Generic Letter 89-10 Closure Response

Valve Factor Grouping Methodology
and
Assumption Validation

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Valve Factor Grouping Methodology

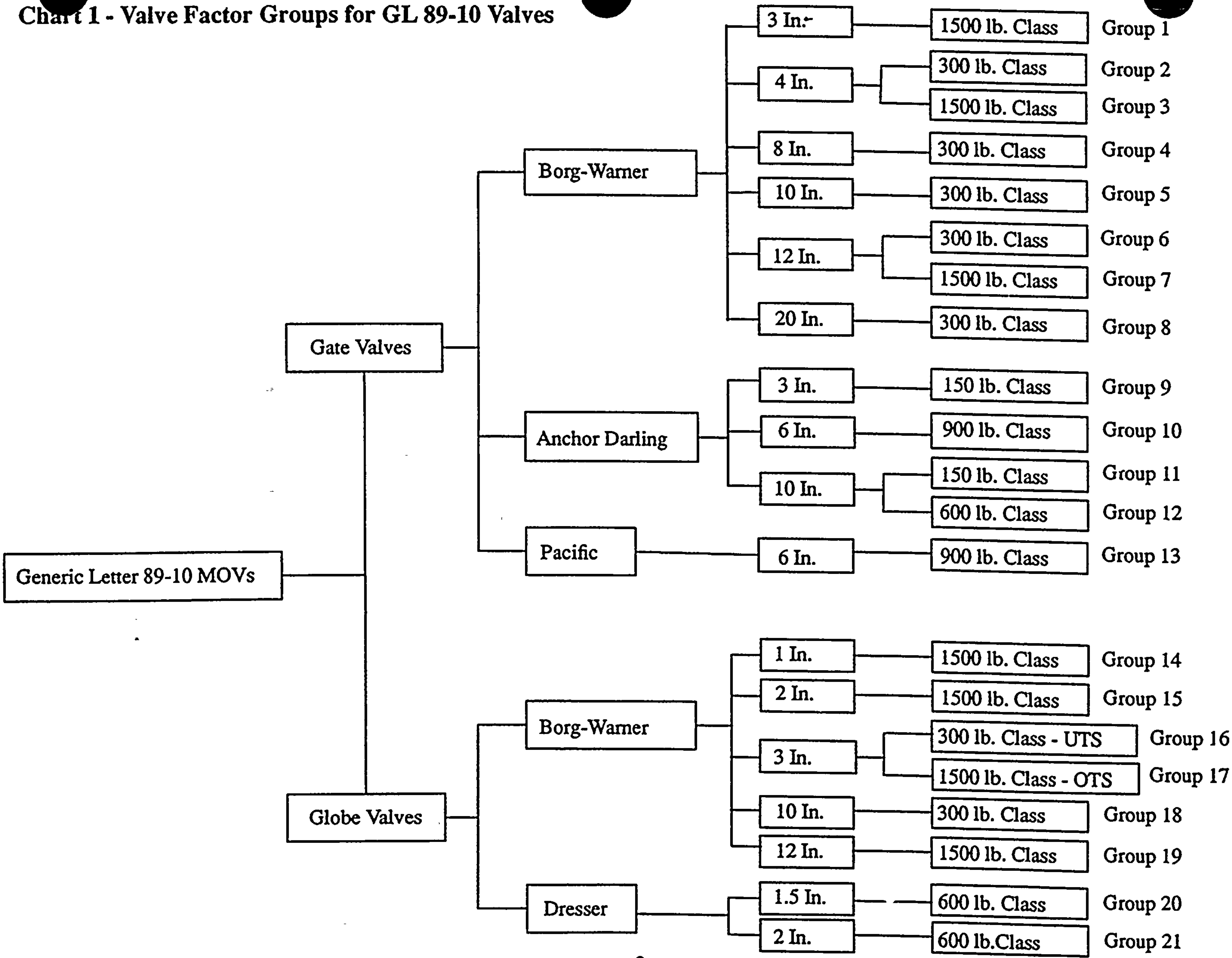
Because the entire population of the MOVs at PVNGS is not practicable to test under in-situ differential pressure conditions near their postulated design basis scenarios, a grouping methodology must be employed to validate the valve factor assumptions used as input for calculating the minimum thrust required to open or close the MOVs under design basis conditions. At PVNGS, it is recognized that valve type, valve manufacturer, valve size, and ANSI pressure class should be considered when grouping MOVs for a valve factor assumption. However, for some MOV configurations there may be no on-site or industry in-situ test data available to provide a test basis for some specific MOV configurations (i.e. type, manufacturer, size, and pressure class). In these instances, the MOVs must be grouped based upon a broader approach. As a minimum, a MOV group's relationship is defined by the valve's type and manufacturer. The type of MOVs at PVNGS, which require an assumed valve factor for input in calculating their minimum thrust requirement, are gate and globe valves. The gate and globe population are grouped by type and manufacturer as follows:

Gate Valves - Borg-Warner Flex Wedge
Anchor Darling Flex Wedge
Pacific Flex Wedge

Globe Valves - Borg-Warner
Dresser

Having established the initial criteria for valve factor grouping, the above five MOV groups are then divided into more specific groups to evaluate the test basis for each group's valve factor assumption. Each MOV group is described by its type, manufacturer, size, and ANSI pressure class. For some valve groups, the design basis differential pressure requirements may vary significantly for MOVs within the same group. In-situ test data for some MOV groups indicate the valve factor may vary in relation to significant differences in test differential pressure. In these instances, the valve groups are further divided into sub-groups based upon their design basis differential pressure requirements. Chart 1 describes each of the valve factor groups for all of the Generic Letter 89-10 gate and globe MOVs at PVNGS.

