Vogtle Electric Generating Plant

Generic Letter 89-10
Close-Out Submittal

Volume 2

Design-Basis
Capability Verification
Report

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TABLE OF CONTENTS

1.0 INTRODUCTION

The objective of this document is to outline the basis for justifying that each of the valves included in the VEGP GL 89-10 program is be capable of performing its design-basis function. To support this objective the valves included in the VEGP GL 89-10 program have been divided into 30 valve groups as outlined in Table 1-1. The valves in each group are identical with respect to manufacturer, type, size and pressure class. In certain cases the valve stems and/or the valve operators may be different; however, the internal construction of all of the valves within a specific valve group are identical.

The basis for many of the capability justifications outlined in the VEGP GL 89-10 Design-Basis Capability Verification Report are founded largely in detailed engineering calculations performed utilizing conservative methodologies which have evolved over the course of implementing this program. The analytical methodologies have been validated based on an extensive in-situ differential pressure test program which included tests on 83 of the 256 valves included in the VEGP GL 89-10 program. In many cases the analytical methodologies being utilized were revised substantially based on the results of these tests. Although differential pressure tests could not be performed on valves from each of the valve groups, sufficient testing was performed on the various valve types to provide a high degree of confidence in the overall methodology.

The most conservative basis for ensuring that a valve will be capable of performing its design-basis function is to test the valve under design-basis differential pressure conditions. In cases where valves have been differential pressure tested in-situ at VEGP these tests are the primary justifications for valve capability. Tests of similar valves at other facilities also provide a strong basis for demonstrating capability, and in some cases credit has been taken for differential pressure testing performed by EPRI in conjunction with the Performance Prediction Program (PPP).

Although the in-situ differential pressure testing provides a basis for verifying the capability of tested valves, the primary objective of the VEGP differential pressure test program was to validate the analytical methodology utilized in the design review calculations. Validating the design review methodology in this manner allows non-tested valves to be evaluated analytically, and valve capability to be demonstrated based on calculated margins. A detailed discussion of the design review methodology, the differential pressure test results and the subsequent reconciliation of the differential pressure test results with the design review methodology is contained in the Program Summary Report.

It should also be noted that the margins identified in this document are based on differential pressures which include consideration of valve mispositioning. It is anticipated that Supplement 7 to GL 89-10 will delete the requirement that valve

mispositioning be addressed in conjunction with GL 89-10 for PWRs. However, mispositioning differential pressures are included in the current VEGP calculations. In cases where margins are limited based on mispositioning differential pressures, credit is taken for the actual safety function differential pressure and is so noted.

Table 1-1
Valve Groups

Group No.	Manufacturer	Valve Type	Valve Size	ANSI Rating	Total Valves
AD-1	Anchor-Darling	Gate	2.5 Inch	1500 lb	8
AD-2	Anchor-Darling	Gate	3.0 Inch	1500 lb	2
AD-3	Anchor-Darling	Gate	4.0 Inch	150 lb	4
AD-4	Anchor-Darling	Gate	4.0 Inch	900 lb	6
W-1	Westinghouse	Gate	3.0 Inch	150 lb	2
W-2A	Westinghouse	Gate	3.0 Inch	2035 lb	8
W-2B	Westinghouse	Gate	3.0 Inch	2035 lb	8
W-3	Westinghouse	Gate	4.0 Inch	150 lb	4
W-4	Westinghouse	Gate	4.0 Inch	900 lb	4
W-5	Westinghouse	Gate	4.0 Inch	1525 lb	16
W-6	Westinghouse	Gate	6.0 Inch	150 lb	14
W-7	Westinghouse	Gate	8.0 Inch	150 lb	6
W-8	Westinghouse	Gate	8.0 Inch	316 lb	12
W-9	Westinghouse	Gate	8.0 Inch	1525 lb	4
W-10	Westinghouse	Gate	10.0 Inch	150 lb	12
W-11	Westinghouse	Gate	12.0 Inch	316 lb	4
W-12	Westinghouse	Gate	12.0 Inch	1525 lb	10
W-13	Westinghouse	Gate	14.0 Inch	316 lb	4
FG-1	Fisher	Globe	0.5 Inch	1710 lb	2
FG-2	Fisher	Globe	2.0 Inch	900 lb	4
FG-3	Fisher	Globe	4.0 Inch	900 lb	16
V-1	Velan	Globe	1.0 Inch	1500 lb	2
V-2	Velan	Globe	1.5 Inch	1500 lb	12
V-3	Velan	Globe	2.0 Inch	1500 lb	22
FB-1	Fisher	Butterfly	4.0 Inch	150 lb	4
FB-2	Fisher	Butterfly	8.0 Inch	150 lb	28
FB-3	Fisher	Butterfly	10.0 Inch	150 lb	10
FB-4	Fisher	Butterfly	18.0 Inch	150 lb	16
FB-5A	Fisher	Butterfly	24.0 Inch	150 lb	8
FB-5B	Fisher	Butterfly	24.0 Inch	150 lb	4

2.0 ANCHOR-DARLING GATE VALVES

There are a total of 20 Anchor-Darling gate valves included in the VEGP GL 89-10 program. The valves are all of the flex-wedge design and utilize carbon steel discs and valve bodies. The disc guide slot and body guides are also carbon steel and the disc face and body seats are hardfaced with Stellite. These valves have been divided into four groups of identical valves as outlined in Table 2-1.

Table 2-1
Anchor-Darling Valve Groups

Group No.	Manufacturer	Valve Type	Valve Size	ANSI Rating	Total Valves
AD-1	Anchor-Darling	Gate	2.5 Inch	1500 lb	8
AD-2	Anchor-Darling	Gate	3.0 Inch	1500 lb	2
AD-3	Anchor-Darling	Gate	4.0 Inch	150 lb	4
AD-4	Anchor-Darling	Gate	4.0 Inch	900 lb	6

The thrust requirements for the valves in groups AD-1, AD-2 and AD-4 were calculated with the EPRI Performance Prediction Program (PPP) methodology utilizing the default friction coefficients. The thrust requirements for the valves in group AD-3 were calculated with the Industry Standard Equation utilizing a 0.5 valve factor since the EPRI PPP methodology does not apply to air systems. This methodology is discussed in more detail in Section 3.3.1.1 of the Program Summary Report.

The Anchor-Darling valves are equipped with valve stems utilizing stub ACME threads and a stem friction coefficient of 0.20 was utilized in calculating the stem factors for these valves. The basis for utilizing a 0.20 stem friction coefficient for these valves is outlined in Section 9.6 of the Program Summary Report.

The opening and closing capability margins were calculated for each of the valves in these groups. In addition, for valves which are controlled in the closing direction by a torque switch, the closing setup margin is also included. The setup margin takes into account test equipment accuracy, torque switch repeatability and Load Sensitive Behavior and for the purposes of this document values of 10%, 5% and 20% respectively were utilized to account for these uncertainties. In practice, the values utilized for test equipment accuracy and torque switch repeatability would be determined based on each specific valve setup. Section 4.0 of the Program Summary Report discusses the various margins in detail and outlines the basis for determining the adjustments necessary to account for test equipment accuracy, torque switch repeatability and Load Sensitive Behavior.

In reviewing the various margins contained in this document it should be noted that the margins are based on the MOV's as-modified configuration. A total of six Anchor-Darling valves are scheduled to be modified in the 1996 refueling outages and the margins outlined in this document reflect those modifications. Section 6.2 of the Program Summary Report identifies the valves to be modified as well as the various modifications.

2.1 Anchor-Darling Group AD-1 Valves

Description

This group is composed of eight, 2-1/2 inch, 1500 lb, Anchor-Darling gate valves. These valves are normally open and have a safety function to close to isolate the Auxiliary Component Cooling Water (ACCW) to the thermal barriers in the event of a thermal barrier tube rupture. The thrust requirements for these valves were calculated with the EPRI Performance Prediction Methodology utilizing the default friction coefficients.

Table 2-2
Anchor-Darling Group AD-1 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-19051	Thermal Barrier Isolation Valve	143	2364	Close
2HV-19051	Thermal Barrier Isolation Valve	143	2364	Close
1HV-19053	Thermal Barrier Isolation Valve	143	2364	Close
2HV-19053	Thermal Barrier Isolation Valve	143	2364	Close
1HV-19055	Thermal Barrier Isolation Valve	143	2364	Close
2HV-19055	Thermal Barrier Isolation Valve	143	2364	Close
1HV-19057	Thermal Barrier Isolation Valve	143	2364	Close
2HV-19057	Thermal Barrier Isolation Valve	143	2364	Close

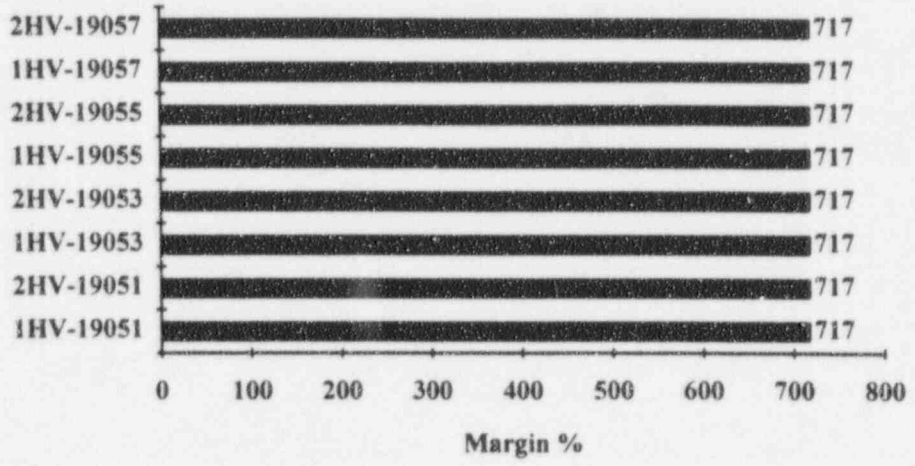
Differential Pressure Test Status

These valves have a differential pressure test priority of 2 in the opening direction and 5 in the closing direction. Based on the priority 5 ranking the valves require differential pressure testing in the VEGP program. However, the valves were not differential pressure tested because the design-basis differential pressure is based on a thermal barrier tube rupture which can not be simulated for test purposes. The normal ACCW system pressure is less than 10% of the design-basis differential pressure for these valves, therefore, performing differential pressure tests on these valves would not have provided meaningful results.

Calculated Margins

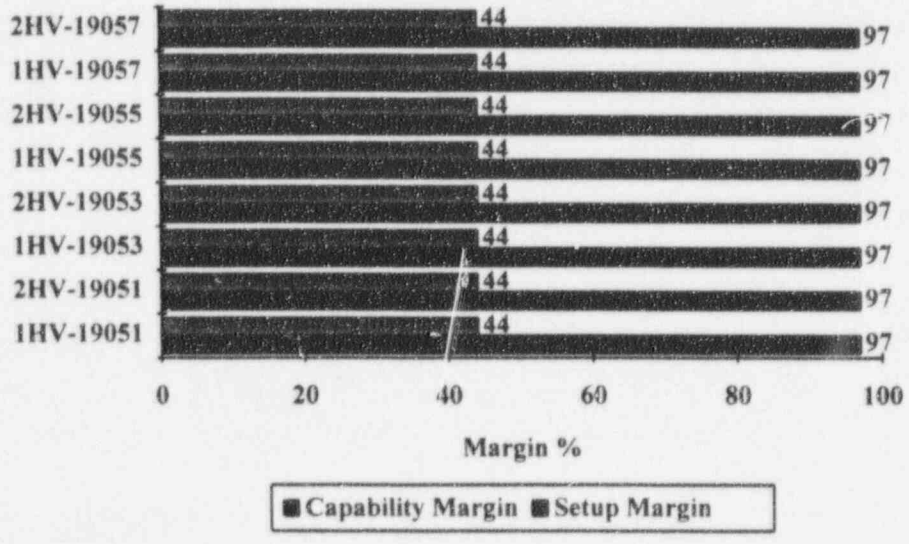
The opening margins were determined based on a design-basis differential pressure of 143 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

Figure 2-1
Opening Capability Margin



The closing margins were determined based on a design-basis differential pressure of 2364 psid which is associated with the safety function of isolating the ACCW system in the event of a thermal barrier tube rupture.

Figure2-2
Closing Capability & Setup Margins



Design-Basis Capability Justification

1. Valves 1/2HV-5106 are 4", 900 lb Anchor-Darling (Group AD-4) valves similar in design to the valves in group AD-1. These valves were differential pressure tested in-situ at VEGP on steam under blowdown conditions and performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology. The actual opening thrusts were 54% and 52% of the predicted values respectively and the actual closing thrusts were 51% and 64% of the predicted values respectively.

2. EPRI Valve Number 3 is a 6", 900 lb Anchor-Darling valve similar in design to the valves in group AD-1. This valve was tested in a flow loop with 500° F water under blowdown conditions and performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology.

3. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of 717% and a closing setup margin of 44%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

2.2 Anchor-Darling Group AD-2 Valves

Description

This group is composed of two, 3-0 inch, 1500 lb, Anchor-Darling gate valves. These valves are normally open and have a safety function to close to isolate the Auxiliary Component Cooling Water (ACCW) to the thermal barriers in the event of a thermal barrier tube rupture. The thrust requirements for these valves were calculated with the EPRI Performance Prediction Methodology utilizing the default friction coefficients.

Table 2-3
Anchor-Darling Group AD-2 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-2041	Thermal Barrier Isolation Valve	144	2235	Close
2HV-2041	Thermal Barrier Isolation Valve	144	2235	Close

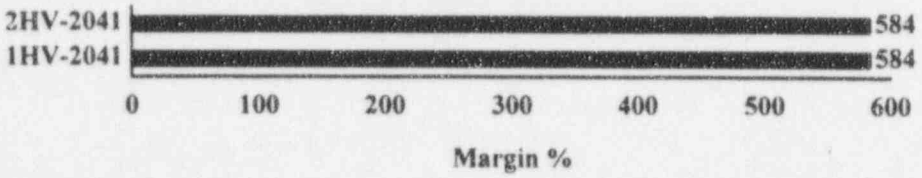
Differential Pressure Test Status

These valves have a differential pressure test priority of 2 in the opening direction and 6 in the closing direction. Based on the priority 6 ranking the valves require differential pressure testing in the VEGP program. However, the valves were not differential pressure tested because the design-basis differential pressure is based on a thermal barrier tube rupture which can not be simulated for test purposes. The normal ACCW system pressure is less than 10% of the design-basis differential pressure for these valves, therefore, performing differential pressure tests on these valves would not have provided meaningful results.

Calculated Margins

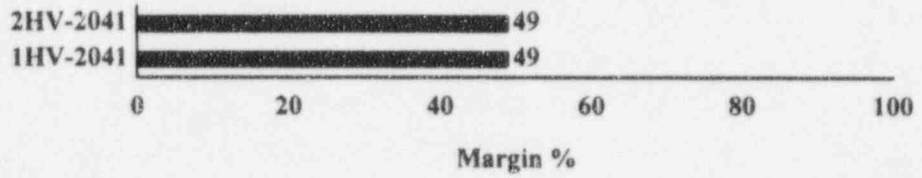
The opening margins were determined based on a design-basis differential pressure of 144 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

Figure 2-3
Opening Capability Margins



The closing margins were determined based on a design-basis differential pressure of 2235 psid which is associated with the safety function of isolating the ACCW system in the event of a thermal barrier tube rupture. These valves are controlled by a limit switch in the closing direction, therefore, the closing capability margin and setup margin are equivalent for these valves.

Figure 2-4
Closing Capability Margins



Design-Basis Capability Justification

1. Valves 1/2HV-5106 are 4", 900 lb Anchor-Darling (Group AD-4) valves similar in design to the valves in group AD-2. These valves were differential pressure tested in-situ at VEGP on steam under blowdown conditions and performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology. The actual opening thrusts were 54% and 52% of the predicted values respectively and the actual closing thrusts were 51% and 64% of the predicted values respectively.

2. EPRI Valve Number 3 is a 6", 900 lb Anchor-Darling valve similar in design to the valves in group AD-2. This valve was tested in a flow loop with 500° F water under blowdown conditions and performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology.

3. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of 584% and a closing margin of 49%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

2.3 Anchor-Darling Group AD-3 Valves

Description

This group is composed of four, 4-0 inch, 150 lb, Anchor-Darling gate valves. These valves are normally closed and have a safety function to open to supply service air to containment for post LOCA purge. The thrust requirements for these valves were calculated with the Industry Standard Equation utilizing a 0.5 valve factor.

Table 2-4
Anchor-Darling Group AD-3 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-9380A	Cnmt. Atmosphere Service Air	132	0	Open
2HV-9380A	Cnmt. Atmosphere Service Air	132	0	Open
1HV-9380B	Cnmt. Atmosphere Service Air	132	0	Open
2HV-9380B	Cnmt. Atmosphere Service Air	132	0	Open

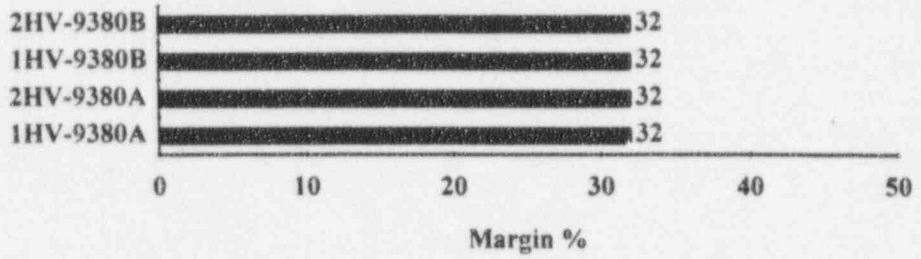
Differential Pressure Test Status

These valves have a differential pressure test priority of 4 in the opening direction and 4 in the closing direction. The VEGP program only requires that Anchor-Darling valves with differential pressure test priorities of 5 or higher be differential pressure tested, therefore, these valves were not tested.

Calculated Margins

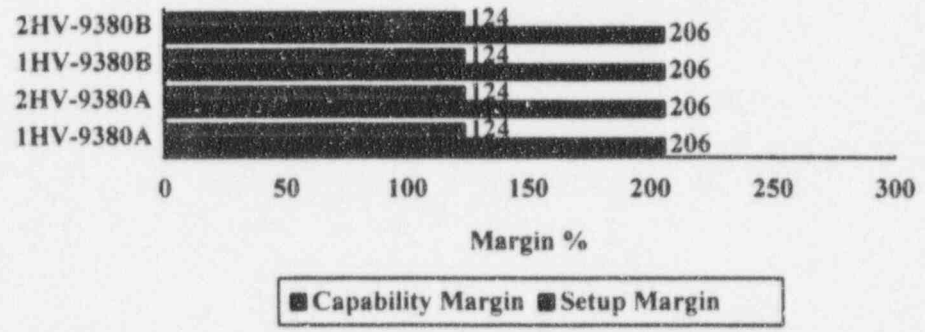
The opening margins were determined based a design-basis differential pressure of 132 psid which is associated with the valves safety function of opening to provide service air for post LOCA purge.

Figure 2-5
Opening Capability Margins



The closing margins were determined based on a design-basis differential pressure of 0 psid which is associated with closing the valves under normal conditions with two normally closed containment isolation valves located upstream of these valves. These valves do not have an active safety function to close.

Figure 2-6
Closing Capability & Setup Margins



Design-Basis Capability Justification

1. These valves are located in a service air system and operate against relatively low differential pressures. The industry standard equation utilizing a 0.5 valve factor will conservatively predict thrust requirements for valves operating in relatively mild applications.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of 32% and a closing setup margin of 124%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

2.4 Anchor-Darling Group AD-4 Valves

This group is composed of six, 4-0 inch, 900 lb, Anchor-Darling gate valves. Valves 1/2HV-3009 and 1/2HV-3019 are normally open and have a safety function to close to isolate a downstream line break in the steam supply piping to the auxiliary feedwater (AFW) pump turbine. Valves 1/2HV-5106 are normally closed and have a safety function to open to admit steam to the AFW pump turbine. The thrust requirements for these valves were calculated with the EPRI Performance Prediction Program utilizing the default friction coefficients.

Table 2-5
Anchor-Darling Group AD-4 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-3009	Steam to AFW Pump Turbine	1185	1185	Open/Close
2HV-3009	Steam to AFW Pump Turbine	1185	1185	Open/Close
1HV-3019	Steam to AFW Pump Turbine	1185	1185	Open/Close
2HV-3019	Steam to AFW Pump Turbine	1185	1185	Open/Close
1HV-5106	Steam to AFW Pump Turbine	1185	0	Open
2HV-5106	Steam to AFW Pump Turbine	1185	0	Open

Differential Pressure Test Status

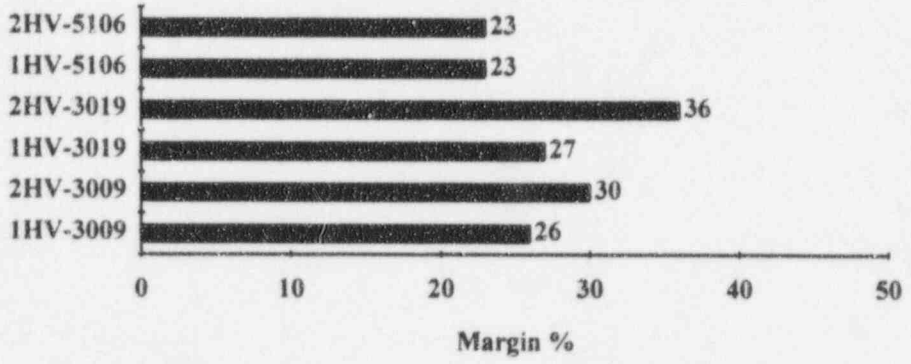
These valves have a differential pressure test priority of 5 in the opening direction and 6 in the closing direction. Based on the priority 5 and 6 rankings these valves require testing in the VEGP program. Valves 1HV-3009 and 1/2HV-5106 have been differential pressure tested. In performing the differential pressure test on valve 1HV-3009 it was determined that this valve could not be tested at a significant differential pressure. There is a large volume of piping between valve 1HV-3009 and the AFW pump turbine, and due to the piping downstream of the valve, in combination with the flow restriction provided by the AFW turbine governor valve, the steam pressure downstream of valve 1HV-3009 decays very slowly after flow isolation. Due to the magnitude of the downstream pressure transient following flow isolation, the actual differential pressure at flow isolation is relatively low and difficult to determine with any degree of certainty. Valves 1HV-3019 and 1/2HV-3019 are utilized in identical applications to valve 1HV-3009, therefore, these valves were not differential pressure tested due to the low differential pressure attainable under the test conditions.

Calculated Margins

The opening margins for valves 1/2HV-3009 and 1/2HV-3019 were determined based on a design-basis differential pressure of 1185 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

The opening margins for valves 1/2HV-5106 were determined based on a design-basis differential pressure of 1185 psid which is associated with the safety function of opening to provide steam to the AFW pump turbine.

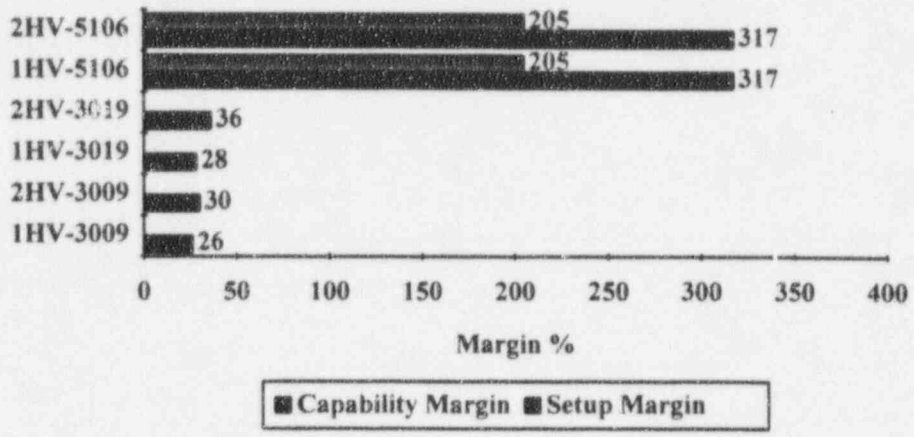
Figure 2-7
Opening Capability Margin



The closing margins for valves 1/2HV-3009 and 1/2HV-3019 were determined based a design-basis differential pressure of 1185 psid which is associated the safety function of closing to isolate a downstream break in the steam supply piping to the AFW pump turbine. These valves are controlled by a limit switch in the closing direction, therefore, the closing capability margin and setup margin are equivalent for these valves.

The closing margins for valves 1/2HV-5106 were determined based on a design-basis differential pressure of 0 psid which is associated with closing the valve under normal conditions with the AFW pump turbine trip-throttle valve closed. These valves do not have an active safety function to close.

Figure 2-8
Closing Capability & Setup Margins



Design-Basis Capability Justification

1. Valves 1/2HV-5106 were differential pressure tested in-situ at VEGP on steam under blowdown conditions and performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology. The actual opening thrusts were 54% and 52% of the predicted values respectively and the actual closing thrusts were 51% and 64% of the predicted values respectively.

2. EPRI Valve Number 3 is a 6", 900 lb Anchor-Darling valve similar in design to the valves in group AD-4. This valve was tested in a flow loop with 500° F water under blowdown conditions and performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology.

3. Based on conservative calculations of valve thrust requirements and operator capabilities valves 1/2HV-3009 and 1/2HV-3019 have an opening margin of at least 26% and closing margin of at least 26%. Valves 1/2HV-5106 have an opening margin of 23 % and a closing setup margin of 205%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.0 WESTINGHOUSE GATE VALVES

There are a total of 108 Westinghouse gate valves included in the VEGP GL 89-10 program. The valves are of the flex-wedge design and utilize stainless steel discs and valve bodies. The disc guide slot and the disc face and body seats are hardfaced with Stellite. These valves have been divided into 14 groups of identical valves as outlined in Table 3-1. Groups W-2A and W-2B appear to be identical based on the criteria identified in the table, however, there are internal differences in the valves construction, therefore, the valves were placed in separate groups.

