TU ELECTRIC
COMANCHE PEAK STEAM ELECTRIC STATION

ENGINEERING REPORT

RESOLUTION OF NRC GENERIC LETTER 95-07
"PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES"

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PREPARED BY: P.C. Chiu (Mechanical Engineering) P.C. Chiu 2/6/96

REVIEWED BY: J.W. Meyer (NSSS Systems Engineering) Randall S. Epan for J.W. Meyer 2/13/96

REVIEWED BY: J.H. Brau (Operation Supports Engineering) 2/7/96

REVIEWED BY: R.G. Withrow (Maintenance Engineering) RG Withrow 2/13/96

APPROVED BY: J.L. Barker (Mechanical Engineering Manager) JL Barker 2/9/96

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1.0 Purpose

The NRC has been studying problems associated with valve inoperability events due to pressure locking or thermal binding for many years and has documented these studies in such reports as Information Notice IN 92-26 and NUREG-1275, Vol.9. These reports, as well as other studies of pressure locking and thermal binding valve problems, have lead to the issuance of Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves." The purpose of this engineering report is to document the results of the work done to satisfy the requirements of Generic Letter 95-07. It includes a review of Units 1 and 2 power-operated gate valves to:

- Identify conditions under which the phenomenon of pressure locking or thermal binding may occur,
- Identify power-operated gate valves that may be subjected to pressure locking or thermal binding conditions, and
- Determine the corrective action for valves that are considered susceptible to pressure locking or thermal binding.

The report includes initial screening using simple criteria, developed by the WOG, to identify valves that warrant further susceptibility evaluation. It includes, as necessary, component and system considerations, i.e., a thermal effects and design-basis depressurization, or actuator analysis to find out its capability under various scenarios.

The review considered valves that are required to open during or immediately following postulated design-basis events. During such plant evolutions that involve system transients or unusual system alignment, valve performance could be severely challenged by the rapid cool down, heat-up, depressurization rates, and high differential pressure across its discs. Plant documents were reviewed to identify whether, when, and how often each valve must be opened. The location of the valve was determined, the process fluid and ambient temperature expected from the design-basis events for the identified location was determined, and equipment operability for the expected conditions was then assessed.

The screening and evaluation are applicable to both Units 1 and 2 since both units are essentially identical. Unit 1 and Unit 2 tag numbers are the same except the prefix.

2.0 Scope

2.1 Valves Included in Pressure Locking Screening

Safety related power-operated gate valves that are:

2.1.1 Normally closed valves, *double disk, flexible-wedge, and split-wedge,* that are:
- A) Required to open automatically on "S" or "P" signal; or
- B) Required to be opened by operator action in the switchover from post-LOCA injection mode to recirculation modes (cold leg and hot leg); or
- C) May be opened by operator action to facilitate RCS cooldown during a small break LOCA, MSLB, or SGTR.

2.1.2 Normally open valves, *double disk, flexible-wedge, and split-wedge* that are required to be closed for post-LOCA cold leg recirculation and subsequently reopened for hot leg recirculation.

2.2 Valves Included in Thermal Binding Screening

Safety related power-operated gate valves that are:

2.2.1 Normally closed valves, i.e., *solid-wedge and flexible-wedge,* that is:
- A) Required to open automatically on "S" or "P" signal; or
- B) Required to be opened by operator action in the switch over from post-LOCA injection mode to recirculation modes (cold leg and hot leg); or
- C) May be opened by operator action to facilitate RCS cooldown during a small break LOCA, MSLB, or SGTR.

2.2.2 Normally opened valves, i.e., *solid-wedge and flexible-wedge,* required to be closed for post-LOCA cold leg recirculation and subsequently reopen for hot leg recirculation.

Table 1 provides total number (148) of power-operated gate valves in Unit 1 & 2 included in GL 95-07 screening on the basis of the criteria listed above. Based on guidance at NRC public workshop, those that have a "no" answer in the last column in Table 1 were excluded from further consideration. Those that have a "yes" answer were further screened and evaluated using section 4.0 criteria.

3.0 Pressure Locking and Thermal Binding Phenomenon

3.1 Conditions that are conducive to *pressure locking*

3.1.1 Differential pressure locking can occur when the valve has differential pressure across the disc in the closed position. The pressurized side of the flexible disc can move away

slightly from its seat, allowing high pressure liquid to enter the bonnet cavity. With time, the bonnet pressure will tend to equalize with the pressure in the body cavity. If pressure within the valve body is subsequently decreased, i.e., during a LOCA, the bonnet pressure will force the disc against its seat. If no internal or external pressure equalizing path for the bonnet is provided, bonnet pressure locking may occur, i.e., the pressure differential can cause the disc forces on the valve seats to become sufficiently high that the valve cannot be opened.

3.1.2 Liquid entrapment pressure locking can occur when the system, including the valve bonnet, is full of cold liquid with the valve closed. As the system temperature increases, the bonnet liquid temperature eventually increases, potentially resulting in a rise in pressure in the bonnet cavity.

3.1.3 When the valve is in its closed position under some upstream pressure, and this upstream pressure is subsequently reduced, e.g., due to tripping of an upstream pump, the original (higher) upstream pressure may remain trapped in the bonnet cavity. This can result in an increase in the opening thrust requirements similar to condition described in section 3.1.1.

3.2 Conditions that are conducive to *thermal binding*

3.2.1 Thermal binding is generally associated with a wedge gate valve that is closed while the system is hot and then is allowed to cool before attempting to open the valve. Mechanical interference occurs because of different expansion and contraction characteristics of the valve body and disk materials. Thus, reopening the valve might be prevented until the valve and disk are reheated.

3.2.2 Alternatively, thermal binding may occur if a valve is closed hot, with no subsequent cooldown, then required to be opened. Higher seating contact force may occur due to thermal expansion of the newly inserted portion of the stem. Thus, the valve may require higher opening loads than previously anticipated.

4.0 Screening and Evaluation Criteria

4.1 Component function screening criteria:

A) Does the valve have a primary safety function to open?
B) Is the valve normally or occasionally closed during normal or safety related operations?

4.2 Pressure locking (hydraulic effects) screening criteria:

A) Is the valve normally or occasionally exposed to high pressure fluid, e.g., check valve back leakage, system pressure, or pump discharge pressure, *and* the attached piping could depressurize rapidly before valve actuation?

B) Will any normal or accident condition result in system pressure decreasing after the valve is closed?

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

4.3 Pressure locking (Thermal induced) screening criteria:

A) Is the valve stem oriented in a horizontal or below a horizontal configuration such that condensed steam may be trapped in the bonnet when the valve is 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 environmental temperature conditions, potentially experience high environmental temperature conditions (e.g., high energy line break)?

4.4 Thermal binding or stem growth effects screening criteria:

A) Will the valve be closed while the system is hot and then allowed to cool before attempting to open?

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

C) Is the valve closed hot, with no subsequent cooldown, then required to open (stem growth effects)?

D) Will the valve be called to open when the *temperature* is greater than 200°F?

Per ESBU/WOG-95-387, 200°F can be considered a threshold temperature for thermal binding. If the valve active function temperature is below 200°F, the thermal binding effect need not be further evaluated.

Based on valve manufacturer study [ESBU/WOG-95-387], for purposes of thermal binding screen, *a significant* ΔT is defined as:

$\Delta T \geq$ 50°F for *solid wedge* gate valves or
$\Delta T \geq$ 100°F for *flexible wedge* gate valves

The additional screening and evaluation results (41 valves per unit) are shown on pages 17 thru 33 and tabulated in *Table 2*.

5.0 Further Analysis

Once a valve is determined to be susceptible to either pressure locking or thermal binding, a test verified analytical method may be used to quantify the total stem thrust required to open the valve. As an alternative, the valve may be modified to alleviate the effects of pressure locking or thermal binding.

5.1 Total opening stem thrust requirements (T_{total})

As part of a short term operability decision, the total opening stem thrust requirements for a susceptible valve can be determined by summation of all the loads applied to the stem. For stem thrust requirements in the opening direction under pressure locking or thermal binding conditions, a summation of the appropriate loads yields:

$$\mathbf{T_{total} = [T_{dbp} - T_{pd} + T_{un} + T_{vert}] + T_{sg} + TB}$$

Where

T_{dbp} = required stem thrust due to bonnet pressure locking, lbs.

T_{pd} = stem rejection load due to pressure upstream or downstream of the valve, lbs.

T_{un} = stem unwedging load from static test result, lbs.

T_{vert} = reverse piston effect, lbs.

T_{sg} = required stem thrust due to stem growth, lbs.

TB = required stem thrust due to disc and seat thermal binding effects, lbs.

The *TB* (due to thermal effects) can have significant impact on the operability of the valve during opening. It does not lend itself to reliable quantification, thus analytical methods are not used to assess valve operability. Instead, operating procedure revisions, and/or equipment modifications will be considered to eliminate this susceptibility. The other factors in the equation can be determined as described below.

5.1.1 Stem thrust required due to higher bonnet pressure during design-basis depressurization

(T_{dbp})

The current industry analytical method is used to predict the thrust required to overcome bonnet pressure locking.