Chart 1 - Valve Factor Groups for GL 89-10 Valves



Validation Data

The test basis for validating the valve factor assumption for each group of MOVs has been formed from four sources:

Palo Verde's on-site differential pressure in-situ testing data
EPRI's Performance Prediction Program differential pressure flow loop testing data. (Ref. 1, 2)
EPRI's Phase I in-situ testing data acquired from participating utilities' MOV programs. (Ref. 3)
EPRI's Phase II in-situ testing data acquired from participating utilities' MOV programs. (Ref.4)

To draw a direct correlation between Palo Verde's and EPRI's test results, it was the goal of this validation process to evaluate the raw data from the EPRI flow loop testing data using the PVNGS Dynamic Test Evaluation methodology which was used to evaluate the PVNGS 89-10 MOV test data. However, the only raw test data provided from EPRI's flow loop testing was acquired after the valve seats were preconditioned, i.e., the valves were cycled repeatedly against their maximum differential pressure to achieve a stable disc friction coefficient. Because the majority of the MOVs at PVNGS are not regularly stroked against their maximum differential pressure, the EPRI data which was acquired after preconditioning was not included as part of the validation test basis for a specific MOV group. However, the disc friction coefficient data acquired up to the point of preconditioning, as well as the final stabilized disc friction coefficient values were used as part of the test basis to support the bounding valve factor assumptions, where broader valve groups have been established.

The valve factor used in determining the design thrust setpoints at PVNGS differs from the disc friction coefficient, as determined and evaluated in the EPRI Performance Prediction Program. At PVNGS, the valve factor is a ratio between the MOVs opening or closing thrust requirement based upon the differential pressure and the differential pressure's force exerted on the surface area of the disc/gate. EPRI describes the disc friction coefficient in terms of its relationship to the valve disc's half angle. In comparing the two parameters, enough similarity exists between the PVNGS valve factor and EPRI's disc friction coefficient to justify using the disc coefficient values from EPRI's flow loop testing to support the validation process for PVNGS's valve factors. Therefore, in the interest of simplicity, EPRI's flow loop testing disc friction coefficient data will be referred to as valve factor data in the context of this discussion.

Because the test data provided in EPRI's Phase I and II in-situ test programs was gathered from MOVs in service at other participating utilities, the data is considered applicable to the test basis for the MOV groups established at PVNGS. The raw test data provided as part of EPRI's Phase I and II in situ test reports was evaluated using the PVNGS Dynamic Test Evaluation methodology to establish the valve factors used as part of the test basis for the validation process. Using the PVNGS Dynamic Test Evaluation methodology to determine the valve factor for each of the applicable in-situ test program MOVs ensures a direct correlation to the valve factor data acquired at PVNGS.

Validation Methodology

Two methods are used for validating the valve factor assumption for a specific valve group. This approach assures that on-site dynamic test data and/or industry in-situ test data specific to a MOV group (i.e. valve type, manufacturer, size and pressure class) is considered where available, while also providing a test basis for making a conservative valve factor assumption for MOV groups where no group specific test data exists.

The following is a discussion of each approach:

Method 1:

The preferred method for validating the valve factor assumption for a MOV group is to evaluate the PVNGS on-

site differential pressure in-situ testing data acquired at or near design basis conditions, as well as EPRI's Performance Prediction Program differential pressure flow loop testing data and EPRI's Phase I and II in-situ testing data acquired from participating utilities' MOV programs for a specific group of MOVs. The valves must share the same type, manufacturer, size and class. To use this method, the test basis must represent a minimum of 30% of the MOVs within the specific group and be comprised of no less than two MOVs. The valve factor assumption is based upon a value which bounds the highest valve factor measured during testing any particular valve in the group, then that valve factor is applied to the entire group.

Method 2:

If test data is not available for a specific valve group from the above listed sources, the next method for validating the valve factor assumption for an MOV group is to evaluate a broader valve group based on valve data for the same valve type and manufacturer. Data for the MOV groups meeting the broader criteria acquired from all four data sources will provide the test basis for the assumption. For conservatism, the valve factor assumption is based upon a value which bounds the highest valve factor measured during testing any particular valve within the broader group, and then that valve factor is applied to the specific group for which the assumption is being validated.

<u>Borg-Warner Flex Wedge Gate Valves</u>

Groups 1 through 8 are made up of Borg-Warner flex wedge gate MOVs. Of these eight groups, seven groups have an adequate test basis for using Method 1 for validating the open valve factor assumption, and two groups have an adequate test basis for using Method 1 for validating the close valve factor assumption. Group 8 requires application of Method 2 for validating the open valve factor assumption, and Groups 1,4,5,6,7, and 8 require application of Method 2 for validating the close valve factor assumption.

Using Method 2, a conservative open and close valve factor assumption must be determined for application to the setpoint calculations for Borg-Warner flex wedge gate valves for which there is no group specific test basis available. The test basis for determining the open and close valve factor assumption is made up of data from the following MOV configurations:

PVNGS Data:

Valve Size	Valve Class	Test DP	Population	Stroke Direction	High Vf
3 Inch	1500 Lbs	~ 75 psid	3	Open	0.42
3 Inch	1500 Lbs	~ 1900 psid	8	Open	0.48
4 Inch	300 Lbs	~ 60 psid	3	Open/Close	0.43/0.31
4 Inch	1500 Lbs	~ 1200 psid	4	Open/Close	0.51/0.48
8 Inch	300 Lbs	~ 350 psid	6	Open	0.52
10 Inch	300 Lbs	~ 400 psid	12	Open	0.52
12 Inch	300 Lbs	~ 375 psid	5	Open	0.54
12 Inch	1500 Lbs	~ 2350 psid	6	Open	0.59
12 Inch	1500 Lbs	~ 375 psid	12	Open	0.68

EPRI's Phase I and II in-situ testing data acquired from participating utilities' MOV programs:

Valve Size	Valve Class	Test DP	Population	Stroke Direction	High Vf
4 Inch	900 Lbs	~ 1560 psid	1	Open/Close	0.33/0.53
[illegible] Inch	1500 Lbs	~ 2700 psid	1	Open/Close	0.44/0.51
16 Inch	300 Lbs	~ 300 psid	2	Open/Close	0.33/0.38

From the above tabulated data it is determined that an open valve factor assumption of 0.70 and a close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and in EPRI's in-situ testing for Borg-Warner flex wedge gate valves.

