW GATE
EGHV0132	CCW FROM RCS CTMT EGHV0062 BYP ISO	Passive Safety Function only.	VELAN	PSG
EGHV0133	CCW FROM RCP THRM BAR EGHV0061 BYP ISO	Passive Safety Function only.	VELAN	PSG
EJFCV0610	RHR PMP A MINIFLOW CTRL		WESTINGHOUSE	FW GATE
EJFCV0611	RHR PMP B MINIFLOW CTRL		WESTINGHOUSE	FW GATE
EJHV8701A	RCS HL 1 TO RHR PMP SUCTION ISO	Cold SD, N/A for GL 95-07	WESTINGHOUSE	FW GATE
EJHV8701B	RCS HL 4 TO RHR PMP SUCTION ISO	Cold SD, N/A for GL 95-07	WESTINGHOUSE	FW GATE
EJHV8716A	RHR TRN A SI SYS HOT LEG RECIRC ISO		WESTINGHOUSE	FW GATE
EJHV8716B	RHR TRN B SI SYS HOT LEG RECIRC ISO		WESTINGHOUSE	FW GATE
EJHV8804A	RHR TRN A CHARGING PUMPS SPLY ISO		WESTINGHOUSE	FW GATE
EJHV8804B	RHR TRN B SI PUMPS SPLY ISO		WESTINGHOUSE	FW GATE
EJHV8809A	RHR TRN A ACC INJ SPLY ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
EJHV8809B	RHR TRN B ACC INJ SPLY ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE

	Callaway GL 95-07 Valve Data			
Valve ID	Noun Name	Remarks	Valve Manufacturer	Valve Type
EJHV8811A	CTMT RECIRC SUMP TO RHR PUMP A SUCT ISO		WESTINGHOUSE	FW GATE
EJHV8811B	CTMT RECIRC SUMP TO RHR PUMP B SUCT ISO		WESTINGHOUSE	FW GATE
EJHV8840	RHR TO HOT LEG RECIRC ISO		WESTINGHOUSE	FW GATE
EMHV8801A	BORON INJ OUTLET ISO		WESTINGHOUSE	FW GATE
EMHV8801B	BORON INJ OUTLET ISO		WESTINGHOUSE	FW GATE
EMHV8802A	SI PMP A DISCH TO HOT LEG INJ ISO		WESTINGHOUSE	FW GATE
EMHV8802B	SI PMP B DISCH TO HOT LEG INJ ISO		WESTINGHOUSE	FW GATE
EMHV8803A	BORON INJ HDR SPLY FROM CCP A ISO		WESTINGHOUSE	FW GATE
EMHV8803B	BORON INJ HDR SPLY FROM CCP B ISO		WESTINGHOUSE	FW GATE
EMHV8807A	RHR HX A TO SI PMPS SUCT DNSTRM ISO		WESTINGHOUSE	FW GATE
EMHV8807B	RHR HX A TO SI PMPS SUCT DNSTRM ISO		WESTINGHOUSE	FW GATE
EMHV8821A	SI PMP A DISCH TO COLD LEG INJ ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
EMHV8821B	SI PMP B DISCH TO COLD LEG INJ ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
EMHV8835	SI PMPS DISCH TO COLD LEG INJ ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
EMHV8923A	RWST TO SI PMP A SUCT ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
EMHV8923B	RWST TO SI PMP B SUCT ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
ENHV0001	CTMT RECIRC SMP TO CTMT SPRY PMP A		ANCHOR-DARLING	FW GATE
ENHV0006	CTMT SPRY PMP A DISCH		ANCHOR-DARLING	FW GATE
ENHV0007	CTMT RECIRC SMP TO CTMT SPRY PMP B		ANCHOR-DARLING	FW GATE
ENHV0012	CTMT SPRY PMP B DISCH		ANCH[illegible]LING	FW GATE
EPHV8808A	SI ACC TK A OUT ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
EPHV8808B	SI ACC TK B OUT ISO	Passive Safety Function only.	WESTINGHOUSE	FW GATE
EPHV8808C	SI ACC TK C OUT ISO	Passive Safety Function only.	WESTINGHOUSE	FW GATE
EPHV8808D	SI ACC TK D OUT ISO	Safety Function to close only.	WESTINGHOUSE	FW GATE
KAHV0030	H2 CTRL SYS M/U AIR HV	Passive Safety Function only.	BORG-WARNER	SW GATE
KCHV0253	F-PROT LOOP TO RX BLD OUTER CTMT ISO	Safety Function to close only.	VELAN	PSG
LFFV0095	CTMT NORM SMP PMPS DISCH HDR	Safety Function to close only.	ANCHOR-DARLING	FW GATE
LFHV0105	DRW SMPS DISCH HDR DNSTRM HV	Safety Function to close only.	ANCHOR-DARLING	FW GATE
LFHV0106	DRW SMPS DISCH HDR UPSTRM HV	Safety Function to close only.	ANCHOR-DARLING	FW GATE
BGFCV0110B	M/U TO VCT OUT HDR	Passive Safety Function only.	GRINNELL	
BGFCV0111B	M/U TO VCT IN HDR	Passive Safety Function only.	GRINNELL	
BGPCV0115	VCT PURGE TO WST GAS CMPSRS	Passive Safety Function only.	GRINNELL	
BLHV8047	RX M/U WTR OUTER CTMT ISO	Safety Function to close only.	GRINNELL	
ABHV0011	SG D MAIN STEAM LINE ISO	Safety Function to close only.	ANCHOR-DARLING	DD GATE
ABHV0014	SG A MAIN STEAM LINE ISO	Safety Function to close only.	ANCHOR-DARLING	DD GATE
ABHV0017	SG B MAIN STEAM LINE ISO	Safety Function to close only.	ANCHOR-DARLING	DD GATE
ABHV0020	SG C MAIN STEAM LINE ISO	Safety Function to close only.	ANCHOR-DARLING	DD GATE
AEFV0039	SG A FW SPLY ISO	Safety Function to close only.	ANCHOR-DARLING	DD GATE
AEFV0040	SG B FW SPLY ISO	Safety Function to close only.	ANCHOR-DARLING	DD GATE
AEFV0041	SG C FW SPLY ISO	Safety Function to close only.	ANCHOR-DARLING	DD GATE
AEFV0042	SG D FW SPLY ISO	Safety Function to close only.	ANCHOR-DARLING	DD GATE