5.1.2 Stem rejection load due to valve internal pressure is calculated using standard industry equation (T_{pd})

Stem rejection load is defined as:

T_{pd} = (Bonnet Pressure)(Stem Area)
= $(P_{bonnet})(\pi d_s^2/4)$ where d_s is the stem diameter

5.1.3 Stem unwedging load (T_{un})

A stem unwedging load is a wedging load from the previous closing cycle, including the effect of inertia overshoot. This load is obtained from a previous static test result.

5.1.4 Reverse piston effect (T_{vert})

The reverse piston effect is the term used in this calculation to refer to the pressure force acting downward against the valve disk. This force is equal to the differential pressure across the valve disk times the area of the valve disk times the sine of the seat angle times 2 (for two disk faces)

$$T_{vert} = \pi.a^2.\sin\theta.(P_{bonnet} - P_{up} + P_{bonnet} - P_{down}) = \pi.a^2.\sin\theta.(2.P_{bonnet} - P_{up} - P_{down})$$

5.1.5 Stem thrust required due to stem growth (T_{sg}) [Ref. 9.10]

Stem thrust due to stem growth when the valve temperature remains the same after closing may be estimated as:

T_{sg} = (Stem and valve topworks stiffness, lb/in)(stem growth, in)
= $(K)(\delta_s)$

where
δ_s = $(l_s)(\alpha_s)(\Delta T_s)$

and
l_s = the stem length which is subjected to an average stem temperature change

		of ΔT_s after the valve is closed, in.
α_s	=	stem thermal expansion coefficient, in/in°F
ΔT_s	=	average stem temperature change, °F

The total required stem thrust is then compared with the operator output capability determined in the GL 89-10 program in which valve operability is assessed. If operability cannot be shown, an appropriate action is initiated.

6.0 Corrective Action

6.1 Methods to Prevent *Pressure Locking* [9.3]

6.1.1 Drill a small hole on the upstream side of the valve disc to relieve a pressure buildup in the bonnet and between the discs. This method makes the valve unidirectional in sealing against high pressure. The drilled side of the disc should always be toward the high pressure. An alternative is to drill a hole in the bridge between the seat ring and the valve bonnet on the upstream side of the valve.

6.1.2 Install a pressure relief or a vent valve in the bonnet to relieve the bonnet pressure automatically. This method requires the use of external components. If a manual vent valve instead of an automatic relief valve is used to release pressure when the system heats up, operator action would be needed to position it.

6.1.3 Install an external bypass valve with a manual valve from the bonnet to the upstream side of the valve. Manually open the bypass valve during heat up to relieve pressure from the bonnet. This method provides an alternate to the method described in 6.1.1 when isolation in both directions is required.

6.1.4 For valves not required to provide complete isolation, stopping the valve disc travel by position limit switches rather than motor torque can keep the valve from going completely closed and by that, prevent high pressure fluid from being trapped in the bonnet.

6.2 Methods to Prevent *Thermal Binding* [9.3]

6.2.1 Double-disc, Parallel-seat valves are less susceptible to thermal binding than flexible-wedge gate valves. Replacing existing flexible-wedge gate with parallel-seat would alleviate the susceptibility.

6.2.2 While cooling the system, periodically open the valve slightly and then reclose it several

times to allow uniform cooling and contraction of discs and bodies. This will involve changes of operating procedures and operator actions.

6.2.3 Ensure that the valve actuation or actuating medium is properly adjusted to prevent excessive closing forces on the valve disc. This may not be an effective means to prevent thermal binding if the temperature transient is large.

6.2.4 Installation of compensating spring packs on motor operators to absorb inertial closing forces after the motor has stopped will avoid excessive closing forces on fast acting valves.

7.0 Conclusions

Based upon the information presented herein, the susceptible valves are summarized below. Although these valves were determined to be susceptible to bonnet pressure locking, by using the best available analytical methods to predict the additional loads required to operate the valves and current switch setting under Generic Letter 89-10 program, their operability has been justified. However, for the long-term solution, valve modifications are planned as described below.

Note: *The screening, evaluation, and conclusion are applicable to both Units 1 and 2 since both units are essentially identical. Unit 1 and Unit 2 tag numbers are the same except for the prefix.*

Valve Tag # (Unit 1 & 2)	Valve Function	Findings and Corrective Actions
8802A & B	SI pump discharge to hot leg isolation (containment isolation valve)	Susceptible to bonnet pressure locking (see Attachment 1for details) Operability justification: Current industry analytical method is used to show that the actuator has adequate design margins (see Table 3). Corrective action: Provide relief path from the bonnet to the upstream side of the valve as described in section 6.1.2.

8840	RHR pump discharge to loop 2 & 3 hot leg isolation valve (containment isolation valve)	Susceptible to bonnet pressure locking (see Attachment 1 details). Operability justification: Current industry analytical method is used to show that the actuator has adequate design margins (see Table 3). Corrective action: Provide relief path from the bonnet to the upstream side of the valve as described in section 6.1.2.

8.0 Nomenclature and Notes

AF	=	Auxiliary Feedwater System
AFT	=	Active Function Temperature, °F
CC	=	Component Cooling Water System
CH	=	Chilled Water System
CS	=	Chemical Volume Control System
CT	=	Containment Spray System
FP	=	Fire Protection System
FT	=	Process Fluid Temperature, °F
NAT	=	Normal Ambient Temperature, °F
RC	=	Reactor Cooling System
RHR	=	Residual Heat Removal System
SI	=	Safety Injection System
MT	=	Exercise power-operated valve full-stroke to its safety function position and measure stroke time per OM-10 [9.11].
LT	=	Leaks test, other than containment isolation, per requirements of OM-10, Para 4.2.2.3 [9.11].
LTJ	=	Leaks test, containment isolation, per the requirements of OM-10, Para 4.2.2.2 [9.11].
CS	=	Perform exercise test during each cold shutdown.
Q	=	Perform exercise test nominally every three months.
RF	=	Perform exercise test during each refueling outage.
TS	=	Perform test at the applicable Technical Specification frequency.

8.1 General Notes:

1. Operational Mode, temperatures only [CPSES Technical Specifications]

Mode		Average Coolant Temperature
1.	Power Operation	≥350°F
2.	Startup	≥350°F
3.	*Hot Standby*	*≥350°F*
4.	Hot Shutdown	350°F > T_{avg} >200°F
5.	Cold Shutdown	≤200°F
6.	Refueling	≤140°F

2. *Design-basis events* are defined as conditions of normal operation, including anticipated operational occurrences, design-basis accidents, external events, and natural phenomena for which the plant must be designed to ensure (i) the integrity of the reactor coolant pressure boundary, (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition, and (iii) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines of 10 CFR Part 100.

   Hot standby is a stable condition of the reactor achieved shortly after a programmed or emergency shutdown of the plant and is the safe shutdown design basis for Comanche Peak Steam Electric Station. A hot standby plant does not rely on the RHR system for decay heat removal [FSAR Section 7.4].

   Cold shutdown is a stable condition of the plant achieved after the residual heat removal process has brought the primary coolant temperature below 200°F.

3. CPSES system operating procedure, SOP-102A, Section 4.0 requires that during normal plant heat up and cooldown, ***RCS heat up or cooldown rate should not exceed 60°F in any one hour.***

4. Operations Testing Procedure Manual (OPT-nnn) requires personnel to perform ***independent verification of valve restoration*** after surveillance testing is completed.

5. Safety Function Position: The position (open or closed) to which a valve must ***move to*** **or** ***remain in*** to accomplish its required safety function(s).

6. At the time of switching from injection to cold leg recirculation (between 10-60 minutes) after an assumed large break LOCA, the maximum containment sump temperature is expected to correspond to the saturation temperature at a containment pressure of approximately 30 psia. For conservatism, use a pressure of 35 psia. Thus, the fluid temperature at the time of cold leg recirculation is 260°F.

7. At the time of switching from cold leg to hot leg recirculation (≈ 6 hours) after an assumed large break LOCA, the maximum containment sump temperature is expected to correspond to the saturation temperature at a containment pressure of approximately 20 psia. Thus, the fluid temperature at the time of cold leg recirculation is 230°F.

8. All valves in this review scope are either one-piece Westinghouse (EMD) or BW/IP flexible wedge gate except 1&2-HV-8220 and 1&2-HV-8221 which are Valcor type gate valves.

9. Active Function Temperature (AFT) is a temperature at which the valve must be operable to mitigate an accident [Reference drawing: M1-3000, and M2-3000].

9.0 REFERENCES

9.1 NRC Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," June 28, 1 989.

9.2 Supplement 6 to GL 89-10, "Information on Schedule and Grouping and Staff Responses to Additional Public Questions," July 15, 1993.

9.3 NUREG-1275, Volume 9, "Operating Experience Feedback Report - Pressure Locking and Thermal Binding of Gate Valves," March 1993.

9.4 NUREG/CP - 0137, Volume 2, "Proceedings of the Third NRC/ASME Symposium on Valve and Pump Testing," July 18 - 21, 1994.

9.5 NRC Information Notice 95-14, "Susceptibility of Containment Sump Recirculation Gate Valves to Pressure Locking," February 28, 1995,

9.6 INPO SOER 84-7, "Pressure Locking and Thermal Binding of Gate Valves."

9.7 NRC Information Notice 92-26, "Pressure Locking of Motor Operated Flexible Wedge Gate Valves," April 2, 1992,

9.8 NRC GL 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," August 17, 1995.

9.9 EPRI NP-6516, "Guide for Application and Use of Valves in Power Plant Systems," August 1990.

9.10 NUREG/CR-5807, KEI No, 1721, "Improvements in Motor-Operated Gate Valve Design and Prediction Models for Nuclear Power Plant Systems", April, 1991.