Table 3-1
Valve Groups

Group No.	Manufacturer	Valve Type	Valve Size	ANSI Rating	Total Valves
W-1	Westinghouse	Gate	3.0 Inch	150 lb	2
W-2A	Westinghouse	Gate	3.0 Inch	2035 lb	8
W-2B	Westinghouse	Gate	3.0 Inch	2035 lb	8
W-3	Westinghouse	Gate	4.0 Inch	150 lb	4
W-4	Westinghouse	Gate	4.0 Inch	900 lb	4
W-5	Westinghouse	Gate	4.0 Inch	1525 lb	16
W-6	Westinghouse	Gate	6.0 Inch	150 lb	14
W-7	Westinghouse	Gate	8.0 Inch	150 lb	6
W-8	Westinghouse	Gate	8.0 Inch	316 lb	12
W-9	Westinghouse	Gate	8.0 Inch	1525 lb	4
W-10	Westinghouse	Gate	10.0 Inch	150 lb	12
W-11	Westinghouse	Gate	12.0 Inch	316 lb	4
W-12	Westinghouse	Gate	12.0 Inch	1525 lb	10
W-13	Westinghouse	Gate	14.0 Inch	316 lb	4

The thrust requirements for these valves were calculated with the EPRI NMAC equation utilizing a 0.55 friction coefficient for valves in steam service and a 0.60 friction coefficient for valves in water service. The EPRI Performance Prediction Program (PPP) methodology was not available when these calculations were performed. The EPRI NMAC methodology is discussed in more detail in Section 3.3.1.2 of the Program Summary Report.

The Westinghouse valves are equipped with valve stems utilizing standard ACME threads and a stem friction coefficient of 0.15 was utilized in calculating the stem factors for these valves. The basis for utilizing a 0.15 stem friction coefficient for these valves is outlined in Section 9.6 of the Program Summary Report.

The opening and closing capability margins were calculated for each of the valves in these groups. In addition, for valves which are controlled in the closing direction by a torque switch, the closing setup margin is also included. The setup margin takes into account test equipment accuracy, torque switch repeatability and Load Sensitive Behavior and for the purposes of this document values of 10%, 5% and 20% respectively were utilized to account for these uncertainties. In practice, the values utilized for test equipment accuracy and torque switch repeatability would be determined based on each specific valve setup. Section 4.0 of the Program Summary Report discusses the various margins in detail and outlines the basis for determining the adjustments necessary to account for test equipment accuracy, torque switch repeatability and Load Sensitive Behavior.

In reviewing the various margins contained in this document it should be noted that the margins are based on the MOV's as-modified configuration. A total of 28 Westinghouse valves are scheduled to be modified in the 1996 refueling outages and the margins outlined in this document reflect those modifications. Section 6.2 of the Program Summary Report identifies the valves to be modified as well as the various modifications.

3.1 Westinghouse Group W-1 Valves

Description

This group is composed of two, 3 inch, 150 lb, Westinghouse gate valves. These valves are normally closed and have a safety function to open on a containment high pressure signal to provide sodium hydroxide to the containment spray system. The valves have a safety function to close following depletion of the sodium hydroxide. The thrust requirements for these valves were calculated with the EPRI NMAC equation utilizing a 0.6 coefficient of friction. It should be noted that the Unit 2 valves have been abandoned in place and the Unit 1 valves will abandoned in place following the 1996 refueling outage.

Table 3-1
Westinghouse Group W-1 Valves

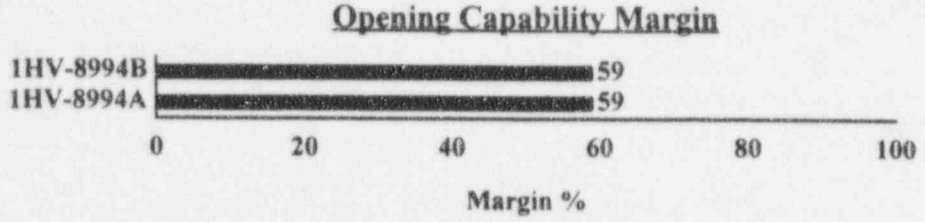
Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8994A	Spray Additive Tank Outlet	17	17	Open/Close
1HV-8994B	Spray Additive Tank Outlet	17	17	Open/Close

Differential Pressure Test Status

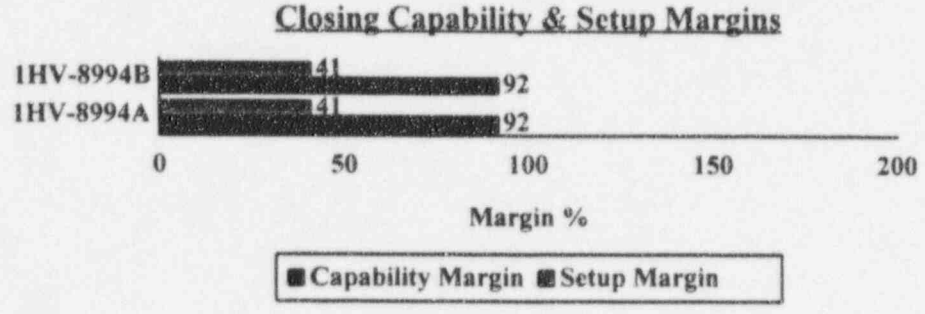
These valves have a differential pressure test priority of 4 in the opening direction and 3 in the closing direction. Based on the priority 4 ranking the valves require differential pressure testing in the VEGP program. However, the valves were not differential pressure tested because stroking the valves under a differential pressure would have allowed sodium hydroxide to enter the containment spray system. The discharge of the containment spray system is aligned to the RWST during surveillance testing and this contaminated water would have ultimately been pumped to the RWST.

Calculated Margins

The opening margins were determined based on a design-basis differential pressure of 17 psid which is associated with the safety function of opening to admit sodium hydroxide to the containment spray system.



The closing margins for these valves were calculated based on a design-basis differential pressure of 17 psid which is associated with the safety function of closing following depletion of the sodium hydroxide tank.



Design-Basis Capability Justification

1. The design-basis differential pressure of 17 psid which these valves are required to operate against is extremely low and results in loads which are comparable to those encountered in a static test. In addition, these valves will be abandoned in place following the Unit 1 refueling outage in 1996.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of 59% and a closing setup margin of 41%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.2 Westinghouse Group W-2A Valves

Description

This group is composed of eight, 3 in, 2035 lb, Westinghouse gate valves. Valves 1/2LV-0610 and 1/2LV-0611 are normally open to provide RHR pump miniflow. The valves have a safety function to close when RHR flow increases above a setpoint and to re-open when RHR flow decreases below a setpoint. Valves 1/2HV-8146 and 1/2HV-8147 are the normal and alternate charging path to the RCS. The function of these valves is alternated over the life of the plant with the normal charging valve open and the alternate charging valve closed. These valves are aligned during cold shutdown. In addition, the valves have a safety function to open to provide an emergency boration flowpath. The thrust requirements for these valves were calculated with the EPRI NMAC equation utilizing a 0.6 coefficient of friction.

Table 3-2
Westinghouse Group W-2A Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1FV-0610	RHR Pump Miniflow Isolation	202	202	Open/Close
2FV-0610	RHR Pump Miniflow Isolation	202	202	Open/Close
1FV-0611	RHR Pump Miniflow Isolation	202	202	Open/Close
2FV-0611	RHR Pump Miniflow Isolation	202	202	Open/Close
1HV-8146	Normal Charging to RCS	490	0	Open
2HV-8146	Normal Charging to RCS	490	0	Open
1HV-8147	Alternate Charging to RCS	490	0	Open
2HV-8147	Alternate Charging to RCS	490	0	Open

Differential Pressure Test Status

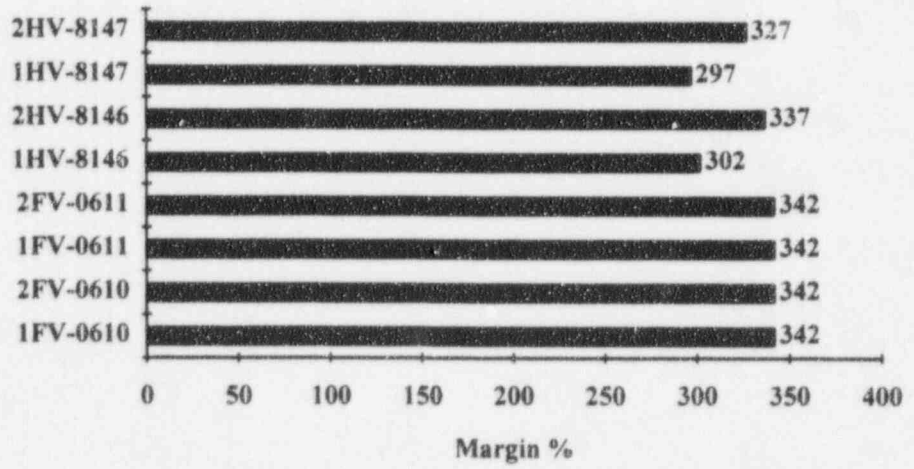
All of the valves in this group have a differential pressure test priority of 4 in either the open or close direction. Based on the priority 4 ranking these valves require testing in the VEGP program and differential pressure tests on these valves have been completed.

Calculated Margins

The opening margins for valves 1/2FV-0610 and 1/2FV-0611 were determined based on a design-basis differential pressure of 202 psid which is associated with the safety function of opening to provide RHR pump miniflow.

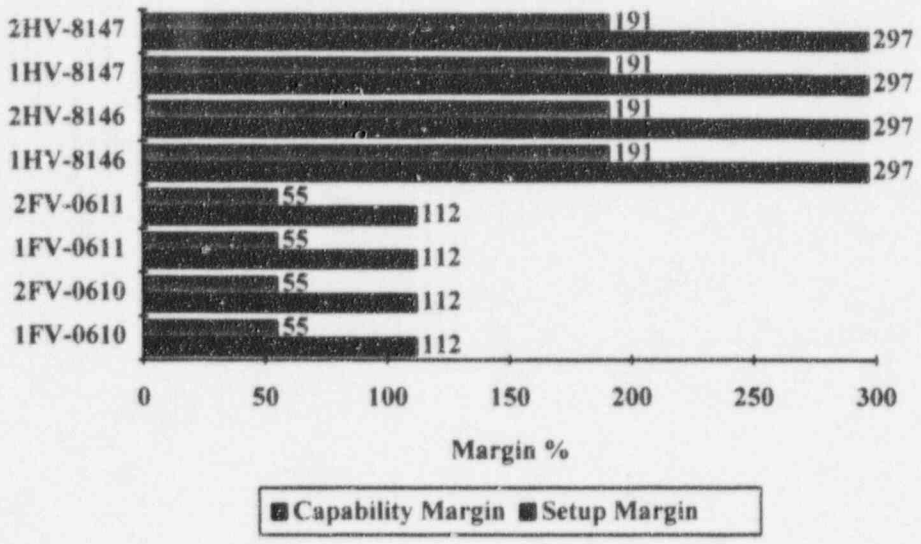
The opening margins for valves 1/2HV-8146 and 1/2HV-8147 were determined based on a design-basis differential pressure of 490 psid which is associated with recovering from mispositioning. These valves have a safety function to open to provide an emergency boration flow path with a differential pressure of 96 psid.

Opening Capability Margin



The closing margins for valves 1/2FV-0610 and 1/2FV-0611 were determined based on a design-basis differential pressure of 202 psid which is associated with the safety function of closing to isolate RHR miniflow on increasing RHR pump flow.

The closing margins for valves 1/2HV-8146 and 1/2HV-8147 were determined based on a design-basis differential pressure of 0 psid which is associated with aligning the valves during cold shutdown. These valves do not have an active safety function to close.



Design-Basis Capability Justification

1. All of the valves in this group were differential pressure tested in-situ at VEGP and operated successfully. The apparent friction coefficients for these tests ranged from 0.81 to 1.49 in the opening direction and from 0.50 to 0.72 in the closing direction. The apparent friction coefficients are in many cases higher than the design value of 0.6, however, the test result are not considered to be credible due to the low dynamic loads associated with these tests. Section 9.2.1 of the Program Summary Report contains a detailed discussion of the differential pressure test results for this group of valves.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 297% and a closing setup margin of at least 55%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.3 Westinghouse Group W-2B Valves

Description

This group is composed of eight, 3 inch, 2035 lb, Westinghouse gate valves. Valves 1/2HV-8000A/B are normally open and have a safety function to close to isolate a leaking or stuck open Pressure Operated Relief Valve (PORV). In the event that the valves are closed to isolate a leaking PORV, the valves are required to open to mitigate a steam generator tube rupture. Valves 1/2HV-8105 and 1/2HV-8106 are normally open to provide charging flow to the regenerative heat exchanger and have a safety function to close on an SI signal to isolate normal charging to the RCS. The thrust requirements for valves 1/2HV-8000A/B were calculated with the EPRI NMAC equation utilizing a 0.55 coefficient of friction. The thrust requirements for valves 1/2HV-8105 and 1/2HV-8106 were calculated with the EPRI NMAC equation utilizing a 0.6 coefficient of friction.

Table 3-3
Westinghouse Group W-2B Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8000A	PORV Block Valve	2485	2485	Open/Close
2HV-8000A	PORV Block Valve	2485	2485	Open/Close
1HV-8000B	PORV Block Valve	2485	2485	Open/Close
2HV-8000B	PORV Block Valve	2485	2485	Open/Close
1HV-8105	Charging Pump to RCS Isolation	460	2681	Close
2HV-8105	Charging Pump to RCS Isolation	460	2681	Close
1HV-8106	Charging Pump to RCS Isolation	460	2681	Close
2HV-8106	Charging Pump to RCS Isolation	460	2681	Close

Differential Pressure Test Status

Valves 1/2HV-8000A/B have a differential pressure test priority of 5 in the opening direction and 6 in the closing direction. Valves 1/2HV-8105 and 1/2HV-8106 have a differential pressure test priority of 3 in the opening direction and 6 in the closing direction. Based on the 6 priority rankings these valves require testing in the VEGP program. Valves 1/2HV-8105 and 1/2HV-8106 have been tested. However, valves 1/2HV-8000A/B were not tested because performing a differential pressure test on these valves would have required opening the PORV's at rated temperature and pressure which would have essentially simulated a LOCA. This action would have placed the plant in a potentially

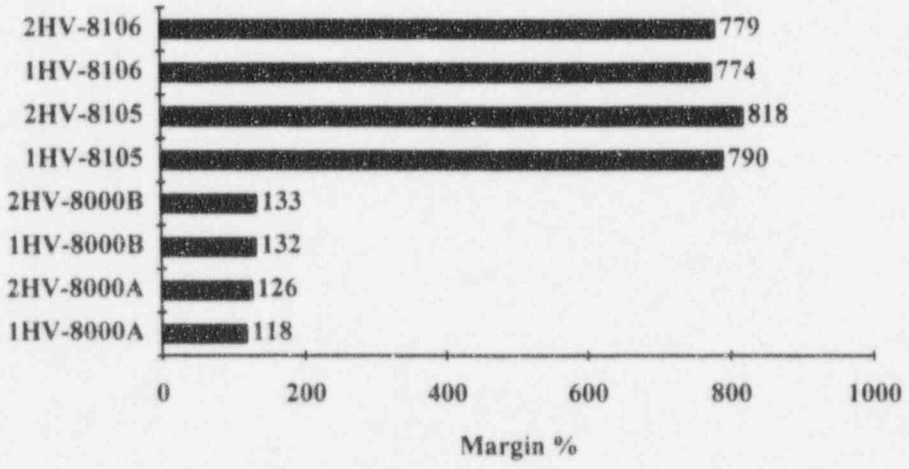
unsafe condition, therefore, these valves were determined not to be testable under differential pressure conditions.

Calculated Margins

The opening margins for valves 1/2HV-8000A/B were determined based on a design-basis differential pressure of 2485 psid which is associated with opening to mitigate a steam generator tube rupture.

The opening margins for valves 1/2HV-8105 and 1/2HV-8106 were determined based on a design-basis differential pressure of 460 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

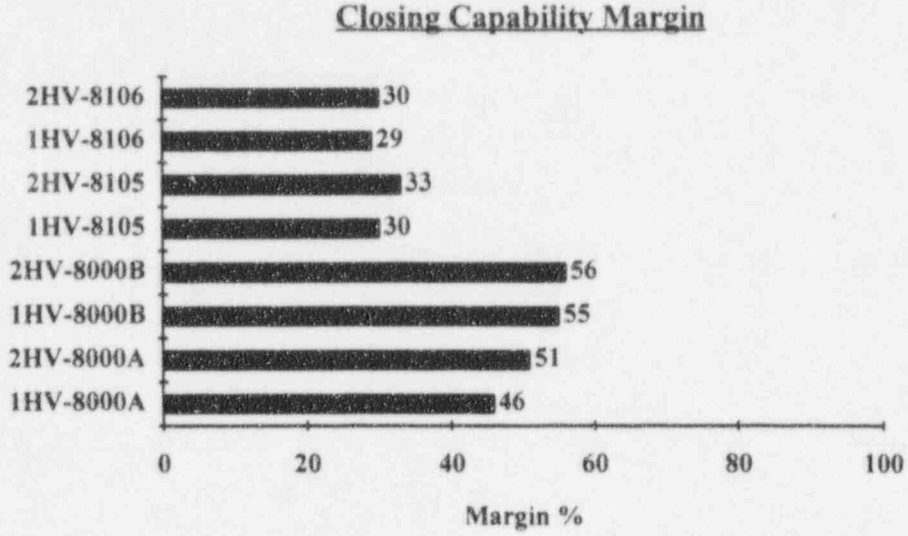
Opening Capability Margin



The closing margins for valves 1/2HV-8000A/B were determined based on a design-basis differential pressure of 2485 psid which is associated with the safety function of closing to isolate a leaking or stuck open PORV.

The closing margins for valves 1/2HV-8105 and 1/2HV-8106 were determined based on a design-basis differential pressure of 2681 psid which is associated with the safety function of closing on an SI signal to isolate normal charging to the RCS.

All of the valves in this group are controlled by a limit switch in the closing direction, therefore, the closing capability margin and setup margin are equivalent for these valves.



Design-Basis Capability Justification

1. Valves 1/2HV-8105 and 1/2HV-8106 were differential pressure tested in-situ at VEGP and operated successfully. The apparent friction coefficients for these tests ranged from 0.32 to 0.66 in the opening direction and from 0.16 to 0.50 in the closing direction. The apparent opening friction coefficient for valve 1HV-8106 exceeded the design value of 0.6, however, the difference is within the overall accuracy of the test process. In addition, the opening test was performed at a differential pressure of 2441 psid and the design-basis differential pressure for this valve is 460 psid which is based on mispositioning. The valve does not have an active safety function to open.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 118% and a closing margin of at least 29%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.4 Westinghouse Group W-3 Valves

Description

This group is composed of four, 4 inch, 150 lb, Westinghouse gate valves. These valves are normally open to provide Volume Control Tank (VCT) suction to the Caps and have a safety function to close on an SI signal to isolate VCT suction to the Caps. The thrust requirements for these valves were calculated with the EPRI NMAC equation utilizing a 0.6 coefficient of friction.

Table 3-4
Westinghouse Group W-3 Valves

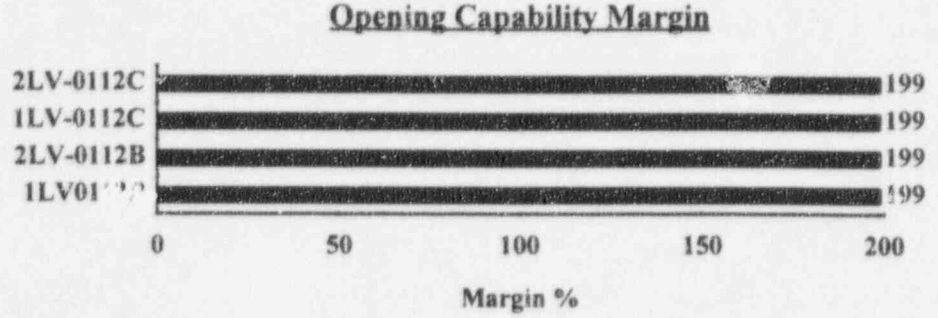
Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1LV-0112B	VCT Outlet Isolation	78	42	Close
2LV-0112B	VCT Outlet Isolation	78	42	Close
1LV-0112C	VCT Outlet Isolation	78	42	Close
2LV-0112C	VCT Outlet Isolation	78	42	Close

Differential Pressure Test Status

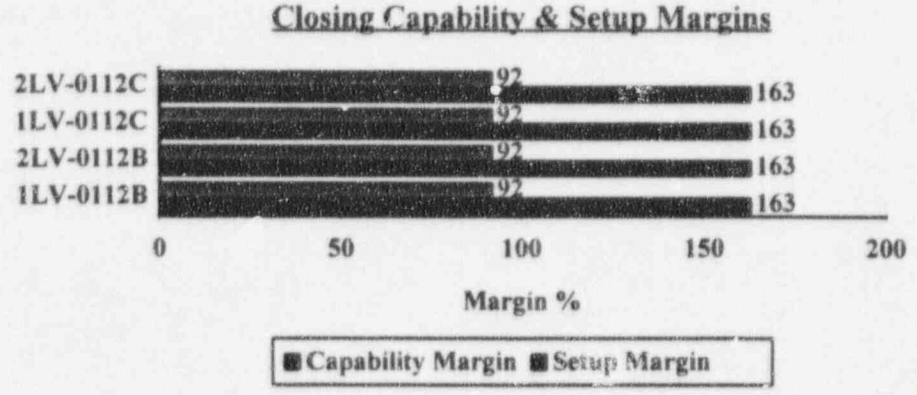
These valves have a differential pressure test priority of 2 in the opening direction and 3 in the closing direction. The VEGP program only requires that Westinghouse valves with a differential pressure test priority of 4 or higher be differential pressure tested, therefore, these valves were not tested. In addition, these valves are located in the suction piping to the charging pumps and testing the valves under flow conditions could have damaged the pumps due to low suction head.

Calculated Margins

The opening margins were determined based on a design-basis differential pressure of 78 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.



The closing margins were determined based on a design-basis differential pressure of 42 psid which is associated with the safety function of closing on an SI signal to isolate VCT suction to the CCPs.



Design-Basis Capability Justification

1. The design-basis differential pressures of 78 psid in the opening direction and 42 psid in the closing direction are extremely low and result in loads which are comparable to those encountered in a static test.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of 199% and a closing setup margin of 92%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.5 Westinghouse Group W-4 Valves

Description

This group is composed of four, 4 inch, 900 lb, Westinghouse gate valves. These valves are normally open to provide to provide an SI flow path to the RCS during injection and cold-leg recirculation. The valves have a safety function to close to isolate flow to the cold-legs when transferring to hot-leg recirculation. The thrust requirements for these valves were calculated with the EPRI NMAC equation utilizing a 0.6 coefficient of friction.

Table 3-5
Westinghouse Group W-4 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8821A	SI Pump to RCS Cold Leg Isol.	1750	1750	Open/Close
1HV-8821A	SI Pump to RCS Cold Leg Isol.	1750	1750	Open/Close
1HV-8821A	SI Pump to RCS Cold Leg Isol.	1750	1750	Open/Close
1HV-8821A	SI Pump to RCS Cold Leg Isol.	1750	1750	Open/Close

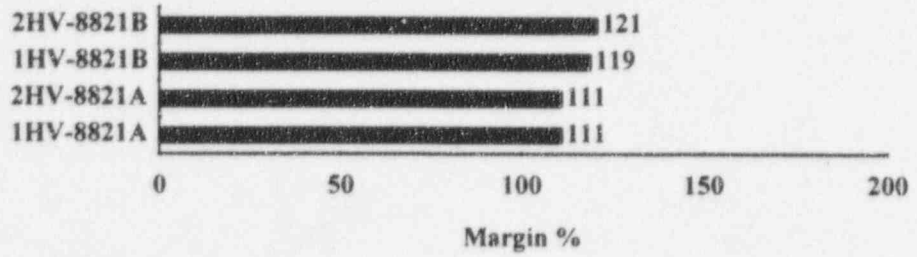
Differential Pressure Test Status

These valves have a differential pressure test priority of 5 in the opening direction and 6 in the closing direction. Based on the priority 6 ranking these valves require testing in the VEGP program and differential pressure tests on these valves have been completed.

Calculated Margin

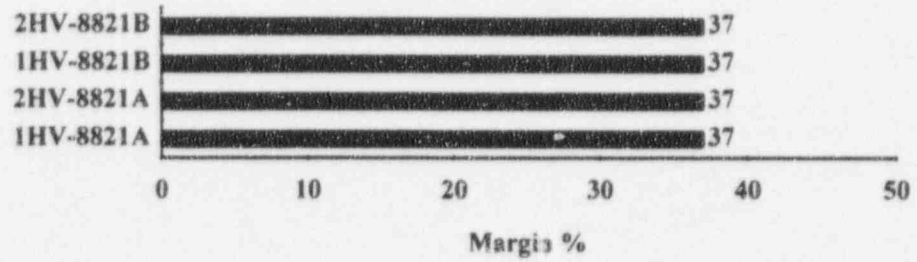
The opening margins were determined based on a design-basis differential pressure of 1750 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

Opening Capability Margin



The closing margins were determined based on a design-basis differential pressure of 1750 psid which is associated with closing to isolate a passive failure leak 50 gpm or less during recirculation. These valves are controlled by a limit switch in the closing direction, therefore, the closing capability margin and setup margin are equivalent for these valves.

