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SUBJECT: Submits info to support NRC closure of review of GL 89-10, "Safety-Related Motor-Operated Valve Testing & Surveillance Program," per NRC Bulletin 89-003.

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United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
SUBMITTAL OF INFORMATION TO SUPPORT NRC CLOSURE OF THE REVIEW OF GENERIC LETTER NO. 89-10, "SAFETY-RELATED MOTOR-OPERATED VALVE TESTING AND SURVEILLANCE" PROGRAM

Gentlemen:

On June 28, 1989, the NRC issued Generic Letter (GL) No. 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," which expanded the scope of the previously issued NRC Bulletin 85-03, dated November 15, 1985, and Supplement 1 of NRC Bulletin 85-03, dated April 27, 1988. The GL No. 89-10 recommended that licensees' programs with respect to Motor Operated Valves (MOVs) should provide for testing, inspection, and maintenance of MOVs to maintain the necessary assurance that they will function as required when subjected to both normal operation and abnormal events within the design basis of the plant. The GL No. 89-10 also requires licensees to notify the NRC in writing within 30 days after the actions described in the first paragraph of item (i) of GL No. 89-10 have been completed.

Carolina Power & Light (CP&L) Company responded to GL No. 89-10 for the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2 by letter dated December 27, 1989, describing our MOV program. We supplemented the original response by letter dated June 6, 1991, providing additional clarifications regarding our MOV program. The NRC issued six additional GL No. 89-10 Supplements, of which we were required to respond to Supplement 5, "Inaccuracy of Motor-Operated Valve Diagnostic Equipment." Our response to Supplement 5 was provided by letter dated September, 28, 1993. CP&L notified the NRC by letter dated July 28, 1994, that HBRSEP, Unit No. 2 completed implementation of the MOV program (i.e., GL No. 89-10 items a through h) in accordance with the commitments provided in our letters dated December 27, 1989, and June 6, 1991. In addition, the NRC has conducted Phase I, "Program Review," and Phase II, "Verification of Program Implementation," inspections between June 10 through 14, 1991, as documented in the NRC Inspection Report No. 50-261/91-201, and between March 28 through April 1, 1994, as documented in the NRC Inspection Report No. 50-261/94-06, respectively.

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The purpose of this letter is to transmit information that should assist the NRC in closing its review of our GL No. 89-10 program. As recommended and provided to us by the NRC during a meeting held with Region II licensees on November 8, 1994, we have used NRC memorandum, "Guidance on Closure of Staff Review of Generic Letter 89-10 Programs," dated July 12, 1994, in the preparation of the enclosed information.

Questions regarding this matter may be referred to Mr. A. L. Garrou at (803) 857-1544.

Very truly yours,

R. M. Krich
Manager - Regulatory Affairs

DTG\dtg
Enclosure: Information Supporting Closure of NRC Review of GL 89-10 Program Attachments
c: Mr. S. D. Ebneter, Regional Administrator, USNRC, Region II
Ms. B. L. Mozafari, USNRC Project Manager, HBRSEP
Mr. W. T. Orders, USNRC Senior Resident Inspector, HBRSEP

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
INFORMATION SUPPORTING CLOSURE OF NRC REVIEW OF GL 89-10 PROGRAM

The following descriptive information and actions to date are provided for the closure of the NRC review of the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, Generic Letter (GL) No. 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," program implementation. The guidance on closure of NRC review of GL 89-10 programs was provided to us during the November 8, 1994, NRC Region II meeting held in Atlanta, Georgia. During the meeting, the NRC recommended using NRC memorandum, "Guidance on Closure of Staff Review of Generic Letter 89-10 Programs," dated July 12, 1994, from Mr. Brian W. Sheron, Director for Division of Engineering, Office of Nuclear Reactor Regulation, to the Regional Reactor Safety Directors, as specific guidance for the closure of NRC reviews. The guidance provided in this memorandum was followed in preparing the information provided below regarding our GL 89-10 Motor Operated Valve (MOV) program. Additionally, an update of the actions taken or status of the NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, follow-up items and ongoing issues has been included. Therefore, this information addresses the appropriate elements from the NRC memorandum for closeout of the NRC review of our GL 89-10 program.

A. Information Addressing Specific Guidance for NRC Closure Review

The items in this section are designated with the same numbering scheme as provided in the NRC's memorandum from B. W. Sheron, Enclosure 2, dated July 12, 1994, in order to facilitate proper referencing between documents.

Guidance Item 04.04 **"Select a sample of MOVs for detailed review from the population of MOVs in the generic letter program:**

- **a. Valve number and system label name**
- **b. Safety function description (and probabilistic-risk-assessment priority if applicable)**
- **c. Manufacturer, type, and size for valve, actuator, and motor for each MOV**
- **d. Control switch thrust versus calculated minimum and maximum thrust**
- **e. Test status (static/dynamic/Design-Basis Differential-Pressure /Percent DBDP during test)**

f. Basis for closure:
(1) Full d/p or extrapolated partial d/p test
(2) Static test only
(a) grouping with other valves d/p tested
(b) prototype testing
(c) reliance on EPRI or industry test data
(d) large calculated margin
(e) other (PRA, etc.)
g. Remaining activities with schedule for completion."

Response There are a total of 59 MOVs in our GL 89-10 MOV program. The information requested in Guidance Item 04.04, Sub-items "a" through "f" is provided in the attached Tables A, B, C, and D.

Sub-item "g" of Guidance Item 04.04 requests schedule completion dates for the remaining activities. We have completed the remaining GL 89-10 MOV program activities during the past Refueling Outage (RO)-16, that ended on June 21, 1995. Additional enhancements are planned for specific MOVs identified in Section C of this enclosure. The MOVs are operable under current conditions. The enhancements will provide an increase in valve capability.

Guidance Item 04.04 **"Mispositioning"**

Response The NRC stated that Supplement 7 to GL 89-10 will be issued to address valve mispositioning for pressurized water reactors. We will review any future Supplement to GL 89-10 for program applicability and provide an appropriate response as necessary. We have previously responded to the mispositioning issue by letter to the NRC, dated June 6, 1991; there are no changes to our response at this time.

Guidance Item 04.05 **"Verify that the licensee has performed design-basis reviews of the sampled MOVs consistent with the generic letter or its commitments (where accepted under Part 1), as appropriate."**

Response A design basis review of each GL 89-10 MOV has been completed. The NRC reviewed this information and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, Paragraph 2.1.

Guidance Item 04.05 **"Pressure Locking and Thermal Binding"**

Response Pressure Locking/Thermal Binding (PL/TB) problems that have been identified in the past have been resolved. The NRC reviewed our corrective actions as documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, Section 2.8. Since these corrective actions were implemented, no MOV PL/TB operability concerns have been identified. One potential thermal binding occurrence associated with plant cooldown was identified on Feedwater (FW)-V2-6B valve during RO-16. Prevention of this condition is currently controlled through plant cooldown procedures. The valve does not have a safety function to open.

GL 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," dated August 17, 1995, has been recently received. The GL requires a 60 and 180 day written response from each licensee. We will review the NRC GL on PL/TB and address the issue separately from the GL 89-10 MOV program. In addition, we will continue to monitor MOV gate valve performance as committed with regard to this matter.

Guidance Item 04.06 **"Verify that the licensee has adequately sized the sampled MOVs in accordance with the generic letter or its commitments (where accepted under Part 1), as appropriate. Verify that switch settings are consistent with the expected design conditions for operation of the valve."**

Response The GL 89-10 MOV program valves have been verified for proper sizing and torque switch settings. The NRC has reviewed our verification records, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, Section 2.2. Our response to the items identified in the NRC Inspection Report is provided in Section B of this enclosure.

Guidance Item 04.07 **"Verify that the licensee has demonstrated the design-basis capability of the sampled MOVs and the adequacy of the licensee's program applied to the sampled MOVs in accordance with the generic letter or its commitments (where accepted under Part 1), as appropriate.**

Response The NRC reviewed a sample of our MOVs and the results are documented in attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, Section 2.3.