9.11 NUREG-1275, Vol. 9, "Pressure Locking and Thermal Binding of Gate Valves."

9.12 CPSES Unit 1 & 2 In service Testing Plan.

9.13 CPSES Unit 1 and Unit 2 Master Surveillance Test List, Section X.

Attachment 1

Valve No.	Valve Function and its safety related positions (Evaluation is done for one train only)
1-8000A 1-8000B 3"- Flexible wedge Rating: 1525 Actuator: SB-00 Limit closed with torque switch as backup System: RC	Design-Basis Pressurizer PORV block valve: Normally open. This valve is closed to isolate a leaking PORV. Once closed, this valve would be required to be opened to prevent a challenge to pressurizer safety valves, mitigate a steam generator tube rupture accident, or for feed and bleed following a loss of all feedwater. In addition, this valve is required to be opened if the PORV vent path were relied upon for low temperature overpressure protection (two of the four devices for providing this protection, Tech Spec 3.4.8.3)[DBD-ME-250, Calc. RXE-TA-CP1/0-017, Rev. 3]. Safety Function Position: **Open/Closed** Normal Plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is normally open during plant operation [IPO-001A, IPO-005A, SOP-101A]. Surveillance Testing: Stroke testing every three months. Stroke testing is performed during Mode 1 thru 6 [OPT-109A]. **Evaluation:** This valve is in containment building, room 161. It is not subjected to high ambient temperature changes, i.e., active function temperature of 120°F and maximum normal operating temperature of 120°F. It is closed to isolate a leaking PORV and is required to be open during the steam generator tube rupture event, if pressurizer spray is not available for depressurizing the RCS. This valve is at a short distance from the pressurizer and has direct exposure to the pressurizer steam space if the PORV were leaking. As such, it is not exposed to a liquid environment. The pressurizer steam space temperature (≈653°F) is typically higher than RCS bulk temperature. Once the valve is closed and cools down, trapped steam in the bonnet will condense and create a slight vacuum in the bonnet but it is unlikely that large amounts of condensed steam can fill and be trapped in the bonnet cavity. Based upon the absence of a liquid-filled cavity and of any means to increase the temperature in the valve bonnet area, liquid entrapment thermally induced pressure locking is not a concern for this valve.
From static test T_{wo} are as follows: Tag# T_{wo} 1-8000A 3472 lbs 1-8000B 5209 lbs 2-8000A 5036 lbs 2-8000B 4535 lbs Motor capability based on GL 89-10 program is 21259 lbs. The worst case motor margins is greater than 300%	Once closed to isolate a leaking PORV, this block valve may be required to be open to depressurize the RCS during steam generator tube rupture event [EOP-3.0A]. Reopening this valve, during such scenarios, could be done at a lower temperature than when it was closed [TE 95-1153], and thus a thermal binding condition may exist. However, based on (i) previous operating experience at CPSES, when the PORV was leaking and the block valve was closed to isolate the leak, the valve was successfully stroke tested (performed per surveillance testing procedure [OPT-109A and B]) and subsequently opened during plant cooldown; (ii) the actuator is a SB model with compensator spring pack, limit switch closure controlled and a torque switch as back up which will limit the magnitude of seating thrust from previous closing cycle or stem growth to an appropriate value; (iii) the valve has a flexible wedge design which is also less susceptible to thermal binding than solid wedge design; (iv) during steam generator tube rupture event, RCS pressure is less than the normal operating pressure of 2235 psig due to loss of inventory and small cooldown and this lower differential pressure would result in additional actuator motor margins available for valve opening; and (v) this valve was stroke tested quarterly even when it was used to isolate leaking PORV. Therefore, it is concluded that this valve is operable for the described condition and no modification is required.

1-8701A 1-8701B 12"-Flexible wedge Rating: 1525 Actuator: SB-2 Limit closed System: RHR	<u>Design-Basis</u> RHR pump hot leg suction isolation valve: Normally closed. Only required to be opened when placing RHR in *normal* shutdown cooling [DBD-ME-260]. Safety Function Position: **Open/Closed** <u>Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases</u> In Mode 1-3, this valve is closed and power is removed. During normal plant cool down, at RCS temperature and pressure of approximately 350°F and 400 psig, this valve may be opened if its respective train is used for cooling. During plant heat-up, this valve stays open until coolant temperature is approximately 140°F; then this valve may be closed. If not closed, then it will be closed sometime before coolant temperature of reaches 350°F [IPO-008A, 010A, 001A, SOP-102A]. <u>Surveillance Testing</u>: Full stroke testing during cold shutdown and LTJ & LT/TS This valve is full-stroke exercised, seat leakage tested (using air as test medium), and seat leakage tested (using water as test medium) in either Mode 5 or 6 [OPT-512A, PPT-S1-8003A, and PPT-S1-7000A]. During water test this valve may be exposed to RCS temperature of ≤ 200°F. **Evaluation:** This valve is in the containment building, room 154 approximately 55 ft length of piping from the RCS hot leg and is normally closed with water solid upstream piping and a normally closed MOV (8702A or 8702B) that isolates the valve from reactor coolant temperature. The active function ambient temperature of the valve is expected to be about 120°F. This valve remains closed and acts as a containment isolation valve during injection and recirculation phases following design-basis accidents, i.e., LOCA or steam line break. During plant heat up this valve is initially closed when RCS temperature is between 140-350°F and stays closed. Over time after the valve is closed, due to heat loss, this valve will cool down and becomes in equilibrium with ambient temperature. Each time, *during normal plant operation*, the RCS is pressurized to normal operating pressure and temperature and later depressurized to RHR operating conditions (RCS ≈ 350°F and 400 psig) the opportunities for thermal binding do exist. However, this valve has a flexible wedge and based on numerous normal plant heatups and cooldowns at CPSES, this valve has operated successfully without evidence of thermal binding. Furthermore, *the magnitude of an increase in the seat contact force depends upon the change in temperature, the difference in coefficient of thermal expansion between body and gate*, etc.; the valve body and the flexible disc are made of the same materials. Thus, the increase of the seat contact force is relatively small. In summary, this valve is considered operable for this condition. As for pressure locking, during *normal plant cool down* at the time of RHR alignment, the upstream side of the valve may be exposed to RCS pressure of ≤ 425 psig (RCS interlock set pressure) and 30 psig on the downstream side when it is opened. This is because there is a reverse check valve installed between the inboard and this outboard valve that will prevent high pressure fluid from becoming trapped between these RHR isolation valves following RCS depressurization. Any trapped bonnet pressure should relieve itself concurrently with the RCS depressurization through the packing and disk seats but in the worst case some pressure may remain trapped in the bonnet and cause bonnet pressure locking. Using analytical methods and the conservative bonnet pressure of 2235 psig, the actuator is determined to have adequate design margin to overcome this postulated bonnet pressure locking [TE-95-927-00-00]. This valve is isolated from reactor coolant system after the inboard valve (8702A or 8702B) is closed and over time it will cool down to ambient temperature. Therefore, thermally induced bonnet pressure locking is unlikely. Based on numerous normal plant heatups and cooldowns at CPSES, this valve operated successfully without evidence of pressure locking. Therefore, it is concluded that this valve is operable for this condition without modification. It should also be noted that, design basis *<u>safe</u>* shutdown for CPSES is in hot standby mode in which this valve is not relied on to be opened for aligning RHR Train for decay heat removal.

1-8702A 1-8702B 12"-Flexible wedge Rating: 1525 Actuator: SB-2 Limit closed System: RHR	Design-Basis RHR pump hot leg suction isolation valve: Normally closed. Only required to be opened when placing RHR in *normal* shutdown cooling [DBD-ME-260]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases In Mode 1-3, this valve is closed and power is removed. During plant cool down, at RCS temperature of approximately 350°F, this valve may be opened if the train is required for cooling. During plant heatup, this valve stays open until coolant temperature is approximately 140°F then this valve may be closed. If not closed, then it will be closed sometime prior to coolant temperature reaches 350°F [IPO-008A, 010A, 001A, SOP-102A]. Surveillance Testing: Full stroke testing during cold shutdown and LTJ & LT/TS This valve is full-stroke exercised and seat leakage tested (using water as test medium) in either Mode 5 or 6 [OPT-512A, PPT-S1-7000A]. During water test this valve may be exposed to RCS temperature of ≤ 200°F. **Evaluation:** This valve is in the containment building, room 154 approximately 14 ft length of piping from the hot leg and is normally closed with water solid upstream piping which isolates the valve from reactor coolant temperature. The active function ambient temperature at the valve is expected to be about 120°F. This valve remains closed and acts as containment isolation during injection and recirculation phases following a LOCA or steam line break. During plant heat up this valve is initially closed at a temperature is between 140-350°F and stays closed. Over time after the valve is closed, due to heat loss, this valve will cool down and becomes in equilibrium with ambient temperature. Each time, *during normal plant operation,* the RCS is pressurized to normal operating pressure and temperature and later reduced to RHR operating conditions (RCS≈ 350°F and 400psig) the opportunities for thermal binding do exist. However, this valve has a flexible wedge and based on numerous normal plant heatups and cooldowns at CPSES, this valve has operated successfully without evidence of thermal binding. Furthermore, the magnitude of an increase in the seat contact force depends upon the change in temperature, *the difference in coefficient of thermal expansion between body and gate*, etc.; the valve body and the flexible disc are made of the same materials. Thus, the increase of the seat contact force is relatively small. It is concluded that this valve is operable for this condition. As for pressure locking, *during normal plant cool down* at the time of RHR alignment (4 hours after shutdown), the upstream side of the valve may be exposed to RCS pressure of ≤ 425 psig (RCS interlock set pressure) and slightly lower pressure on the downstream side when it is opened. Any trapped bonnet pressure should relieve itself concurrently with the RCS depressurization through the packing and disk seats but in the worst case some pressure may remain trapped in the bonnet and cause bonnet pressure locking. Using analytical methods and the conservative bonnet pressure of 2235 psig, the actuator is determined to have adequate design margins to overcome this postulated bonnet pressure locking. This valve is in direct interface with the reactor coolant system and thus it is exposed to its temperature. Over time, due to heat loss, the valve will cool down and becomes in equilibrium with ambient temperature. Therefore, thermally induced bonnet pressure locking is unlikely. Based on numerous normal plant heatups and cooldowns at CPSES, this valve operated successfully without evidence of pressure locking. Therefore, it is concluded that this valve is operable for this condition without modification. It should also be noted that, design basis *safe* shutdown for CPSES is in hot standby mode in which this valve is not relied on to be opened for aligning RHR Train for decay heat removal.