Closing Capability Margins



Design-Basis Capability Justification

1. All of the valves in this group were differential pressure tested in-situ at VEGP and operated successfully. The apparent friction coefficients for these tests ranged from 0.12 to 0.26 in the opening direction and from 0.10 to 0.32 in the closing direction. The apparent friction coefficients for all of the tests are bounded by the design value of 0.6.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 111% and a closing margin of 37%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.6 Westinghouse Group W-5 Valves

Description

This group is composed of sixteen, 4 inch, 1525 lb, Westinghouse gate valves. These valves are utilized in a variety of applications in the Safety Injection(SI) system and the Chemical and Volume Control System (CVCS). The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 coefficient of friction.

Table 3-6
Westinghouse Group W-5 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8438	CCP Crosstie Isolation	0	227	Open/Close
2HV-8438	CCP Crosstie Isolation	0	227	Open/Close
1HV-8485A	CCP Discharge Isolation	227	0	Open/Close
2HV-8485A	CCP Discharge Isolation	227	0	Open/Close
1HV-8485B	CCP Discharge Isolation	227	0	Open/Close
2HV-8485B	CCP Discharge Isolation	227	0	Open/Close
1HV-8801A	BIT Discharge Isolation	2674	483	Open/Close
2HV-8801A	BIT Discharge Isolation	2674	483	Open/Close
1HV-8801B	BIT Discharge Isolation	2674	483	Open/Close
2HV-8801B	BIT Discharge Isolation	2674	483	Open/Close
1HV-8802A	SIP to RCS Hot Leg Isolation	1735	0	Open/Close
2HV-8802A	SIP to RCS Hot Leg Isolation	1735	0	Open/Close
1HV-8802B	SIP to RCS Hot Leg Isolation	1735	0	Open/Close
2HV-8802B	SIP to RCS Hot Leg Isolation	1735	0	Open/Close
1HV-8835	SIP to RCS Cold Leg Isolation	1728	0	Open/Close
2HV-8835	SIP to RCS Cold Leg Isolation	1728	0	Open/Close

Valves 1/2HV-8438 are normally open to crosstie the discharge of CCPs A and B. The valves have a safety function to close to isolate a passive failure leak of less than 50 gpm during recirculation.

Valves 1/2HV-8485A/B are normally open to provide a CCP discharge flow path. The valves have a safety function to close in establishing safety grade cold shutdown and to isolate a passive failure leak of less than 50 gpm during recirculation.

Valves 1/2HV-8801A/B are normally closed and have a safety function to open on an SI signal to provide a flow path from the CCPs to the RCS cold legs. The valves also have a safety function to open to provide an emergency boration flow path if the normal charging path is not available.

Valves 1/2HV-8802A/B are normally closed and have a safety function to open to provide a SI flow path to the hot legs when transferring to hot-leg recirculation.

Valves 1/2HV-8835 are normally open to provide an SI flow path to the RCS cold-legs. The valves have a safety function to close when transferring to hot-leg recirculation.

Differential Pressure Test Status

All of the valves in this group with the exception of 1/2HV-8438 and 1/2HV-8485A/B have a differential pressure test priority of 6. All of the valves with differential pressure test priorities of 6 have been tested.

Calculated Margin

The opening margin for valves 1/2HV-8438 were determined based on a design-basis differential pressure of 0 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

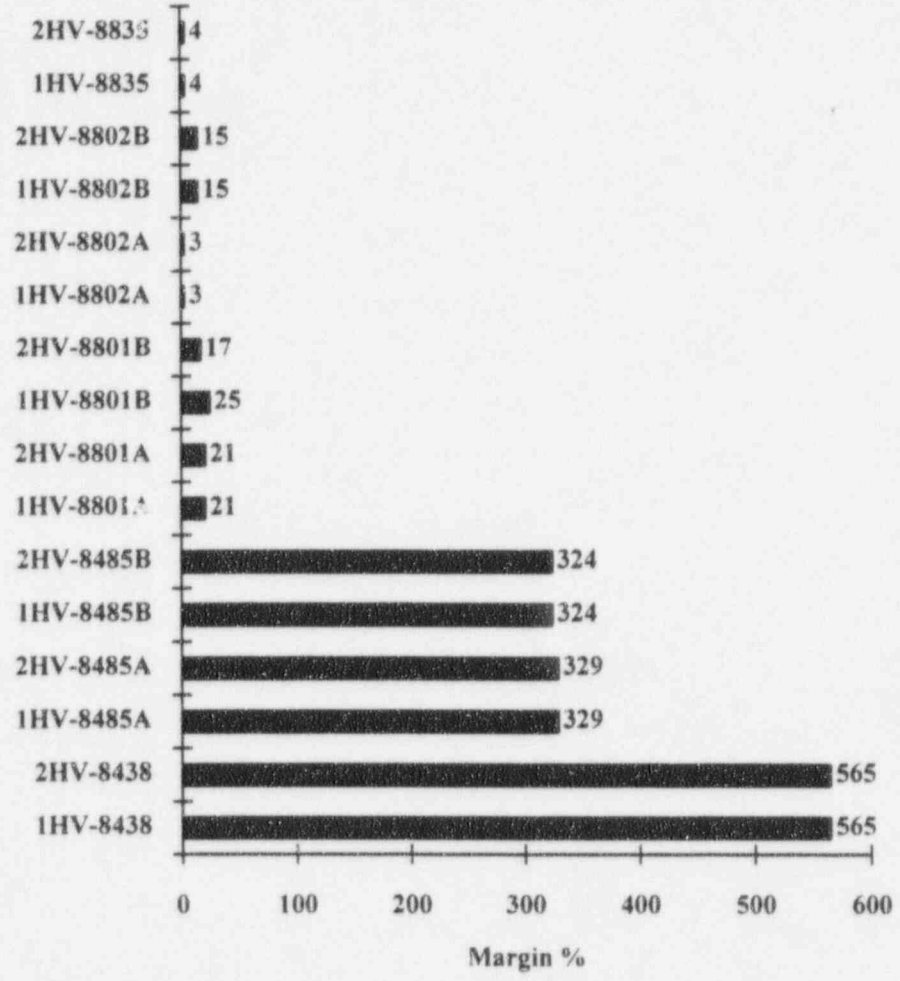
The opening margin for valves 1/2HV-8485A/B were determined based on a design-basis differential pressure of 227 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

The opening margins for valves 1/2HV-8801A/B were determined based on a design-basis differential pressure of 2674 psid which is associated with opening on an SI signal to provide a flow path from the CCPs to the RCS cold-legs.

The opening margins for valves 1/2HV-8802A/B were determined based on a design-basis differential pressure of 1735 psid which is associated with recovering from mispositioning. The valves have a safety function to open when transferring to hot-leg recirculation with a differential pressure of 189 psid.

The opening margins for valves 1/2HV-8835 were determined based on a design-basis differential pressure of 1728 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

Opening Capability Margin



The closing margins for valves 1/2HV-8438 were determined based on a design-basis differential pressure of 227 psid which is associated with isolating a passive failure leak of 50 gpm or less during recirculation.

The closing margins for valves 1/2HV-8485A/B were determined based on a design-basis differential pressure of 0 psid which is associated with closing to establish safety grade cold shutdown. Valve 2HV-8485B is controlled by a limit switch in the closing direction, therefore, the closing capability margin and setup margin are equivalent for this valve.

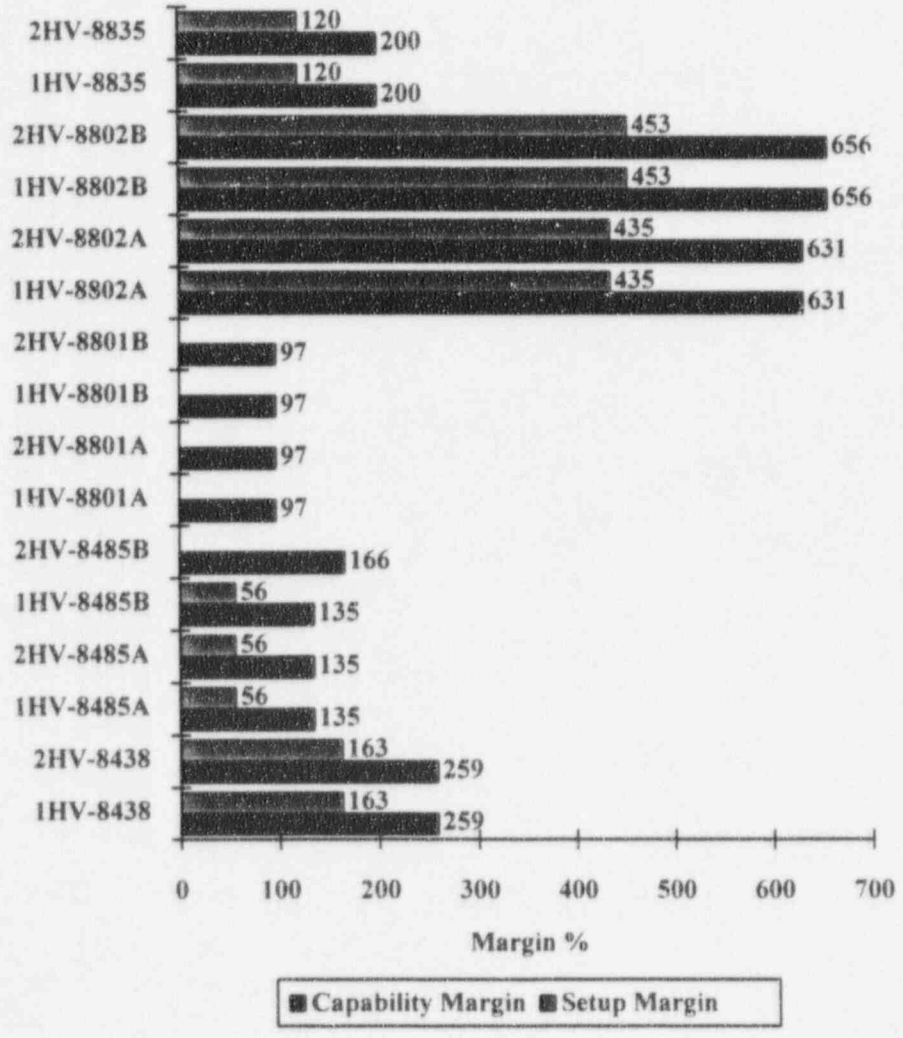
The closing margins for valves 1/2HV-8801A/B were determined based on a design-basis differential pressure of 483 psid which is associated with recovering from mispositioning. The valves are required to close to isolate a passive failure leak of 50 gpm or less during recirculation with a differential pressure of 270 psid.

These valves are controlled by a limit switch in the closing direction, therefore, the closing capability margin and setup margin are equivalent for these valves.

The closing margins for valves 1/2HV-8802A/B were determined based on a design-basis differential pressure of 0 psid which is associated with aligning the valves to their normal position during start-up. These valves do not have an active safety function to close.

The closing margins for valves 1/2HV-8835 were determined based on a design-basis differential pressure of 0 psid which is associated with closing to align the SI system for hot-leg recirculation.

Closing Capability & Setup Margins



Design-Basis Capability Justification

1. Valves 1/2HV-8801A/B were differential pressure tested in-situ at VEGP at conditions approaching design-basis and operated successfully. The apparent friction coefficients for these tests ranged from 0.25 to 0.47 in the opening direction and from 0.15 to 0.54 in the closing direction. The apparent friction coefficients for all of the tests are bounded by the design value of 0.6.

2. Valves 1/2HV-8802A/B and 1/2HV-8835 were differential pressure tested in-situ at VEGP at conditions approaching design-basis and operated successfully in the opening direction. The apparent friction coefficients in the opening direction ranged from 0.25 to 0.51. The apparent friction coefficients for all of the tests are bounded by the design value of 0.6. In addition, the opening margins for these valves, which in some cases are as low as 3%, were calculated based on differential pressures associated with mispositioning. The safety function opening differential pressure for the 1/2HV-8802A/B valves is 189 psid as opposed to the mispositioning differential pressure of 1735 psid and the safety function differential pressure for the 1/2HV-8835 valves is 0 psid as opposed to a mispositioning differential pressure of 1728 psid. Utilizing the safety function differential pressures results in calculated opening margins of at least 294% for these valves. The design-basis differential pressure for these valves in the closing direction is 0 psid, however, these valves were tested in the closing direction a differential pressures of at least 1392 psid to obtain generic test data on Westinghouse valves. Due to the higher than design test differential pressures, the torque switches on some of the valves operated prior to the valve reaching flow cutoff. This is not a concern for these valves, since the test differential pressure was much higher than the design-basis differential pressure, and the data for these valves was not evaluated further. Section 9.2.4 of the Program Summary Report contains a detailed discussion of the differential pressure test results for this group of valves.

3. Based on conservative calculations of valve thrust requirements and operator capabilities valves 1/2HV-8485A/B and 1/2HV-8438 have an opening margin of at least 324% and a closing margin of at least 56%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.7 Westinghouse Group W-6 Valves

Description

This group is composed of fourteen, 6 inch, 150 lb, Westinghouse gate valves. These valves are utilized in a variety of applications in the Safety Injection (SI) system and Chemical and Volume Control System (CVCS). The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 coefficient of friction.

Table 3-7
Westinghouse Group W-6 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8471A	CCP Suction Isolation	220	220	Open/Close
2HV-8471A	CCP Suction Isolation	220	220	Open/Close
1HV-8471B	CCP Suction Isolation	220	220	Open/Close
2HV-8471B	CCP Suction Isolation	220	220	Open/Close
1HV-8807A	RHR to SIP Suction	0	220	Open/Close
2HV-8807A	RHR to SIP Suction	0	220	Open/Close
1HV-8807B	RHR to SIP Suction	0	220	Open/Close
2HV-8807B	RHR to SIP Suction	0	220	Open/Close
1HV-8923A	SIP Suction	220	220	Open/Close
2HV-8923A	SIP Suction	220	220	Open/Close
1HV-8923B	SIP Suction	220	220	Open/Close
2HV-8923B	SIP Suction	220	220	Open/Close
1HV-8924	RHR to SIP Suction Isolation	0	220	Open/Close
2HV-8924	RHR to SIP Suction Isolation	0	220	Open/Close

Valves 1/2HV-8471A/B are normally open to provide a suction flow path to the CCPs. The valves have a safety function to close to isolate a passive failure leak of 50 gpm or less during recirculation.

Valves 1/2HV-8807A/B are normally closed and have a safety function to open to provide an SI pump suction flow path from the RHR pumps when transferring to cold-leg recirculation. The valves have a safety function to close to isolate a passive failure leak of 50 gpm or less during recirculation.

Valves 1/2HV-8923A/B are normally open to provide a suction flowpath to the SI pumps. The valves have a safety function to close to isolate a passive failure leak of 50 gpm or less during recirculation.

Valves 1/2HV-8924 are normally open to provide a flow path between the RHR pump discharge and the SI pump suction. The valves have a safety function to close to isolate a passive failure leak of 50 gpm or less during recirculation.

Differential Pressure Test Status

All of the valves in this group have a differential pressure test priority of 4 and all of the valves with the exception of 1/2HV-8471A/B have been tested. Since these valves are all located in pump suction piping, to accomplish this testing the internals were removed from a check valve to establish a return flowpath to the RWST. However, in the case of valves 1/2HV-8471A/B this was not possible since these valves are located directly upstream of the CCP's and stroking these valves under flow conditions would have result in a loss of suction head and possible damage to the CCP's.

Calculated Margins

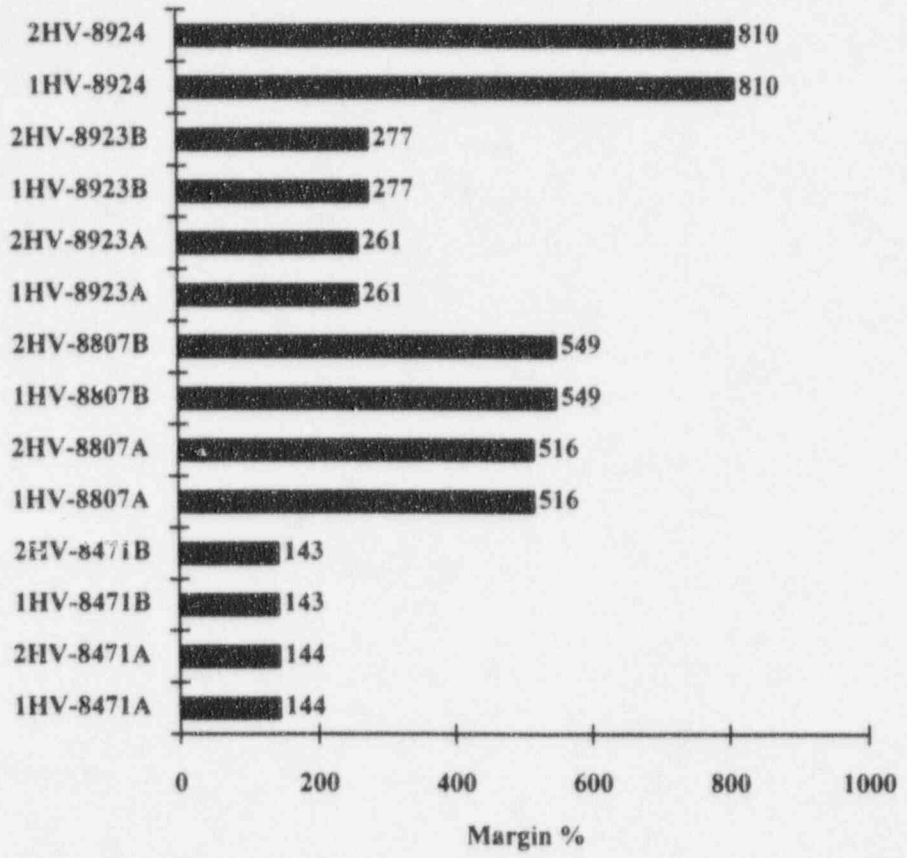
The opening margin for valves 1/2HV-8471A/B were determined based on a design-basis differential pressure of 220 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

The opening margin for valves 1/2HV-8807A/B were determined based on a design-basis differential pressure of 0 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

The opening margin for valves 1/2HV-8923A/B were determined based on a design-basis differential pressure of 220 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

The opening margin for valves 1/2HV-8924 were determined based on a design-basis differential pressure of 0 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

Opening Capability Margin

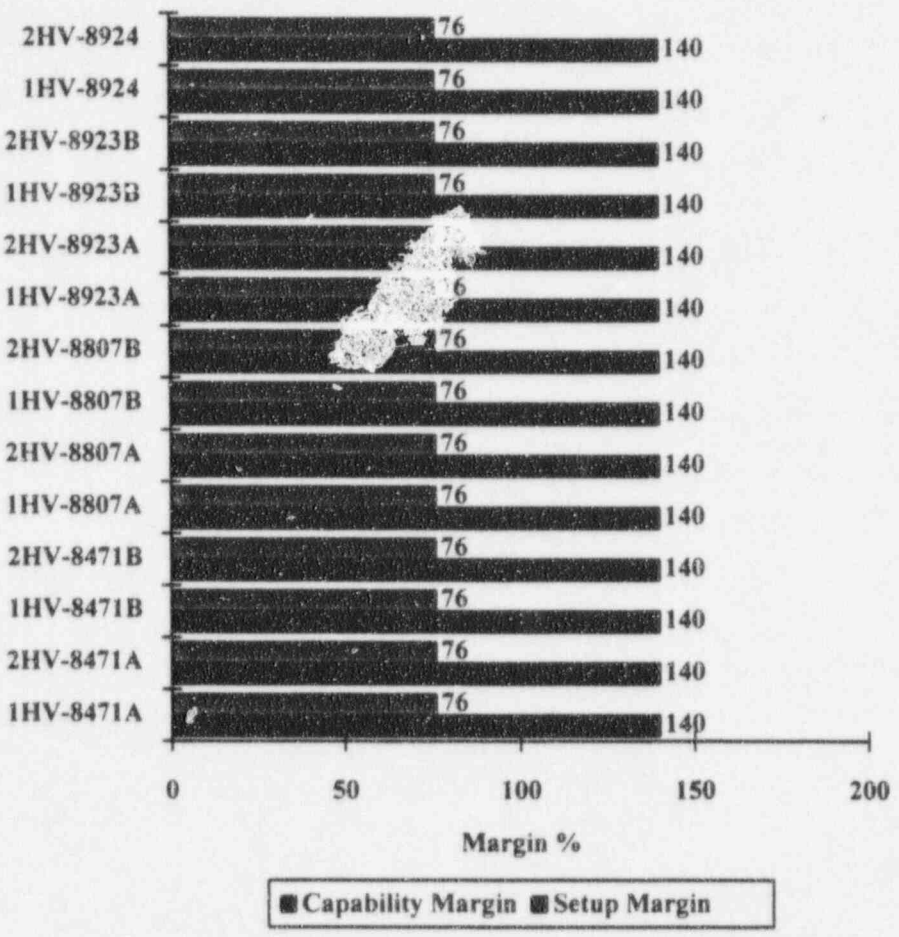


The closing margin for valves 1/2HV-8471A/B were determined based on a design-basis differential pressure of 220 psid which is associated with closing to isolate a passive failure leak of 50 gpm or less while in recirculation.

The closing margin for valves 1/2HV-8807A/B were determined based on a design-basis differential pressure of 220 psid which is associated with closing to isolate a passive failure leak of 50 gpm or less while in recirculation.

The closing margin for valves 1/2HV-8923A/B were determined based on a design-basis differential pressure of 220 psid which is associated with closing to isolate a passive failure leak of 50 gpm or less while in recirculation.

The closing margin for valves 1/2HV-8924 were determined based on a design-basis differential pressure of 220 psid which is associated with closing to isolate a passive failure leak of 50 gpm or less while in recirculation.



Design-Basis Capability Verification

1. Valves 1/2HV-8807A/B, 1/2HV-8923A/B and 1/2HV-8924 were differential pressure tested in-situ at VEGP and operated successfully. The apparent friction coefficients for these tests ranged from 0.29 to 0.56 in the opening direction and from 0.19 to 0.36 in the closing direction. The apparent friction coefficients for all of the tests are bounded by the design value of 0.6.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 143% and a closing setup margin of at least 76%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.8 Westinghouse Group W-7 Valves

Description

This group is composed of six, 8 inch, 150 lb, Westinghouse gate valves. Valves 1/2HV-8806 are normally open to provide a suction flowpath from the RWST to the SI pumps during injection. These valves have a safety function to close when transferring to cold-leg recirculation. Valves 1/2HV-0112D/E are normally closed and have a safety function to open on an SI signal to align the CCP suction to the RWST. The valves have a safety function to close to isolate the CCP suction from the RWST when transferring to cold-leg recirculation. The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 valve factor.

Table 3-8
Westinghouse Group W-7 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8806	RWST to SIP Suction	219	0	Open/Close
2HV-8806	RWST to SIP Suction	219	0	Open/Close
1LV-0112D	RWST to CCP Suction	71	0	Open/Close
2LV-0112D	RWST to CCP Suction	71	0	Open/Close
1LV-0112E	RWST to CCP Suction	71	0	Open/Close
2LV-0112E	RWST to CCP Suction	71	0	Open/Close

Differential Pressure Test Status

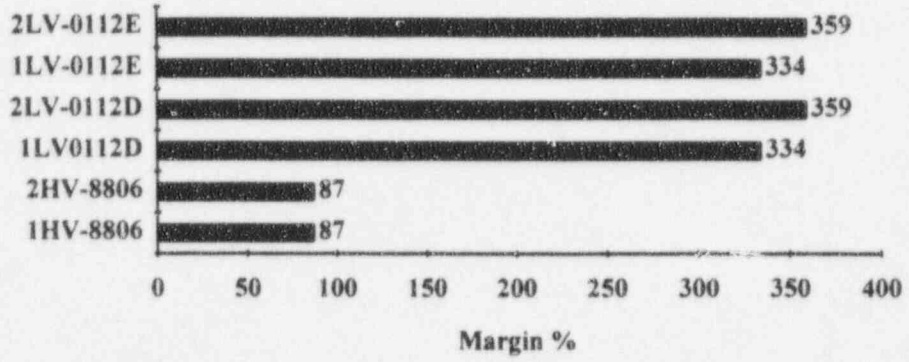
Valves 1/2HV-8806 have a differential pressure test priority of 4 in the opening direction and 4 in the closing direction. Valves 1/2LV-0112D/E have a differential pressure test priority of 2 in the opening direction and 3 in the closing direction. Based on the priority 4 ranking, valves 1/2HV-8806 require testing in the VEGP program and differential pressure tests on these valves have been completed in conjunction with the group W-6 valves utilizing the RWST return flowpath. The VEGP program only requires that Westinghouse valves with priorities of 4 or higher be differential pressure tested, therefore, the 1/2LV-0112D/E valves were not tested.

Calculated Margin

The opening margin for valves 1/2HV-8806 were determined based on a design-basis differential pressure of 219 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

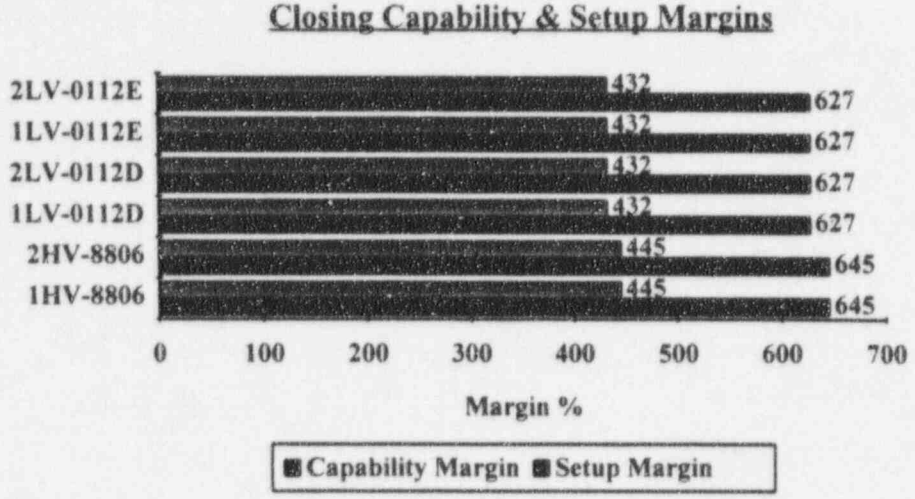
The opening margin for valves 1/2LV-0112D/E were determined based on a design-basis differential pressure of 71 psid which is associated with opening on an SI signal to provide a flow path between the RWST and the suction to the CCPs.