The NRC Inspection Report indicates that there are 64 MOVs in the GL 89-10 MOV program. Subsequent to that inspection, the number of MOVs has been reduced to 59 based on the criteria provided in GL 89-10 Supplement 1, "Results of the Public Workshop, dated June 13, 1990," and Supplement 6, "Information on Schedule and Grouping and Staff Response to Additional Public Questions," dated March 8, 1994.

The GL 89-10 MOV program valves have been tested under dynamic conditions where practical. Forty-three (43) of the 56 gate and globe valves, and the three (3) butterfly valves were tested under maximum differential pressure (dp) conditions that could be achieved during testing. The information on the MOV testing is provided in the attached Tables B and C.

Guidance Item 04.07 **"Diagnostic Test Equipment Accuracy"**

Response A percentage for diagnostic equipment accuracy has been factored into the torque switch trip setup range (i.e., minimum values). The accuracy term provided by the diagnostic equipment vendor (i.e., Liberty Technologies) is applied in the plant procedure for field measurement of thrust using Valve Operation and Test Evaluation System (VOTES) equipment.

Subsequent to our GL 89-10, Phase II, NRC Inspection, the thrust analysis procedure used in the plant for diagnostic testing has been revised. The procedure now includes a step in the dynamic test data evaluation portion that compares the dynamic thrust at torque switch trip to the extrapolated flow isolation thrust needed to close the valve at design dp. There is a 10% margin objective to allow for various uncertainties (e.g., measurement errors, degradation, etc.).

Guidance Item 04.07 **"Grouping"**

Response We have not used the grouping strategy to reduce the number of MOVs that are being dynamically tested.

Guidance Item 04.08 **"Verify that the licensee has established a method for periodic verification of adequate capability of the sampled MOVs in accordance with the generic letter or its commitments (where accepted under Part 1), as appropriate."**

Response The NRC provided licensees with closeout information by letter dated December 8, 1994, "Meeting Summary Motor-Operated Valve Issues with Special Emphasis on the Process for Closing Out Generic Letter 89-10," that included two examples of acceptable periodic verification: (1) dynamic diagnostic testing, or (2) static diagnostic testing with margin based on plant-specific dynamic testing.

Our GL 89-10 MOV program procedure, Technical Management Manual (TMM)-032, "Motor Operated Valve Program," establishes a periodic verification frequency for MOVs to be within three (3) Refueling Outages or within five (5) years. The periodic verification consists of a static retest based on the dynamic testing as discussed in response to Guidance Item 04.07 above.

Static verification will allow thrust and/or torque parameters measured during the initial baseline testing of the GL 89-10 MOV program testing to be reverified. Any changes in MOV capability can be monitored by comparing the baseline value(s) to the new value(s) obtained in the reverification process. While there have been issues relating to diagnostic equipment accuracy and torque switch repeatability, there is a reasonable degree of confidence in the value of the static diagnostic information.

Baseline MOV dynamic test results have been incorporated into the setup calculations of the applicable MOVs. Any future dynamic test results (i.e., Post Maintenance Testing Requirements following valve internal work) will be incorporated into the design calculations as required. The objective of using the dynamic test information is to provide conservatism in the MOV evaluations.

For those valves that have a function to close under torque switch control, margins have been added to the setup parameters to account for uncertainty issues that include "Rate of Loading," where appropriate (i.e., see the attached Tables B, C, and D).

The dynamic testing included many variables that would challenge the ability to perform repeatable dynamic test results over outage time periods. In addition to the uncertainties common to static testing, such as diagnostic accuracy and torque switch repeatability, the following examples listed are additional variables included in the dynamic testing information:

- system pump operation (e.g., pipe/valve vibration),
- pressure gages/Emergency Response Facility Information System computer data (e.g., gage reading tolerance, indicator vibration), and
- diagnostic analysis interpretation.

Due to the variables surrounding dynamic testing, it would be difficult to duplicate the results of a dynamic test in a subsequent time period. Therefore, trending of such results would not be practical.

The objective of performing periodic verifications is to maintain a reasonable level of confidence that an MOV will be capable of performing its design basis function. The data from a static test provides important information concerning the ability of the actuator to convert torque to thrust (i.e., "stem factor"). Both thrust and torque information are scheduled to be obtained during periodic reverification. The ability of an MOV to be able to convert torque to thrust is important when evaluating the capability of those MOVs that have to change position in the event of an accident.

The GL 89-10 MOV program valves that were found to have small thrust margins (i.e., between the setup thrust and the available thrust), based on best data available, either had the close torque switch bypassed by approximately 98% (i.e., for "closed" safety function valves), or had the open torque switch jumpered (i.e., for "open" safety function valves). The MOVs that required the torque switch to either be bypassed or jumpered were modified during RO-16.

Bypass or jumper of the MOVs torque switch, will allow "full motor capability," subject to voltage conditions, regardless of the torque switch setting. These MOVs are essentially controlled by the actuator's limit switch until either the fluid flow stops (i.e., for "closed" safety function valves) or the valve is fully open (i.e., for "open" safety function valves). The ability of an MOV to convert torque to thrust is very important for those valves that have to change position; therefore, full motor capability is available to accomplish the design function. Static reverification will ensure that this capability remains satisfactory.

In addition to the periodic static testing, we currently plan to perform dynamic retests of approximately 10% of the GL 89-10 MOV program valves over the next two (2) refueling outages. These valves will be tested under near identical conditions as the original dynamic tests (i.e., pressure/flow), and the test results will be reviewed using the same criteria as the initial dynamic tests. The review emphasis will be to determine any evidence of valve performance degradation as indicated by an increase in the value of the "Valve Factor." If there is no evidence of valve performance degradation, the follow-up dynamic test program will be considered completed.

Guidance Item 04.09 **"Verify that (1) the licensee has analyzed MOV failures which have occurred and has an effective corrective action plan to prevent recurrence and (2) the licensee trends failures of MOVs in accordance with the generic letter or its commitments (where accepted under Part 1), as appropriate."**

Response The NRC has reviewed our corrective action program for MOVs and found it acceptable. This information and the NRC conclusions are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, Section 2.5.

Guidance Item 04.10 **"Verify that the licensee is meeting the program schedule in accordance with the generic letter or its commitments (where accepted under Part 1), as appropriate."**

Response Our letter to the NRC, dated July 28, 1994, documents the completion of the GL 89-10 MOV program implementation.

Guidance Item 04.11 **"Verify quality assurance program implementation in the design control and testing of the sampled MOVs."**

Response The NRC reviewed the internal assessments of our GL 89-10 MOV program, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, Section 2.9. The documented NRC conclusions indicated that the assessments were adequate and a contributor to the improvement of the GL 89-10 MOV program.

In addition, it should be noted that our Design Guide (DG)-I.11, "Limitorque Motor-Operated Valve Mechanical Evaluations," which was referenced in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, is used for evaluating MOV sizing and switch setting. Our MOV evaluation methodology was reviewed by the NRC during the Phase I, "Program Review," and Phase II, "Verification of Program Implementation," Inspections, and by our internal assessments. The Design Guide has been revised as needed to reflect changes in MOV technology.

B. Information Addressing Part 1 Issues

An overview of actions taken in response to NRC Inspection Report No. 50-261/91-201, dated July 25, 1991, and NRC Inspection Report No. 50-261/94-06, dated May 10, 1994, Open Items, Inspector Follow-up Items (IFIs) and ongoing issues.

1. Open Item 50-261/91-201-01 - Determination of Design Basis Flow Rate.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-01, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

2. Open Item 50-261/91-201-02 - Failure to Review Mispositionable MOVs.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-02, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

3. Open Item 50-261/91-201-03 - Undersized Actuators for Valves FW-V2-6A, 6B, and 6C.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. In addition, our response to the NRC Violation 50-261/91-201-01, "Conditions That Questioned the Operability of MOV (i.e., FW-V2-6A) Were Not Properly Identified or Evaluated to Determine Equipment Operablity And The Appropriate Corrective Action," cited in Notice of Violation, dated October 4, 1991, is documented in our letters to the NRC, dated November 2, 1991, and Jannuary 6, 1992.