1-8716A 1-8716B 10"-Flexible wedge Rating: 316 Actuator: SB-1 Torqye closed System: RHR	Design-Basis Train "A" and "B" RHR pumps cross-tie valve: Normally open. This valve must be closed during a switch over from injection to cold leg recirculation to provide train separation and opened when ECCS is switched from cold leg recirc to hot leg recirc [DBD-ME-260]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases During Mode 1 thru 3, this valve is open [Tech.Spec. 3/4.5.2]. For *plant cool down*, in Mode 4 this valve may be closed when reactor coolant temperature is approching 250°F, must be closed and stays closed when the plant enters Mode 5 and 6. For *plant heat-up*, Mode 6 this valve is closed except for cavity drain. In Mode 5, this valve is opened when reactor coolant temperature reaches approximately 140°F. If not opened in Mode 5, then it will be opened in Mode 4. Once opened during startup, this valve remains open [OWI-104, IPO-001A, SOP-102A]. Surveillance Testing: Full stroke testing during cold shutdown Stroke testing is performed in Mode 5 or 6 [OPT-203A]. **Evaluation:** This valve is located in safeguard building, room 67 and is not subjected to significant ambient temperature changes, i.e., active function temperature of 133°F and maximum normal operating temperature of 122°F. This valve, located in the piping crosstie downstream of the residual heat exchanger, is normally open during normal plant operation and RHR operation. For a design-basis accident, short time after a reactor tripped, when ECCS is switching from injection to cold leg recirculation (RCS at RHR HX outlet≈ 200°F [RXE-LA-CPX/0-018, Rev.1]), this valve is closed to provide train separation, essentially at the same temperature as RCS's. Subsequently, about six hours later, when ECCS is switching from cold leg to hot leg recirc, this valve is opened. The fluid temperature from a containment sump at that time is slightly lower than 200°F and thus this process fluid temperature plus small ΔT (within the acceptable threshold temperature defined in section 4.4.D) is not considered a significant contributor to thermal binding. Furthermore, *the magnitude of an increase in the seat contact force depends upon the change in temperature, the difference in coefficient of thermal expansion between body and gate*, etc.; the valve body and the flexible disc are made of the same materials. Thus, the increase of the seat contact force is relatively small. Therefore, it is concluded that this valve is operable for this condition. Since this valve is normally open, pressure locking due to trapped pressurized water in the bonnet is not possible. The valve is closed for cold leg recirculation and then opened about six hours later for hot leg recirculation. At six hours post LOCA, the containment sump temperature is less than 200°F. This valve located downstream of RHR heat exchanger, where the sump fluid has been cooled. Furthermore, this valve is located in a stagnant leg, not direcily in contact with the fluid to the cold leg. Therefore, thermally induced pressure locking does not exist and no further evaluation is required.

1-8801A 1-8801B 4"- Flexible wedge Rating: 1525 Actuator: SBD-00 Torque closed System: SI	Design-Basis Centrifugal charging pump discharge to cold legs isolation: Normally closed. Auto open on SI signal during injection phase. Must be closed when *normal* charging is established [DBD-ME-261]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always closed during normal plant operation [IPO-001A]. Surveillance Testing: Full stroke testing during refueling [OPT-510A]. **Evaluation:** This valve is in safeguard building room 77 and is not subjected to significant ambient temperature changes, i.e., active function temperature of 125°F and maximum normal operating temperature of 104°F. This valve is normally closed and downstream piping (> 65 ft length of piping) is water solid which isolates the valve from reactor coolant temperature. It is automatically opened on a safety injection signal for the charging pump to inject cold water from refueling water storage tank to the cold legs. Therefore, no significant temperature increase is expected when the valve is opened thus precluding it from thermal binding effects. This valve is isolated from RCS by two check valves in series and *constantly* exposed to charging pump discharge pressure of approximately 2600 psig during normal operation. Since this valve automatically opens immediately after a design-basis accident, the potential for pressurized fluid to trap in the bonnet as described in section 3.1.1 is not possible. The design opening DP of this valve is 2696 psid and actuator capability calculation [ME-CA-0000-1093] shows that the motor operator has substantial design margins to overcome this differential pressure. Therefore, this valve is not susceptible to pressure locking and no modification is required.

1-8802A 1-8802B 4"- Flexible wedge Rating: 1525 Actuator: SBD-00 Torque closed System: SI	<u>Design-Basis</u> SI pump discharge to hot legs RCS isolation valve: Normally closed. Must be opened when ECCS is placed in hot leg recirc. Must be closed when ECCS is returned to cold leg recirc [DBD-ME-261]. Safety Function Position: **Open/Closed** <u>Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases</u> This valve is closed during normal plant operation [SOP-201A, IPO-001A]. <u>Surveillance Testing</u>: Full stroke testing during cold shutdown Stroke testing is performed in Mode 5 or 6 [OPT-510A]. **Evaluation:** This valve is in safeguard building room 77 and is not subjected to significant ambient temperature changes, i.e., active function temperature of 125°F and maximum normal operating temperature of 104°F. The valve is normally closed and downstream piping (> 65 feet length of piping to the hot legs connection) is water solid which isolates the valve from reactor coolant temperature. It is opened, approximately six hours after an accident, when ECCS is switching from cold leg to hot leg recirculation. Prior to valve actuation, the temperature of the valve is likely to be about the same as ambient temperature. This is because the nearest heat source is the hot fluid in the reactor coolant system which is isolated from the valve by water filled piping some distance away. Therefore, the valve is not exposed to high temperature and thermal binding is not a concern and further evaluation is not required. This valve is isolated from RCS by two check valves in series. Condition described in section 3.1.1 may exist in cases of check valve back leakage. The trapped bonnet pressure may be as high as 2235 psi. Actuator capability calculation (Table 3) shows that the motor operator has adequate design margins to overcome this bonnet pressure locking and the valve is operable. However, for long-term solution of this issue, the valve will be modified using method in section 6.1.3.

1-8804A 1-8804B 8"- Flexible wedge Rating: 316 Actuator: SB-00 Limit closed System: SI References: BRP-SI-1-SB-50 BRP-RH-1-SB-16 BRP-RH-1-SB-09 BRP-SI-1-SB-03 BRP-SI-1-RB-56 BRP-SI-1-RB-37	Design-Basis Train "A/B" RHR pump/heat exchanger to CCP/SI pump suction isolation valve: Normally closed. Must be opened when realigning the CCP/SI pumps to take suction from the discharge of the RHR pump instead of the RWST, during switchover from injection to cold leg recirc [DBD-ME-261]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is closed during normal plant operation [IPO-001A, SOP-102A]. Surveillance Testing: Full stroke testing during cold shutdown This valve is full-stroke exercised in either Mode 5 with the loop filled and the RCS not water solid or in Mode 6 with the water level greater than or equal to 23 feet above the top of the reactor vessel flange or the core is off loaded [OPT-512A]. **Evaluation:** This valve is in safeguard building, room 67 approximately 147 feet length of piping, water solid, from the cold legs connection. It is not subjected to significant ambient temperature changes, i.e., active function temperature of 133°F and maximum normal operating temperature of 122°F. Initially the valve is closed at ambient temperature and is required to be opened, approximately 10 minutes after an accident (conservatively estimated for large break LOCA), when ECCS is switching from injection to cold leg recirculation. At this mode, the pump is aligned to take suction from a containment sump in which the fluid temperature is conservatively estimated to be about 260°F. This valve is not exposed to high temperature fluid because the nearest heat source is the hot fluid in the cold legs piping. This heat source is approximately 147 feet length of piping, and water solid, away from the valve. Therefore, thermal binding is not a concern and further evaluation is not required. This valve is isolated from RCS by three check valves in series. These check valves are important in preventing overpressurization and rupture of the ECCS low pressure piping which could result in a LOCA. These check valves are tested periodically [OPT-203A & B] to ensure low probability of gross failure. In addition, RCS water inventory is verified at least once per 72 hours during steady state operation which limit the total RCS leakage, including leakage from these check valves, to within Tech Spec allowable [Tech Spec 4.4.5.2.1c and OPT-303]. Therefore, bonnet pressure locking due to undetected leakage through these check valves is a low likelihood event and further evaluation is not required.