Opening Capability Margin



The closing margin for valves 1/2HV-8806 were determined based on a design-basis differential pressure of 0 psid which is associated with closing to isolate the suction of the SI pumps from the RWST when transferring to cold-leg recirculation.

The closing margin for valves 1/2LV-0112D/E were determined based on a design-basis differential pressure of 0 psid which is associated with closing to isolate the suction of the CCP pumps from the RWST when transferring to cold-leg recirculation.



Design-Basis Capability Justification

1. Valves 1/2HV-8806 were differential pressure tested in-situ and operated successfully. The apparent friction coefficients for these tests ranged from 0.34 to 0.36 in the opening direction and from 0.25 to 0.31 in the closing direction. The apparent friction coefficients for all of the tests are bounded by the design value of 0.6.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 87% and a closing setup margin of at least 432%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.9 Westinghouse Group W-8 Valves

Description

This group is composed of twelve, 8 inch, 316 lb, Westinghouse gate valves. These valves are utilized in a variety of applications in the Residual Heat Removal (RHR) system and Containment Spray (CS) system. The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 coefficient of friction.

Table 3-9
Westinghouse Group W-8 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8716A	RHR to RCS Hot Leg Isolation	253	273	Open/Close
2HV-8716A	RHR to RCS Hot Leg Isolation	253	273	Open/Close
1HV-8716B	RHR to RCS Hot Leg Isolation	253	273	Open/Close
2HV-8716B	RHR to RCS Hot Leg Isolation	253	273	Open/Close
1HV-8804A	RHR to CCP Suction	425	217	Open/Close
2HV-8804A	RHR to CCP Suction	425	217	Open/Close
1HV-8804B	RHR to SI Pump Suction	425	217	Open/Close
2HV-8804B	RHR to SI Pump Suction	425	217	Open/Close
1HV-9001A	CS Pump Discharge	255	124	Open/Close
2HV-9001A	CS Pump Discharge	255	124	Open/Close
1HV-9001B	CS Pump Discharge	258	124	Open/Close
2HV-9001B	CS Pump Discharge	258	124	Open/Close

Valves 1/2HV-8716A/B are normally open to crosstie the discharge of the two trains of the RHR system. The valves have a safety function to close when transferring to cold-leg recirculation and to open when transferring to hot-leg recirculation. The valves have a safety function to close to isolate a passive failure leak of 50 gpm or less during recirculation and to close when aligning for safety-grade cold shutdown.

Valves 1HV-8804A/B are normally closed and have a safety function to open to establish a flow path between the discharge of the RHR pumps and the suction of the SI or CCP pumps when transferring to cold-leg recirculation. The valves have a safety function to close to isolate a passive failure leak of 50 gpm or less during recirculation.

Valves 1HV-9001A/B are normally closed and have a safety function to open on a high containment pressure signal to establish a flow path between the containment spray pumps and the spray header. The valves have a safety function to close to isolate a passive failure leak of 50 gpm or less during recirculation.

Differential Pressure Test Status

All of the valves in this group have a differential pressure test priority of 4 or higher. Based on the priority 4 ranking all of the valves require differential pressure testing in the VEGP program. Valves 1/2HV-8716A/B have been tested and valves 1/2HV-8804A/B were tested in conjunction with the Group W-6 valves utilizing the RWST return flowpath. Valves 1/2HV-9001A/B were not tested because stroking these valves under flow conditions would have resulted in discharging water inside containment which would have had a detrimental effect on the material condition of the plant.

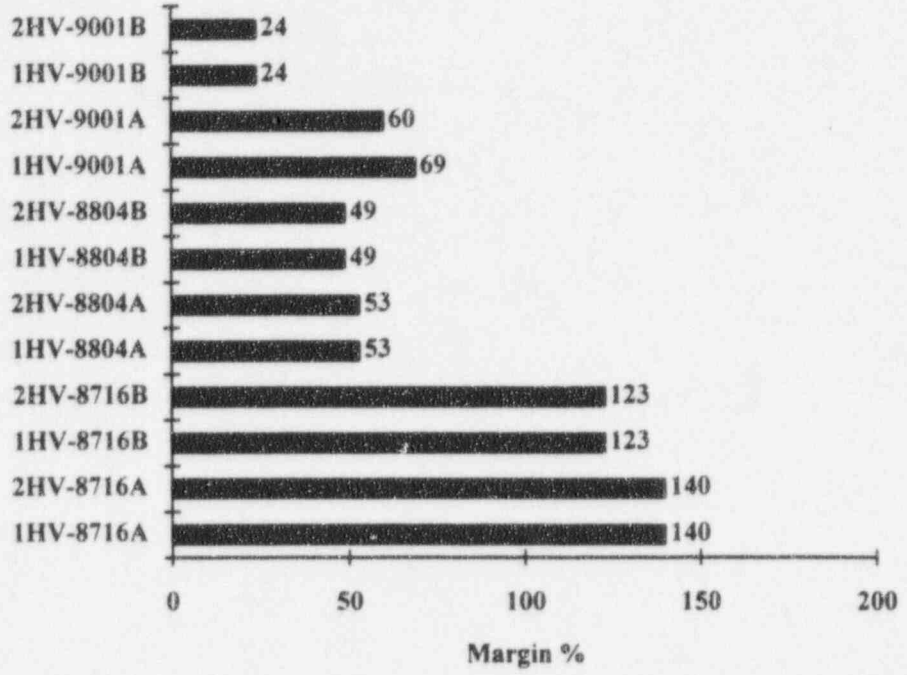
Calculated Margin

The opening margins for valves 1/2HV-8716A/B were determined based on a design-basis differential pressure of 253 psid which is associated with the safety function of opening when transferring to hot-leg recirculation.

The opening margins for valves 1/2HV-8804A/B were determined based on a design-basis differential pressure of 425 psid which is associated with the safety function of opening when transferring to cold-leg recirculation.

The opening margins for valves 1/2HV-9001A/B were determined based on a design-basis differential pressure of 255 or 258 psid which is associated with recovering from mispositioning. The valves have a safety function to open on a containment spray signal at a differential pressure of 245 or 248 psid.

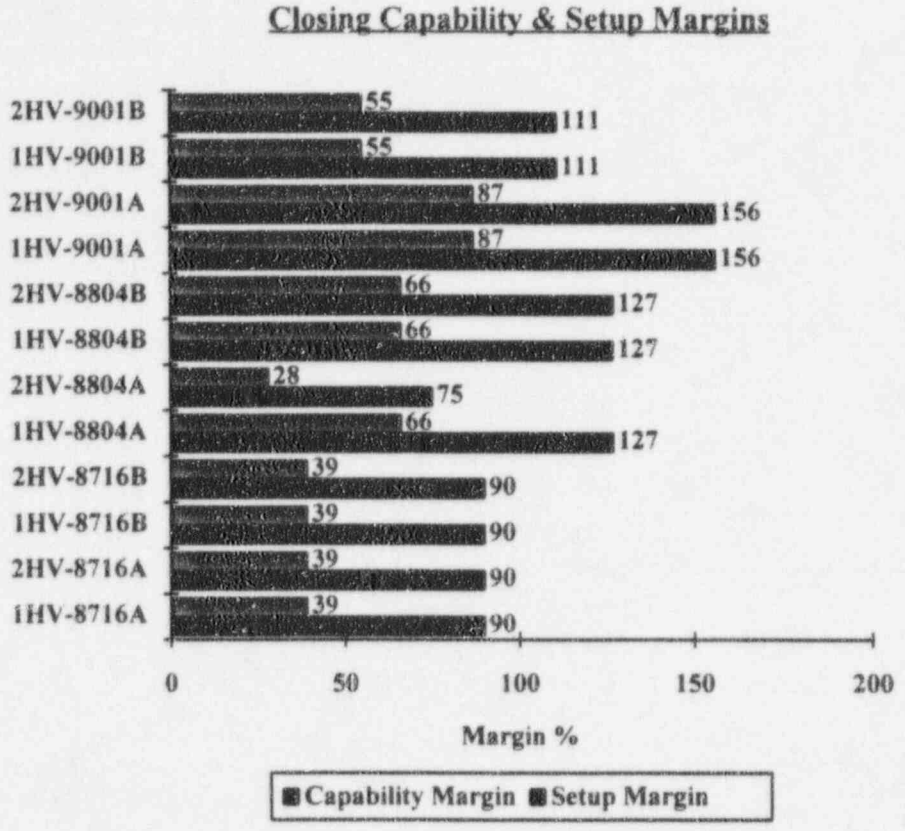
Opening Capability Margin



The closing margins for valves 1/2HV-8716A/B were determined based on a design-basis differential pressure of 273 psid which is associated with the safety function of closing when transferring to cold-leg recirculation.

The closing margins for valves 1/2HV-8804A/B were determined based on a design-basis differential pressure of 217 psid which is associated with closing to isolate a passive failure leak of 50 gpm or less.

The closing margins for valves 1/2HV-9001A/B were determined based on a design-basis differential pressure of 124 psid which is associated with closing to isolate a passive failure leak of 50 gpm or less.



Design-Basis Capability Justification

1. Valves 1/2HV-8716A/B and 1/2HV-8804A/B were differential pressure tested in-situ at VEGP and operated successfully. The apparent friction coefficients for these tests ranged from 0.30 to 0.84 in the opening direction and from 0.23 to 0.62 in the closing direction. The apparent opening friction coefficient for valve 2HV-8716A and the apparent closing friction coefficient for valves 2HV-8804A/B exceeded the design value of 0.6, however, the differences were within the overall accuracy of the test process. The apparent opening friction coefficient for valve 2HV-8804B appears high, however, a review of the test evaluation identified inconsistencies which may have affected the test results. Section 9.2.7 of the Program Summary Report contains a detailed discussion of the differential pressure test results for this group of valves.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 24% and a closing setup margin of at least 28%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.10 Westinghouse Group W-9 Valves

Description

This group is composed of four, 8 inch, 1525 lb, Westinghouse gate valves. These valves are normally open to provide a flow path between the RHR pump discharge and the cold legs. The valves have a safety function to close when transferring to hot-leg recirculation. The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 coefficient of friction.

Table 3-10
Westinghouse Group W-9 Valves

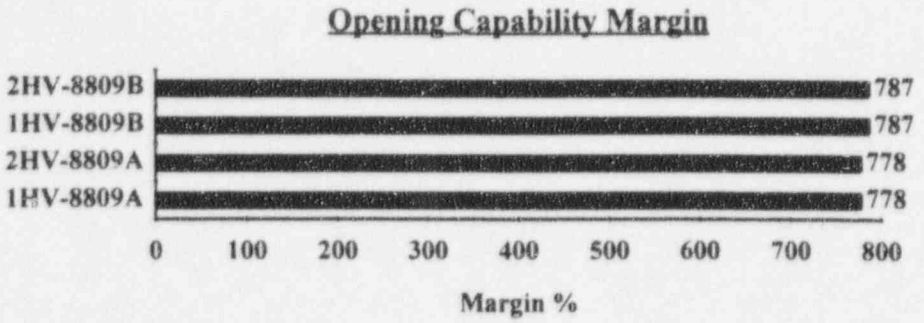
Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8809A	RHR to RCS Cold Leg	199	199	Open/Close
1HV-8809A	RHR to RCS Cold Leg	199	199	Open/Close
1HV-8809A	RHR to RCS Cold Leg	199	199	Open/Close
1HV-8809A	RHR to RCS Cold Leg	199	199	Open/Close

Differential Pressure Test Status

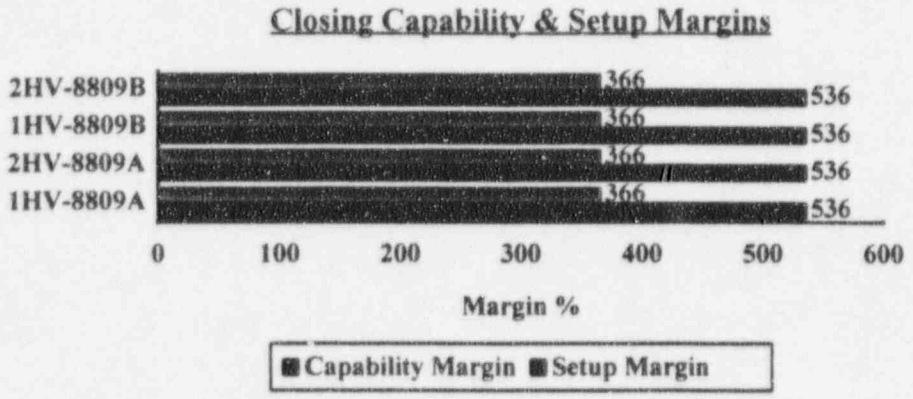
These valves have a differential pressure test priority of 2 in the opening direction and 2 in the closing direction. The VEGP program requires that Westinghouse valves with a priority of 4 or higher be tested, therefore, these valves were not differential pressure tested.

Calculated Margin

The opening margins for these valves were determined based on a design-basis differential pressure of 199 psid which is associated with the normal operation of the RHR system. These valves do not have an active safety function to open.



The closing margins for these valves were determined based on a design-basis differential pressure of 199 psid which is associated with closing when transferring to hot leg recirculation.



Design-Basis Capability Justification

1. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 778% and a closing setup margin of 366%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.11 Westinghouse Group W-10 Valves

Description

This group is composed of twelve, 10 inch, 150 lb, Westinghouse gate valves. Valves 1/2HV-9002A/B and 1/2HV-9003A/B are normally closed and have a safety function to open when transferring to recirculation to provide a flow path between the containment sumps and the suction of the containment spray pumps. The valves have a safety function to close to isolate a passive failure leak of less than 50 gpm during recirculation. Valves 1/2HV-9017A/B are normally open to provide a flowpath between the RWST and the suction of the containment spray pumps. The valves have a safety function to close when transferring to recirculation. The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 coefficient of friction.

Table 3-11
Westinghouse Group W-10 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-9002A	Containment Spray Sump Suction	101	58	Open/Close
2HV-9002A	Containment Spray Sump Suction	101	58	Open/Close
1HV-9002B	Containment Spray Sump Suction	101	58	Open/Close
2HV-9002B	Containment Spray Sump Suction	101	58	Open/Close
1HV-9003A	Containment Spray Sump Suction	101	58	Open/Close
2HV-9003A	Containment Spray Sump Suction	101	58	Open/Close
1HV-9003B	Containment Spray Sump Suction	101	58	Open/Close
2HV-9003B	Containment Spray Sump Suction	101	58	Open/Close
1HV-9017A	RWST to Contain. Spray Suction	66	23	Open/Close
2HV-9017A	RWST to Contain. Spray Suction	66	23	Open/Close
1HV-9017B	RWST to Contain. Spray Suction	66	23	Open/Close
2HV-9017B	RWST to Contain. Spray Suction	66	23	Open/Close

Differential Pressure Test Status

All of the valves in this group have a differential pressure test priority of 4 with the exception of valves 1/2HV-9017A which have a differential pressure test priority of 3. Based on the priority 4 ranking valves 1/2HV-9002A/B, 1/2HV-9003A/B and 1/2HV-9017B require differential pressure testing in the VEGP program. However, it was not feasible to test these valves under flow conditions

because they are located in the suction piping to the containment spray pumps and stroking these valves under flow conditions would have resulted in a loss of suction head to the pumps which could damage the pumps. In addition, the 1/2HV-9002A/B and 1/2HV-9003A/B valves which are aligned to provide suction from the sumps could not be tested under flow conditions because water is not normally available in the sumps.

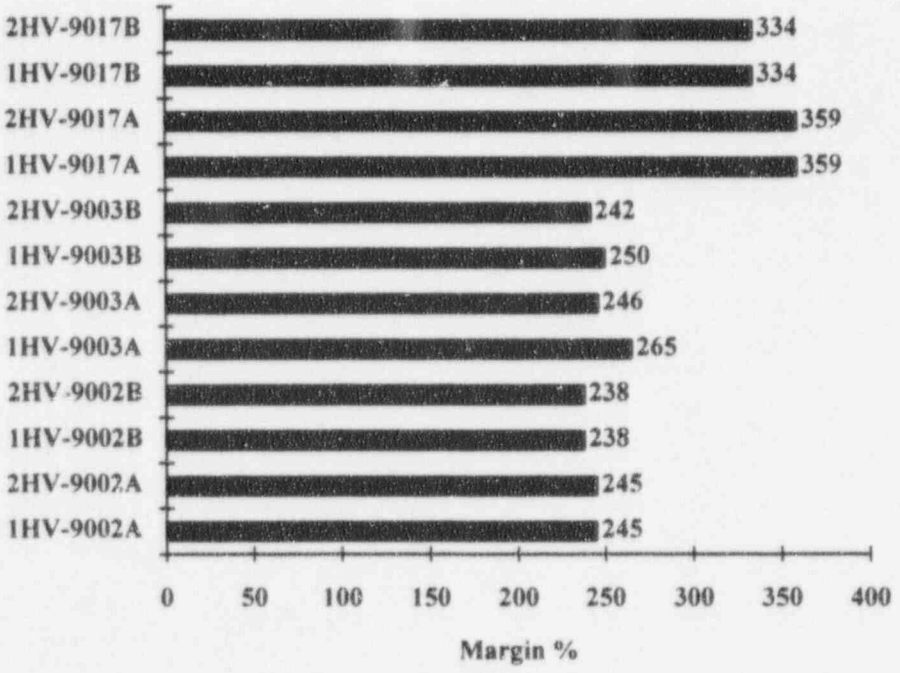
Calculated Margins

The opening margins for valves 1/2HV-9002A/B were determined based on a design-basis differential pressure of 101 psid which is associated with the safety function of opening when transferring to cold-leg recirculation.

The opening margins for valves 1/2HV-9003A/B were determined based on a design-basis differential pressure of 101 psid which is associated with the safety function of opening when transferring to cold-leg recirculation.

The opening margins for valves 1/2HV-9017A/B were determined based on a design-basis differential pressure of 66 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

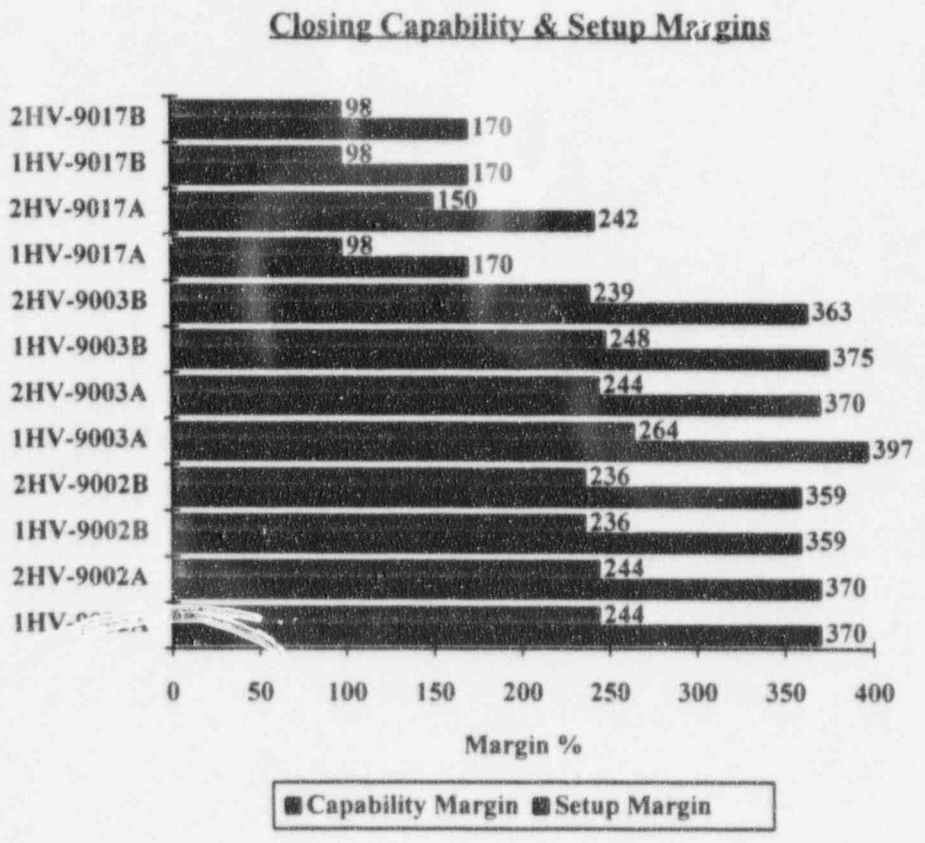
Opening Capability Margin



The closing margins for valves 1/2HV-9002A/B were determined based on a design-basis differential pressure of 58 psid which is associated with the safety function of closing to isolate a passive failure leak of 50 gpm or less.

The closing margins for valves 1/2HV-9003A/B were determined based on a design-basis differential pressure of 58 psid which is associated with the safety function of closing to isolate a passive failure leak of 50 gpm or less.

The closing margins for valves 1/2HV-9017A/B were determined based on a design-basis differential pressure of 23 psid which is associated with the safety function of closing when transferring to recirculation.



Design-Basis Capability Justification

1. EPRI In-Situ Test Valve Number 19 is a 10 inch, 1525 lb Westinghouse valve similar in design to the valves in group W-10. This valve was tested at a differential pressure of 265 psid and operated successfully. The test results were evaluated utilizing the NMAC methodology and the apparent opening and closing friction coefficients were less than 0.6.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 238% and a closing setup margin of at least 98%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3.12 Westinghouse Group W-11 Valves

Description

This group is composed of four, 12 inch, 316 lb, Westinghouse gate valves. These valves are normally open to provide a flow path between the RWST and the suction of the RHR pumps. The valves have a safety function to close when transferring to cold-leg recirculation. The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 coefficient of friction.

Table 3-12
Westinghouse Group W-11 Valves

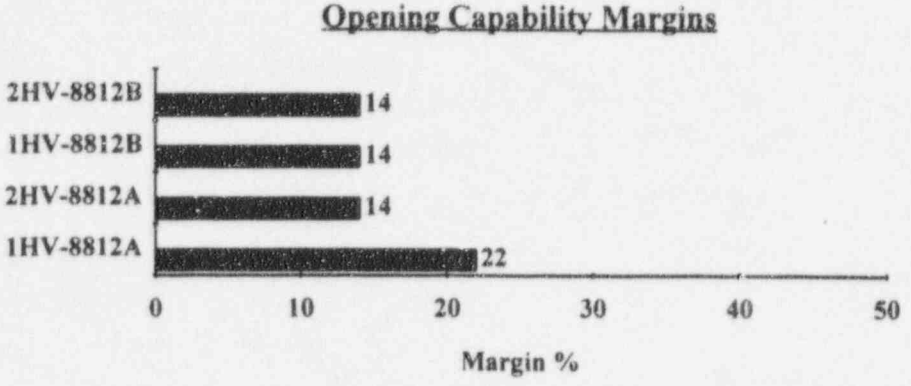
Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8812A	RWST to RHR Pump Suction	430	25	Open/Close
1HV-8812A	RWST to RHR Pump Suction	430	25	Open/Close
1HV-8812A	RWST to RHR Pump Suction	430	25	Open/Close
1HV-8812A	RWST to RHR Pump Suction	430	25	Open/Close

Differential Pressure Test Status

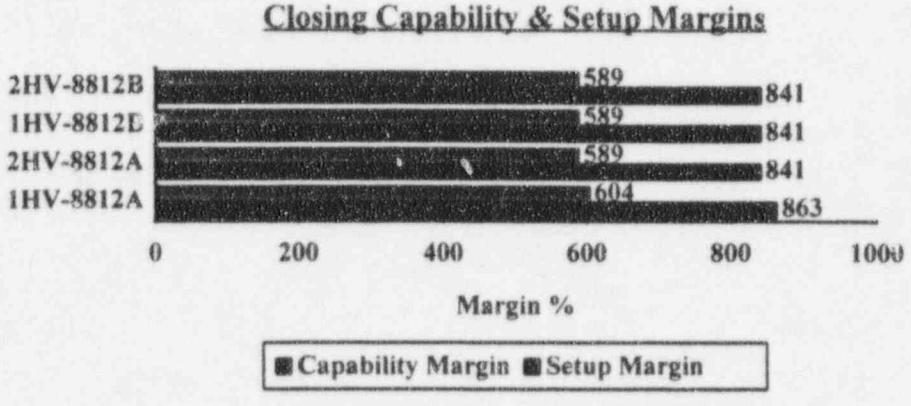
These valves have a differential pressure test priority of 5 in the opening direction and 2 in the closing direction. Based on a priority ranking of 5 these valves require testing in the VEGP program. However, these valves are located in the suction piping to the RHR pumps and stroking these valves under flow conditions would have resulted in a loss of suction head and potential pump damage. Therefore, these valves were not differential pressure tested.

Calculated Margin

The opening margins for these valves were calculated based on a design-basis differential pressure of 430 psid which is associated with aligning the valves to their normal position during start-up. These valves do not have an active safety function to open.



The closing margins for these valves were calculated based on a design-basis differential pressure of 25 psid which is associated with the safety function of closing when transferring to recirculation.