In addition, four Borg-Warner Flex Wedge Gate valves were included as part of EPRI's Performance Prediction Program's differential pressure flow loop testing, Ref.'s 5 through 8. The individual test reports for each of these MOVs have been reviewed in an effort to evaluate each MOVs differential pressure test data using PVNGS' Dynamic Testing Evaluation methodology for determining the open and close valve factors. Upon review it was discovered that EPRI had stroked each of the MOVs several hundred times against the MOV's maximum test differential pressure in an effort to "precondition" the valves and achieve a stable valve factor. The following table lists the MOVs tested by EPRI and the valve factors resulting after the preconditioning:

Valve ID	Valve Size	Valve Class	Test DP	Precon. Strokes	Vf (O/C)
MOV 7	3 Inch	1500 Lbs	~ 2500 psid	~ 300	0.51/0.58
MOV 8	6 Inch	150 Lbs	~ 250 psid	~ 150	0.52 Open
MOV 9	6 Inch	1500 Lbs	~ 1800 psid	~ 120	0.68 Open
MOV 10	12 Inch	300 Lbs	~ 1500 psid	~ 475	0.60/0.60

The preconditioning data demonstrated that the valve factor starts at a lower value and increases gradually for each stroke in its ascension to its stabilized preconditioned value. Therefore, it is important to note that the valve factor values acquired at the onset of the preconditioning process were more in line with the values determined from the industry's in-situ testing data. This indicates that the valve factor for a MOV not frequently stroked against its design basis differential pressure will be significantly lower than its expected preconditioned value. The following table lists the MOVs tested by EPRI and the valve factor ranges measured for the indicated number of preconditioning strokes:

Valve ID	Valve Size	Valve Class	Precon. Strokes	Vf Range
MOV 7	3 Inch	1500 Lbs	~ 225	0.10 - 0.50
MOV 8	6 Inch	150 Lbs	~ 120	0.30 - 0.50 (Open only)
MOV 9	6 Inch	1500 Lbs	~ 60	0.20 - 0.60 (Open only)
MOV 10	12 Inch	300 Lbs	~ 325	< 0.50

The results from the testing for these four MOVs provide further support for a bounding open valve factor assumption of 0.7 and a bounding close valve factor assumption of 0.6 for Borg-Warner flex wedge gate valves.

Anchor Darling Flex Wedge Gate Valves

Groups 9 through 12 are made up of Anchor Darling flex wedge gate MOVs. Of these four groups, three groups have an adequate test basis for using Method 1 for validating the open valve factor assumption, and two groups have an adequate test basis for using Method 1 for validating the close valve factor assumption. Group 9 requires application of Method 2 for validating the open valve factor assumption, and Groups 9 and 12 require application of Method 2 for validating the close valve factor assumption.

Using Method 2, a conservative open and close valve factor assumption must be determined for application to the setpoint calculations for Anchor Darling flex wedge gate valves for which there is no group specific test basis available. The test basis for determining the open and close valve factor assumption is made up of test data from the following PVNGS and EPRI data:

PVNGS Data:

Valve Size	Valve Class	Test DP	Population	Stroke Direction	High Vf
6 Inch	900 Lbs	~ 1750 psid	6	Open/Close	0.54/.55
6 Inch	900 Lbs	~ 600 psid	6	Open/Close	0.59/.54
10 Inch	150 Lbs	~ 75 psid	9	Open/Close	0.40/0.47
10 Inch	600 Lbs	~ 185 psid	1	Open	0.25 Open

EPRI's Phase I and II in-situ testing data acquired from participating utilities' MOV programs:

Valve Size	Valve Class	Test DP	Population	Stroke Direction	High Vf
10 Inch	150 Lbs	~ 100 psid	1	Open/Close	0.44/0.48
16 Inch	600 Lbs	~ 350 psid	2	Open/Close	0.19/0.19

From the above data it is determined that an open and close valve factor assumption of 0.60 bounds all the measured values acquired at PVNGS and in EPRI's in-situ testing for Anchor Darling flex wedge gate valves.

In addition, seven Anchor Darling flex wedge gate valves were included as part of EPRI's Performance Prediction Program's differential pressure flow loop testing, Ref.'s 10 through 16. Like the Borg-Warner valves, EPRI had stroked each of the MOVs several hundred times against the MOV's maximum test differential pressure in an effort to "precondition" the valves and achieve a stable valve factor. The following table lists the MOVs tested by EPRI and the valve factors resulting from the preconditioning:

Valve ID	Valve Size	Valve Class	Test DP	Precon. Strokes	Vf (O/C)
MOV 1	3 Inch	300 Lbs	~ 740 psid	~ 550	0.38/0.40
MOV 2	6 Inch	150 Lbs	~ 275 psid	~ 90	0.10/0.15
MOV 3	6 Inch	900 Lbs	~ 1800 psid	~ 900	0.48 Open
MOV 4	10 Inch	300 Lbs	~ 740 psid	~ 400	0.30 Open
MOV 5	10 Inch	900 Lbs	~ 1400 psid	~ 180	0.46/0.49
MOV 6	18 Inch	300 Lbs	~ 500 psid	~ 100	0.57/0.57
MOV 16	3 Inch	900 Lbs	~ 1500 psid	~ 690	0.46/0.47

The results from the testing for these seven MOVs provide further support for a bounding open and close valve factor assumption of 0.60 for Anchor Darling flex wedge gate valves.

Pacific Flex Wedge Gate Valves

Group 13 is made up of Pacific flex wedge gate MOVs. All four Pacific flex wedge gate valves at PVNGS have been tested under differential pressure conditions, thus validation Method 1 can be employed to determine an open and close bounding valve factor assumption for these valves. Therefore, determining a bounding valve factor for application to validation Method 2 is not required.

Borg-Warner UTS Globe Valves

Groups 14, 15, 16, 18, and 19 are made up of Borg-Warner flex wedge gate MOVs. Of these five groups, three groups have an adequate test basis for using Method 1 for validating the close valve factor assumption. Groups 14 and 16 require application of Method 2 for validating the close valve factor assumption.

Using Method 2, a conservative close valve factor assumption must be determined for application to the setpoint calculations for Borg-Warner Under-the-Seat (UTS) globe valves, for which there is no group specific test basis available. The test basis for determining the close valve factor assumption is made up of data from the following

MOV configurations:

PVNGS Data:

Valve Size	Valve Class	Test DP	Population	Stroke Direction	High Vf
2 Inch	1500 Lbs	~ 1900 psid	24	Close	1.36
2 Inch	1500 Lbs	~ 200 psid	6	Close	1.56
10 Inch	300 Lbs	~ 200 psid	12	Close	1.74
12 Inch	1500 Lbs	~ 250 psid	10	Close	1.99

In addition, one Borg-Warner globe valve was included as part of EPRI's Performance Prediction Program's differential pressure flow loop testing, MOV #44, Ref. 9:

Valve Size	Valve Class	Test DP	Population	Stroke Direction	Vf
6 Inch	900 Lbs	~ 1800 psid	1	Close	2.0

From the above data it is determined that a close valve factor of 2.0 bounds all of the measured values acquired at PVNGS and EPRI's in-situ testing for Borg-Warner UTS globe valves.