WOG VALVE CATEGORIZATION CRITERIA FOR PRESSURE LOCKING AND THERMAL BINDING

VALVE: __________

INITIAL SCREENING TO ELIMINATE ALL NON-APPLICABLE VALVES

1. *Valve Applicability*

   (a) Is the valve a safety related Power Operated Gate Valve? __________

   (b) Does the valve have a licensing commitment? __________

   If NO to BOTH, then the valve is considered not applicable.

2. *Function*

   (a) Does the valve have a safety-related function to open? __________

   If YES,

   (i) Is it normally or occasionally closed during normal or safety related operations? __________

   If NO, then valve is considered not applicable.

   If no, then valve is considered not applicable.

3. *Component Design for Pressure Locking*

   (a) Is the valve a solid wedge gate valve? __________

   If YES, then the valve is considered not applicable for pressure locking.

4. *Component Design for Thermal Binding*

   (a) Is the valve a double disk gate valve? __________

   (b) Is the valve a parallel disk gate valve? __________

   If YES to ANY, then the valve is considered not applicable for thermal binding.

COMPONENT LEVEL SCREENING

5. *Pressure Locking*

(a) Does the valve have a design feature that mitigates pressure locking (i.e., hole in disk, bonnet bypass line, bonnet pressure relief, active packing leakoff line, etc.)? ________

If YES, then the valve is considered not susceptible to pressure locking.

6. *Thermal Binding*

None exists

SYSTEM LEVEL SCREENING

7A. *Pressure Locking (Hydraulic Effects)*

(a) Is the valve normally or occasionally exposed to high pressure fluid and is the attached piping potentially depressurized prior to valve actuation? ________

(b) Is the valve, which is not normally exposed to high pressure fluid, potentially subjected to high pressure fluid due to leakage from a high pressure source and is the attached piping potentially depressurized prior to valve actuation? ________

If NO to ALL, then valve is considered not susceptible to pressure locking due to hydraulic effects.

7B. *Pressure Locking (Thermal Effects)*

(a) Is the valve stem oriented in a horizontal or below horizontal configuration as to trap steam condensate in the bonnet when closed? ________

(b) Does the valve, which is not normally or occasionally exposed to hot fluid, potentially experience body temperature changes from fluid temperature conditions in the attached piping? ________

(c) Does the valve, which is not normally exposed to high temperature conditions, potentially experience hot temperature conditions (e.g., high energy line break)? ________

(d) Can the valve see a temperature increase greater than normal ambient swings? ________

If NO to ALL, then the valve is considered not susceptible to pressure locking due to thermal effects.

8A. *Thermal Binding (Wedge Effect)*

(a) Is the valve closed hot followed by a significant cooldown and then required to open? ________

(b) Is the hot valve required to close while the system/valve is cooling down (i.e., subject valve closure terminates cooling) and required to open after the valve has cooled down? ________

(c) Can a significant temperature gradient develop across the valve after it is closed and is the valve then required to be opened? ________

If NO to ALL, then the valve is considered not susceptible to thermal binding due to the wedge effect.

8B. *Thermal Binding (Stem Effect)*

(a) Is the valve closed hot, with no subsequent cooldown, then required to open? ________

(b) Is the hot valve required to close while the system/valve is being cooled down and signaled to open before the valve cools down (i.e., not completely cooled down)? ________

If NO to ALL, then the valve is considered not susceptible to thermal binding due to the stem effect.

COMMENTS

EVALUATION CRITERIA TO ELIMINATE REMAINING VALVES

1. *Pressure Locking*

(a) Does the valve inservice testing conditions bound the postulated thermal and hydraulic pressure locking conditions? ________

(b) Is the actuator sized for maximum expected bonnet pressure due to combined thermal and hydraulic pressure locking conditions? ________

If YES to Either, then the valve is considered not susceptible to pressure locking.

2A. *Thermal Binding (Wedge Effect)*

(a) Does a procedure exist that requires cycling the valve at a cooling ΔT interval of approximately 20-50°F. ________

If YES, then the valve is considered not susceptible to thermal binding due to the wedge effect.

2B. *Thermal Binding (Stem Effect)*

(a) Does the valve actuator have a compensating spring for stem growth? ________

If YES, then the valve is considered not susceptible to thermal binding due to the stem effect.

2C. *Thermal Binding (General)*

(a) Is the actuator sized for unseating thrust which takes into account differential thermal contraction of valve disk and body as well as stem growth? ________

(b) Does the valve inservice testing conditions bound the postulated thermal binding conditions? ________

If YES to ANY, then the valve is considered not susceptible to thermal binding.