Design-Basis Capability Justification

1. The design-basis differential pressure of 430 psid in the opening direction is associated with aligning the valves to their normal position during start-up. The calculation assumes that the RHR system remains pressurized and that the check valve downstream of these valves leaks, which in turn pressurizes the downstream side of these valves. These are extremely conservative assumptions and result in a much higher calculated differential pressure than would normally be expected at these valves. The 430 psid differential pressure translated into calculated margins which are as low as 14% for these valves. However, these valves are stroked open after securing the RHR system during each unit start-up, thereby demonstrating their ability to open. In addition, the valves do not have an active safety function to open.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have a closing setup margin of at least 589%. This margin is adequate to ensure that these valves will be capable of closing to perform their design-basis function.

3.13 Westinghouse Group W-12 Valves

Description

This group is composed of ten, 12 inch, 1525 lb, Westinghouse gate valves. Valves 1/2HV-8701A/B and 1/2HV-8702A/B are normally closed and have a safety function to open when aligning the RHR system for safety grade cold shutdown. Valves 1/2HV-8840 are normally closed and have a safety function to open when transferring to hot-leg recirculation to provide a flow path between the RHR pump discharge and the RCS hot-legs. The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 coefficient of friction.

Table 3-13
Group W-12 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8701A	RCS to RHR Pump Suction	365	425	Open/Close
2HV-8701A	RCS to RHR Pump Suction	365	425	Open/Close
1HV-8701B	RCS to RHR Pump Suction	365	425	Open/Close
2HV-8701B	RCS to RHR Pump Suction	365	425	Open/Close
1HV-8702A	RCS to RHR Pump Suction	365	425	Open/Close
2HV-8702A	RCS to RHR Pump Suction	365	425	Open/Close
1HV-8702B	RCS to RHR Pump Suction	365	425	Open/Close
2HV-8702B	RCS to RHR Pump Suction	365	425	Open/Close
1HV-8840	RHR to RCS Hot Legs	193	0	Open/Close
2HV-8840	RHR to RCS Hot Legs	193	0	Open/Close

Differential Pressure Test Status

Valves 1/2HV-8701A/B and 1/2HV-8702A/B have a differential pressure test priority of 4 in the opening direction and 5 in the closing direction. Valves 1/2HV-8840 have a differential pressure test priority of 2 in the opening direction and 2 in the closing direction. Based on the priority 5 ranking valves 1/2HV-8701A/B and 1/2HV-8702A/B require testing in the VEGP program. However, these valves are located in the suction piping to the RHR pumps and stroking these valves under flow conditions would result in a loss of suction head and potential pump damage. Therefore, these valves were not differential pressure

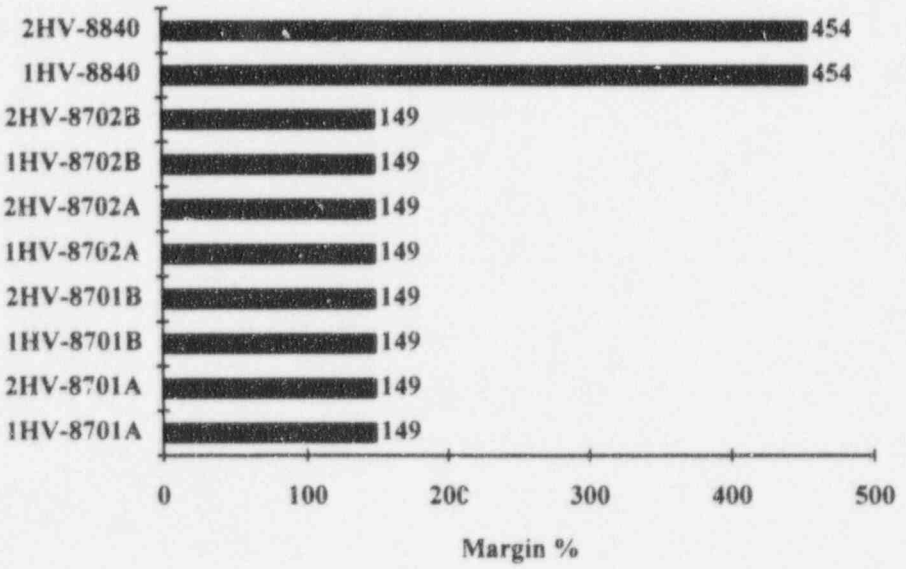
tested. Valves 1/2HV-8840 did not require testing due to their low priority ranking.

Calculated Margin

The opening margins for valves 1/2HV-8701A/B and 1/2HV-8702A/B were determined based on a design-basis differential pressure of 365 psid which is associated with the safety function of opening to align the RHR system for safety grade cold shutdown.

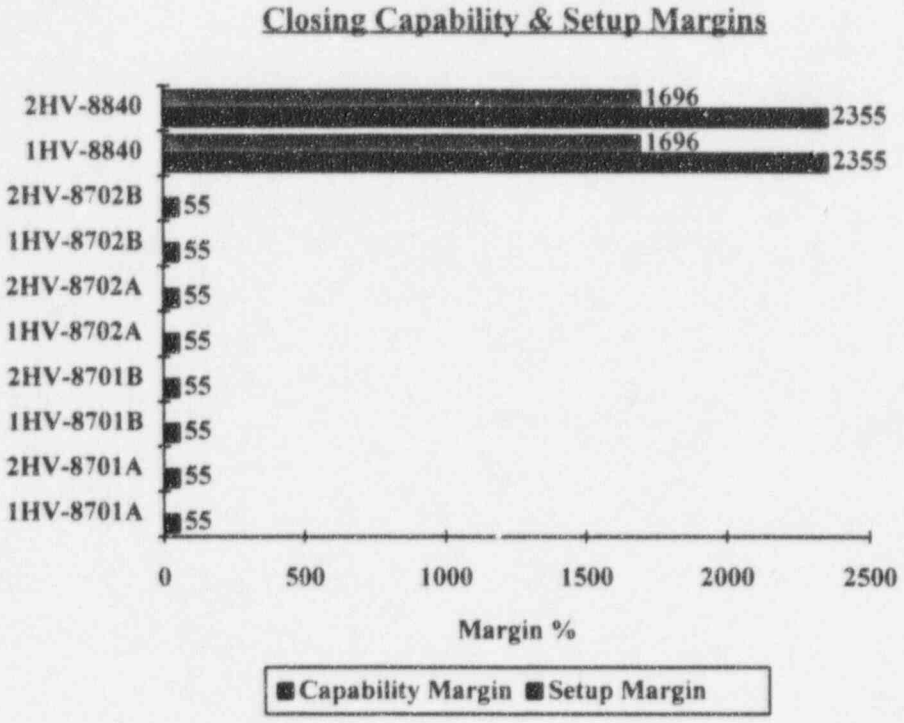
The opening margins for valves 1/2HV-8840 were determined based on a design-basis differential pressure of 193 psid which is associated with the safety function of opening when transferring to hot-leg recirculation.

Opening Capability Margin



The closing margins for valves 1/2HV-8701A/B and 1/2HV-8702A/B were determined based on a design-basis differential pressure of 425 psid which is associated with the safety function of isolating the RCS from the RHR system. These valves are controlled by a limit switch in the closing direction, therefore, the closing capability margin and setup margin are equivalent for these valves.

The closing margins for valves 1/2HV-8840 were determined based on a design-basis differential pressure of 0 psid which is associated with aligning the valve to its normal position prior to start-up.



Design-Basis Capability Justification

1. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 149%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

2. Based on conservative calculations of valve thrust requirements and operator capabilities valves 1/2HV-8840 have a closing setup margin of 1696%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3. Based on conservative calculations of valve thrust requirements and operator capabilities valves 1/2HV-8701A/B and 1/2HV-8702A/B have a closing margin of 55%. Considering the conservative differential pressure utilized in the calculations, these margins are adequate to ensure that these valves will be capable of performing their design-basis function. It should be noted that the required closing thrust for these valves was calculated based on a design-basis differential pressure of 425 psid which is the maximum RCS pressure for RHR system operation. The 425 psid differential pressure was assumed in the calculations for conservatism and to avoid the complexity of performing a dynamic evaluation of the closing differential pressures for these valves. When manipulating the valves in conjunction with a normal plant startup, the RHR

pumps are secured prior to closing these valves. Since the pumps are not running there is no flow in the RHR system, therefore, these valves are not exposed to any differential pressure when performing this function. With respect to isolating a leak downstream of these valves, the RHR system is considered a moderate energy system. The limiting failures which must be considered are through-wall cracks which would result in minimal leakage. The resulting differential pressure would occur primarily across the crack, with only limited differential pressure present across these valves. Therefore, the use of a differential pressure of 425 psid in evaluating these valves results in a calculated margin which is very conservative relative to the design-basis functions the valve is required to perform.

3.14 Westinghouse Group W-13 Valves

Description

This group is composed of four, 14 inch, 316 lb, Westinghouse gate valves. These valves are normally closed and have a safety function to open when transferring to cold-leg recirculation to provide a flow path between the containment sumps and the suction of the RHR pumps. The valves have a safety function to close to isolate a passive failure leak of less than 50 gpm during recirculation. The thrust requirements for these valves were calculated utilizing the EPRI NMAC equation with a 0.6 valve factor.

Table 3-14
Westinghouse Group W-13 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8811A	Contain. Sump to RHR Pump	57	57	Open/Close
2HV-8811A	Contain. Sump to RHR Pump	57	57	Open/Close
1HV-8811B	Contain. Sump to RHR Pump	57	57	Open/Close
2HV-8811B	Contain. Sump to RHR Pump	57	57	Open/Close

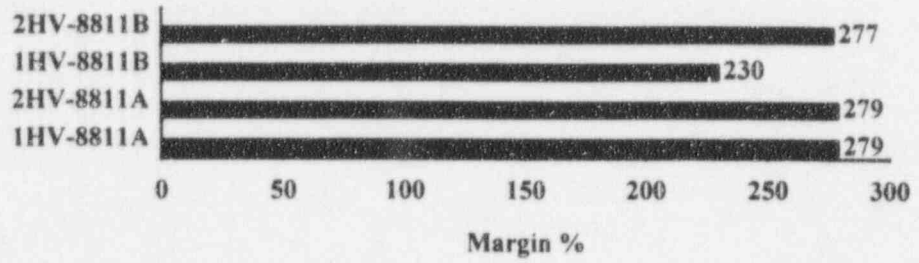
Differential Pressure Test Status

These valves have a differential pressure test priority of 2 in the opening direction and 2 in the closing direction. The VEGP program requires that valves with a priority ranking of 4 or higher be tested, therefore, these valves did not require testing. In addition, the valves are located in the RHR pump suction piping and stroking the valves under flow conditions would result in a loss of suction head and potential pump damage.

Calculated Margin

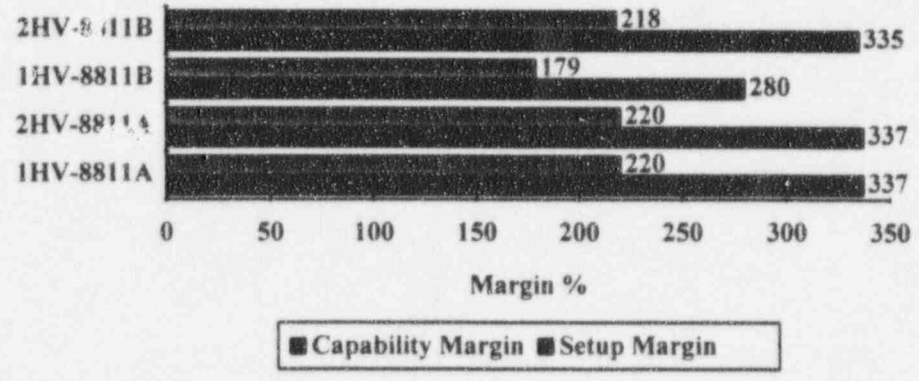
The opening margins for these valves were calculated based on a design-basis differential pressure of 57 psid which is associated with the safety function of opening when transferring to recirculation.

Opening Capability Margins



The closing margins for these valves were determined based on a design-basis differential pressure of 57 psid which is associated with the safety function of closing to isolate a passive failure leak of 50 gpm or less while in recirculation.

Closing Capability & Setup Margins



Design-Basis Capability Justification

1. The design-basis differential pressures of 57 psid in the opening and closing direction is extremely low and result in loads which are not substantially higher than those encountered in a static test.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 230% and a closing setup margin of at least 179%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

4.0 FISHER GLOBE VALVES

There are a total of 22 Fisher globe valves included in the VEGP GL 89-10 program. The valves have been divided into three groups of identical valves as outlined in Table 4-1. The valves in groups FG-1 and FG-2 are of the unbalanced disk design and the valves in group FG-3 are of the balanced disk design.

Table 4-1
Valve Groups

Group No.	Manufacturer	Valve Type	Valve Size	ANSI Rating	Total Valves
FG-1	Fisher	Globe	0.5 Inch	1710 lb	2
FG-2	Fisher	Globe	2.0 Inch	900 lb	4
FG-3	Fisher	Globe	4.0 Inch	900 lb	16

The thrust requirements for these valves were determined by Fisher utilizing proprietary methodology. This methodology is discussed in more detail in Section 3.3.1.3 of the Program Summary Report.

The Fisher valves are equipped with valve stems utilizing standard ACME threads and a stem friction coefficient of 0.15 was utilized in calculating the stem factors for these valves. The basis for utilizing a 0.15 stem friction coefficient for these valves is outlined in Section 9.6 of the Program Summary Report.

The opening and closing capability margins were calculated for each of the valves in these groups. In addition, for valves which are controlled in the closing direction by a torque switch, the closing setup margin is also included. The setup margin takes into account test equipment accuracy, torque switch repeatability and Load Sensitive Behavior and for the purposes of this document values of 10%, 5% and 20% respectively were utilized to account for these uncertainties. In practice, the values utilized for test equipment accuracy and torque switch repeatability would be determined based on each specific valve setup. Section 4.0 of the Program Summary Report discusses the various margins in detail and outlines the basis for determining the adjustments necessary to account for test equipment accuracy, torque switch repeatability and Load Sensitive Behavior.

4.1 Fisher Group FG-1 Globe Valves

Description

This group is composed of two, 1/2 inch, 1710 lb, Fisher globe valves. These valves are normally open and have a safety function to close on a containment isolation signal to isolate the RCS from the nuclear sampling system. The thrust requirements for these valves were determined by Fisher utilizing proprietary methodology.

Table 4-1
Fisher Group FG-1 Globe Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-3548	RCS Hot Leg Sample	2485	2485	Close
2HV-3548	RCS Hot Leg Sample	2485	2485	Close

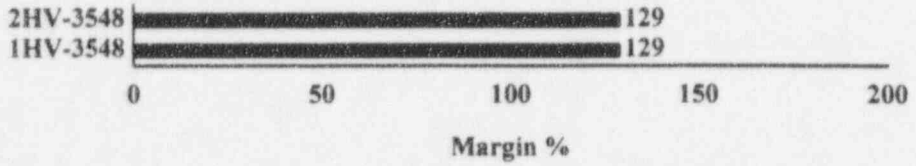
Differential Pressure Test Status

These valves have a differential pressure test priority of 5 in the opening direction and 5 in the closing direction. Based on the priority 5 ranking the valves require testing in the VEGP program. However, due to the extremely small size of these valves and the fact that the valves are located inside containment, these valves were not differential pressure tested. A containment entry, with the RCS at rated temperature and pressure, was not warranted to test these valves in light of the data which had been accumulated at VEGP on the larger Fisher unbalanced disk globe valves.

Calculated Margin

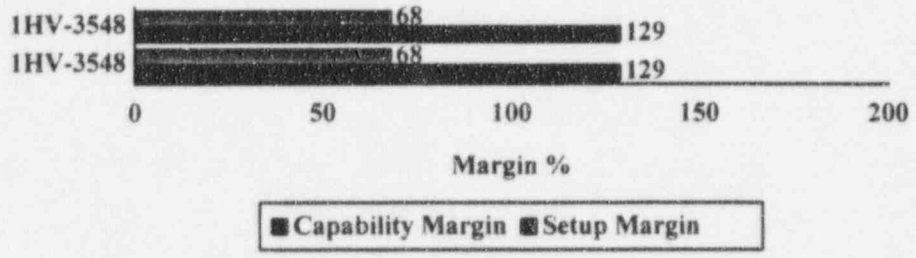
The opening margins were determined based on a design-basis differential pressure of 2485 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

Opening Capability Margins



The closing margins were determined based on a design-basis differential pressure of 2485 psid which is associated with the safety function of closing on a containment isolation signal to isolate the RCS from the nuclear sampling system.

Closing Capability & Setup Margins



Design-Basis Capability Justification

1. Valves 1/2HV-5154 and 1/2HV-5155 (Group FG-2) are similar in design to the 1/2HV-3548 valves and these valves were differential pressure tested in-situ at VEGP and performed within the bounds of the thrust predicted by the Fisher methodology. The actual opening thrusts ranged from 2% to 42% of the predicted values and the actual closing thrusts ranged from 24% to 52% of the predicted values.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of 129% and a closing setup margin of 68%. In addition, the margins for these MOVs are limited by the valve allowable rather than the operator capability. The margins based on operator capability are significantly higher, and the existing margins are adequate to ensure that these valves will be capable of performing their design-basis function.

4.2 Fisher Group FG-2 Globe Valves

Description

This group is composed of four, 2 inch, 900 lb, Fisher globe valves. These valves are normally open to provide the motor-driven AFW pumps with a miniflow path to the Condensate Storage Tank (CST) and have a safety function to close on high AFW pump flow. The valves have a safety function to open on low AFW pump flow. The thrust requirements for these valves were determined by Fisher utilizing proprietary methodology.

Table 4-2
Fisher Group FG-2 Globe Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1FV-5154	AFW Pump Miniflow	1715	1715	Open/Close
2FV-5155	AFW Pump Miniflow	1715	1715	Open/Close
1FV-5154	AFW Pump Miniflow	1715	1715	Open/Close
2FV-5155	AFW Pump Miniflow	1715	1715	Open/Close

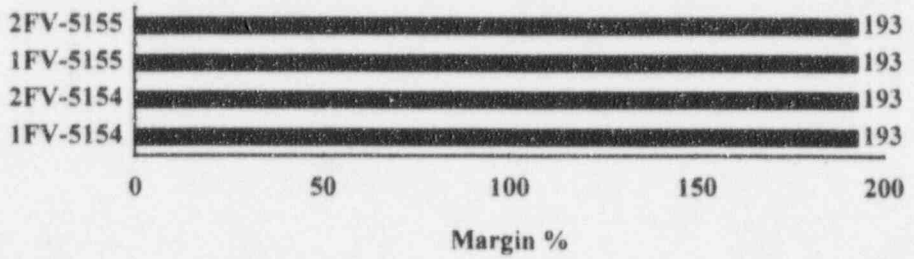
Differential Pressure Test Status

These valves have a differential pressure test priority of 5 in the opening direction and 5 in the closing direction. Based on the priority 5 ranking the valves require testing in the VEGP program and differential pressure tests on these valves have been completed.

Calculated Margin

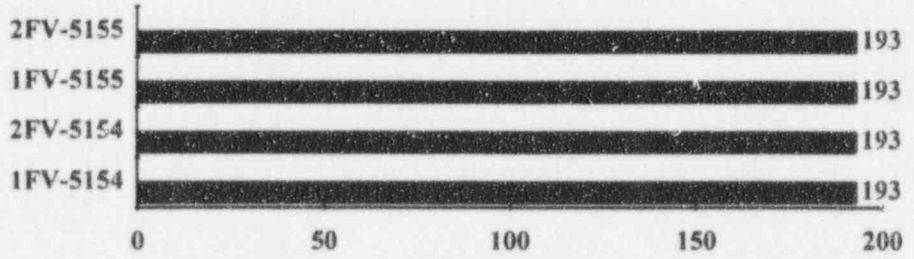
The opening margins were determined based on a design-basis differential pressure of 1715 psid which is associated with the safety function of opening on low AFW flow to provide a miniflow path to the CST.

Opening Capability Margins



The closing margins for these valves were determined based on a design-basis differential pressure of 1715 psid which is associated with closing to isolate miniflow on high AFW pump flow. These valves are controlled by a limit switch in the closing direction, therefore, the closing capability margin and setup margin are equivalent for these valves.

Closing Capability Margins



Design-Basis Capability Justification

1. Valves 1/2HV-5154 and 1/2HV-5155 were differential pressure tested in-situ at VEGP and performed within the bounds of the thrust predicted by the Fisher methodology. The actual opening thrusts ranged from 2% to 42% of the predicted values and the actual closing thrusts ranged from 24% to 52% of the predicted values.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of 193% and a closing margin of at least 193%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

4.3 Group FG-3

Description

This group is composed of sixteen, 4-0 inch, 900 lb, Fisher globe valves. These valves are utilized in the AFW system to control feedwater flow to the steam generators. The thrust requirements for these valves were determined by Fisher utilizing proprietary methodology.

Valves 1/2HV-5120, 1/2HV-5122, 1/2HV-5125 and 1/2HV-5127 are normally open to provide a flow path from the turbine-driven AFW pump to the steam generators. The valves have a safety function to open and close as required to modulate flow to each individual steam generator.

Valves 1/2HV-5132,1/2HV-5134, 1/2HV-5137 and 1/2HV-5139 are normally open to provide a flow path from the motor-driven AFW pumps to the steam generators. The valves have a safety function to open and close as required to modulate flow to each individual steam generator.

Table 4-3
Fisher Group FG-3 Globe Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-5120	AFW Pump Discharge Train C	1776	1776	Open/Close
2HV-5120	AFW Pump Discharge Train C	1776	1776	Open/Close
1HV-5122	AFW Pump Discharge Train C	1776	1776	Open/Close
2HV-5122	AFW Pump Discharge Train C	1776	1776	Open/Close
1HV-5125	AFW Pump Discharge Train C	1765	1765	Open/Close
2HV-5125	AFW Pump Discharge Train C	1765	1765	Open/Close
1HV-5127	AFW Pump Discharge Train C	1765	1765	Open/Close
2HV-5127	AFW Pump Discharge Train C	1765	1765	Open/Close
1HV-5132	AFW Pump Discharge Train B	1765	1765	Open/Close
2HV-5132	AFW Pump Discharge Train B	1765	1765	Open/Close
1HV-5134	AFW Pump Discharge Train B	1765	1765	Open/Close
2HV-5134	AFW Pump Discharge Train B	1765	1765	Open/Close
1HV-5137	AFW Pump Discharge Train A	1767	1767	Open/Close
2HV-5137	AFW Pump Discharge Train A	1767	1767	Open/Close
1HV-5139	AFW Pump Discharge Train A	1767	1767	Open/Close
2HV-5139	AFW Pump Discharge Train A	1767	1767	Open/Close

Differential Pressure Test Status

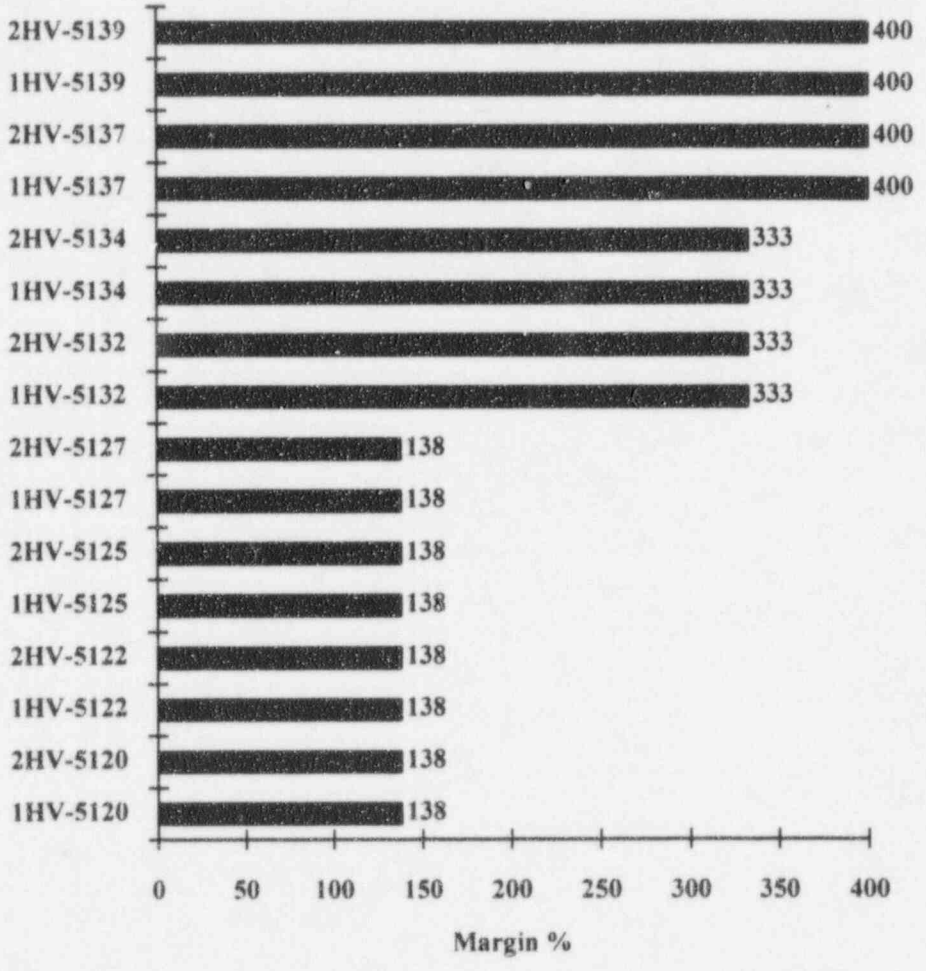
Valves 1/2HV-5120, 1/2HV-5122, 1/2HV-5125 and 1/2HV-5127 have a differential pressure test priority of 5 in the opening direction and 5 in the closing direction. Valves 1/2HV-5132, 1/2HV-5134, 1/2HV-5137 and 1/2HV-5139 have a differential pressure test priority of 4 in the opening direction and 4 in the closing direction. The valves with a priority 5 ranking require testing in the VEGP program. However, based on Georgia Power's letter of December 2, 1992 to the NRC the scope of valves to be tested in this group was reduced to a total of four valves. The justification for reducing the test scope was that globe valves are predictable performers and four valves would be sufficient to identify any problems within this group of valves. The purpose of reducing the scope was to maintain the total number of valves to be tested approximately constant while increasing the number of Westinghouse gate valves to be tested.