The NRC reviewed and closed Violation 50-261/91-201-01, and the results are documented in the attached NRC Inspection Report No. 50-261/92-19, dated July 22, 1992. However, as a result of the NRC Inspection, the NRC cited Violation 50-261/92-19-01, "Inadequate Design Control Involving Unverified Assumptions Related to D/P for Valve FW-2V-6A, B and C," in the Notice of Violation, dated July 22, 1992. Our response to the NRC Violation 50-261/92-19-01 is documented in our letter to the NRC, dated August 20, 1992. The NRC reviewed and closed Violation 50-261/92-19-01 and Open Item 50-261/91-201-03, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

4. Open Item 50-261/91-201-04 - Setting of Closed-to-Open Torque Switch Bypass Limit.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-04, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

5. Open Item 50-261/91-201-05 - Procedures for Controlling Design Basis Testing.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-05, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

6. Open Item 50-261/91-201-06 - Periodic Verification of MOV Operability.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-06, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

7. Open Item 50-261/91-201-07 - Inadequate Documentation and Corrective Action for MOV Deficiencies.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-07, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

8. Open Item 50-261/91-201-08 - MOV Setpoint Document Control of Switch Settings.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-08, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

9. Open Item 50-261/91-201-09 - MOV Post-Maintenance Testing.

   Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-09, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

10. Open Item 50-261/91-201-10 - Failure to Periodically Test Thermal Overloads.

    Response: Our letter to the NRC, dated September 23, 1991, documents our response to the identified weakness. The NRC reviewed and closed Open Item 50-261/91-201-10, and the results are documented in the attached NRC Inspection Report No. 50-261/94-06, dated May 10, 1994.

11. IFI 50-261/94-06-01 (Section 2.2) - Margin for Load Sensitive Behavior.

    Response: The NRC reviewed and closed IFI 50-261/94-06-01, and the results are documented in the attached NRC Inspection Report No. 50-261/95-07, dated April 9, 1995.

12. IFI 50-261/94-06-02 (Section 2.2) - Correction of Maximum Settings for Torque Switch Repeatability.

    Response: The NRC reviewed and closed IFI 50-261/94-06-02, and the results are documented in the attached NRC Inspection Report No. 50-261/95-07, dated April 9, 1995.

13. IFI 50-261/94-06-03 (Section 2.2) - Actions to Ensure Capabilities of RHR-744 Valves.

    Response: The NRC reviewed and closed IFI 50-261/94-06-03, and the results are documented in the attached NRC Inspection Report No. 50-261/95-07, dated April 9, 1995.

14. IFI 50-261/94-06-04 (Section 2.3) - Revision of Design Criteria Assumptions Based on Test Data.

    Response: The NRC reviewed and closed IFI 50-261/94-06-04, and the results are documented in the attached NRC Inspection Report No. 50-261/95-07, dated April 9, 1995.

15. IFI 50-261/94-06-05 (Section 2.4) - Adequacy of Periodic Verification Methods.

    Response: See response to Guidance Item 04.08 above.

16. IFI 50-261/94-06-06 (Section 2.3) - MOV Post Maintenance Testing.

    Response: The NRC reviewed and closed IFI 50-261/94-06-06, and the results are documented in the attached NRC Inspection Report No. 50-261/95-07, dated April 9, 1995.

12. IFI 50-261/94-06-07 (Section 2.10 c.) - Mispositioning.

    Response: See response to Guidance Item 04.04 above.

13. IFI 50-261/94-06-08 (Section 2.10 e.) - Setting Closed-to-Open Bypass Switch Limit.

    Response: The NRC reviewed and closed IFI 50-261/94-06-08, and the results are documented in the attached NRC Inspection Report No. 50-261/95-07, dated April 9, 1995.

C. Information Addressing Part 1 Issues

Summary of MOV enhancements that have been completed since last inspection:

- Modification No. 1167, Residual Heat Removal (RHR)-744A and 744B valves motor cable replacement with larger cables,

- Modification No. 1145, FW-V2-6B and V2-6C valves motor cable replacement with larger cables in order to provide more motor torque under degraded voltage conditions, and

- Modification No. 1172, MOV torque switch bypass jumpers installation for reasons discussed in response to Guidance Item 04.08 above.

As an addition enhancement, we plan to increase actuator capability for MOVs RHR-744A and B, RHR-752A and B, and Chemical Volume and Control (CVC)-381 by changing motor pinion gear ratios.

Weak Link calculations were developed by the individual valve vendors and incorporated into the mechanical calculations. As a further enhancement to the GL 89-10 MOV program, our Design Guide, DG-II.23, "Motor Operated Valve Structural Evaluation," which was referenced in the attached NRC Inspection Report No. 50-261/94-06, was developed to promote consistency between the CP&L nuclear plants in the evaluation of MOV Weak Link calculations. New Weak Link calculations using the criteria of the Design Guide are under preparation. The GL 89-10 MOV program valves will be reevaluated using the latest Weak Link calculated thrusts. The reevaluations may result in potential setpoint or hardware changes and the appropriate corrective actions will be taken as necessary.

D. Information Addressing Part 1 Issues

Current status of issue(s) resolution.

1. Mispositioning

   Response: See response to Guidance Item 04.04 above.

2. Pressure Locking/Thermal Binding

   Response: See response to Guidance Item 04.05 above.