Borg-Warner OTS Globe Valves

Group 17 is made up of Borg-Warner OTS globe MOVs. All six Borg-Warner Over-the-Seat (OTS) globe valves at PVNGS have been tested under differential pressure conditions, thus validation Method 1 can be employed to determine a bounding open valve factor assumption for these valves. Therefore, determining a bounding valve factor for application to validation Method 2 is not required.

Dresser Globe Valves

Groups 20 and 21 are made up of Dresser globe MOVs. None of the Dresser globe valves at PVNGS were practicable to test under in-situ conditions. As well, there were no Dresser globe valves tested as part of EPRI's Performance Prediction testing programs. A review of the EPRI MOV General Information Database revealed two 2 Inch, 600 Lb. Dresser globe valves at Browns Ferry Nuclear Station and one 1.25 Inch 1500 Lb. Dresser globe valve at Perry Nuclear Station, which are part of the Generic Letter 89-10 MOV population. Through conversations with engineering representatives from each of these plants, it was found that none of the three Dresser globe valves had been tested under dynamic conditions. In the absence of any group specific test data from which to build a test basis for validating a valve factor assumption and in light of the fact that all of these MOVs are used in low pressure (5 psid, 52 psid, 63 psid, 142 psid) gas-media applications, a valve factor assumption of 2.0 is considered conservative based upon test results from other globe valves at PVNGS and in EPRI's test programs.

MOVs With No Differential Pressure Requirement

For some MOVs in Palo Verde's Generic Letter 89-10 Program there is no identified open or close flowing design basis differential pressure case under which the MOV must operate. For these MOV groups, a conservative differential pressure of 100 psid is used to determine the design minimum thrust required to open and close the MOV. In addition, a valve factor is used which has been determined to be conservative for the MOV group based on one of the above two methods.

Valve Factor Assumption Summary Table

The following table provides a summary of the bounding valve factor assumptions determined for each MOV group as well as a comparison to the effective valve factor used in determining the minimum thrust requirement for each group in Calculation 13-JC-ZZ-201:

Valve ID	Valve Group	Bounding Group Vf Assumption Open	Bounding Group Vf Assumption Close	Effective Open Vf Assumption used in Calculation 13-JC-ZZ-201	Effective Close Vf Assumption used in Calculation 13-JC-ZZ-201	Validation Method Open/Close
13JCHEHV0536	1	0.5	0.6	0.5*/1.51[1]	1.66[1]	Op - 1/Cl - 2
13JSIAHV0604	1	0.5	0.6	0.5*/0.6	1.66[2]	Op - 1/Cl -2
13JSIBHV0609	1	0.5	0.6	0.5*/0.6	1.66[2]	Op - 1/Cl - 2
13JCHNUV0501	2	0.5	0.5	0.5*/1.52[3]	0.55	Op - 1/Cl - 1
13JSIAHV0698	3	0.55	0.55	0.55	0.55	Op - 1/Cl - 1
13JSIBHV0699	3	0.55	0.55	0.55	0.55	Op - 1/Cl - 1
13JSIBUV0671	4	0.55	0.6	0.6	0.65	Op - 1/Cl - 2
13JSIAUV0672	4	0.55	0.6	0.6	0.65	Op - 1/Cl - 2
12JSIAHV0684	5	0.55	0.6	0.6*/1.82[4]	1.82[4]	Op - 1/Cl - 2
13JSIBHV0689	5	0.55	0.6	0.6*/1.82[4]	1.82[4]	Op - 1/Cl - 2
13JSIAHV0685	5	0.55	0.6	0.55*/1.52[5]	1.66[5]	Op - 1/Cl - 2
13JSIBUV0694	5	0.55	0.6	0.55*/1.52[5]	1.66[5]	Op - 1/Cl - 2
13JSIAHV0687	5	0.55	0.6	0.6*/1.82[4]	1.82[4]	Op - 1/Cl - 2
13JSIBHV0695	5	0.55	0.6	0.6*/1.82[4]	1.82[4]	Op - 1/Cl - 2
13JSIAHV0688	5	0.55	0.6	0.55*/1.82[4]	1.82[4]	Op - 1/Cl - 2
13JSIBHV0693	5	0.55	0.6	0.55*/1.82[4]	1.82[4]	Op - 1/Cl - 2
13JSIAUV0655	6	0.55	0.6	0.6*/0.6	1.82[6]	Op - 1/Cl - 2
13JSIBUV0656	6	0.55	0.6	0.6*/0.6	1.82[6]	Op - 1/Cl - 2
13JSIAUV0651	7a	0.65	0.65	0.65*/1.82 7	1.82[7]	Op - 1/Cl - 2
13JSIBUV0652	7a	0.65	0.65	0.65*/1.82 7	1.82[7]	Op - 1/Cl - 2
13JSICUV0653	7b	0.7	0.7	0.7*/1.82[8]	1.82[8]	Op - 1/Cl - 2
13JSIDUV0654	7b	0.7	0.7	0.7*/1.82[8]	1.82[8]	Op - 1/Cl - 2
13JSIBUV0614	7b	0.7	0.7	0.7	0.7	Op - 1/Cl - 2
13JSIBUV0624	7b	0.7	0.7	0.7	0.7	Op - 1/Cl - 2