In addition, two of the priority 4 valves were substituted for two of the priority 5 valves. The priority 5 valves are located in the turbine-driven AFW systems and the priority 4 valves are located in the motor-driven AFW systems. The turbine-driven AFW discharge valves which were tested saw only limited differential pressures due to the relatively high steam pressure required in the steam generators to operate the turbine-driven AFW systems. The steam generator pressure is present on the downstream side of the discharge valves, thereby limiting the differential pressure developed across these valves. The valves located in the motor-driven AFW systems could be tested at a much higher differential pressure since the steam generators could be depressurized when the testing was performed. The valves themselves are identical and the reason the priority rankings vary is due to the capability of the operators installed on the respective valves.

Calculated Margin

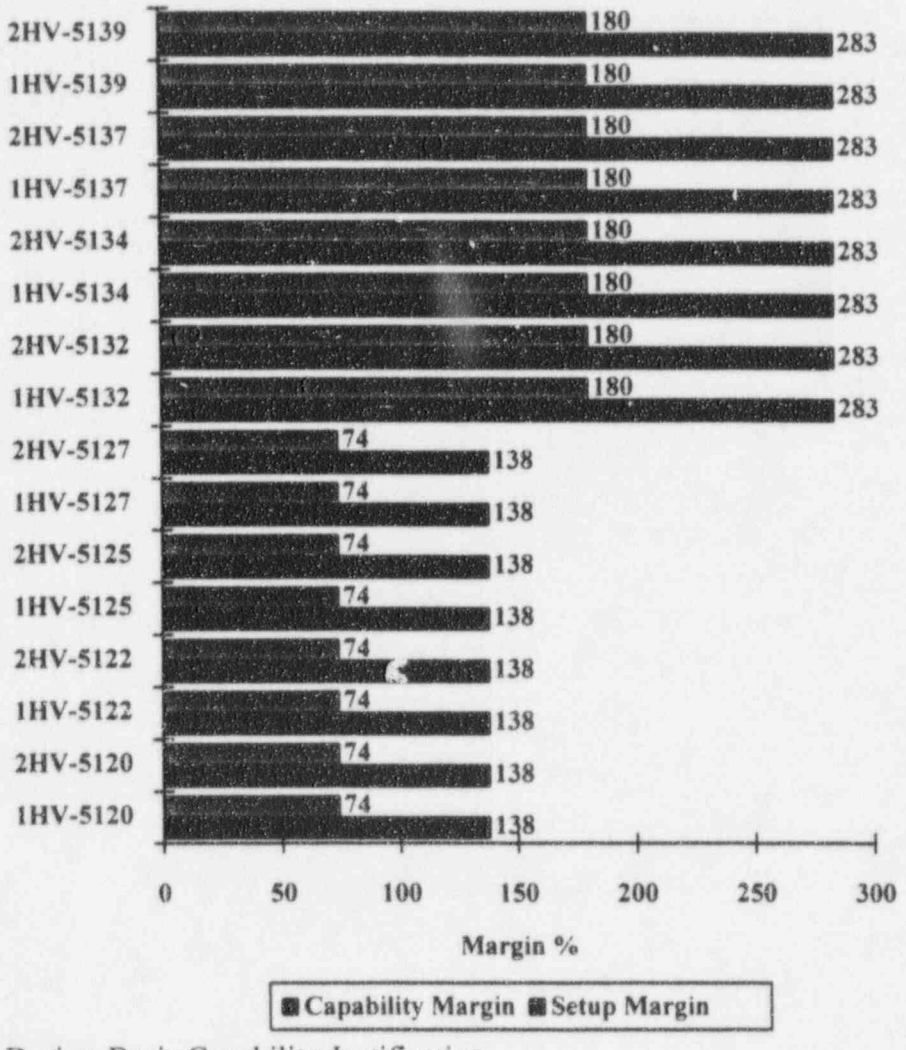
The opening margins were determined based on a design-basis differential pressure of 1765, 1767 or 1776 psid which is associated with the safety function of opening as required to control AFW flow.

Opening Capability Margin



The closing margins were determined based on a design-basis differential pressure of 1765, 1767 or 1776 psid which is associated with the safety function of closing as required to control AFW flow.

Closing Capability & Setup Margins



Design-Basis Capability Justification

1. Valves 1HV-5137, 1HV-5139, 2HV-5120 and 2HV-5122 were differential pressure tested in-situ at VEGP and performed within the bounds of the thrust predicted by the Fisher methodology. The actual opening thrusts ranged from 19% to 55% of the predicted values and the actual closing thrust ranged from 71% to 86% of the predicted values.

2. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 138% and a closing setup margin of at least 74%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

5.0 VELAN GLOBE VALVES

There are a total of 36 Velan globe valves included in the VEGP GL 89-10 program. The valves are all of the unbalanced disc, seat-based design. The valves have been divided into three groups of identical valves as outlined in Table 5-1.

Table 5-1
Valve Groups

Group No.	Manufacturer	Valve Type	Valve Size	ANSI Rating	Total Valves
V-1	Velan	Globe	1.0 Inch	1500 lb	2
V-2	Velan	Globe	1.5 Inch	1500 lb	12
V-3	Velan	Globe	2.0 Inch	1500 lb	22

Although the Velan valves have been divided into three groups based on the manufacturers stated valve size, the performance of all of the groups are similar. The stated valve sizes are based on the diameter of the valve nozzle connections rather than the seat diameter. All of the valves utilize a nominal 1.875" seat diameter and, therefore, are essentially identical with respect to valve thrust requirements and overall performance.

The thrust requirements for these valves were calculated with the EPRI Performance Prediction Program (PPP) methodology for seat based globe valves. This methodology is discussed in more detail in Section 3.3.1.4 of the Program Summary Report.

The Velan valves are equipped with valve stems utilizing standard ACME threads and a stem friction coefficient of 0.15 was utilized in calculating the stem factors for these valves. The basis for utilizing a 0.15 stem friction coefficient for these valves is outlined in Section 9.6 of the Program Summary Report.

The opening and closing capability margins were calculated for each of the valves in these groups. In addition, for valves which are controlled in the closing direction by a torque switch, the closing setup margin is also included. The setup margin takes into account test equipment accuracy, torque switch repeatability and Load Sensitive Behavior and for the purposes of this document values of 9.5%, 5% and 20% respectively were utilized to account for these uncertainties. In practice, the values utilized for test equipment accuracy and torque switch repeatability would be determined based on each specific valve setup. Section 4.0 of the Program Summary Report discusses the various margins in detail and

outlines the basis for determining the adjustments necessary to account for test equipment accuracy, torque switch repeatability and Load Sensitive Behavior.

In reviewing the various margins contained in this document it should be noted that the margins are based on the MOV's as-modified configuration. A total of 22 Velan valves are scheduled to be modified in the 1996 refueling outages and the margins outlined in this document reflect those modifications. Section 6.2 of the Program Summary Report identifies the valves to be modified as well as the various modifications.

5.1 Velan Group V-1 Valves

Description

This group is composed of two 1 inch, 1500 lb, Velan globe valves. These valves are normally closed and receive a close signal on a safety injection (SI) signal. The valves have a safety function to open to provide a safety grade charging path on a loss of instrument air. The thrust requirements for these valves were calculated utilizing the EPRI Performance Prediction Methodology for seat based globe valves.

Table 5-2
Velan Group V-1 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8116	CCP A Discharge	2674	0	Open/Close
2HV-8116	CCP A Discharge	2674	0	Open/Close

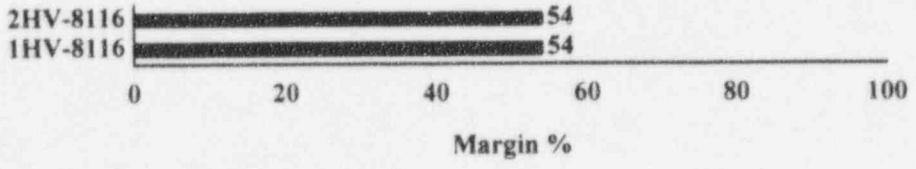
Differential Pressure Test Status

These valves have a differential pressure test priority of 6 in the opening direction and 2 in the closing direction. Based on the priority 6 ranking the valves require testing in the VEGP program. Differential pressure tests on these valves have been completed.

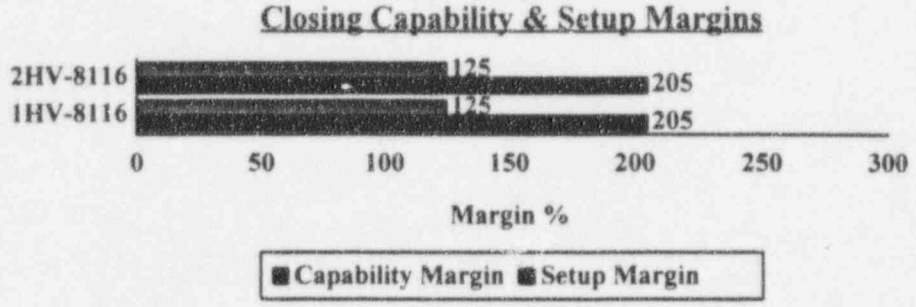
Calculated Margins

The opening margins were determined based on a design-basis differential pressure of 2674 psid which is associated with the valves safety function of opening to provide a safety grade charging path.

Opening Capability Margins



The closing margins were calculated based on a design-basis differential pressure of 0 psid which is associated with the mispositioning of these valves. These valves do not have an active safety function to close.



Design-Basis Capability Justification

1. Valves 1/2HV-8816 were differential pressure tested in-situ at VEGP and performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology. The actual opening thrusts were 92% and 64% of the predicted values respectively.

2. A total of twenty additional Velan globe valves were differential pressure tested at VEGP and each of these valves operated successfully. Sufficient data was collected in sixteen of the tests to evaluate the thrust requirements against the EPRI predicted thrusts and in all cases the test thrust requirements were bounded by the calculations.

3. Based on conservative calculations of valve thrust requirements and operator capabilities valves 1/2HV-8816 have an opening margin of 54% and a closing margin of 125%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

5.2 Velan Group V-2 Valves

Description

This group is composed of 12, 1-1/2 inch, 1500 lb, Velan globe valves. Valves 1/2HV-8103A,B,C&D are normally open to provide reactor coolant pump (RCP) seal injection flow and have a safety function to close to isolate a line break inside containment. Valves 1/2HV-8814 and 1/2HV-8920 are normally open to provide A and B train SI pump miniflow respectively to the reactor water storage tank (RWST) and have a safety function to close when transferring to cold-leg recirculation. The thrust requirements for these valves were calculated utilizing the EPRI Performance Prediction Program Methodology.

Table 5-3
Velan Group V-2 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8103A	RCP 1 Seal Water Inlet	2715	2715	Open/Close
2HV-8103A	RCP 1 Seal Water Inlet	2715	2715	Open/Close
1HV-8103B	RCP 1 Seal Water Inlet	2715	2715	Open/Close
2HV-8103B	RCP 1 Seal Water Inlet	2715	2715	Open/Close
1HV-8103C	RCP 1 Seal Water Inlet	2715	2715	Open/Close
2HV-8103C	RCP 1 Seal Water Inlet	2715	2715	Open/Close
1HV-8103D	RCP 1 Seal Water Inlet	2715	2715	Open/Close
2HV-8103D	RCP 1 Seal Water Inlet	2715	2715	Open/Close
1HV-8814	SI Pump A Miniflow Isolation	1521	1521	Open/Close
2HV-8814	SI Pump A Miniflow Isolation	1521	1521	Open/Close
1HV-8920	SI Pump B Miniflow Isolation	1521	1521	Open/Close
2HV-8920	SI Pump B Miniflow Isolation	1521	1521	Open/Close

Differential Pressure Test Status

Valves 1/2HV-8103A,B,C&D have a differential pressure test priority of 6 in the opening direction and 6 in the closing direction. Valves 1/2HV-8814 and 1/2HV-8920 have a differential pressure test priority of 5 in the opening direction and 5 in the closing direction. Based on the 5 and 6 priority rankings all of these valves would require testing in the VEGP program. However, based on Georgia Power's letter of December 2, 1992 to the NRC the scope of valves to be tested in this group was reduced to a total of four valves. The justification for reducing the test scope was that globe valves are predictable performers and four valves would be

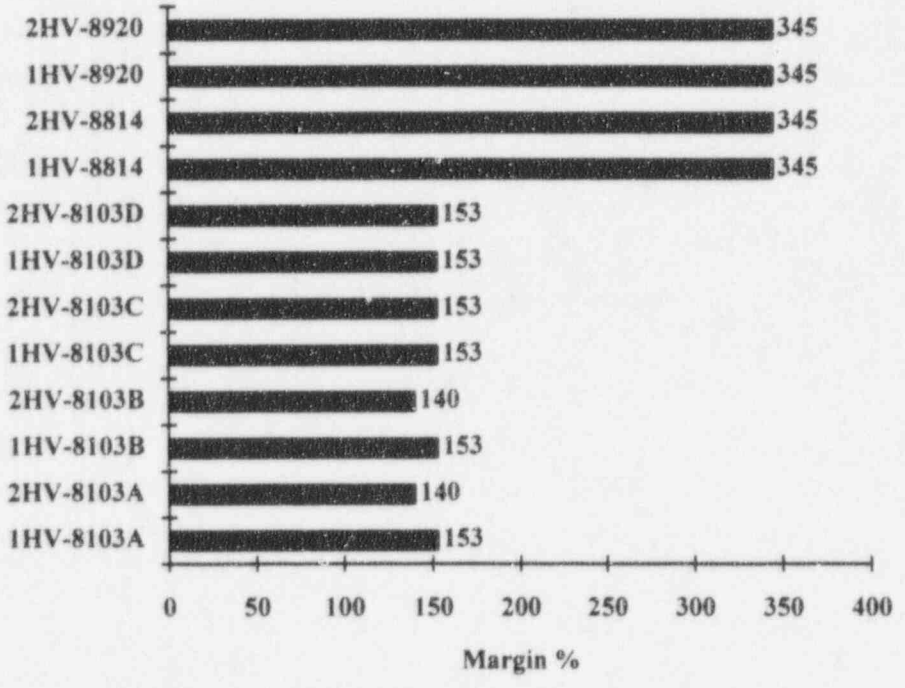
sufficient to identify any problems within this group of valves. The purpose of reducing the scope was to maintain the total number of valves to be tested approximately constant while increasing the number of Westinghouse gate valves to be tested. Valves 1HV-8103B, 1HV-8103C, 1HV-8920 and 1HV-8814 have been differential pressure tested.

Calculated Margins

The opening margins for valves 1/2HV-8103A,B,C&D were determined based on a design-basis differential pressure of 2715 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

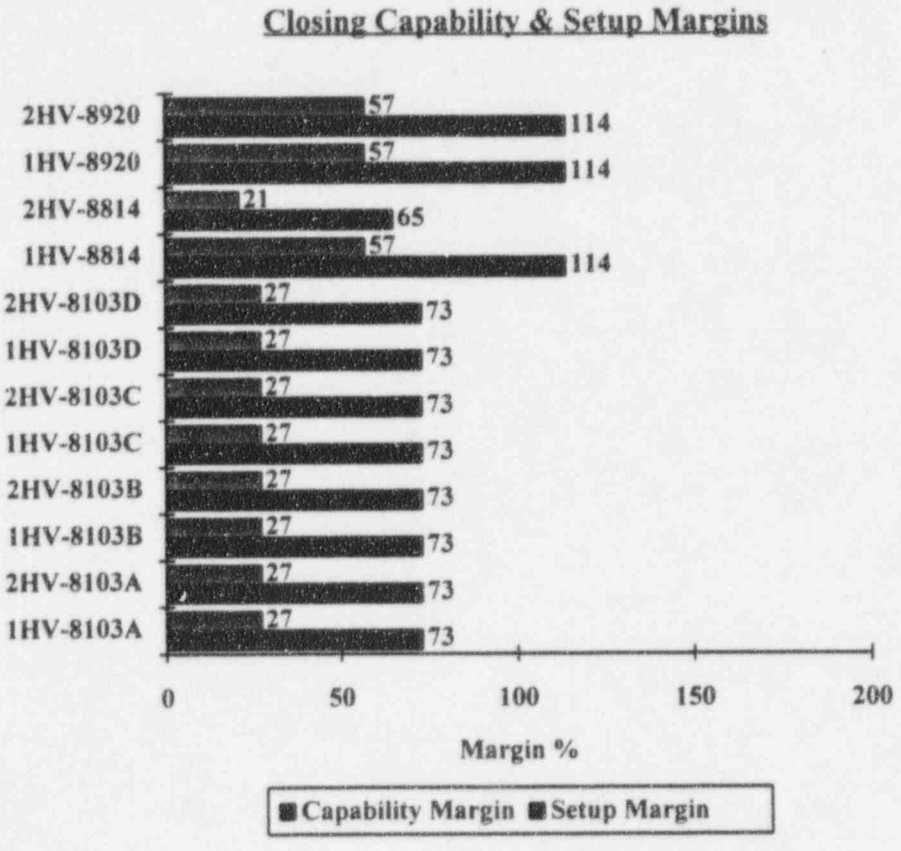
The opening margins for valves 1/2HV-8814 and 1/2HV-8920 were determined based on a design-basis differential pressure of 1521 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

Opening Capability Margins



The closing margins for valves 1/2HV-8103A,B,C&D were determined based on a design-basis differential pressure of 2715 psid which is associated with the safety function of closing to isolate a line break inside containment.

The closing margins for valves 1/2HV-8814 and 1/2HV-8920 were determined based on a design-basis differential pressure of 1521 psid which is associated with the safety function of closing to isolate SI pump miniflow to the RWST when transferring to cold-leg recirculation.



Design-Basis Capability Justification

1. Valves 1HV-8103A/B, 1HV-8814 and 1HV-8920 were differential pressure tested in-situ at VEGP and operated successfully. Only valve 1HV-8920 had valid test data and this valve performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology. The actual closing thrust was 73% of the predicted value.

2. A total of eighteen additional Velan globe valves were differential pressure tested at VEGP and each of these valves operated successfully. Sufficient data was collected in seventeen of the tests to evaluate the thrust requirements against the EPRI predicted thrusts and in all cases the test thrust requirements were bounded by the calculations.

3. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 140% and a closing

setup margin of at least 27% with the exception of valve 2HV-8814 which has a margin of 21%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

It should be noted that valve 2HV-8814 is limited by the torque rating of the spring pack. With a stiffer spring pack this valve required a torque switch setting of 1 to fall within the design range of the valve. A lighter spring pack was installed and the valve was setup successfully with a torque switch setting of 2. The torque switch setting of 2 indicates that substantial additional margin exists, although the valve appears to be spring pack limited when evaluated analytically.

5.3 Velan Group V-3 Valves

Description

This group is composed of 22, 2 inch, 1500 lb, Velan globe valves. These valves are utilized in a variety of applications in the Safety Injection (SI) system and the Chemical and Volume Control System (CVCS). The thrust requirements for these valves were calculated utilizing the EPRI Performance Prediction Methodology for seat-based globe valves.

Table 5-4
Velan Group V-4 Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-8100	RCP Seal Water Isolation	160	160	Close
2HV-8100	RCP Seal Water Isolation	160	160	Close
1HV-8104	BAST to CCP A	91	91	Open/Close
2HV-8104	BAST to CCP A	91	91	Open/Close
1HV-8110	CCP Miniflow Isolation	2644	2676	Close
1HV-8110	CCP Miniflow Isolation	2644	2676	Close
1HV-8111A	CCP Miniflow Isolation	2643	2676	Close
2HV-8111A	CCP Miniflow Isolation	2643	2676	Close
1HV-8111B	CCP Miniflow Isolation	2643	2676	Close
2HV-8111B	CCP Miniflow Isolation	2643	2676	Close
1HV-8112	RCP Seal Water Isolation	159	159	Close
2HV-8112	RCP Seal Water Isolation	159	159	Close
1HV-8508A	CCP Miniflow Isolation	2641	2620	Open/Close
2HV-8508A	CCP Miniflow Isolation	2641	2620	Open/Close
1HV-8508B	CCP Miniflow Isolation	2641	2620	Open/Close
2HV-8508B	CCP Miniflow Isolation	2641	2620	Open/Close
1HV-8509A	CCP Miniflow Isolation	2641	2620	Open/Close
2HV-8509A	CCP Miniflow Isolation	2641	2620	Open/Close
1HV-8509B	CCP Miniflow Isolation	2641	2620	Open/Close
2HV-8509B	CCP Miniflow Isolation	2641	2620	Open/Close
1HV-8813	SI Pump Common Miniflow	0	1521	Open/Close
1HV-8813	SI Pump Common Miniflow	0	1521	Open/Close

Valves 1/2HV-8100 are normally open to provide RCP seal water return flow and have a safety function to close on a containment isolation signal.

Valves 1/2HV-8104 are normally closed and have a safety function to open to provide an emergency boration flow path from the boric acid transfer pump to the suction of the CCPs. The valves have a safety function to close following emergency boration.

Valves 1/2HV-8110 are normally open to provide CCP miniflow to the seal water heat exchanger and have a safety function to close on a safety injection signal to isolate normal CCP miniflow.

Valves 1/2HV-8111A/B are normally open to provide CCP miniflow to the seal water heat exchanger and have a safety function to close on a safety injection signal to isolate normal CCP miniflow.

Valves 1/2HV-8112 are normally open to provide RCP seal water return flow and have a safety function to close on a containment isolation signal.

Valves 1/2HV-8508A/B are normally closed and have a safety function to open on a safety injection signal concurrent with high CCP discharge pressure to provide CCP miniflow to the RWST. The valves have a safety function to close when transferring to cold-leg recirculation.

Valves 1/2HV-8509A/B are normally open and have a safety function to close when transferring to cold-leg recirculation

Valves 1/2HV-8813 are normally open to provide SI pump miniflow to the RWST and have a safety function to close when transferring to cold-leg recirculation.

Differential Pressure Test Status

All of the valves in this group with the exception of valves 1/2HV-8100, 1/2HV-8104 and 1/2HV-8112 have differential test priorities of 5 or 6. All of the valves with differential pressure test priorities of 5 or 6 have been tested.

Calculated Margins

The opening margins for valves 1/2HV-8100 were determined based on a design-basis differential pressure of 160 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

The opening margins for valves 1/2HV-8104 were determined based on a design-basis differential pressure of 91 psid which is associated with the safety function

of opening to provide an emergency boration flow path from the boric acid transfer pump to the suction of the CCPs.

The opening margins for valves 1/2HV-8110 were determined based on a design-basis differential pressure of 2644 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

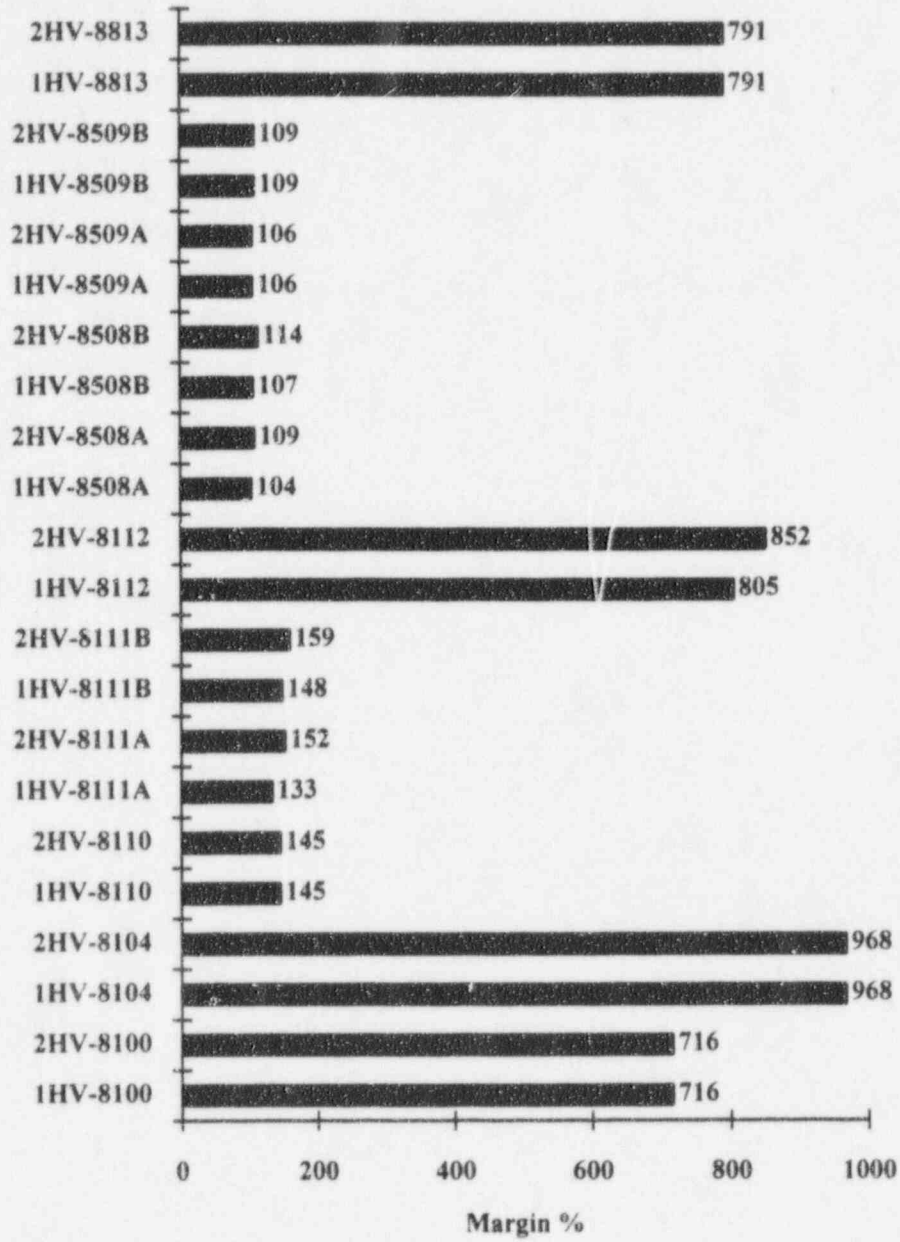
The opening margins for valves 1/2HV-8111A/B were determined based on a design-basis differential pressure of 2643 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

The opening margins for valves 1/2HV-8112 were determined based on a design-basis differential pressure of 159 psid which is associated with recovering from mispositioning. These valves do not have an active safety function to open.