TABLE A
VALVE, OPERATOR, AND MOTOR DATA FOR HBRSEP GL 89-10 PROGRAM VALVES

VALVE	TITLE	SAFETY FUNCTION	VALVE					LIMITORQUE OPERATOR TYPE	MOTOR	
			MFG.	TYPE	SIZE	CLASS	MATERIAL		START TORQUE	VOLTAGE
AFW-V2-14A	SDAFW PMP FW DISCHARGE TO S/G A	O/C (1)	A/D	DD	4"	900	CS	SMB-00	15 FT-LB	208
AFW-V2-14B	SDAFW PMP FW DISCHARGE TO S/G B	O/C (1)	A/D	DD	4"	900	CS	SMB-00	15 FT-LB	208
AFW-V2-14C	SDAFW PMP FWDISCHARGE TO S/G C	O/C (1)	A/D	DD	4"	900	CS	SMB-00	15 FT-LB	208
AFW-V2-16A	AFW HEADER DISCHARGE TO S/G A	O/C (2)	A/D	DD	4"	900	CS	SMB-00	15 FT-LB	208
AFW-V2-16B	AFW HEADER DISCHARGE TO S/G B	O/C (2)	A/D	DD	4"	900	CS	SMB-00	15 FT-LB	208
AFW-V2-16C	AFW HEADER DISCHARGE TO S/G C	O/C (2)	A/D	DD	4"	900	CS	SMB-00	15 FT-LB	208
CC-716B	RC PUMPS COOLING WATER INLET ISOL.	CLOSE (3)	A/D	DD	6"	150	CS	SMB-00	10 FT-LB	440
CC-730	RC BRG COOLING WATER RETURN ISOL.	CLOSE (3)	A/D	DD	6"	150	CS	SMB-00	10 FT-LB	440
CC-735	RC PUMPS THERMAL BARRIER OUTLET ISOL.	CLOSE (4)	VELAN	F/W	3"	1500	CS	SMB-00	10 FT-LB	440
CC-749A	RHR HX A COOLING WATER OUTLET ISOL.	OPEN (5)	CRANE	S/W	16"	150	CS	SMB-0	15 FT-LB	440
CC-749B	RHR HX B COOLING WATER OUTLET ISOL.	OPEN (5)	CRANE	S/W	16"	150	CS	SMB-0	15 FT-LB	440
CVC-350	BA TO CHARGING PMP SUCTION HDR	N/A (6) *	ALOYCO	DD	2"	150	SS	SMB-000	5 FT-LB	480
CVC-381	RCP SEAL WTR RETURN ISOL	CLOSE (7)	ALOYCO	DD	3"	150	SS	SMB-000	5 FT-LB	480
FCV-626	RC PUMPS THERMAL BARRIER CCW OUTLET ISOL.	CLOSE (4)	VELAN	F/W	3"	1500	CS	SMB-00	10 FT-LB	440
FP-248	ELECTRICAL PENETRATION PRE-ACTION SPRINKLER SYSTEM UPSTREAM ISOL.	CLOSE (8)	A/D	F/W	4"	900	CS	SMB-00	15 FT-LB	460
FP-249	ELECTRICAL PENETRATION PRE-ACTION SPRINKLER SYSTEM UPSTREAM ISOL.	CLOSE (8)	A/D	F/W	4"	900	CS	SMB-00	15 FT-LB	460
FP-256	RCP'S A/B/C PRE-ACTION SPRINKLER SYSTEM AND CV HOSE STATION ISOL.	CLOSE (8)	A/D	F/W	4"	900	CS	SMB-00	15 FT-LB	460
FP-258	RCP'S A/B/C PRE-ACTION SPRINKLER SYSTEM AND CV HOSE STATION ISOL.	CLOSE (8)	A/D	F/W	4"	900	CS	SMB-00	15 FT-LB	460
FW-V2-6A	FEEDWATER HEADER SECTION VALVE A	CLOSE (9)	CRANE	S/W	16"	900	CS	SMB-2	60 FT-LB	208
FW-V2-6B	FEEDWATER HEADER SECTION VALVE B	CLOSE (9)	CRANE	S/W	16"	900	CS	SMB-2	60 FT-LB	208
FW-V2-6C	FEEDWATER HEADER SECTION VALVE C	CLOSE (9)	CRANE	S/W	16"	900	CS	SMB-2	60 FT-LB	208
MS-V1-8A	S/G A STEAM SUPPLY TO AUX FEEDWATER PUMP	OPEN (10)	A/D	DD	2"	900	CS	SMB-000	5 FT-LB	460
MS-V1-8B	S/G B STEAM SUPPLY TO AUX FEEDWATER PUMP	OPEN (10)	A/D	DD	2"	900	CS	SMB-000	5 FT-LB	460
MS-V1-8C	S/G C STEAM SUPPLY TO AUX FEEDWATER PUMP	OPEN (10)	A/D	DD	2"	900	CS	SMB-000	5 FT-LB	460
RC-535	PRESSURIZER ISOL. TO PORV PCV-456	N/A (11) *	W	F/W	3"	1500	SS	SB-00	15 FT-LB	460
RC-536	PRESSURIZER ISOL. TO PORV PCV-455C	N/A (11) *	W	F/W	3"	1500	SS	SB-00	15 FT-LB	460
RHR-744A	RHR RETURN TO RC COLD LEGS	O/C (12)	VELAN	F/W	10"	1500	SS	SB-3	100 FT-LB	480
RHR-744B	RHR RETURN TO RC COLD LEGS	O/C (12)	VELAN	F/W	10"	1500	SS	SB-3	100 FT-LB	480
RHR-750	RC LOOP 2 HOT LEG TO RHR SYSTEM	N/A (13) *	COPES	DD	14"	1500	SS	SMB-1	40 FT-LB	440
RHR-751	RC LOOP 2 HOT LEG TO RHR SYSTEM	N/A (13) *	COPES	DD	14"	1500	SS	SMB-1	40 FT-LB	440

TABLE A
VALVE, OPERATOR, AND MOTOR DATA FOR HBRSEP GL 89-10 PROGRAM VALVES

VALVE	TITLE	SAFETY FUNCTION	VALVE					LIMITORQUE OPERATOR TYPE	MOTOR	
			MFG.	TYPE	SIZE	CLASS	MATERIAL		START TORQUE	VOLTAGE
RHR-752A	RHR PUMP A SUCTION ISOL.	N/A (14) *	A/D	DD	14"	300	SS	SMB-2	40FT-LB	480
RHR-752B	RHR PUMP B SUCTION ISOL.	N/A (14) *	A/D	DD	14"	300	SS	SMB-2	40 FT-LB	480
RHR-759A	RHR HX A OUTLET ISOL.	N/A (15) *	ALOYCO	S/W	10"	300	SS	SMB-1	25 FT-LB	460
RHR-759B	RHR HX B OUTLET ISOL.	N/A (15) *	ALOYCO	S/W	10"	300	SS	SMB-1	25 FT-LB	460
SI-845A	CV SPRAY ADDITIVE TANK DISCHARGE ISOL.	OPEN (16)	VELAN	GL	2"	1500	SS	SMB-00	15 FT-LB	440
SI-845B	CV SPRAY ADDITIVE TANK DISCHARGE ISOL.	OPEN (16)	VELAN	GL	2"	1500	SS	SMB-00	15 FT-LB	460
SI-845C	CV SPRAY ADDITIVE THROTTLING	OPEN (17)	VELAN	GL	2"	1500	SS	SMB-00	15 FT-LB	460
SI-860A	CV SUMP RECIRC SUCTION TO RHR PUMP A	OPEN (18)	A/D	DD	14"	300	SS	SMB-0	40 FT-LB	440
SI-860B	CV SUMP RECIRC SUCTION TO RHR PUMP B	OPEN (18)	A/D	DD	14"	300	SS	SMB-0	40 FT-LB	440
SI-861A	CV SUMP RECIRC SUCTION TO RHR PUMP A	OPEN (18)	A/D	DD	14"	300	SS	SMB-0	40 FT-LB	440
SI-861B	CV SUMP RECIRC SUCTION TO RHR PUMP B	OPEN (18)	A/D	DD	14"	300	SS	SMB-0	40 FT-LB	440
SI-862A	RWST ISOL. TO RHR LOOP	CLOSE (19)	A/D	DD	14"	300	SS	SMB-0	40 FT-LB	440
SI-862B	RWST ISOL. TO RHR LOOP	CLOSE (19)	A/D	DD	14"	300	SS	SMB-0	40 FT-LB	440
SI-863A	RHR LOOP RECIRC ISOL. VALVE	OPEN (18)	ALOYCO	DD	8X6X8	300	SS	SMB-00	15 FT-LB	440
SI-863B	RHR LOOP RECIRC ISOL. VALVE	OPEN (18)	ALOYCO	DD	8X6X8	300	SS	SMB-00	15 FT-LB	440
SI-864A	RWST DISCHARGE ISOL.	CLOSE (19)	A/D	DD	16X14 X16	300	SS	SMB-0	40 FT-LB	440
SI-864B	RWST DISCHARGE ISOL.	CLOSE (19)	A/D	DD	16X14 X16	300	SS	SMB-0	40 FT-LB	440
SI-866A	LOOP 3 HOT LEG INJECTION	O/C (18)	VELAN	GL	2"	1500	SS	SMB-00	15 FT-LB	460
SI-866B	LOOP 2 HOT LEG INJECTION	O/C (18)	VELAN	GL	2"	1500	SS	SMB-00	15 FT-LB	460
SI-869	LOOPS 2 AND 3 HOT LEG INJECTION	O/C (18)	A/D	DD	3"	1500	SS	SMB-00	15 FT-LB	440
SI-870A	BORON INJECTION TANK OUTLET ISOL.	O/C (20)	A/D	DD	3"	1500	SS	SMB-00	15 FT-LB	460
SI-870B	BORON INJECTION TANK OUTLET ISOL.	O/C (20)	A/D	DD	3"	1500	SS	SMB-00	15 FT-LB	460
SI-880A	CV SPRAY PUMP A DISCHARGE ISOL.	OPEN (16)	A/D	DD	6"	300	SS	SMB-0	15 FT-LB	440
SI-880B	CV SPRAY PUMP A DISCHARGE ISOL.	OPEN (16)	A/D	DD	6"	300	SS	SMB-0	15 FT-LB	440
SI-880C	CV SPRAY PUMP B DISCHARGE ISOL.	OPEN (16)	A/D	DD	6"	300	SS	SMB-0	15 FT-LB	440
SI-880D	CV SPRAY PUMP B DISCHARGE ISOL.	OPEN (16)	A/D	DD	6"	300	SS	SMB-0	15 FT-LB	440
V6-16A	NORTH SERVICE WATER SUPPLY TO TURBINE BLDG	CLOSE (21)	A/C	BF	16"	150	CI	SMB-000	5 FT-LB	208
V6-16B	SOUTH SERVICE WATER SUPPLY TO TURBINE BLDG	CLOSE (21)	A/C	BF	16"	150	CI	SMB-000	5 FT-LB	208
V6-16C	TURBINE BLDG COOLING WATER ISOL.	CLOSE (21)	A/C	BF	16"	150	CI	SMB-000	5 FT-LB	208