Valve ID	Valve Group	Bounding Group Vf Assumption Open	Bounding Group Vf Assumption Close	Effective Open Vf Assumption used in Calculation 13-JC-ZZ-201	Effective Close Vf Assumption used in Calculation 13-JC-ZZ-201	Validation Method Open/Close
13JSIAUV0634	7b	0.7	0.7	0.7	0.7	Op - 1/Cl - 2
13JSIAUV0644	7b	0.7	0.7	0.7	0.7	Op - 1/Cl - 2
13JCHBHV0530	8	0.6	0.6	0.6*/1.52 [5]	1.66 [5]	Op - 2/Cl - 2
13JCHAHV0531	8	0.6	0.6	0.6*/1.52 [5]	1.66 [5]	Op - 2/Cl - 2
13JSIAHV0683	8	0.6	0.6	0.6*/1.02 [9]	1.66 [9]	Op - 2/Cl - 2
13JSIBHV0692	8	0.6	0.6	0.6*/1.02 [9]	1.66 [9]	Op - 2/Cl - 2
13JSIAHV0686	8	0.6	0.6	0.6*/0.6	0.6	Op - 2/Cl - 2
13JSIBHV0696	8	0.6	0.6	0.6*/0.6	0.6	Op - 2/Cl - 2
13JRDAUV0023	9	0.6	0.6	1.82 [10]	1.33 [10]	Op - 2/Cl - 2
1JSGNHV1142	10	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
1JSGNHV1144	10	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
13JSGAUV0134	10	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
13JSGAUV0138	10	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
13JAFBUV0034	10	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
13JAFBUV0035	10	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
13JAFCUV0036	10	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
13JAFAUV0037	10	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
13JSGEHV0041	10	0.6	0.6	0.6*/2.30 [11]	2.30 [11]	Op - 1/Cl - 1
13JSGEHV0042	10	0.6	0.6	0.6*/2.30 [11]	2.30 [11]	Op - 1/Cl - 1
13JSGEHV0043	10	0.6	0.6	0.6*/2.30 [11]	2.30 [11]	Op - 1/Cl - 1
13JSGEHV0044	10	0.6	0.6	0.6*/2.30 [11]	2.30 [11]	Op - 1/Cl - 1
13JWCBUV0061	11	0.5	0.5	0.6	0.6	Op - 1/Cl - 1
13JWCAUV0062	11	0.5	0.5	0.6	0.6	Op - 1/Cl - 1
13JWCBUV0063	11	0.5	0.5	0.6	0.6	Op - 1/Cl - 1
03JSIAHV0684	12	0.5	0.6	0.6	0.6	Op - 1/Cl - 2
23JSGNHV1142	13	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
23SGNHV1144	13	0.6	0.6	0.6	0.6	Op - 1/Cl - 1
13JRCEHV0430	14	2.0	2.0	2.0	2.0	Cl - 2

Valve ID	Valve Group	Bounding Group Vf Assumption Open	Bounding Group Vf Assumption Close	Effective Open Vf Assumption used in Calculation 13-JC-ZZ-201	Effective Close Vf Assumption used in Calculation 13-JC-ZZ-201	Validation Method Open/Close
13JRCEHV0431	14	2.0	2.0	2.0	2.0	Cl - 2
13JRCEHV0432	14	2.0	2.0	2.0	2.0	Cl - 2
13JRCEHV0433	14	2.0	2.0	2.0	2.0	Cl - 2
13JSIBUV0616	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIAUV0617	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIBUV0626	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIAUV0627	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIBUV0636	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIAUV0637	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIBUV0646	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIAUV0647	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIAUV0666	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIBUV0667	15a	N/A	1.37	N/A	1.37	Cl - 1
13JSIAUV0664	15b	N/A	1.60	N/A	1.70	Cl - 1
13JSIBUV0665	15b	N/A	1.60	N/A	1.70	Cl - 1
13JSIBUV0668	15b	N/A	1.60	N/A	1.60	Cl - 1
13JSIAUV0669	15b	N/A	1.60	N/A	1.60	Cl - 1
13JCHAHV0524	15b	N/A	1.60	N/A	3.33 [12]	Cl - 1
13JCHBHV0255	15b	N/A	1.60	N/A	3.33 [12]	Cl - 1
13JCHNUV0514	16	N/A	2.0	N/A	3.33 [12]	Cl - 2
13JSICHV0321	17	1.20	N/A	1.38	N/A	Op - 1
13JSIDHV0331	17	1.20	N/A	1.38	N/A	Op - 1
13JSIAHV0306	18	N/A	1.80	N/A	1.80	Cl - 1
13JSIBHV0307	18	N/A	1.80	N/A	1.80	Cl - 1
13JSIAUV0690	18	N/A	1.80	N/A	1.80	Cl - 1
13JSIBUV0691	18	N/A	1.80	N/A	1.80	Cl - 1
13JSIBUV0615	19	N/A	2.0	N/A	3.05 [13]	Cl - 1
13JSIBUV0625	19	N/A	2.0	N/A	3.05 [13]	Cl - 1

Valve ID	Valve Group	Bounding Group Vf Assumption Open	Bounding Group Vf Assumption Close	Effective Open Vf Assumption used in Calculation 13-JC-ZZ-201	Effective Close Vf Assumption used in Calculation 13-JC-ZZ-201	Validation Method Open/Close
13JSIAUV0635	19	N/A	2.0	N/A	3.05 [13]	Cl - 1
13JSIAUV0645	19	N/A	2.0	N/A	3.05 [13]	Cl - 1
13JGRAUV0001	20	N/A	2.0	N/A	2.0	Cl - 2
13JHPAUV0001	21	N/A	2.0	N/A	2.39 [14]	Cl - 2
13JHPBUV0002	21	N/A	2.0	N/A	2.39 [14]	Cl - 2
13JHPAUV0003	21	N/A	2.0	N/A	30.14 [15]	Cl - 2
13JHPBUV0004	21	N/A	2.0	N/A	30.14 [15]	Cl - 2
13JHPAUV0005	21	N/A	2.0	N/A	2.90 [16]	Cl - 2
13JHPBUV0006	21	N/A	2.0	N/A	2.90 [16]	Cl - 2

* - Applied only to the Open Hydrostatic DP Case.

Notes:

Note 1: The open and close design basis differential pressure cases for these MOVs are 26 psid and 0 psid, respectively. However, 100 psid is used to calculate the minimum thrust required to open and close the MOVs. An open valve factor of 0.5 and close valve factor of 0.55 are used to calculate the minimum required thrust to overcome 100 psid. Based on an open and close design basis differential pressure case of 33 psid, as recommended by the Limitorque SEL guide, the existing minimum thrust setpoint results in an effective open valve factor of 1.92 and an effective close valve factor of 1.66

Note 2: There is no closing flowing design basis differential pressure case against which these MOVs are required to operate. However, 100 psid is used to calculate the minimum thrust required to close the MOVs. A close valve factor of 0.55 is used to calculate the minimum required thrust to overcome 100 psid. Based on a minimum close differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoint results in an effective close valve factor of 1.66

Note 3: There is no opening flowing design basis differential pressure case against which these MOVs are required to operate. However, 100 psid is used to calculate the minimum thrust required to open the MOVs. An open valve factor of 0.50 is used to calculate the minimum required thrust to overcome 100 psid. Based on a minimum open differential pressure of 33 psid, as recommended by the Limitorque SEL guide, the existing minimum thrust setpoint results in an effective open valve factor of 1.52

Note 4: There is no flowing design basis differential pressure case against which these MOVs are required to operate. However, 100 psid is used to calculate the minimum thrust required to open and close the MOVs. An open and close valve factor of 0.6 are used to calculate the minimum required thrust to overcome 100 psid. Based on a minimum differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoints result in an effective open and close valve factor of 1.82.