The opening margins for valves 1/2HV-8508A/B and 1HV-8509A/B were determined based on a design-basis differential pressure of 2641 psid which is associated with the safety function of opening to provide CCP miniflow to the RWST.

The opening margins for valves 1/2HV-8813 were determined based on a design-basis differential pressure of 0 psid which is associated with the aligning these valves to their normal position during start-up. These valves are provided with interlocks to prevent mispositioning and the valves do not have an active safety function to open.

Opening Capability Margins



The closing margins for valves 1/2HV-8100 were determined based on a design-basis differential pressure of 160 psid which is associated with the safety function of closing on a containment isolation signal.

The closing margins for valves 1/2HV-8104 were determined based on a design-basis differential pressure of 91 psid which is associated with the safety function of closing following emergency boration.

The closing margins for valves 1/2HV-8110 were determined based on a design-basis differential pressure of 2676 psid which is associated with the safety function of closing to isolate normal CCP miniflow on an SI signal.

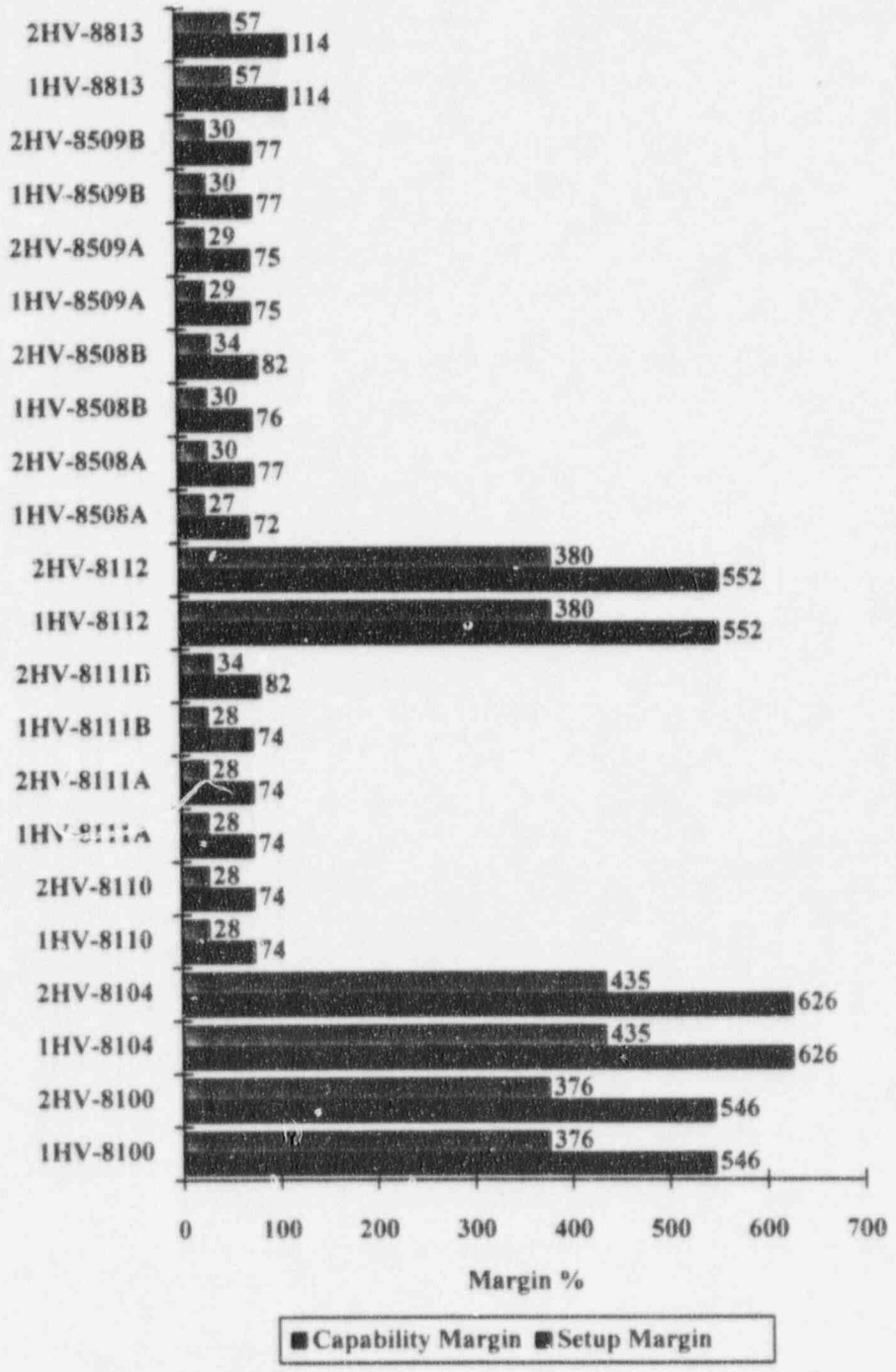
The closing margins for valves 1/2HV-8111A/B were determined based on a design-basis differential pressure of 2676 psid which is associated with the safety function of closing to isolate normal CCP miniflow on an SI signal.

The closing margins for valves 1/2HV-8112 were determined based on a design-basis differential pressure of 159 psid which is associated with the safety function of closing on a containment isolation signal.

The closing margins for valves 1/2HV-8508A/B and 1/2HV-8509A/B were determined based on a design-basis differential pressure of 2620 psid which is associated with the safety function of closing to isolate CCP miniflow to the RWST when transferring to cold-leg recirculation.

The closing margins for valves 1/2HV-8813 were determined based on a design-basis differential pressure of 1521 psid which is associated with the safety function of closing to isolate SI pump miniflow to the RWST when transferring to cold-leg recirculation.

Closing Capability & Setup Margins



Design-Basis Capability Justification

1. Valves 1/2HV-8110, 1/2HV-8111A/B, 1/2HV-8508A/B, 1/2HV-8509A/B and 1/2HV-8813 were differential pressure tested in-situ at VEGP and operated successfully. Fifteen of the sixteen valves tested had valid test data and all of these valves performed within the bounds of the thrust predicted by the EPRI Performance Prediction Program methodology. The actual closing thrusts ranged from 69% to 95% of the predicted value.

2. A total of six additional Velan globe valves were differential pressure tested at VEGP and each of these valves operated successfully. Sufficient data was collected in three of the tests to evaluate the thrust requirements against the EPRI predicted thrusts and in all cases the test thrust requirements were bounded by the calculations.

3. Based on conservative calculations of valve thrust requirements and operator capabilities these valves have an opening margin of at least 104% and a closing setup margin of at least 27%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

6.0 FISHER BUTTERFLY VALVES

There are a total of 70 Fisher butterfly valves in the VEGP GL 89-10 program. The valves are of the non-symmetrical disc, single offset design. These valves have been divided into six groups of identical valves as outlined in Table 6-1. Groups FB-5A and FB-5B appear to be identical based on the criteria identified in the table, however, the valves in group FB-5A utilize 2 inch stems and the valves in group FB-5B utilized 2-1/2 inch stems. Since torque requirements vary as a function of stem diameter the valves were placed in separate groups.

Table 6-1
Valve Groups

Group No.	Manufacturer	Valve Type	Valve Size	ANSI Rating	Total Valves
FB-1	Fisher	Butterfly	4.0 Inch	150 lb	4
FB-2	Fisher	Butterfly	8.0 Inch	150 lb	28
FB-3	Fisher	Butterfly	10.0 Inch	150 lb	10
FB-4	Fisher	Butterfly	18.0 Inch	150 lb	16
FB-5A	Fisher	Butterfly	24.0 Inch	150 lb	8
FB-5B	Fisher	Butterfly	24.0 Inch	150 lb	4

The torque requirements for these valves were calculated utilizing a combination of Fisher and EPRI NMAC methodology. The dynamic torque requirements were calculated utilizing the Fisher methodology while the packing loads were calculated utilizing the EPRI NMAC methodology. This methodology is discussed in more detail in Section 3.3.1.5 of the Program Summary Report.

The opening and closing capability margins were calculated for each of the valves in these groups. It should be noted that setup margins were not included for these valves although the opening and closing torque switches for these valves are currently in service. However, the opening and closing torque switches for these valves will be bypassed in conjunction with each valves next scheduled preventive maintenance or periodic test. In addition, certain valves will be repacked based on a revised packing configuration to ensure that the static loads for these valves are bounded by the packing loads utilized in the calculations. The margins outlined in this document reflect the bypassing of the opening and closing torque switches and the installation of the revised packing configuration as applicable. Section 6-2 of the Program Summary Report identified the valves to be modified and the associated schedules for these modifications.

6.1 Fisher Group FB-1 Butterfly Valves

Description

This group is composed of four, 4 inch, 150 lb, Fisher butterfly valves. These valves are normally closed and have a safety function to open when placing the Containment Post LOCA Purge system in operation following the loss of both hydrogen recombiners. The valves have a safety function to close following a failure of the filtration system. The torque requirements for these valves were calculated utilizing proprietary Fisher methodology with packing loads derived from an EPRI NMAC equation.

Table 6-2
Fisher Group FB-1 Butterfly Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-2624A	Post LOCA Purge Exhaust	37	37	Open/Close
2HV-2624A	Post LOCA Purge Exhaust	37	37	Open/Close
1HV-2624B	Post LOCA Purge Exhaust	37	37	Open/Close
2HV-2624B	Post LOCA Purge Exhaust	37	37	Open/Close

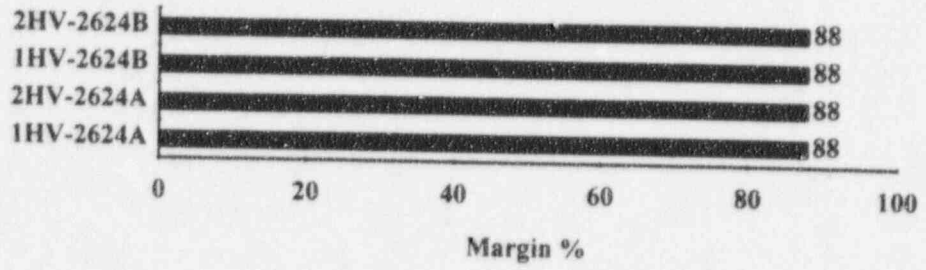
Differential Pressure Test Status

These valves have a differential pressure test priority of 2 in the opening direction and 2 in the closing direction. The VEGP program only requires that Fisher butterfly valves with a differential pressure test priority of 5 or higher be differential pressure tested, therefore, these valves were not tested.

Calculated Margins

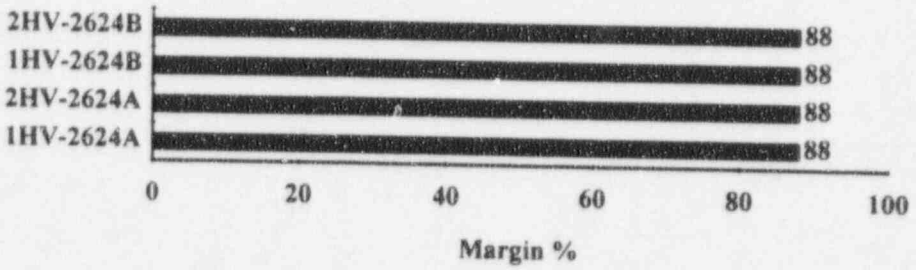
The opening margins were determined based on a design-basis differential pressure of 37 psid which is associated with the safety function of opening to place the Containment Post LOCA Purge system in operation.

Opening Capability Margins



The closing margins were determined based on a design-basis differential pressure of 37 psid which is associated with the safety function of closing following a failure of the Containment Post LOCA Purge system.

Closing Capability Margins



Design-Basis Capability Justification

1. Valves 1HV-1823, 1HV-1831, 2HV-2135 and 2HV-2139 are 8 inch, 150 lb Fisher butterfly valves similar in design to the valves in group FB-1. These valves were differential pressure tested in-situ at VEGP and their performance was consistent with that predicted by the Fisher methodology. The actual dynamic opening torques were 62% to 105% of the predicted values and the actual closing torques were 96% to 105% of the predicted values.

2. Based on conservative calculations of valve torque requirements and operator capabilities these valves have an opening margin of 88% and a closing margin of 88%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

6.2 Fisher Group FB-2 Butterfly Valves

Description

This group is composed of twenty-eight, 8 inch, 150 lb, Fisher butterfly valves. These valves are utilized in a variety of applications in the Auxiliary Feedwater (AFW) system and the Nuclear Service Cooling Water (NSCW) system. The torque requirements for these valves were calculated utilizing proprietary Fisher methodology with packing loads derived from an EPRI NMAC equation.

Valves 1/2HV-1806, 1/2HV-1807, 1/2HV-1808, 1/2HV-1809, 1/2HV-1822, 1/2HV-1823, 1/2HV-1830 and 1/2HV-1831 are normally open to provide NSCW flow to the containment coolers. The valves have a safety function to close on a manual actuation to provide containment isolation.

Valves 1/2HV-2134, 1/2HV-2135, 1/2HV-2138 and 1/2HV-2139 are normally open to provide NSCW flow to the containment auxiliary coolers and the reactor cavity coolers. The valves have a safety function to close on a loss of off-site power or an SI signal to divert NSCW flow to more critical loads.

Valves 1/2HV-5118 and 1/2HV-5119 are normally closed and have a safety function to open on a decreasing level in Condensate Storage Tank (CST) 001 to provide a suction path from CST 002 for the motor-driven AFW pumps.

Differential Pressure Test Status

Valves 2HV-5118 and 2HV-5119 have a differential pressure test priority of 4 in the opening and closing direction. Valves 1HV-5118 and 1HV-5119 have a differential pressure test priority of 2 in the opening and closing direction. The remaining valves in this group have a differential pressure test priority of 2 in the opening and closing direction. The VEGP program only requires that Fisher butterfly valves with a differential pressure test priority of 5 or higher be differential pressure tested. However, in order to validate the Fisher methodology valves 1HV-1823, 1HV-1831, 2HV-2135 and 2HV-2139 were differential pressure tested.

Table 6-3
Fisher Group FB-2 Butterfly Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-1806	NSCW to Containment Cooler	74	74	Open/Close
2HV-1806	NSCW to Containment Cooler	74	74	Open/Close
1HV-1807	NSCW to Containment Cooler	70	70	Open/Close
2HV-1807	NSCW to Containment Cooler	70	70	Open/Close
1HV-1808	NSCW to Containment Cooler	74	74	Open/Close
2HV-1808	NSCW to Containment Cooler	74	74	Open/Close
1HV-1809	NSCW to Containment Cooler	70	70	Open/Close
2HV-1809	NSCW to Containment Cooler	70	70	Open/Close
1HV-1822	NSCW from Containment Cooler	74	74	Open/Close
2HV-1822	NSCW from Containment Cooler	74	74	Open/Close
1HV-1823	NSCW from Containment Cooler	70	70	Open/Close
2HV-1823	NSCW from Containment Cooler	70	70	Open/Close
1HV-1830	NSCW from Containment Cooler	70	70	Open/Close
2HV-1830	NSCW from Containment Cooler	70	70	Open/Close
1HV-1831	NSCW from Containment Cooler	70	70	Open/Close
2HV-1831	NSCW from Containment Cooler	70	70	Open/Close
1HV-2134	NSCW to Reactor Cavity Cooler	70	70	Close
2HV-2134	NSCW to Reactor Cavity Cooler	70	70	Close
1HV-2135	NSCW to Reactor Cavity Cooler	73	73	Close
2HV-2135	NSCW to Reactor Cavity Cooler	73	73	Close
1HV-2138	NSCW from Reac. Cavity Cooler	70	70	Close
2HV-2138	NSCW from Reac. Cavity Cooler	70	70	Close
1HV-2139	NSCW from Reac. Cavity Cooler	73	73	Close
2HV-2139	NSCW from Reac. Cavity Cooler	73	73	Close
1HV-5118	CST to MDAFW Pump Suction	24	24	Open
2HV-5118	CST to MDAFW Pump Suction	24	24	Open
1HV-5119	CST to MDAFW Pump Suction	24	24	Open
2HV-5119	CST to MDAFW Pump Suction	24	24	Open

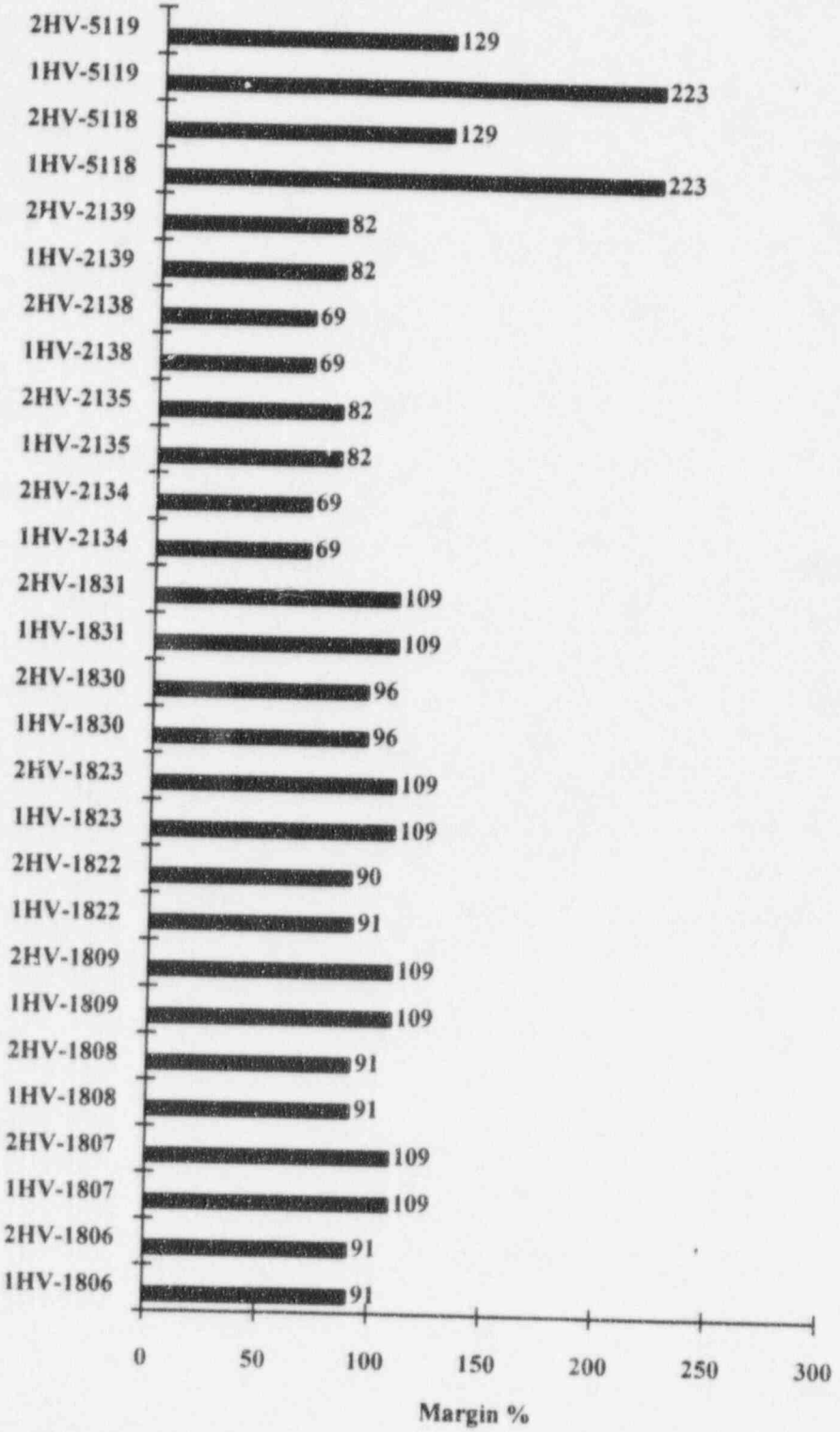
Calculated Margin

The opening margins for 1/2HV-1806, 1/2HV-1807, 1/2HV-1808, 1/2HV-1809, 1/2HV-1822, 1/2HV-1823, 1/2HV-1830 and 1/2HV-1831 were determined based on a design-basis differential pressure of 70 psid or 74 psid which is associated with the safety function of opening on an SI signal.

The opening margins for valves 1/2HV-2134, 1/2HV-2135, 1/2HV-2138 and 1/2HV-2139 were determined based on a design-basis differential pressure of 70 psid or 73 psid which is associated with opening to recover from mispositioning. These valves do not have an active safety function to open.

The opening margins for valves 1/2HV-5118 and 1/2HV-5119 were determined based on a design-basis differential pressure of 24 psid which is associated with the safety function of opening to provide a suction flowpath from CST 2 to the motor-driven AFW pumps.

Opening Capability Margins

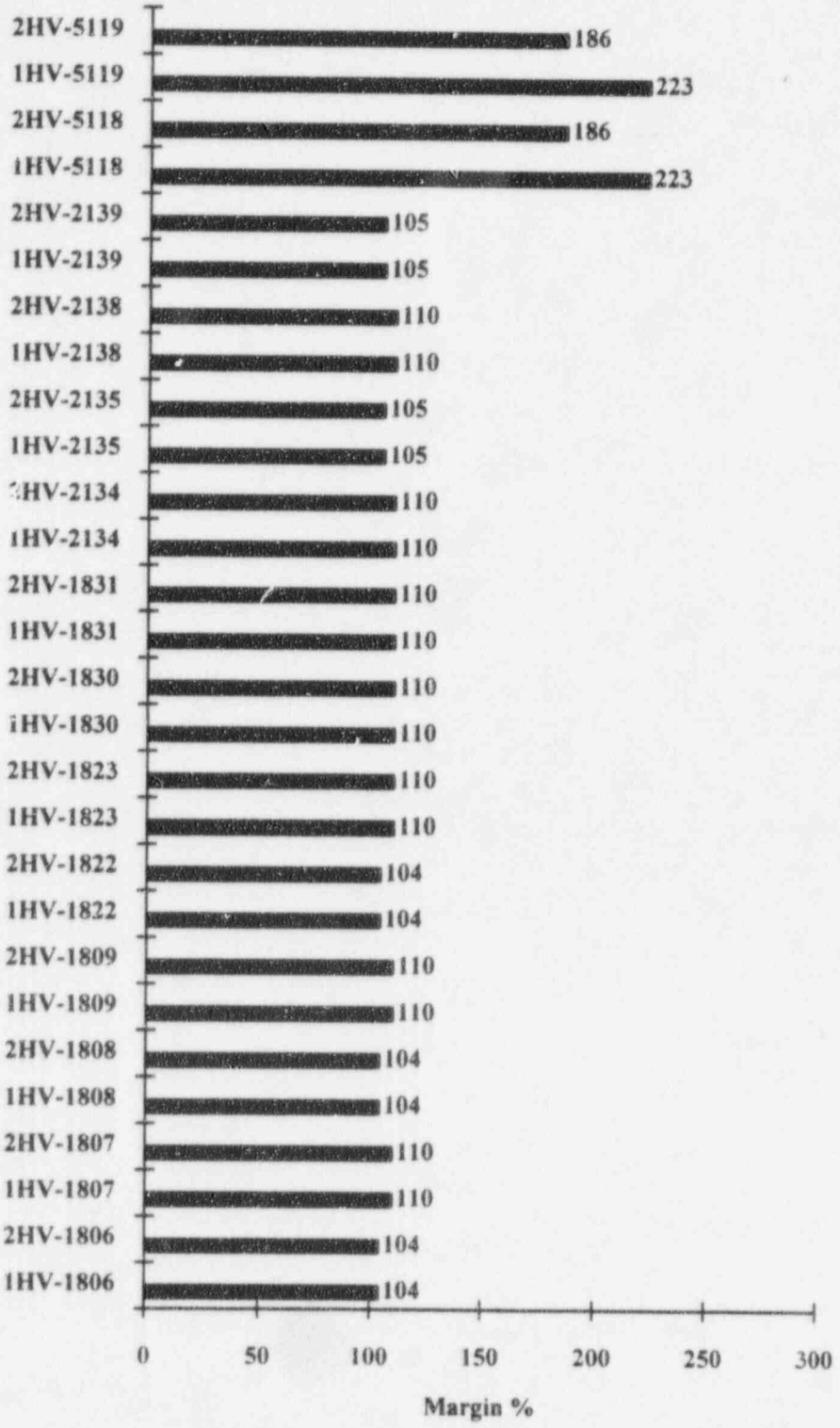


The closing margins for 1\2HV-1806, 1/2HV-1807, 1/2HV-1808, 1/2HV-1809, 1/2HV-1822, 1/2HV-1823, 1/2HV-1830 and 1/2HV-1831 were determined based on a design-basis differential pressure of 70 psid or 74 psid which is associated with the safety function of closing to provide containment isolation.