1-8807A 1-8807B 6"- Flexible wedge Rating: 150 Actuator: SB-00 Limit closed System: SI	Design-Basis SI pump and CCP suction supply cross-tie valve: Normally closed. Must be opened when realigning the SI and CCP pumps to take suction from the discharge of the RHR pumps instead of the RWST, during switchover from injection to cold leg recirc [DBD-ME-261]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is closed during normal plant operation [IPO-001A, SOP-201A]. Surveillance Testing: Stroking testing every three months. Stroke testing is performed in Mode 1 thru 6 [OPT-510A].
References: BRP-SI-1-SB-50 BRP-RH-1-SB-16 BRP-RH-1-SB-09 BRP-SI-1-SB-03 BRP-SI-1-RB-56 BRP-SI-1-RB-37 BRP-SI-1-SB-10	**Evaluation:** This valve is in safeguard building room 67 approximately 162 ft length of piping from the cold legs connenction. It is not subjected to significant ambient temperature changes, i.e., active function temperature of 133°F and maximum normal operating temperature of 122°F. During normal operation the valve is closed at ambient temperature and is required to be opened, approximately 10 minutes after an accident (conservatively estimated for large break LOCA), when ECCS is switching from injection to cold leg recirculation. At this mode, the pump is aligned to take suction from a containment sump in which the fluid temperature is conservatively estimated to be about 260°F. This valve is not exposed to high temperature fluid because the nearest heat source is the hot fluid in the cold legs piping. This heat source is approximately 162 feet length of piping, and water solid, away from the valve. Therefore, thermal binding is not a concern and further evaluation is not required. This valve is isolated from RCS by three check valves in series. These check valves are important in preventing overpressurization and rupture of the ECCS low pressure piping which could result in a LOCA. These check valves are tested periodically [OPT-203A & B] to ensure low probability of gross failure. In addition, RCS water inventory is verified at least once per 72 hours during steady state operation which limit the total RCS leakage, including leakage from these check valves, to within Tech Spec allowable [Tech Spec 4.4.5.2.1c and OPT-303]. Therefore, bonnet pressure locking due to undetected leakage through these check valves is a low likelihood event and further evaluation is not required.

1-8809A 1-8809B 10"-Flexible wedge Rating: 1525 Actuator: SBD-3 Torque closed System: SI	<u>Design-Basis</u> RHR pump discharge to cold legs RCS isolation valve: Normally open. Must be closed when ECCS is switched from cold leg recirc to hot leg recirc [DBD-ME-261]. Safety Function Position: **Open/Closed** <u>Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases</u> During normal plant operation, this valve is always opened. For plant cool down, the valve is opened from Mode 1 thru 4. In Mode 5 and 6 this valve may be closed if RHR pump is shut-off (RCS at 325 psig and ≤200°F). For plant heat-up, this valve is closed in Mode 5 and 6 (typically temperature is approximately 100°F). Before entering Mode 4, this valve must be opened (RCS temperature - 200°) [IPO-005A, 001A, SOP-102A]. <u>Surveillance Testing:</u> MT /CS & LTJ/TS This valve is full-stroke exercised and seat leakage tested in either Mode 5 with the loop filled and the RCS not water solid or in Mode 6 with the water level greater than or equal to 23 feet above the top of the reactor vessel flange or the core off loaded [OPT-512A]. The test configurations could subject this valve to temperature of ≤ 200°F [PPT-S1-8069A]. **Evaluation:** This valve is in safeguard building room 77 and is not subjected to significant ambient temperature changes, i.e., active function temperature of 125°F and normal operating temperature of 104°F. Since this valve is normally open, pressure locking due to trapped pressurized water in the bonnnet is not possible. Approximately six hours later, when ECCS is switching from cold leg to hot leg recirculation, this valve is closed. At that time the valve is exposed to about 200°F containment sump fluid temperatures. Once closed, this valve may be opened when ECCS is switched back to cold leg recirculation 24 hours later. The RCS temperature at that time is less than 120°F. This valve has a flexible wedge with same body and disk material and is exposed to minimum temperature differential. As a result, it is not susceptible to thermal binding [Criterion 4.4.D].

1-8811A 1-8811B 14"-Flexible wedge Rating: 316 Actuator: SB-2 Torque closed System: SI	<u>Design-Basis</u> Containment Sump to RHR pump suction isolation valve: Normally closed. Automatically open with SI signal <u>AND</u> RWST low-low level signal during changeover operation from injection phase to cold leg recirculation phases [DBD-ME-261]. Safety Function Position: **Open/Closed** <u>Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases</u> This valve is always closed during normal plant operation [IPO-001A, SOP-102A]. <u>Surveillance Testing:</u> MT /CS This valve is full-stroke exercised in either Mode 5 with the loop filled and the RCS not water solid or in Mode 6 with the water level greater than or equal to 23 feet above the top of the reactor vessel flange or the core off loaded [OPT-512A]. **Evaluation:** This valve is stroked close at ambient temperature conditions. The valve must be opened during post-accident temperature which is at higher than ambient temperature. Therefore, under such condition the valve is hotter than that when it was closed, and precluding the possibility for thermal binding. *Note: Not further evaluated for pressure locking because this valve was modified, using method described in section 6.1.2 [DM 89-303].*
1-8821A 1-8821B 4"- Flexible wedge Rating: 900 Actuator: SB-00 Torque closed System: SI	<u>Design-Basis</u> Train "A" and "B" SI pumps discharge cross-tie valve: Normally opened. Must be closed, for separation of SI pumps discharge header when aligning SI pump for hot leg recirc [DBD-ME-261]. Safety Function Position: **Open/Closed** <u>Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases</u> This valve is always open during normal plant operation and is closed during filling of SI accumulators from RWST when RCS pressure < 1700 psig [IPO-001A, SOP-201A]. <u>Surveillance Testing</u>: MT/Q Stroke testing is performed in Mode 1 thru 6 [OPT-510A]. **Evaluation:** This valve is located in safeguard building room 67 and is not subjected to significant ambient temperature changes, i.e., active function temperature of 133°F and normal operating temperature of 122°F. The valve is normally opened during initial ECCS injection and cold leg recirculation. Approximately six hours later, when ECCS is switched from cold leg to hot leg recirculation, this valve is closed to provide SI pumps train separation. At that time the valve is exposed to about 200°F containment sump temperature. Once closed, this valve may be opened, 24 hours later, for cold leg recirculation. The RCS temperature at that time is less than 120°F. Therefore, this valve would not be subjected to pressure locking or thermal binding [Criterion 4.4.D].

1-8835 4"- Flexible wedge Rating: 1525 Actuator: SBD-00 Torque closed System: SI	Design-Basis Train "A" or "B" SI pump discharge to cold legs RCS isolation valve: Normally opened. Must be closed to establish hot leg recirc [DBD-ME-261]. Safety Function: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always open during normal plant operation. As an alternative, this valve can be closed during filling of accumulators from RWST when Train "B" SI pump is in service [IPO-001A, SOP-201A, 1RFO-102]. Surveillance Testing: Full stroke testing during cold shutdown Stroke testing is performed in Mode 5 or 6 [OPT-510A]. **Evaluation:** This valve is located in safeguard building room 77 and is not subjected to significant ambient temperature changes, i.e., active function temperature of 125°F and normal operating temperature of 104°F. The valve is normally opened during initial ECCS injection and cold leg recirculation. Approximately six hours later, when ECCS is switching from cold leg to hot leg recirculation, this valve is closed to establish hot leg recirc. At that time the valve may be exposed to about 200°F containment sump temperature. Once closed, this valve may be opened, 24 hours later, for cold leg recirculation. The RCS temperature at that time is less than 120°F. Therefore, this valve would not be subjected pressure locking or thermal binding [Criterion 4.4.D].

1-8840 10"-Flexible wedge Rating: 1525 Actuator: SBD-3 Torque closed System: SI	<u>Design-Basis</u> Train "A" or "B" RHR pump discharge to loop 2 & 3 hot legs RCS isolation valve: Normally closed. Must be opened when ECCS is switched from cold leg recirc to hot leg recirc. Must be closed when RHR is returned to cold leg recirc [DBD-ME-261]. Safety Function Position: **Open/Closed** <u>Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases</u> Normally closed, opened only in Mode 6 to fill reactor cavity from RWST [IPO-001A, SOP-102A]. <u>Surveillance Testing</u>: Full stroke testing during cold shutdown & LTJ/TS This valve is full-stroke exercised and seat leakage tested in either Mode 5 with the loop filled and the RCS not water solid or in Mode 6 with the water level greater than or equal to 23 feet above the top of the reactor vessel flange or the core is off loaded [OPT-512A]. The test configurations could subject this valve to temperature of ≤ 200°F [PPT-S1-8069A & B]. **Evaluation:** This valve is located in safeguard building, room 77 and is not subjected to significant ambient temperature changes, i.e., active function temperature of 125°F and maximum normal operating temperature of 104°F. Initially, the valve is opened in mode 6 for filling of refueling cavity and is closed at ambient temperature. This valve remains closed throughout plant heat up process. The upstream and downstream piping of this valve is water solid which isolates the valve from reactor coolant temperature. During design basis accident the valve is opened prior to being exposed to the hotter sump fluid when switching to hot legs recirc. Therefore, thermal binding is not a concern and further evaluation is not required. This valve is isolated from the RCS by two check valves in series. The condition described in section 3.1.1 could exist in the event of multiple check valves back leakage. The trapped bonnet pressure can be as high as 2235 psig (RCS pressure). Actuator capability calculation (Table 3) shows that the motor operator has adequate design margins to overcome this bonnet pressure locking and the valve is operable. However, for long-term solution of this issue, the valve will be modified using method in section 6.1.3.