TABLE A
VALVE, OPERATOR, AND MOTOR DATA FOR HBRSEP GL 89-10 PROGRAM VALVES

Notes:

1 Valve is normally closed and opens on the following signals: (a) low-low level in 2 steam generators, (b) loss of voltage on 4 KV busses 1 and 4, or (c) receipt of a non-safety AMSAC signal. The valve must close to isolate a faulted steam generator.
2 Valve is normally closed and opens on the following signals: (a) low-low level in 1 steam generator, (b) open breakers of the feedwater pumps (c) SI signal, (d) black out on the emergency bus, or (e) on receipt of a non-safety AMSAC signal. The valve must close to isolate a faulted steam generator.
3 Valve is normally open and closes automatically on receipt of a containment isolation "P" signal.
4 Valve is normally open and closes automatically on receipt of a containment isolation "P" signal. The valve will also close on receipt of a high flow signal.
5 Valve is normally closed and does not receive an automatic signal. However, this valve does receive a remote manual signal to open when transferring to cold leg recirculation..
6 Valve is normally closed and does not have an active safety function. However, this valve may receive a remote manual signal to open during SI termination actions.
7 Valve is normally open and automatically closes on receipt of a containment isolation "P" signal.
8 Valve is normally open and automatically closes on receipt of a containment isolation "T" signal
9 Valve is normally open and automatically closes on receipt of a SI signal.
10 Valve is normally closed and opens on the following signals: (a) low-low level in 2 steam generators, (b) loss of voltage on 4160 busses 1 and 4, or (c) when a non-safety AMSAC signal is present.
11 Valve is normally open and is remote manually closed to prevent pressurizer blowdown in the event the associated Pressurizer PORV fails open. It is also remote manually closed during normal operation to isolate a leaking PORV.
12 Valve is normally closed and automatically opens on receipt of a SI signal. The valve also closes on a manual remote signal when transferring to the SI recirculation phase.
13 Valve is normally closed and does not have an active safety function. The valve opens on a remote manual signal during plant cooldown evolutions when less than 375 psig.
14 Valve is normally open and does not have an active safety function. However, the valve must shut on a remote manual signal to isolate a failed RHR pump seal or pipe break.
15 Valve is normally open and has no active safety function. However, the valve must close on receipt of a remote manual signal to prevent RHR pump runout when establishing a flow path from the RHR pump to the SI pump suction for the SI recirculation phase.
16 Valve is normally closed and automatically opens on receipt of a containment spray "P" signal.
17 Valve is normally open (throttled) and modulates to control flow from the Spray Additive Tank during an accident.
18 Valve is normally closed and must open on receipt of a remote manual signal on initiation of SI recirculation phase.
19 Valve is normally open and must close on a remote manual signal when transferring to the recirculation phase of a SI incident.
20 Valve is normally closed and opens automatically on receipt of a SI signal. The valve must also close on receipt of a remote manual signal when aligning for SI hot leg recirculation.
21 Valve is normally open and automatically closes on the following signals: (a) low SW header pressure signal coincident with a reactor trip signal, or (b) undervoltage signal on the safeguard (i.e. E1 and E2) busses coincident with a SI signal.
* These valves do not perform an active safety function, however, they are included in the GL 89-10 program because they are operated in response to an action in the EOP network.

TABLE A
VALVE, OPERATOR, AND MOTOR DATA FOR HBRSEP GL 89-10 PROGRAM VALVES

Abbreviations and Acronyms:

A/D .... Anchor Darling Valve
AFW .... Auxiliary Feedwater System
AMSAC . ATWS (Anticipated Transient without Scram) Mitigating System Actuating Circuitry
BA ..... Boric Acid
BF ..... Butterfly Valve
C ..... Close
CI ..... Cast Iron
CS ..... Carbon Steel
CV ..... Containment Vessel
DD ..... Double Disc
F/W .... Flex Wedge
FW ..... Feedwater
GL ..... Globe Valve
LOCA ... Loss of Coolant Accident
O ..... Open
"P" ..... High Containment Pressure Signal
PORV ... Power Operated Relief Valve
RC ..... Reactor Coolant
RCP .... Reactor Coolant Pump
RHR .... Residual Heat Removal
RWST ... Refueling Water Storage Tank
SDAFW .. Steam Driven Auxiliary Feedwater
S/G .... Steam Generator
SI ..... Safety Injection
SS ..... Stainless Steel
S/W .... Solid Wedge
SW ..... Service Water
"T" Signal Safety Injection Signal
W ..... Westinghouse Valve