The closing margins for valves 1/2HV-2134, 1/2HV-2135, 1/2HV-2138 and 1/2HV-2139 were determined based on a design-basis differential pressure of 70 psid or 73 psid which is associated with the safety function of closing on an SI signal or loss of offsite power.

The closing margins for valves 1/2HV-5118 and 1/2HV-5119 were determined based on a design-basis differential pressure of 24 psid which is associated with closing to recover from mispositioning. These valves do not have an active safety function to close.

Closing Capability Margins



Design-Basis Capability Justification

1. Valves 1HV-1823, 1HV-1831, 2HV-2135 and 2HV-2139 were differential pressure tested in-situ at VEGP and their performance was consistent with that predicted by the Fisher methodology. The actual dynamic opening torques were 62% to 105% of the predicted values and the actual closing torques were 96% to 105% of the predicted values.

2. Based on conservative calculations of valve torque requirements and operator capabilities these valves have an opening margin of at least 69% and a closing margin of at least 104%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

6.3 Fisher Group FB-3 Butterfly Valves

Description

This group is composed of ten, 10 inch, 150 lb, Fisher butterfly valves. Valves 1/2HV-1974, 1/2HV-1975, 1/2HV-1978 and 1/2HV-1979 are normally open to provide Auxiliary Component Cooling Water (ACCW) to the RCP thermal barriers, the excess letdown heat exchangers and the reactor coolant drain tank heat exchangers. The valves have a safety function to close to provide containment isolation. Valves 1/2HV-5113 are normally closed and have a safety function to open on a decreasing level in CST 001 to provide a suction flow path from CST 002 to the turbine-driven AFW pumps. The torque requirements for these valves were calculated utilizing proprietary Fisher methodology with packing loads derived from an EPRI NMAC equation.

Table 6-4
Fisher Group FB-3 Butterfly Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-1974	ACCW from RCP Coolers	95	95	Close
2HV-1974	ACCW from RCP Coolers	95	95	Close
1HV-1975	ACCW from RCP Coolers	96	96	Close
2HV-1975	ACCW from RCP Coolers	96	96	Close
1HV-1978	ACCW to RCP Coolers	95	95	Close
2HV-1978	ACCW to RCP Coolers	95	95	Close
1HV-1979	ACCW to RCP Coolers	96	96	Close
2HV-1979	ACCW to RCP Coolers	96	96	Close
1HV-5113	CST to TDAFW Pump Suction	23	23	Open
2HV-5113	CST to TDAFW Pump Suction	23	23	Open

Differential Pressure Test Status

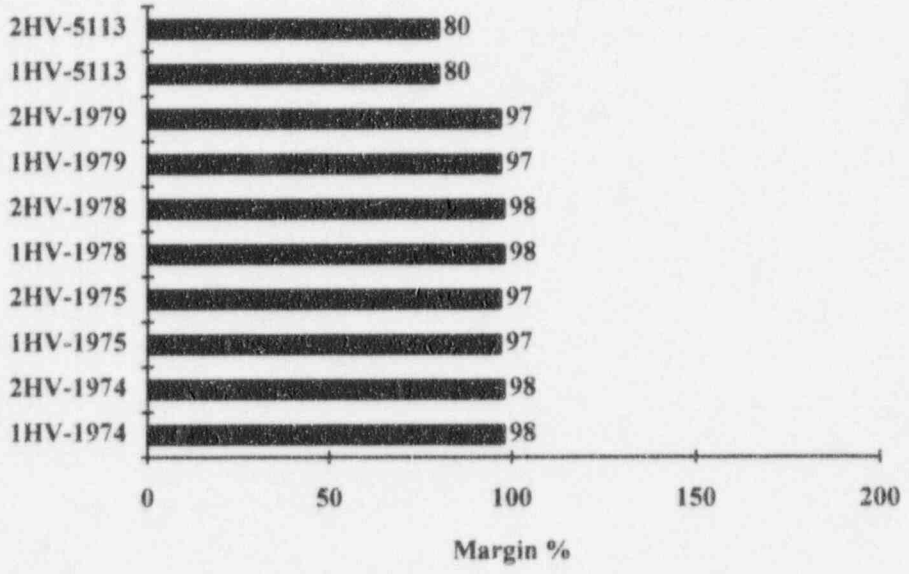
These valves have a differential pressure test priority of 4 in the opening direction and 4 in the closing direction. The VEGP program only requires that Fisher butterfly valves with a differential pressure test priority of 5 or higher be differential pressure tested, therefore, these valves were not tested.

Calculated Margin

The opening margins for valves 1/2HV-1974, 1/2HV-1975, 1/2HV-1978 and 1/2HV-1979 were determined based on a design-basis differential pressure of 95 psid or 96 psid which is associated with opening to recover from mispositioning. These valves do not have an active safety function to open.

The opening margins for valves 1/2HV-5113 were determined based on a design-basis differential pressure of 23 psid which is associated with the safety function of opening to provide a suction flowpath from CST 2 to the turbine-driven AFW pump.

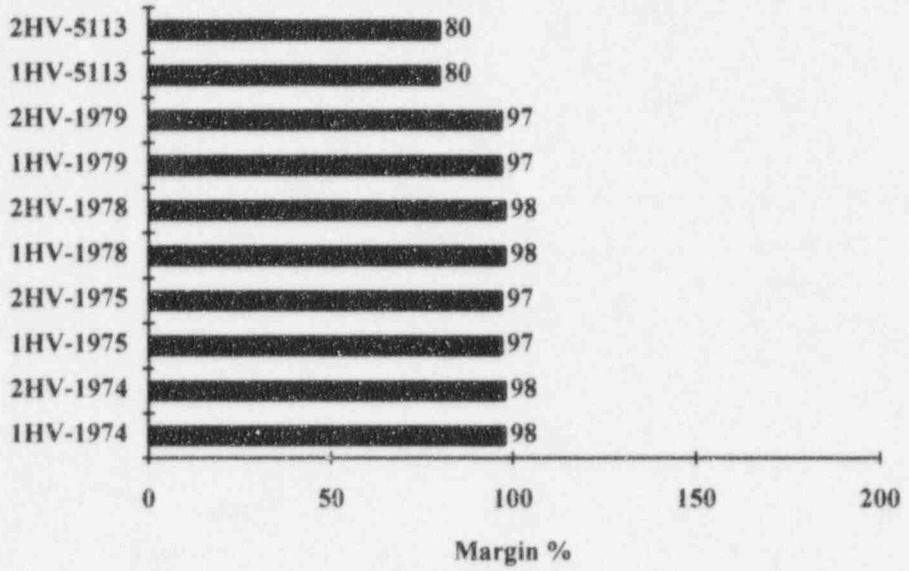
Opening Capability Margins



The closing margins for valves 1/2HV-1974, 1/2HV-1975, 1/2HV-1978 and 1/2HV1979 were determined based on a design-basis differential pressure of 95 psid or 96 psid which is associated with the safety function of closing to provide containment isolation.

The closing margins for valves 1/2HV-5113 were determined based on a design-basis differential pressure of 23 psid which is associated with closing to recover from mispositioning. These valves do not have an active safety function to close.

Closing Capability Margins



Design-Basis Capability Justification

1. Valves 1HV-1823, 1HV-1831, 2HV-2135 and 2HV-2139 are 8 inch, 150 lb Fisher butterfly valves similar in design to the valves in group FB-3. These valves were differential pressure tested in-situ at VEGP and their performance was consistent with that predicted by the Fisher methodology. The actual dynamic opening torques were 62% to 105% of the predicted values and the actual closing torques were 96% to 105% of the predicted values.

2. Based on conservative calculations of valve torque requirements and operator capabilities these valves have an opening margin of at least 80% and a closing margin of at least 80%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

6.4 Fisher Group FB-4 Butterfly Valves

Description

This group is composed of sixteen, 18 inch, 150 lb, Fisher butterfly valves. Valves 1/2HV-11600, 1/2HV-11605, 1/2HV-11606, 1/2HV-11607, 1/2HV-11612 and 1/2HV-11613 are normally open when their respective NSCW pump is running and are normally closed when their respective NSCW pump is not running. The valves have a safety function to open 45 seconds following the start of an NSCW pump. Valves 1/2HV-1668B and 1/2HV-1669B are normally closed and have a safety function to open on low NSCW return water temperature to divert flow to the tower basins. The valves have a safety function to open on increasing NSCW return water temperature to direct flow to the towers. The torque requirements for these valves were calculated utilizing proprietary Fisher methodology with packing loads derived from an EPRI NMAC equation.

Table 6-5
Fisher Group FB-4 Butterfly Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-11600	NSCW Pump Discharge	173	0	Open
2HV-11600	NSCW Pump Discharge	173	0	Open
1HV-11605	NSCW Pump Discharge	173	0	Open
2HV-11605	NSCW Pump Discharge	173	0	Open
1HV-11606	NSCW Pump Discharge	173	0	Open
2HV-11606	NSCW Pump Discharge	173	0	Open
1HV-11607	NSCW Pump Discharge	173	0	Open
2HV-11607	NSCW Pump Discharge	173	0	Open
1HV-11612	NSCW Pump Discharge	173	0	Open
2HV-11612	NSCW Pump Discharge	173	0	Open
1HV-11613	NSCW Pump Discharge	173	0	Open
2HV-11613	NSCW Pump Discharge	173	0	Open
1HV-1668B	NSCW Tower Bypass	31	31	Open/Close
1HV-1668B	NSCW Tower Bypass	31	31	Open/Close
1HV-1669B	NSCW Tower Bypass	31	31	Open/Close
1HV-1669B	NSCW Tower Bypass	31	31	Open/Close

Differential Pressure Test Status

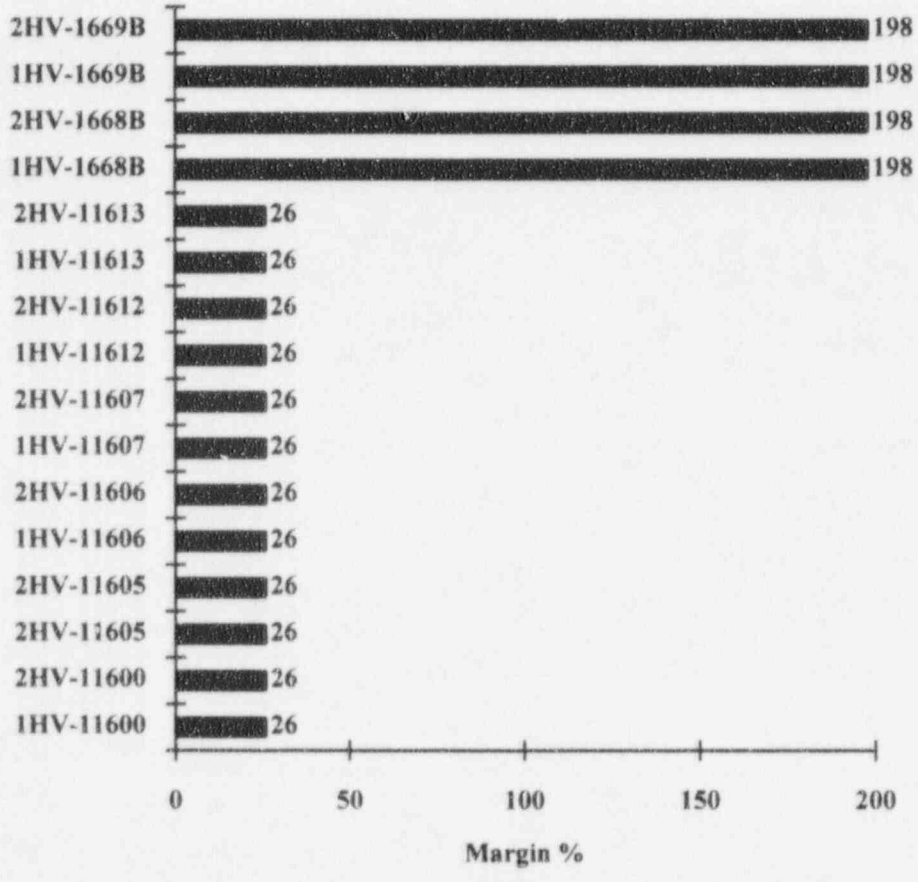
These valves have a differential pressure test priority of 4 in the opening direction and 4 in the closing direction. The VEGP program only requires that Fisher butterfly valves with a differential pressure test priority of 5 or higher be differential pressure tested, therefore, these valves were not tested.

Calculated Margin

The opening margins for valves 1/2HV-11600, 1/2HV-11605, 1/2HV-11606, 1/2HV-11607, 1/2HV-11612 and 1/2HV-11613 were determined based on a design-basis differential pressure of 173 psid which is associated with the safety function of opening following the start of an NSCW pump.

The opening margins for valves 1/2HV-1668B and 1/2HV-1669B were determined based on a design-basis differential pressure of 31 psid which is associated with the safety function of opening on low NSCW return water temperature.

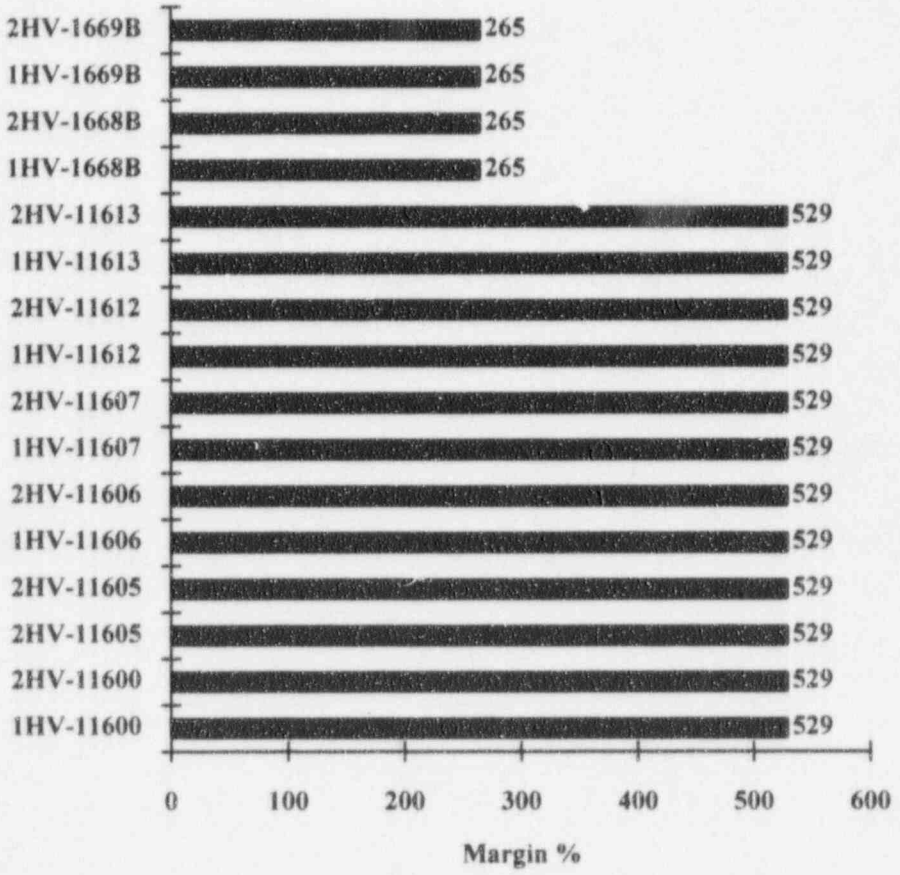
Opening Capability Margins



The closing margins for valves 1/2HV-11600, 1/2HV-11605, 1/2HV-11606, 1/2HV-11607, 1/2HV-11612 and 1/2HV-11613 were determined based on a design-basis differential pressure of 0 psid which is associated with closing following a pump trip. These valves do not have an active safety function to close.

The closing margins for valves 1/2HV-1668B and 1/2HV-1669B were determined based on a design-basis differential pressure of 31 psid which is associated with the safety function of closing on high NSCW return water temperature.

Closing Capability Margins



Design-Basis Capability Justification

1. Valves 1HV-1823, 1HV-1831, 2HV-2135 and 2HV-2139 are 8 inch, 150 lb Fisher butterfly valves similar in design to the valves in group FB-4. These valves were differential pressure tested in-situ at VEGP and their performance was consistent with that predicted by the Fisher methodology. The actual

dynamic opening torques were 62% to 105% of the predicted values and the actual closing torques were 96% to 105% of the predicted values.

2. Based on conservative calculations of valve torque requirements and operator capabilities valves 1/2HV-1668B and 1/2HV-1669B have an opening margin of 198% and a closing margin of 265%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

3. Based on conservative calculations of valve torque requirements and operator capabilities valves 1/2HV-11600, 1/2HV-11605, 1/2HV-11606, 1/2HV-11607, 1/2HV-11612 and 1/2HV-11613 have an opening margin of 26% and a closing margin of 529%. In addition, these valves are stroked open at design-basis conditions each time an NSCW pump is started. Therefore, these margins, combined with the fact that the valves are stroked against design-basis conditions in normal operation, are adequate to ensure that these valves will be capable of performing their design-basis function.

6.5 Fisher Group FB-5A Butterfly Valves

Description

This group is composed of eight, 24 inch, 150 lb, Fisher butterfly valves equipped with 2 inch valve stems. These valves are normally closed and power is locked out to prevent operation in modes 1 through 4. The valves receive a close signal on a containment isolation signal. The torque requirements for these valves were calculated utilizing proprietary Fisher methodology with packing loads derived from an EPRI NMAC equation.

Table 6-6
Fisher Group FB-5A Butterfly Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-2626A	Normal Purge Supply	0	0	Close
2HV-2626A	Normal Purge Supply	0	0	Close
1HV-2627A	Normal Purge Supply	0	0	Close
2HV-2627A	Normal Purge Supply	0	0	Close
1HV-2628A	Normal Purge Exhaust	0	0	Close
2HV-2628A	Normal Purge Exhaust	0	0	Close
1HV-2629A	Normal Purge Exhaust	0	0	Close
2HV-2629A	Normal Purge Exhaust	0	0	Close

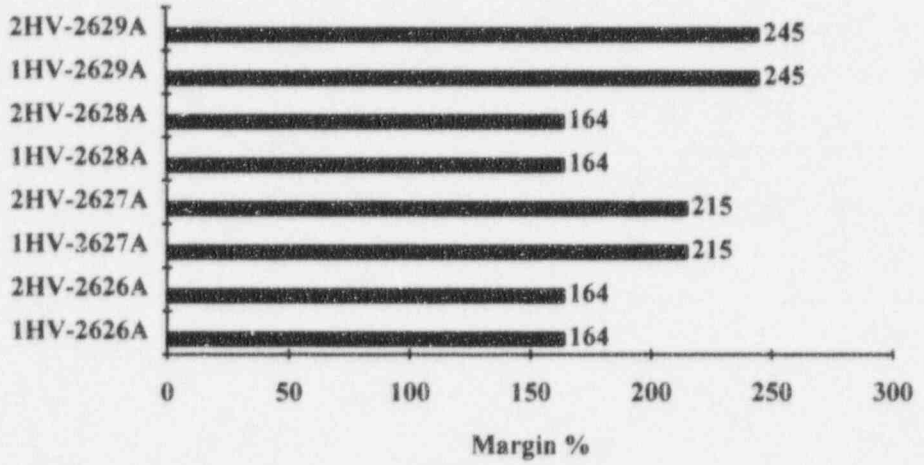
Differential Pressure Test Status

These valves have a differential pressure test priority of 2 in the opening direction and 2 in the closing direction. The VEGP program only requires that Fisher butterfly valves with a differential pressure test priority of 5 or higher be differential pressure tested, therefore, these valves were not tested.

Calculated Margin

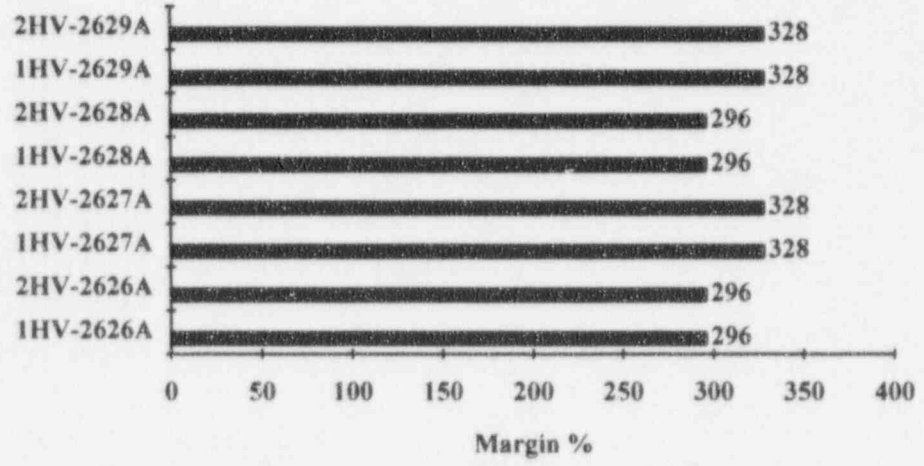
The opening margins for these valves were determined based on a design-basis differential pressure of 0 psid. These valves do not have an active safety function to open.

Opening Capability Margins



The closing margins for these valves were determined based on a design-basis differential pressure of 0 psid which is associated with the safety function of closing to provide containment isolation in modes 5 and 6. The valves are closed and power is locked out to prevent operation in modes 1 through 4.

Closing Capability Margins



Design-Basis Capability Justification

1. Valves 1HV-1823, 1HV-1831, 2HV-2135 and 2HV-2139 are 8 inch, 150 lb Fisher butterfly valves similar in design to the valves in group FB-5A. These valves were differential pressure tested in-situ at VEGP and their performance was consistent with that predicted by the Fisher methodology. The actual

dynamic opening torques were 62% to 105% of the predicted values and the actual closing torques were 96% to 105% of the predicted values.

2. Based on conservative calculations of valve torque requirements and operator capabilities these valves have an opening margin of at least 164% and a closing margin of at least 296%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.

6.6 Fisher Group FB-5B Butterfly Valves

Description

This group is composed of four, 24 inch, 150 lb, Fisher butterfly valves equipped with 2-1/2 inch stems. These valves are normally open to direct NSCW return water to the cooling towers. The valves have a safety function to close on decreasing NSCW return water temperature and to open on increasing NSCW return water temperature. The torque requirements for these valves were calculated utilizing proprietary Fisher methodology with packing loads derived from an EPRI NMAC equation.

Table 6-7
Fisher Group FB-5B Butterfly Valves

Valve Tag No.	Valve Description	Design DP Open	Design DP Close	Safety Position Open/Close
1HV-1668A	NSCW Tower Isolation	31	31	Open/Close
2HV-1668A	NSCW Tower Isolation	31	31	Open/Close
1HV-1669A	NSCW Tower Isolation	31	31	Open/Close
2HV-1669A	NSCW Tower Isolation	31	31	Open/Close

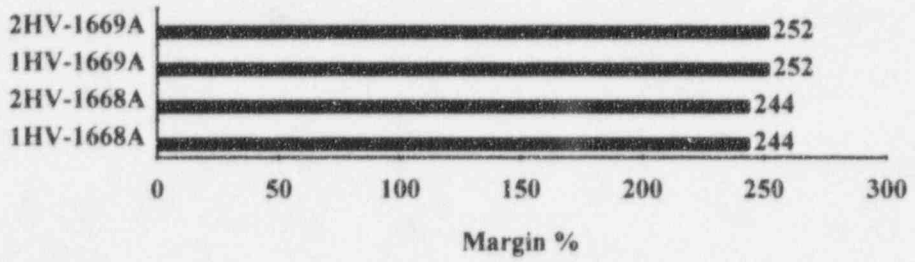
Differential Pressure Test Status

These valves have a differential pressure test priority of 4 in the opening direction and 4 in the closing direction. The VEGP program only requires that Fisher butterfly valves with a differential pressure test priority of 5 or higher be differential pressure tested, therefore, these valves were not tested.

Calculated Margin

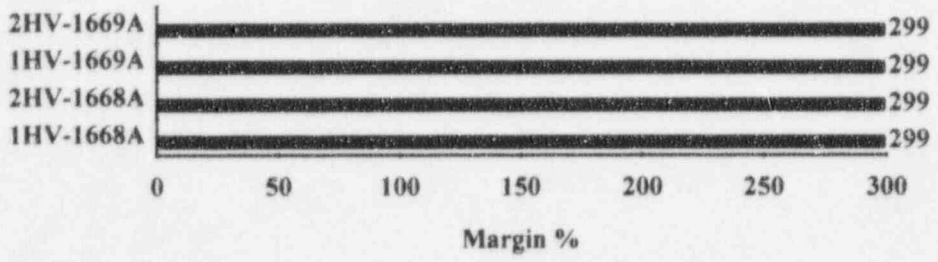
The opening margins for these valves were determined based on a design-basis differential pressure of 31 psid which is associated with the safety function of opening on increasing NSCW return water temperature.

Opening Capability Margins



The closing margins for these valves were determined based on a design-basis differential pressure of 31 psid which is associated with the safety function of closing on decreasing NSCW return water temperature.

Closing Capability Margins



Design-Basis Capability Justification

1. Valves 1HV-1823, 1HV-1831, 2HV-2135 and 2HV-2139 are 8 inch, 150 lb Fisher butterfly valves similar in design to the valves in group FB-5B. These valves were differential pressure tested in-situ at VEGP and their performance was consistent with that predicted by the Fisher methodology. The actual dynamic opening torques were 62% to 105% of the predicted values and the actual closing torques were 96% to 105% of the predicted values.

2. Based on conservative calculations of valve torque requirements and operator capabilities these valves have an opening margin of at least 244% and a closing margin of 299%. These margins are adequate to ensure that these valves will be capable of performing their design-basis function.