1HV-2480 6"- Flexible wedge Rating: 150 Actuator: SB-00 Torque closed System: AF	Design-Basis Auxiliary feedwater pump suction from service water isolation valve: Normally closed. Only required to be opened when SSW is used to supply AFW pump/SGs for loss of SG makeup [DBD-ME-206]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always closed during normal plant operation [IPO-001A, SOP-304A, ABN-305]. Surveillance Testing: Full stroke testing every three months Stroke testing is performed in Mode 1 thru 6 [OPT-502A]. **Evaluation:** This valve is located in safeguard building room 72. The active function temperature is 122°F. The normal operating ambient temperature, obtained from local shiftly surveillances [OPT-102A-07] is approximately 75°F. Therefore, the valve is not exposed to significant temperature increases. This valve is normally closed and is required to be opened, to provide long term cooling, by control room operator upon receipt of a low level signal from the condensate storage tank. This valve is exposed to relatively low differential pressure (≈ 25 psi) during opening function and there is no high pressure source that interfaces with the system. Thus, it is concluded that the valve is not susceptable to either pressure locking or thermal binding.
1HV-2481 6"- Flexible wedge Rating: 150 Actuator: SB-00 Torque closed System: AF	Design-Basis Auxiliary feedwater pump suction from service water isolation valve: Normally closed. Only required to be opened when SSW is used to supply AFW pump/SGs for loss of SG makeup [DBD-ME-206]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always closed during normal plant operation [IPO-001A, SOP-304A, ABN-305]. Surveillance Testing: Full stroke testing every three months Stroke testing is performed in Mode 1 thru 6 [OPT-502A]. **Evaluation:** This valve is located in safeguard building room 72. The active function temperature is 122°F. The normal operating ambient temperature, obtained from local shiftly surveillances [OPT-102A-07] is approximately 75°F. Therefore, the valve is not exposed to significant temperature increases. This valve is normally closed and is required to be opened, to provide long term cooling, by control room operator upon receipt of a low level signal from the condensate storage tank. This valve is exposed to relatively low differential pressure (≈ 25 psi) during opening function and there is no high pressure source that interfaces with the system. Thus, it is concluded that the valve is not susceptable to either pressure locking or thermal binding.

1HV-2482 8"- Flexible wedge Rating: 150 Actuator: SB-00S Torque closed System: AF	Design-Basis Auxiliary feedwater pump suction from service water isolation valve: Normally closed. Only required to be opened when SSW is used to supply AFW pump/SGs for loss of SG makeup [DBD-ME-206]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always closed during normal plant operation [IPO-001A, SOP-304A, ABN-305]. Surveillance Testing: Full stroke testing every three months Stroke testing is performed in Mode 1 thru 6 [OPT-502A]. **Evaluation:** This valve is located in safeguard building room 72. The active function temperature is 122°F. The normal operating ambient temperature, obtained from local shiftly surveillances [OPT-102A-07] is approximately 75°F. Therefore, the valve is not exposed to significant temperature increases. This valve is normally closed and is required to be opened, to provide long term cooling, by control room operator upon receipt of a low level signal from the condensate storage tank. This valve is exposed to relatively low differential pressure (≈ 25 psi) during opening function and there is no high pressure source that interfaces with the system. Thus, it is concluded that the valve is not susceptable to either pressure locking or thermal binding.
1HV-2491A 1HV-2491B 1HV-2492A 1HV-2492B 1HV-2493A 1HV-2493B 1HV-2494A 1HV-2494B 4"- Flexible wedge Rating: 900 Actuator: SMB-0 Torque closed System: AF	Design-Basis Auxiliary feedwater pump (motor and turbine driven) discharge to steam generator isolation valve: Normally opened. May be closed to isolate faulted SG or SG in the event of tube rupture [DBD-ME-206]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is opened during normal plant operation [IPO-001A, SOP-304A]. Surveillance Testing: Full stroke testing every three months Stroke testing is performed in Mode 1 thru 6 [OPT-206A], with precaution that this valve shall not be tested when it is being used to feed or isolate steam generator. **Evaluation:** This valve is located in safeguard building room 100. The active function temperature is 125°F. The maximum normal operating ambient and process fluid temperature is approximately 104°F and 120°F respectively. Therefore, the valve is not exposed to significant temperature increases. This valve is normally opened and stays open during normal plant operation. It is required to be closed to isolate faulted steam generator or tube rupture. Once closed, this valve is not required to be reopened to mitigate the accident. Therefore, further susceptibility review is not required.

1HV-4776 16"-Flexible wedge Rating: 150 Actuator: SB-1 Torque closed System: CT	Design-Basis Train "A" containment spray heat exchanger outlet isolation valve: Normally closed. Automatically open on Phase "B" Containment isolation signal. Must be closed when Containment Spray shutdown [DBD-ME-232]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always close during normal plant operation [IPO-001A, SOP-204A]. Surveillance Testing: Full stroke testing every three months & LTJ/TS This valve is full-stroke exercised in Mode 1 thru 6 [OPT-205A]. It also recieves seat leakage test (using demineralized water as test medium at maximum pressure of 60 psig) in either Mode 5 or 6 [PPT-S1-8012A]. **Evaluation:** This valve is located in an mild environment with maximum normal ambient and active function temperature of 104°F and 125°F respectively. The valve is called upon to open early in the accident sequence and remain open including during recirculation mode. A 110 foot plus water column is maintained on the discharge side of this valve which isolates it from accident containment temperature. Therefore, no significant temperature increase is expected at the valve. The actuator is sized for maximum expected differential pressure, determined for GL 89-10, of 295 psid which is CT pump discharge head. It is concluded that this valve is not susceptible to either pressure locking or thermal binding.
1HV-4777 16"-Flexible wedge Rating: 150 Actuator: SB-1 Torque closed System: CT	Design-Basis Train "A" containment spray heat exchanger outlet isolation valve: Normally closed. Automatically open on Phase "B" Containment isolation signal. Must be closed when Containment Spray shutdown [DBD-ME-232]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always close during normal plant operation [IPO-001A, SOP-204A]. Surveillance Testing: Full stroke testing every three months & LTJ/TS This valve is full-stroke exercised in Mode 1 thru 6 [OPT-205A]. It also recieves seat leakage test (using demineralized water as test medium at maximum pressure of 60 psig) in either Mode 5 or 6 [PPT-S1-8012A]. **Evaluation:** This valve is located in an mild environment with maximum normal ambient and active function temperature of 104°F and 125°F respectively. The valve is called upon to open early in the accident sequence and remain open including during recirculation mode. A 110 foot plus water column is maintained on the discharge side of this valve which isolates it from accident containment temperature. Therefore, no significant temperature increase is expected at the valve. The actuator is sized for maximum expected differential pressure, determined for GL 89-10, of 295 psid which is CT pump discharge head. It is concluded that this valve is not susceptible to either pressure locking or thermal binding.

1HV-4782 16"-Flexible wedge Rating: 150 Actuator: SB-1 Torque closed System: CT	Design-Basis Containment sump to Train "A" containment spray pump suction isolation valve: Normally closed. Must be opened when transferring CT pump suction to Containment Sump. May be closed when CT is shutdown [DBD-ME-232]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always close during normal plant operation [IPO-001A, SOP-204A]. Surveillance Testing: Full stroke testing every three months Stroke testing is performed in Mode 1 thru 6 [OPT-205A]. *Note: Not further evaluated for pressure locking because this valve was modified, using method described in section 6.1.2 [DM 89-303].*
1HV-4783 16"-Flexible wedge Rating: 150 Actuator: SB-1 Torque closed System: CT	Design-Basis Containment sump to Train "B" containment spray pump suction isolation valve: Normally closed. Must be opened when transferring CT pump suction to Containment Sump. May be closed when CT is shutdown [DBD-ME-232]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always close during normal plant operation [IPO-001A, SOP-204A]. Surveillance Testing: Full stroke testing every three months Stroke testing is performed in Mode 1 thru 6 [OPT-205A]. *Note: Not further evaluated for pressure locking because this valve was modified, using method described in section 6.1.2 [DM 89-303].*

1LCV-112D 1LCV-112E 8"- Flexible wedge Rating: 150 Actuator: SB-00 Limit closed System: CS	Design-Basis RWST to charging pump suction isolation valve: Normally closed. Automatically open on SI during injection phase. Must be closed, as a precautionary measure in the case of back leakage through check valve 1-8546, when establishing cold leg recirc. Must be closed when establishing normal charging flow [DBD-ME-255]. Safety Function Position: **Open/Closed** Normal plant Operation, i.e., power generation, no-load, and hot standby operating phases This valve is always closed during normal plant operation [IPO-001A, 002A, 003A, 007, 009A, 0010A, SOP-101A, 103A, ABN-107, 105, 103]. Surveillance Testing: Full stroke testing during cold shutdown Stroke testing is performed in Mode 5 or 6 [OPT-508A]. **Evaluation:** This valve is located in auxiliary building room 207. The active function temperature is 125°F. The normal operating ambient temperature is approximately 104°F. Therefore, the valve is not exposed to significant ambient temperature increases. This valve is normally closed and is automatically opened to supply water from RWST to CCP suction for high pressure injection. The normal operating temperature of RWST is between 50 to 80°F. The valve is isolated from VCT outlet pressure during injection and RHR pump discharge pressure during cold leg recirc by a check valve and it is well within the capability of the motor operator [ME-CA-0000-1093, page 1867]. This valve is not reopened to perform safety function. Thus, further susceptibility review is not required.