TABLE B
SETUP OF dp TESTABLE HBRSEP GL 89-10 MOV PROGRAM VALVES

Valves Which Have a Safety Function to Close

Tag Number	Valve Type	---Valve Factor--- Calc.	Test	Design Basis ΔP(a)	Test ΔP % Design Basis	----------Thrust Additions(b)---------- Diag.	TSR	ROL(c) Calc./Test	-----Stem COF----- Calc.	Test(d)	---Packing Load-- Calc.	Test(e)	----------Thrust---------- Minimum Calc.	Maximum Calc.	Field Setup(f)	PSA Group(g)	Notes
AFW-14A*	Gate	0.34	0.491	1,200	40	*	*	-4,471/-5,830	0.13	0.13	1,500	766	12,754	19,600	15,912	3	1,13,15,20
AFW-14B*	Gate	0.53	0.68	1,200	38	*	*	-1,690/-3,991	0.10	0.10	1,500	682	12,577	19.600	14,770	3	1.13,15,20
AFW-14C*	Gate	0.64	0.79	1,200	40	*	*	-486/-486	0.11	0.11	1,500	570	12,880	19,600	15,221	3	1,13,15,20
AFW-16A*	Gate	0.41	0.56	1,200	>100	*	*	-672/-672	0.15	0.13	1,500	931	9,915	19,600	13,808	3	1,13,15,20
AFW-16B*	Gate	0.35	0.50	1,200	>100	*	*	-5,482/-5,482	0.15	0.10	437	264	12,839	19,600	13,986	3	1,13,15,20
AFW-16C*	Gate	0.53	0.68	1,200	>100	*	*	-882/-882	0.16	0.16	1079	968	11,348	19,600	12,672	3	1,13,15,20
CC-716B	Gate	1.25	1.25	94	87	10%	5%	0/+1,074	0.15	0.13	1,500	279	6,414	12,600	7,360	3	
CC-730	Gate	0.70	0.67	94	92	10%	5%	0/+308	0.15	0.145	1,500	373	4,442	12,600	6,278	3	
CC-735	Gate	0.50	N/A*	2,250	3	*	*	-2,054/+399*	0.22	0.22	1,500	237	10,268	12,600	12,257	3	5,15,16
FCV-626	Gate	0.50	N/A *	2,250	3	*	*	-2,054/-167 *	0.22	0.22	1,500	903	10,268	12,600	12,282	3	5,15,16
FP-248	Gate	0.50	0.15	135	96	10%	20%	-500/-182	0.20	0.296*	1,500	677	3,603	12,600	6,840	3	2
FP-249	Gate	0.50	0.42	135	96	10%	20%	-500/+1021	0.20	0.16	1,500	86	3,603	12,600	10,754	3	
FP-256	Gate	0.50	0.43	135	99	10%	20%	-1,400/-841	0.20	0.10	1,500	668	4,503	12,600	9,108	3	
FP-258	Gate	0.50	0.05	135	99	10%	20%	-1,400/-1174	0.20	0.14	1,500	604	4,503	12,600	11,004	3	
FW-V2-6A	Gate	0.53	0.53	480	>100	*	*	-6,426 /*	0.071	0.071	4,000	638	49,264	63,000	56,621	2	15,17
FW-V2-6B	Gate	0.71	0.71	480	>100	*	*	-7,889/*	0.11	0.11	2,175	2,175	60,481	63,000	51,297	2	15,17
FW-V2-6C	Gate	0.566	0.566	480	>100	*	*	-6,773/*	0.075	0.075	4,000	1,052	51,297	63,000	55,316	2	15,17
RHR-744A	Gate	0.58	0.58	169	88	10%	5%	-2,330/-117	0.20	0.19	2,500	1,462	11,651	71,348	25,167	2	
RHR-744B	Gate	0.44	0.44	169	85	10%	5%	-1999/303	0.20	0.48*	2,500	1,187	9,994	71,348	11,253	2	7
RHR-759A	Gate	0.68	0.68	169	85	10%	5%	-3,463/-3,463	0.21	0.21	1,500	294	17,527	26,206	18,540	2	
RHR-759B	Gate	0.65	0.65	169	82	10%	5%	-832/-832	0.15	0.07	1,500	289	14,366	26,206	22,644	2	
SI-862A	Gate	0.50*	N/A*	14	0*	10%	5%	N/A*	0.20	0.18	2,500	168	14,155	21,600*	21,343	1	8,14, 18,19
SI-862B	Gate	0.50*	N/A*	14	0*	10%	5%	N/A*	0.20	0.18	2,500	585	14,155	21,600*	23,318	1	8,14, 18,19
SI-866A	Globe	1.10	N/A*	1,500	99	10%	5%	1921*	0.20	0.11	1,500	1736*	9,604	12,600*	12,716	1	11,4,12
SI-866B	Globe	1.10	N/A*	1,500	99	10%	5%	1921*	0.20	0.19	1,500	1916*	9,604*	12,600	9,271	1	11,3,
SI-869	Gate	0.50*	N/A*	1,367	>100	10%	5%	N/A*	0.20	0.14	1,500	N/A*	8,760	12,600	10,479	1	11,6,
SI-870A	Gate	0.40	0.305	1,367	>100	10%	5%	0/+924	0.21	0.21	1,500	1,450	8,520	17,640	9,456	1	
SI-870B	Gate	0.40	0.19	1,367	>100	10%	5%	-1,500/-1,404	0.20	0.13	1,500	1,238	10,020	17,640	10,668	1	
V6-16A	Bfly	N/A	N/A	31*	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	
V6-16B	Bfly	N/A	N/A	31*	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	
V6-16C	Bfly	N/A	N/A	31*	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	

Abbreviations	Description	Units
Diag.	Diagnostic accuracy	None
TSR	Torque Switch Repeatability	None
ROL	Rate Of Loading	lbs
COF	Co-efficient Of Friction	None
PSA	Probabilistic Safety Assessment	None
TST	Torque Switch Thrust	lbs
ΔP	Differential Pressure	psid
Calc.	Setup calculation	None

N/R NOT RECORDED
N/A NOT APPLICABLE
* * entries refer to the numerical numbers in the "Notes" column and are explained in the following pages.

TABLE B
SETUP OF dp TESTABLE HBRSEP GL 89-10 MOV PROGRAM VALVES

NOTES:

1. The valve successfully isolated flow during the test and the TST thrust was higher than the extrapolated (to 100% dp) flow isolation thrust. In addition, the close torque switch has been bypassed 96% of the close stroke during RO-16. Bypassing the close torque switch will provide further assurance of valve closure under design basis conditions.

2. The COF of 0.296 was determined from the static test performed during RO-16. The minimum required thrust is still well below the field setup thrust of 6840 lbs.

3. ROL of 20% was used. This caused the required minimum thrust to increase substantially. However this valve was tested during RO-15 at approximately 100% of the design basis dp of 1500 psid. The valve successfully isolated the flow indicating present setting is acceptable. Only Packing Enforcer test was performed during RO-16. The packing load was found to be higher than used in the set up calculation. This is not a problem, because much conservatism has been used in the setup calculation. However, as an enhancement , the torque switch setting will be adjusted during the next scheduled maintenance to bring the TST thrust above the minimum calculation thrust.

4. Based on Kalsi report # 1707C, Rev.0 , dated November 25, 1991, Limitorque published rating of 14,000 lbs for SMB-00 series actuators was increased by 162% to 22,680 lbs .

5. Since the test pressure of 71 psid was a small fraction of the design basis differential pressure of 2250 psid, it was not reasonable to calculate the valve factor based on this low dp. The valve factor used in the set up calculation is based on the design guide DG- I.11, Attachment 22.

6. The assumed dp is 1,367 psid, but the actual dp this valve has to close against is 0 psid. In addition, the assumed dp adds significant conservatism. Therefore, no additional conservatism was added due to ROL.

7. The stem factor calculated was not credible because the test data was not obtained during the same test period. These valves were opened on 1/18/95 (RHR-744A) and 2/20/95 (RHR-744B), when the plant was at 100% power. The differential pressure measured across these valves was 662 psid and 672, respectively. Both valves opened against these pressures without any visible problems. The motor torques required to open these valves was calculated to be approximately equal. No stem factors were calculated from these tests since no thrust measurements were taken. The stem factor calculated for RHR-744A, based on the static test in RFO-15, was 0.0295 (COF = 0.20). Since this value is conservative, we have applied this stem factor to calculate the required actuator torques for both valves. This evaluation has indicated that adequate actuator torque is available for these valves to operate under degraded voltage conditions.

8. Apparent valve factor could not be calculated from the test since the valve was able to be stroked against static pressure only during the closing stroke. A valve factor of 0.5 is used for setup as recommended by design guide DG-I.11, attachment 22.

9. Apparent valve factor could not be calculated from the test since the valve was able to be stroked against the static pressure only during the close stroke.

10. The rate of loading is not applicable for these valves as there is no dp across these valves during close stroke.

11. No valve factor, dp thrust at TST, rate of loading or packing load were determined because the thrust was monitored with an auxiliary sensor (C-clamp) attached to the stem instead of to the votes force sensor. No thrust measurements were recorded for dp test, because the static thrust data recorded from auxiliary sensor was for a partial stroke only.

12. Packing load measured during RO-16 using Packing Enforcer is higher than that used in the setup calculation. However, the minimum required thrust will be lower than the field setup thrust after factoring in the higher packing load.

13. The true zero could not be established during the last dp test performed on these valves. Consequently, an alternate method to account for the zero offset was used to calculate the valve factor and the rate of loading. This method is presently used by in the industry and is considered a more accurate method.

14. Rate of loading will not be added to the minimum set up thrust value because the valve is set up against a closing dp of 135 psid with a line pressure of 135 psig instead of the actual dp of about 6.5 psid from the Refueling Water Storage Tank (RWST) . In reality the valve has to only close against static head from RWST. This is conservative.

15. The close torque switch has been bypassed (96% of the close stroke) until the disk has covered the port. Therefore, torque switch repeatability and diagnostic inaccuracies will not affect the available closing thrust.

16. 20% of the calculated closing thrust is added to account for rate of loading.

17. During the dp test the valve went out on limit switch rather than the torque switch, and during the static test the valve went out on torque switch. As a result, no conclusions can be made on the rate of loading. The calculated closing thrust has been increased by 15% to account for rate of loading.

18. There is no dp across this valve since the valve has to close against a static head from RWST.

19. Based on Kalsi report # 1707C, Rev.0, Limitorque published rating of 24,000 lbs for SMB-0 series actuators was increased by 162% to 38880 lbs.