Note 5: There is no flowing design basis differential pressure case against which these MOVs are required to operate. However, 100 psid is used to calculate the minimum thrust required to open and close the MOVs. An open valve factor of 0.50 and close valve factor of 0.55 are used to calculate the minimum required thrust to overcome 100 psid. Based on a minimum differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoints result in an effective open valve factor of 1.52 and close valve factor of 1.66.

Note 6: The close design basis differential pressure case for these MOVs is 27 psid. However, 100 psid is used to calculate the minimum thrust required to close the MOVs. A close valve factor of 0.55 is used to calculate the minimum required thrust to overcome 100

psid. Based on a minimum close differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoint results in an effective close valve factor of 1.67

Note 7: The open and close design basis differential pressure cases for these MOVs are 23 psid and 0 psid, respectively. However, 100 psid is used to calculate the minimum thrust required to open and close the MOVs. An open and close valve factor of 0.6 is used to calculate the minimum required thrust to overcome 100 psid. Based on a minimum open and close differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoint results in an effective open and close valve factor of 1.82.

Note 8: The open and close design basis differential pressure cases for these MOVs are 23 psid. However, 100 psid is used to calculate the minimum thrust required to open and close the MOVs. An open and close valve factor of 0.6 is used to calculate the minimum required thrust to overcome 100 psid. Based on a minimum open and close differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoint results in an effective open and close valve factor of 1.82.

Note 9: The open and close design basis differential pressure cases for these MOVs are 49 psid and 23 psid, respectively. However, 100 psid is used to calculate the minimum thrust required to open and close the MOVs. An open valve factor of 0.50 and a close valve factor of 0.55 is used to calculate the minimum required thrust to overcome 100 psid. Based on the actual design basis differential pressure cases of 49 psid and a minimum close differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoints result in an effective open valve factor of 1.02 and an effective close valve factor of 1.66.

Note 10: The open and close design basis differential pressure cases for these MOVs are 17 psid and 45 psid, respectively. However, 100 psid is used to calculate the minimum thrust required to open and close the MOVs. An open and close valve factor of 0.6 is used to calculate the minimum required thrust to overcome 100 psid. Based on a minimum open differential pressure of 33 psid as recommended by the Limitorque SEL guide and the actual close design basis differential pressure case 45 psid, the existing minimum thrust setpoint results in an effective open valve factor of 1.82 and an effective close valve factor of 1.33

Note 11: There is no flowing design basis differential pressure case against which these MOVs are required to operate. However, 100 psid is used to calculate the minimum thrust required to open and close the MOVs. An open valve factor of 0.52 and a close valve factor of 0.76 are used to calculate the minimum required thrust to overcome 100 psid. For additional conservatism, the open setpoint is then set equal to the close value. Based on a minimum differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoint results in an effective open and close valve factor of 2.30.

Note 12: There is no flowing design basis differential pressure case against which these MOVs are required to operate. However, 100 psid is used to calculate the minimum thrust required to close the MOVs. A close valve factor of 1.1 is used to calculate the minimum required thrust to overcome 100 psid. Based on a minimum differential pressure of 33 psid as recommended by the Limitorque SEL guide, the existing minimum thrust setpoint results in an effective close valve factor of 3.33.

Note 13: A close valve factor of 1.1 is used to calculate the minimum required thrust to overcome its design basis differential pressure. This minimum thrust value has been increased to equal the worst case maximum thrust required to close any one of these MOVs under in-situ conditions (extrapolated to the design basis condition). The existing minimum thrust setpoint results in an effective close valve factor of 3.05.

Note 14: The close design basis differential pressure case for these MOVs is 63 psid. However, 100 psid is used to calculate the minimum thrust required to close the MOVs. A close valve factor of 1.5 is used to calculate the minimum required thrust to overcome 100 psid. Based on the actual design basis differential pressure case of 63 psid, the existing minimum thrust setpoint results in an effective close valve factor of 2.39.

Note 15: The close design basis differential pressure case for these MOVs is 5 psid. However, 100 psid is used to calculate the minimum thrust required to close the MOVs. A close valve factor of 1.5 is used to calculate the minimum required thrust to overcome 100 psid. Based on the actual design basis differential pressure case of 5 psid, the existing minimum thrust setpoint results in an effective close valve factor of 30.14.

Note 16: The close design basis differential pressure case for these MOVs is 52 psid. However, 100 psid is used to calculate the minimum thrust required to close the MOVs. A close valve factor of 1.5 is used to calculate the minimum required thrust to overcome 100 psid. Based on the actual design basis differential pressure case of 52 psid, the existing minimum thrust setpoint results in an effective close valve factor of 2.90.

Valve Factor Assumption Validation

The following disposition provides the justification for each MOV group's bounding valve factor assumption as well as the test basis used to validate each assumption.

Group 1: 3 Inch Borg-Warner Flex Wedge Gate Valve - 1500 ANSI Class

Nine MOVs at PVNGS meet the specific criteria for being included in Group 1:

1,2,3JCHEHV0536
1,2,3JSIAHV0604
1,2,3JSIBHV0609

All nine of these MOVs have been dynamically tested under hydrostatic conditions, and eight open valve factor values have been determined from the test data (one test was disqualified), thus Method 1 can be employed for validating the open valve factor assumption for this group. Within this group, the design basis differential pressure varies significantly between MOVS 1,2,3-CH-536 (~ 75 psid) and 1,2,3-SI-604/609 (~ 1900 psid) as well as the differential pressures at which they were tested. However, the valve factor data acquired for all of the MOVs did not vary to such a degree that dividing the group was warranted. Therefore, Group 1 will not be divided into two smaller groups.