TAG	SAFETY FUNCTION	NORMAL POSITION	SAFETY POSITION	Test or Surveillance Position	Evaluate Susceptibility Within GL 95-07
1-8000A	Prz. PORV block valve	Open/Closed	Open/Closed	Open/Closed	Yes
1-8000B	Prz. PORV block valve	Open/Closed	Open/Closed	Open/Closed	Yes
1-8701A	RHR suction, hot leg recirc iso.	Closed	Open/Closed	Open/Closed	Yes
1-8701B	RHR suction, hot leg recirc iso.	Closed	Open/Closed	Open/Closed	Yes
1-8702A	RHR suction, hot leg recirc iso.	Closed	Open/Closed	Open/Closed	Yes
1-8702B	RHR suction, hot leg recirc iso.	Closed	Open/Closed	Open/Closed	Yes
1-8716A	Train A & B RHR pump cross-tie valve	Open	Open/Closed	Open/Closed	Yes
1-8716B	Train A & B RHR pump cross-tie valve	Open	Open/Closed	Open/Closed	Yes
1-8801A	CCP discharge to cold leg iso.	Closed	Open/Closed	Open/Closed	Yes
1-8801B	CCP discharge to cold leg iso.	Closed	Open/Closed	Open/Closed	Yes
1-8802A	SI pump discharge to hot leg iso.	Closed	Open/Closed	Open/Closed	Yes
1-8802B	SI pump discharge to hot leg iso.	Closed	Open/Closed	Open/Closed	Yes
1-8804A	Train A RHR pump to CCP suction iso.	Closed	Open/Closed	Open/Closed	Yes
1-8804B	Train A RHR pump to CCP suction iso.	Closed	Open/Closed	Open/Closed	Yes
1-8807A	SI & CCP suction supply from RHR cross-tie valve	Closed	Open/Closed	Open/Closed	Yes
1-8807B	SI & CCP suction supply from RHR cross-tie valve	Closed	Open/Closed	Open/Closed	Yes
1-8808A	Accumulator injection valve	Open	Open/Closed	Open	No
1-8808B	Accumulator injection valve	Open	Open/Closed	Open	No
1-8808C	Accumulator injection valve	Open	Open/Closed	Open	No
1-8808D	Accumulator injection valve	Open	Open/Closed	Open	No
1-8809A	RHR discharge to cold leg iso.	Open	Open/Closed	Open/Closed	Yes
1-8809B	RHR discharge to cold leg iso.	Open	Open/Closed	Open/Closed	Yes
1-8811A	Containment sump to RHR pump suction iso.	Closed	Open/Closed	Open/Closed	Yes
1-8811B	Containment sump to RHR pump suction iso.	Closed	Open/Closed	Open/Closed	Yes
1-8821A	Train A & B SI pump discharge cross-tie valve	Open	Open/Closed	Open/Closed	Yes
1-8821B	Train A & B SI pump discharge cross-tie valve	Open	Open/Closed	Open/Closed	Yes
1-8835	Train A & B SI pump discharge to cold leg iso.	Open	Open/Closed	Open/Closed	Yes
1-8840	Train A & B RHR pump discharge to hot leg iso.	Closed	Open/Closed	Open/Closed	Yes
1-HV-2480	AF pump suction from SW iso valve	Closed	Open/Closed	Open	Yes
1-HV-2481	AF pump suction from SW iso valve	Closed	Open/Closed	Open	Yes
1-HV-2482	AF pump suction from SW iso valve	Closed	Open/Closed	Open	Yes
1-HV-2491A	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
1-HV-2491B	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
1-HV-2492A	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
1-HV-2492B	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
1-HV-2493A	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
1-HV-2493B	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
1-HV-2494A	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
1-HV-2494B	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
1-HV-4776	Containment spray HX outlet iso.	Closed	Open/Closed	Open/Closed	Yes
1-HV-4777	Containment spray HX outlet iso.	Closed	Open/Closed	Open/Closed	Yes
1-HV-4782	Containment sump to CT pump suction iso.	Closed	Open/Closed	Open/Closed	Yes
1-HV-4783	Containment sump to CT pump suction iso.	Closed	Open/Closed	Open/Closed	Yes
1-LCV-112D	RWST to CCP suction iso.	Closed	Open/Closed	Open/Closed	Yes
1-LCV-112E	RWST to CCP suction iso.	Closed	Open/Closed	Open/Closed	Yes
2-8000A	Prz. PORV block valve	Open/Closed	Open/Closed	Open/Closed	Yes
2-8000B	Prz. PORV block valve	Open/Closed	Open/Closed	Open/Closed	Yes
2-8701A	RHR suction, hot leg recirc iso.	Closed	Open/Closed	Open/Closed	Yes
2-8701B	RHR suction, hot leg recirc iso.	Closed	Open/Closed	Open/Closed	Yes
2-8702A	RHR suction, hot leg recirc iso.	Closed	Open/Closed	Open/Closed	Yes
2-8702B	RHR suction, hot leg recirc iso.	Closed	Open/Closed	Open/Closed	Yes
2-8716A	Train A & B RHR pump cross-tie valve	Open	Open/Closed	Open/Closed	Yes

2-8716B	Train A & B RHR pump cross-tie valve	Open	Open/Closed	Open/Closed	Yes
2-8801A	CCP discharge to cold leg iso.	Closed	Open/Closed	Open/Closed	Yes
2-8801B	CCP discharge to cold leg iso.	Closed	Open/Closed	Open/Closed	Yes
2-8802A	SI pump discharge to hot leg iso.	Closed	Open/Closed	Open/Closed	Yes
2-8802B	SI pump discharge to hot leg iso.	Closed	Open/Closed	Open/Closed	Yes
2-8804A	Train A RHR pump to CCP suction iso.	Closed	Open/Closed	Open/Closed	Yes
2-8804B	Train A RHR pump to CCP suction iso.	Closed	Open/Closed	Open/Closed	Yes
2-8807A	SI & CCP suction supply from RHR cross-tie valve	Closed	Open/Closed	Open/Closed	Yes
2-8807B	SI & CCP suction supply from RHR cross-tie valve	Closed	Open/Closed	Open/Closed	Yes
2-8808A	Accumulator injection valve	Open	Open/Closed	Open	No
2-8808B	Accumulator injection valve	Open	Open/Closed	Open	No
2-8808C	Accumulator injection valve	Open	Open/Closed	Open	No
2-8808D	Accumulator injection valve	Open	Open/Closed	Open	No
2-8809A	RHR discharge to cold leg iso.	Open	Open/Closed	Open/Closed	Yes
2-8809B	RHR discharge to cold leg iso.	Open	Open/Closed	Open/Closed	Yes
2-8811A	Containment sump to RHR pump suction iso.	Closed	Open/Closed	Open/Closed	Yes
2-8811B	Containment sump to RHR pump suction iso.	Closed	Open/Closed	Open/Closed	Yes
2-8821A	Train A & B SI pump discharge cross-tie valve	Open	Open/Closed	Open/Closed	Yes
2-8821B	Train A & B SI pump discharge cross-tie valve	Open	Open/Closed	Open/Closed	Yes
2-8835	Train A & B SI pump discharge to cold leg iso.	Open	Open/Closed	Open/Closed	Yes
2-8840	Train A & B RHR pump discharge to hot leg iso.	Closed	Open/Closed	Open/Closed	Yes
2-HV-2480	AF pump suction from SW iso valve	Closed	Open/Closed	Open	Yes
2-HV-2481	AF pump suction from SW iso valve	Closed	Open/Closed	Open	Yes
2-HV-2482	AF pump suction from SW iso valve	Closed	Open/Closed	Open	Yes
2-HV-2491A	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
2-HV-2491B	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
2-HV-2492A	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
2-HV-2492B	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
2-HV-2493A	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
2-HV-2493B	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
2-HV-2494A	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
2-HV-2494B	AF pump discharge to SG iso valve	Open	Open/Closed	Closed	Yes
2-HV-4776	Containment spray HX outlet iso.	Closed	Open/Closed	Open/Closed	Yes
2-HV-4777	Containment spray HX outlet iso.	Closed	Open/Closed	Open/Closed	Yes
2-HV-4782	Containment sump to CT pump suction iso.	Closed	Open/Closed	Open/Closed	Yes
2-HV-4783	Containment sump to CT pump suction iso.	Closed	Open/Closed	Open/Closed	Yes
2-LCV-112D	RWST to CCP suction iso.	Closed	Open/Closed	Open/Closed	Yes
2-LCV-112E	RWST to CCP suction iso.	Closed	Open/Closed	Open/Closed	Yes
1-8105	CVCS charging pump and seal inj iso.	Open	Closed	Open/Closed	No
1-8106	CVCS charging pump and seal inj iso.	Open	Closed	Open/Closed	No
1-8806	RWST to SI pump suction iso.	Open	Closed	Closed	No
1-8812A	RWST discharge to RHR pump suction iso.	Open/Closed	Closed	Closed	No
1-8812B	RWST discharge to RHR pump suction iso.	Open/Closed	Closed	Closed	No
1-8923A	SI pump sunction iso valve	Open	Closed	Closed	No
1-8923B	SI pump sunction iso valve	Open	Closed	Closed	No
1-8924	CCP to SI pumps cross-tie iso valve	Open	Closed	Closed	No
1-HV-2134	FW containment iso.	Closed/Open	Closed	Closed	No
1-HV-2135	FW containment iso.	Closed/Open	Closed	Closed	No
1-HV-2136	FW containment iso.	Closed/Open	Closed	Closed	No
1-HV-2137	FW containment iso.	Closed/Open	Closed	Closed	No
1-HV-4075B	Containment fire protection iso valve	Closed	Closed	Closed	No
1-HV-4075C	Containment fire protection iso valve	Closed	Closed	Closed	No
1-HV-4696	CCW to RCS thermal barrier cooler, return iso.	Open	Closed	Closed	No
1-HV-4699	CCW to RCS thermal barrier cooler, supply iso.	Open	Closed	Closed	No
1-HV-4700	CCW to RCS thermal barrier cooler, supply iso.	Open	Closed	Closed	No
1-HV-4701	CCW to RCP bearing & motor cooler, return iso.	Open	Closed	Closed	No
1-HV-4708	CCW to RCP bearing & motor cooler, return iso.	Open	Closed	Closed	No
1-HV-4709	CCW to RCS thermal barrier cooler, return iso.	Open	Closed	Closed	No