20. The actual numbers for these valves are AFW-V2-14A, AFW-V2-14B, AFW-V2-14C, AFW-V2-16A, AFW-V2-16B and AFW-V2-16C.

TABLE B
SETUP OF dp TESTABLE HBRSEP GL 89-10 MOV PROGRAM VALVES

(a) The assumed design basis differential pressures are typically conservative. Conservative assumptions such as use of pump shutoff head, ignoring alternate flow paths and neglecting frictional losses were commonly made during development of these differential pressures.

(b) Simple addition method (Diagnostics + Torque Switch Repeatability + Rate-of-Loading) in lieu of Square Root Sum of Squares Method was used.

(c) A negative sign indicates a reduction in thrust at dynamic torque switch trip when compared to thrust at static torque switch trip; a positive sign indicates an increase. Both positive and negative "Rate-of-Loading" values are shown in the column; only reductions in thrust at torque switch trip were considered in the setup calculations. No credit was taken for any thrust increase.

(d) The "Test " COF values were based on static diagnostic values of thrust and torque at close torque switch trip.

(e) The "Test" packing load value was obtained from the static test data using VOTES thrust diagnostic measuring equipment.

(f) "As-left" thrust at close switch setting.

(g) The methodology used to develop the probabilistic safety assessment (PSA) is consistent with NUMARC 93-05, and follows the draft methodology proposed by the Electric Power Research Institute and developed by Quadrex Energy Services.

TABLE C
SETUP OF dp TESTABLE HBRSEP GL 89-10 MOV PROGRAM VALVES

Valves Which Have a Safety Function to Open

Tag Number	Valve Type	---Valve Factor--- Calc.	Test	Design Basis ΔP(a)	Test ΔP % Design Basis	-----Stem COF---- Calc.	Test(b)	--Packing Load-- Calc.	Test(c)	--Actuator Torque-- Needed(e)	Avail.(f)	PSA Group(d)	Notes
AFW-V2-14A	Gate	0.50*	0.104	1,200	85	0.20	0.13	1,500	329	100.9	147.9	3	1 ,14
AFW-V2-14B	Gate	0.50*	0.234	1,200	85	0.20	0.10	1,500	987	100.9	165	3	1,14
AFW-V2-14C	Gate	0.53	0.53	1,200	85	0.20	0.11	1,500	342	107.6	147.7	3	14
AFW-V2-16A	Gate	0.40	0.33	1,200	>100	0.20	0.13	1,632	1,519	81	147	3	14
AFW-V2-16B	Gate	0.40	0.21	1,200	>100	0.20	0.10	1,500	560	79	161.6	3	14
AFW-V2-16C	Gate	0.40	0.38	1,200	>100	0.20	0.16	1,500	1,027	79	173.7	3	14
CC-749A	Gate	0.50	N/R*	94	99	0.23	0.23*	2,500	N/R*	291	420.4	2	9
CC-749B	Gate	0.50	N/R*	94	93	0.24	0.24*	2,500	N/R*	294.5	429.2	2	9
CVC-350	Gate	0.50	0.0969*	115	97	0.38*	0.38*	1,000	61	15.9	47.3	3	2,3
MS-V1-8A	Gate	0.71	0.40	1,140	89	0.20	0.14	1,000	578	33	51	3	14
MS-V1-8B	Gate	0.71	0.71	1,140	86	0.20	0.18	1,000	240	33	52	3	14
MS-V1-8C	Gate	0.71	0.43	1,140	89	0.20	0.21*	1,000	257	33	52	3	14,17
RHR-744A	Gate	0.41*	0.41	2,320	6	0.19	0.19	1,800	1515	1040	1,067*	2	4,7,13
RHR-744B	Gate	0.40*	0.28	2,320	6	0.20	0.40*	1,800	1246	1051	1,148*	2	4,5,7,13
SI-845A	Globe	1.1*	N/R*	154	95	0.20	0.12	1,500	N/R*	23.4	166.4	3	13,15
SI-845B	Globe	1.1*	N/R*	154	95	0.20	0.12*	1,500	250*	23.4	156.3	3	6 ,12,13,15
SI-863A	Gate	0.50	0.297	210	73	0.20	0.07	1,500	34*	78.3	96.1	1	12,13,15
SI-863B	Gate	0.50	0.295	210	66	0.20	0.16*	1,500	484*	78.3	98.0	1	6,12,13
SI-866A	Globe	1.1*	N/R*	1,500	99	0.20	0.11	1,500	1896*	19.0	125.2	1	10,11,13,16
SI-866B	Globe	1.1*	N/R*	1,500	99	0.20	0.19	1,500	2029*	19.0	129.0	1	10,11,13,16
SI-869	Gate	0.5	N/R*	1,685	88	0.15	0.14	1,500	N/R*	56.8	118.3	1	9,13
SI-870A	Gate	0.4	0.22	2,235	66	0.21	0.21	1,500	1,450	93.5	218	1	13
SI-870B	Gate	0.4	0.26	2,235	66	0.20	0.13	1,500	992	91	225	1	13
SI-880A	Gate	0.4	N/R*	257	98	0.20	0.16	1,500	N/R*	72	115.3	2	8,9,13
SI-880B	Gate	0.4	0.21	257	97	0.20	0.136	1,500	193	72	115.4	2	13
SI-880C	Gate	0.4	N/R*	257	97	0.20	0.20	1,500	N/R*	72	115.0	2	8,9,13
SI-880D	Gate	0.4	0.13	257	97	0.20	0.12	1,500	104	72	115.4	2	13

Abbreviations	Description	Units
Diag.	Diagnostic accuracy	None
TSR	Torque Switch Repeatability	None
ROL	Rate Of Loading	lbs
COF	Co-efficient Of Friction	None
PSA	Probabilistic Safety Assessment	None
TST	Torque Switch Thrust	lbs
ΔP	Differential Pressure	psid
Calc.	Setup calculation	None

N/R NOT RECORDED
N/A NOT APPLICABLE
* * entries refer to the numerical numbers in the "Notes" column and are explained in the following pages

TABLE C
SETUP OF dp TESTABLE HBRSEP GL 89-10 MOV PROGRAM VALVES

Notes:

1. The valve factor was revised to comply with the requirements of DG-I.11.
2. The opening valve factor calculated is too optimistic (i.e.,too low), because the reliability of the downstream pressure gage was questionable.
3. The stem factor from the test data is used, because this is conservative.
4. During RO-16, valves RHR-744A and B's motor feeder cables were replaced and their open torque switches were jumpered. The feeder cable replacement will provide more available motor torque at the motor terminals, while the open torque switch jumpering will ensure valve opening during a design basis accident.
5. The stem factor calculated was not credible since the test data was not obtained during the same test period. As indicated in note (4) the increase in motor torque and the torque switch jumper will ensure valve function. In addition, different options (gearing change or motor replacement) are being evaluated to enhance the motor capability.
6. COF was calculated from the static test performed during RO-16
7. The use of higher valve factor of 0.5 instead of 0.4 is considered an evolving industry issue. The valves have been shown to be operable at the current valve factor of 0.4/0.41. This was confirmed when the valves were successfully opened on 1/18/95 (RHR-744A) and 2/20/95 (RHR-744B) while the plant was at full power. The motor torques developed during these tests were less than the motor torques required under the noted test pressure conditions. In addition, motor torque availability is being increased by replacing the power cables for these valves during RO-16. One of the future actions planned to enhance the performance of these valves will be to use the higher valve factor of 0.5.
8. The valve factor of 0.4 was used is conservative based on the valve factor calculated from the test data collected for valves SI-880B and D.
9. The valve factor and the open packing load could not be determined, because the data was taken using the auxiliary sensor.
10. Packing loads were recorded during RO-16 (started on 4/29/95). Higher packing loads do not have any impact , because the available torques are more than 6 times the expected torques.
11. Valve factor was not determined, because the data was taken using the auxiliary sensor.
12. Packing loads were recorded during RO-16.
13. The open torque switch of these valves was jumpered during RO-16.
14. The open torque switch of these valves had been jumpered in the past .
15. For accident conditions the flow is under the seat and the valve factor is not considered.
16. The flow assisted the valve during opening since the flow was under the seat.
17. It was decided to use a COF of 0.20 because the VOTES accuracy for STUB ACME threads is questionable. In addition, use of 0.2 COF is conservative and is considered an acceptable value in the industry.