From the eight open valve factor values determined for this group, the average open valve factor was 0.33 and the highest valve factor determined was 0.48. Thus, an open valve factor of 0.50 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, an open valve factor assumption of 0.50 is justified for Group 1.

Because these MOVs were tested under hydrostatic conditions, a close valve factor could not be determined from the test data. One MOV tested as part of EPRI's Performance Prediction Program differential pressure flow loop testing met the criteria for this group, MOV #7 (Ref. 5). The test results from this single MOV provide an inadequate test basis for validating the close valve factor assumption for this group. Therefore, Method 2 must be used to ensure an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and EPRI's in-situ testing for Borg-Warner flex wedge gate valves. Upon this test basis, a close valve factor assumption of 0.60 is justified for Group 1.

Group 2: 4 Inch Borg-Warner Flex Wedge Gate Valve - 300 Lb. ANSI Class

Three MOVs at PVNGS meet the specific criteria for being included in Group 2:

1,2,3JCHNUV0501

All three of these MOVs have been dynamically tested under flowing conditions. Three open valve factor values and two close valve factor values have been determined from the test data (one close test was disqualified), thus Method 1 can be employed for validating the open and close valve factor assumptions for this group.

From the three open valve factor values determined for this group, the average open valve factor was 0.42 and the highest valve factor determined was 0.43. Thus, an open valve factor of 0.50 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, an open valve factor assumption of 0.50 is justified for Group 2.

Both of the two close valve factor values determined for this group were 0.31. While the test basis for this group is limited to two MOV tests, the fact that the open valve factors determined for the three MOVs were identical (0.41-0.43) provides justification for assuming similar close valve factor performance. Thus, a close valve factor of 0.50 conservatively bounds the two close valve factors measured during testing two MOVs of this group. Upon this test basis, a close valve factor assumption of 0.50 is justified for Group 2.

Group 3: 4 Inch Borg-Warner Flex Wedge Gate Valve - 1500 Lb. ANSI Class

Six MOVs at PVNGS meet the specific criteria for being included in Group 3:

1,2,3JSIAHV0698
1,2,3JSIBHV0699

All six of these MOVs have been dynamically tested under flowing conditions. Four open and close valve factor values have been determined from the test data (two open and close tests were disqualified). As well, test data from MOV #15 (4 inch Borg-Warner 1500 Lb. flex wedge gate) acquired as part of EPRI's Phase II In-Situ testing program (Ref. 4) provides an additional test basis. Thus Method 1 can be employed for validating the open and close valve factor assumptions for this group.

From the five open valve factor values determined for this group, the average open valve factor was 0.44 and the highest valve factor determined was 0.51. Thus, an open valve factor of 0.55 bounds the highest valve factor measured of this group's test data. Upon this test basis, an open valve factor assumption of 0.55 is justified for Group 3.

From the five close valve factor values determined for this group, the average close valve factor was 0.40 and the highest valve factor determined was 0.51. Thus, a close valve factor of 0.55 bounds the highest valve factor measured of this group's test data. Upon this test basis, a close valve factor assumption of 0.55 is justified for Group 3.

Group 4: 8 Inch Borg-Warner Flex Wedge Gate Valve - 300 ANSI Class

Six MOVs at PVNGS meet the specific criteria for being included in Group 4:

1,2,3JSIAUV0672
1,2,3JSIBUV0671

All six of these MOVs have been dynamically tested under hydrostatic conditions, and five open valve factor values have been determined from the test data (one test was disqualified), thus Method 1 can be employed for validating the open valve factor assumption for this group. From the five open valve factor values determined for this group, the average open valve factor was 0.33 and the highest valve factor determined was 0.52. Thus, an open valve factor of 0.55 bounds the highest valve factor measured of this group's test data. Upon this test basis, an open valve factor assumption of 0.55 is justified for Group 4.

Because these MOVs were tested under hydrostatic conditions, a close valve factor could not be determined from the test data. Therefore, Method 2 must be used to provide an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and EPRI's in-situ testing for Borg-Warner flex wedge gate valves. Upon this test basis, a close valve factor assumption of 0.60 is justified for Group 4.

Group 5: 10 Inch Borg-Warner Flex Wedge Gate Valve - 300 ANSI Class

Twenty-three MOVs at PVNGS meet the specific criteria for being included in Group 5:

1,2JSIAHV0684
1,2,3JSIBHV0689
1,2,3JSIAHV0685
1,2,3JSIBHV0694
1,2,3JSIAHV0687
1,2,3JSIBHV0695
1,2,3JSIAHV0688
1,2,3JSIBHV0693

Twelve of these MOVs have been dynamically tested under hydrostatic conditions, and twelve open valve factor values have been determined from the test data, thus Method 1 can be employed for validating the open valve factor assumption for this group. From the twelve open valve factor values determined for this group, the average open valve factor was 0.34 and the highest valve factor determined was 0.52. Thus, an open valve factor of 0.55 bounds the highest valve factor measured of this group's test data. Upon this test basis, an open valve factor assumption of 0.55 is justified for Group 5.

Because these MOVs were tested under hydrostatic conditions, a close valve factor could not be determined from the test data. Therefore, Method 2 must be used to ensure to provide an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and in EPRI's in-situ testing for Borg-Warner flex wedge gate valves. Upon this test basis, a close valve factor assumption of 0.60 is justified for Group 5.

Group 6: 10 Inch Borg-Warner Flex Wedge Gate Valve - 300 ANSI Class

Six MOVs at PVNGS meet the specific criteria for being included in Group 6:

1,2,3JSIAUV0655
1,2,3JSIBUV0656

Six of these MOVs have been dynamically tested under hydrostatic conditions, and six open valve factor values have been determined from the test data, thus Method 1 can be employed for validating the open valve factor assumption for this group. From the six open valve factor values determined for this group, the average open valve factor was 0.45 and the highest valve factor determined was 0.54. Thus, an open valve factor of 0.55 bounds the highest valve factor measured of this group's test data. Upon this test basis, an open valve factor assumption of 0.55 is justified for Group 6.