1-HV-4758	RWST to containment spray pump suction iso.	Open	Closed	Closed	No
1-HV-4759	RWST to containment spray pump suction iso.	Open	Closed	Closed	No
1-HV-6082	Chilled water return containment iso.	Open	Closed	Closed	No
1-HV-6083	Chilled water return containment iso.	Open	Closed	Closed	No
1-HV-6084	Chilled water return containment iso.	Open	Closed	Closed	No
1-HV-8220	CCP suction vent iso.	Open	Closed	Closed	No
1-HV-8221	CCP suction vent iso.	Open	Closed	Closed	No
1-LCV-112B	VCT to CCP suction iso.	Open	Closed	Closed	No
1-LCV-112C	VCT to CCP suction iso.	Open	Closed	Closed	No
2-8105	CVCS charging pump and seal inj iso.	Open	Closed	Closed	No
2-8106	CVCS charging pump and seal inj iso.	Open	Closed	Closed	No
2-8806	RWST to SI pump suction iso.	Open	Closed	Closed	No
2-8812A	RWST discharge to RHR pump suction iso.	Open/Closed	Closed	Closed	No
2-8812B	RWST discharge to RHR pump suction iso.	Open/Closed	Closed	Closed	No
2-8923A	SI pump sunction iso valve	Open	Closed	Closed	No
2-8923B	SI pump sunction iso valve	Open	Closed	Closed	No
2-8924	CCP to SI pumps cross-tie iso valve	Open	Closed	Closed	No
2-HV-2134	FW containment iso.	Closed/Open	Closed	Closed	No
2-HV-2135	FW containment iso.	Closed/Open	Closed	Closed	No
2-HV-2136	FW containment iso.	Closed/Open	Closed	Closed	No
2-HV-2137	FW containment iso.	Closed/Open	Closed	Closed	No
2-HV-4075B	Containment fire protection iso valve	Closed	Closed	Closed	No
2-HV-4075C	Containment fire protection iso valve	Closed	Closed	Closed	No
2-HV-4696	CCW to RCS thermal barrier cooler, return iso.	Open	Closed	Closed	No
2-HV-4699	CCW to RCS thermal barrier cooler, supply iso.	Open	Closed	Closed	No
2-HV-4700	CCW to RCS thermal barrier cooler, supply iso.	Open	Closed	Closed	No
2-HV-4701	CCW to RCP bearing & motor cooler, return iso.	Open	Closed	Closed	No
2-HV-4708	CCW to RCP bearing & motor cooler, return iso.	Open	Closed	Closed	No
2-HV-4709	CCW to RCS thermal barrier cooler, return iso.	Open	Closed	Closed	No
2-HV-4758	RWST to containment spray pump suction iso.	Open	Closed	Closed	No
2-HV-4759	RWST to containment spray pump suction iso.	Open	Closed	Closed	No
2-HV-6082	Chilled water return containment iso.	Open	Closed	Closed	No
2-HV-6083	Chilled water return containment iso.	Open	Closed	Closed	No
2-HV-6084	Chilled water return containment iso.	Open	Closed	Closed	No
2-HV-8220	CCP suction vent iso.	Open	Closed	Closed	No
2-HV-8221	CCP suction vent iso.	Open	Closed	Closed	No
2-LCV-112B	VCT to CCP suction iso.	Open	Closed	Closed	No
2-LCV-112C	VCT to CCP suction iso.	Open	Closed	Closed	No

The screening is applicable to both Units 1 and 2 since both units are essentially identical. Unit 1 & 2 tag numbers are the same except the prefix.

TAG #	CRITERION 4.1.A	CRITERION 4.1.B	CRITERION 4.2.A	CRITERION 4.2.B	CRITERION 4.2.C	CRITERION 4.3.A	CRITERION 4.3.B	CRITERION 4.3.C	CRITERION 4.4.A	CRITERION 4.4.B	CRITERION 4.4.C	CRITERION 4.4.D	Susceptible to PL	Susceptible to TB
1-8000A	YES	YES	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES (3)
1-8000B	YES	YES	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES (3)
1-8701A	NA (1)	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NA (1)	NA (1)
1-8701B	NA (1)	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NA (1)	NA (1)
1-8702A	NA (1)	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NA (1)	NA (1)
1-8702B	NA (1)	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NA (1)	NA (1)
1-8716A	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8716B	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8801A	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8801B	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8802A	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
1-8802B	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
1-8804A	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8804B	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8807A	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8807B	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8809A	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8809B	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8811A	NA (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA (2)	NA (2)
1-8811B	NA (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA (2)	NA (2)
1-8821A	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8821B	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8835	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-8840	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
1-HV-2480	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2481	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2482	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2491A	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2491B	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2492A	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2492B	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2493A	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2493B	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2494A	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-2494B	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-4776	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-4777	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-HV-4782	NA (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-HV-4783	NA (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-LCV-112D	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1-LCV-112E	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Notes: 1) CPSES is a hot standby plant and not relies on this valve to align RHR Train for decay heat removal.
2) This valve has been modified using method described in section 6.1.2.
3) See Page 17 of 33 for detail justification of acceptibility.

Tag No.	DMTQ	OAR	POE	AF	Vr	SFunseat	MTR Capability	Tdbp	Tun	Tpd	Tvert	Total	MTR Margin, %	Reference
1-8802A	14.7	41.03	0.45	0.9	0.80	0.0082	19065	5136	4978	2743	4182	11553	65	3-93-309253-01
1-8802B	14.7	41.03	0.45	0.9	0.80	0.0084	18611	5281	4266	2743	4182	10986	69	1-93-53025-0
1-8840	148.8	53.62	0.45	0.9	0.80	0.0181	114258	41008	36033	10971	31043	97113	18	1-93-27323
2-8802A	14.7	41.03	0.45	0.9	0.80	0.0091	17180	4459	4649	2743	4182	10547	63	1-94-068935
2-8802B	14.7	41.03	0.45	0.9	0.80	0.0107	14611	4289	4644	2743	4182	10372	41	1-94-068936
2-8840	148.8	53.62	0.45	0.9	0.80	0.0181	114258	41008	12055	10971	31043	73135	56	1-94-068949

Notes:
DMTQ = Derated Motor Torque Rating Due to Elevated Temperature, Ft-Lbs [Attachment X of ME-CA-0000-1093].
OAR = Actuator Overall Gear Ratio [ME-CA-0000-1093, Attachment J].
POE = Pull Out Efficiency [ME-CA-0000-1093, Attachment J].
AF = Application Factor [ME-CA-0000-1093, Attachment J].
Vr = Ratio of Available Voltage and Nameplate Voltage [Attachment W of ME-CA-0000-1093]. Value of "1" signifies that the valve is not required during sequencing.
SFunseat = Unseat Stem Factor Obtained from Test Results , Ft-Lb/Lb [From Test Data or Attachment T of ME-CA-0000-1093].

MTR Capability = (DMTQ)(OAR)(POE)(AF)(Vr)^2/SFunseat
Tdbp = Thrust required to overcome bonnet pressurization using Com Ed. technique, lb.
Tun = Thrust required to unwedge the valve obtained from static test results, either measured using strain gages or derive from spring pack deflection, lb.
Tpd = Stem rejection load, lbs.
Tvert = Reverse piston effect, lbs.
Ttotal = Tdbp +Tun + Tvert - Tpd
MTR Margin, % = ((MTR Capability - Total Treq'd)/(Total Treq'd))100