(a) The assumed design basis differential pressures are typically very conservative. Conservative assumptions such as use of pump shutoff head, ignoring alternate flow paths and neglecting frictional losses were commonly made during development of these differential pressures.

(b) The "Test " COF value was based on static diagnostic values of thrust and torque at close torque switch trip.

(c) The "Test" packing load value was obtained from the static test data using VOTES thrust diagnostic measuring equipment.

(d) The methodology used to develop the PSA is consistent with NUMARC 93-05, and follows the draft methodology proposed by the Electric Power Research Institute and developed by Quadrex Energy Services.

(e) Torque needed to open the valve using a stem factor based on a 0.20 COF or the actual diagnostic stem factor if greater (applies to gate and globe valves only).

(f) Actuator torque available is based on available motor torque at degraded voltage conditions.

TABLE D
SETUP OF NON dp TESTABLE HBRSEP GL 89-10 MOV PROGRAM VALVES

Valves Which Have a Safety Function to Close

Tag Number	Valve Type	Valve Factor Calc.	Design Basis ΔP	Thrust Additions(a) Diag.	TSR	ROL	COF Calc.	COF Test(g)	ΔP(b) Thrust	Packing Load Calc.	Packing Load Test(h)	Thrust Minimum Calc.	Thrust Maximum Calc.	Thrust Field Setup(d)	PSA Group(c)	Notes
CVC-381	Gate	0.50	141	12%	20%	10%	0.38*	0.308	585	250	99*	1,361	7,200	1,453	3	1
RC-535	Gate	0.639	2319	N/A*	N/A*	N/A*	0.20	N/R*	8,375	1,500	1,204	N/A*	14,000	3114	1	2 ,3,10,17
RC-536	Gate	0.639	2319	N/A*	N/A*	N/A*	0.20	N/R*	8,375	1,500	926	N/A*	14,000	5499	1	2 ,3,10
RHR-752A	Gate	0.40*	375*	10%	5%	*	0.21	0.21	21,075	2,500	539	28,151	63,000	28,165	3	4,7,9
RHR-752B	Gate	0.40*	375*	10%	5%	*	0.20	0.17	21,075	2,500	700	28,151	63,000	32,799	3	4,7,9
SI-864A	Gate	0.50	115*	10%	5%	*	0.20	0.17	8,079	2,500	463	12,483	21,600	20,604	1	5, 6,8
SI-864B	Gate	0.50	115*	10%	5%	*	0.20	0.145	8,079	2,500	728	12,483	21,600	19,085	1	5,6,8

Valves Which Have a Safety Function to Open

Tag Number	Valve Type	Valve Factor Calc.	Design Basis ΔP	COF Calc.	COF Test(g)	ΔP(b) Thrust	Packing Load Calc.	Packing Load Test(h)	Torque Needed(e)	Torque Avail.(f)	PSA Group(c)	Notes
RHR-750	Gate	0.5	375	0.20	*	15,488	2,500	*	329	788	2	11
RHR-751	Gate	0.5	375	0.20	*	15,488	2,500	*	329	832.6	2	11
SI-845C	Globe	1.1	11	0.20	0.16	*	1,500	697	19	148	3	12,13
SI-860A	Gate	0.5	30	0.20	0.196	2108	2,500	525	83	543	1	16
SI-860B	Gate	0.5	30	0.20	0.17	2108	2,500	350	83	536.3	1	16
SI-861A	Gate	0.5	30*	0.20	0.18	2108*	2,500	463	*	539	1	14,15,16
SI-861B	Gate	0.5	30*	0.20	0.15	2108*	2,500	692	*	549	1	14,15,16

Abbreviations	Description	Units
Diag.	Diagnostic accuracy	None
TSR	Torque Switch Repeatability	None
ROL	Rate Of Loading	lbs
COF	Co-efficient Of Friction	None
PSA	Probabilistic Safety Assessment	None
TST	Torque Switch Thrust	lbs
ΔP	Differential Pressure	psid
Calc.	Setup calculation	None

N/R NOT RECORDED
N/A NOT APPLICABLE
* * entries refer to the numerical numbers in the "Notes" column and are explained in the following pages

TABLE D
SETUP OF NON dp TESTABLE HBRSEP GL 89-10 MOV PROGRAM VALVES

NOTES:

1. The packing load measured during RO-16 static test was 99 lbs. The stem factor determined during RO-16 static test was 0.308. However 0.38 was used for conservatism.
2. These valves are limit seated based on the deflection of SB actuator's compensating unit. The torque switch is not wired in their circuits. Set up is supported by Marshall testing for EPRI TMI PORV Block Valve program. The static test was performed and the packing loads were measured using the "VOTES" diagnostic equipment. Valve factor was determined using the methodology provided by the vendor (Westinghouse).
3. Since the valves could not be tested, a factor for diagnostic accuracies was not added..
4. The accident dp for these valves is 20 psid. These valves have to close to isolate the defective RHR pump due to seal failure against a differential pressure of 375 psid. This pressure is not the accident pressure.
5. Conservative value of valve factor of 0.5 was used based on the recommendation of design guide DG I-11.
6. The maximum closing dp during accident conditions is 14 psid (based on RWST head). A conservative dp of 115 psid used for valve setup is based on the sealing pressure assumptions per Anchor Darling Procedure ENG-1 "Computation and Sizing of Limitorque Electric Motor Operators."
7. ROL is not used in the setup of these valves, because 375 psid assumed in the calculation is conservative. The actual accident dp is only 20 psid.
8. ROL is not used in the setup of these valves, because the dp of 115 psid used is conservative and the required thrust is almost 250% above the actual maximum closing thrust based on actual accident dp of 14 psid.
9. The use of valve factor of 0.5 instead of 0.4 is considered an evolving industry issue. Torque required based on the current setup is lower than the available motor torque. In addition, the valves are setup based on a conservative dp of 375 psid instead of 20 psid (expected during accident conditions). One of the future enhancements to these valves will be to use valve factor of 0.5.
10. Additional factor for ROL was not added as the packing load used in the calculation is conservative. In addition the thrust available (based on motor torque) is about 13% more than the required thrust .
11. The valves are limit controlled and cannot be hard seated due to valve design and manufacturer specification. No static test was performed . Only current and switches were recorded during the static testing.
12. The flow is under the seat. The dp assists valve opening. The dp component is N/A under this condition.
13. The flow is under the seat. The dp assists valve opening. The dp component is N/A under this condition.
14. These valves are opened against a dp of 350 psid (not an accident pressure) during performance of RHR system leak test. The expected dp thrust at this dp is 24,588 lbs.
15. The expected opening torque required during the RHR system leak test (350 psid) is 480.3 ft-lbs. The expected opening torque during accident conditions is only 83 ft-lbs.
16. Open torque switch of these valves was jumpered during RO-16.
17. The valves are limit seated. The final thrust is limited to 14,000 lbs.

(a) Simple addition method (Diagnostics + Torque Switch Repeatability + Rate-of-Loading) in lieu of Square Root Sum of Squares Method.
(b) Thrust component due solely from dp effects as calculated using the standard industry equation (Differential Pressure * Area * Valve Factor).
(c) The methodology used to develop the PSA is consistent with NUMARC 93-05, and follows the draft metholology proposed by the Electric Power Research Institute and developed by Quadrex Energy Services.
(d) "As-left" thrust at close torque switch setting.
(e) Actuator torque needed to open the valve using the 0.20 coefficient of friction stem factor unless otherwise noted.
(f) Actuator torque available is based on the available motor torque at degraded voltage conditions.
(g) The "Test" COF value was based on static diagnostic values of thrust and torque at close torque switch trip.
(h) The "Test" packing load value was obtained from the static test data using the VOTES thrust measuring diagnostic equipment.