Because these MOVs were tested under hydrostatic conditions, a close valve factor could not be determined from the test data. One MOV tested as part of EPRI's Performance Prediction Program differential pressure flow loop testing met the criteria for this group; MOV #10, Ref. 8. The test results from this single MOV provide an inadequate test basis for validating the close valve factor assumption for this group. Therefore, Method 2 must be used to ensure an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and in EPRI's in-situ testing for Borg-Warner flex wedge gate valves. Upon this test basis, a close valve factor assumption of 0.60 is justified for Group 6.

Group 7: 12 Inch Borg-Warner Flex Wedge Gate Valve - 1500 ANSI Class

Twenty-four MOVs at PVNGS meet the specific criteria for being included in Group 7. Within this group, the design basis differential pressure varies significantly between MOVS 1,2,3-SI-651/652 (~ 2,350 psid) and 1,2,3-SI-653/654/614/624/634/644 (~ 375 psid) as well as the differential pressures at which they were tested. In-situ test data for these MOVs indicate that the valve factors vary significantly in relation to the test differential pressure. Therefore, the MOVs in Group 7 will be further divided into two sub-groups based upon their design basis differential pressure requirements:

Six MOVs meet the specific criteria for being included in Group 7a:

1,2,3JSIAUV0651
1,2,3JSIBUV0652

Eighteen MOVs meet the specific criteria for being included in Group 7b:

1,2,3JSICUV0653
1,2,3JSIDUV0654
1,2,3JSIBUV0614
1,2,3JSIBUV0624
1,2,3JSIAUV0634
1,2,3JSIAUV0644

All six of the MOVs in Group 7a have been dynamically tested under hydrostatic conditions, and six open valve factor values have been determined from the test data, thus Method 1 can be employed for validating the open valve factor assumption for this sub-group. From the six open valve factor values determined for this group, the average open valve factor was 0.50 and the highest valve factor determined was 0.59. Thus, an open valve factor of 0.65 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, an open valve factor assumption of 0.65 is justified for Group 7a.

All eighteen of the MOVs in Group 7b have been dynamically tested under hydrostatic conditions, and twelve open valve factor values have been determined from the test data (six tests were disqualified), thus Method 1 can be employed for validating the open valve factor assumption for this sub-group. From the twelve open valve factor values determined for this group, the average open valve factor was 0.52 and the highest valve factor determined was 0.68. Thus, an open valve factor of 0.70 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, an open valve factor assumption of 0.70 is justified for Group 7b.

Because the MOVs from both of these sub- groups were tested under hydrostatic conditions, a close valve factor could not be determined from the test data. Therefore, Method 2 must be used to ensure an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and in EPRI's in-situ testing for Borg-Warner flex wedge gate valves. However, in light of the fact that the open valve factor assumptions for both groups are higher than 0.60, the close valve factor assumptions will be set equal to the open valve factor assumptions for additional conservatism. Upon this test basis, a close valve factor assumption of 0.65 is justified for Group 7a, and a close valve factor assumption of 0.70 is justified for Group 7b.

Group 8: 20 Inch Borg-Warner Flex Wedge Gate Valve - 300 ANSI Class

Eighteen MOVs at PVNGS meet the specific criteria for being included in Group 8:

1,2,3JCHBHV0530
1,2,3JCHAHV0531
1,2,3JSIAHV0683
1,2,3JSIBHV0692
1,2,3JSIAHV0686
1,2,3JSIBHV0696

None of these MOVs were tested under differential pressure conditions. As well, there were no 20 inch, 300 lb class Borg-Warner flex wedge gate MOVs tested as part of EPRI's test programs. In addition, EPRI' s MOV General Information Database was reviewed and it was found that no 20 Inch, 300 lb class Borg-Warner Flex wedge gate MOVs are listed for any other utilities. Four 20 Inch, 900 lb Borg-Warner flex wedge gate MOVs were listed for Perry Nuclear Station, however, an engineering representative from Perry indicated that they were inpracticable to test under DP conditions, thus no valve factor data was available. Therefore, Method 2 must be used to ensure to provide an adequate test basis for a conservative open valve factor assumption.

It was determined that an open valve factor of 0.70 bounds all of the measured values acquired at PVNGS and EPRI's in-situ testing for Borg-Warner flex wedge gate valves. Test data indicates, however, that the only instances in which open valve factors above a value of 0.60 were acquired were for the 12 inch, 1500 lb class Borg-Warner flex wedge gate valves, Group 7b. Because the majority of valve factor data available is open valve factor data, a sufficient test basis exists for a spectrum of valve sizes to determine a bounding open valve factor assumption for 300 lb class Borg-Warner flex wedge gate MOVs. Therefore, it is overly conservative to apply a 0.70 open valve factor to Group 8 when test basis exists for an assumption to be made for the group's specific 300 lb pressure class. Justification for developing a test basis specified by pressure class is supported by *the EPRI MOV Performance PredictionProgram Gate Valve Model Report*, Section 3 (Ref. 2). The report discusses that there are basic design differences between pressure classes for gate valves manufactured by Borg-Warner. The test basis for determining the open valve factor assumption is made up of data from the following MOV configurations:

Valve Size	Valve Class	Test DP	Population	Average VF	High Vf
4 Inch	300 Lbs	~ 60 psid	3	0.42	0.43
8 Inch	300 Lbs	~ 350 psid	6	0.33	0.52
10 Inch	300 Lbs	~ 400 psid	12	0.34	0.52
12 Inch	300 Lbs	~ 375 psid	5	0.45	0.54
16 Inch	300 Lbs	~ 300 psid	2	0.33	0.33

Thus, an open valve factor of 0.60 bounds the highest valve factor measured for 300 lb class Borg-Warner flex wedge gate MOVs. Upon this test basis, an open valve factor assumption of 0.60 is justified for Group 8.

Because, none of these MOVs were tested under differential pressure conditions, Method 2 must be used to provide an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and in EPRI's in-situ testing for Borg-Warner flex wedge gate valves. Upon this test basis, a close valve factor assumption of 0.60 is justified for Group 8.

Group 9: 3 Inch Anchor Darling Flex Wedge Gate Valve -150 ANSI Class

Three MOVs at PVNGS meet the specific criteria for being included in Group 9:

1,2,3JRDAUV0023

None of these MOVs were tested under differential pressure conditions. As well, there were no 3 inch, 150 lb class Anchor Darling flex wedge gate MOVs tested as part of EPRI's test programs. Therefore, Method 2 must be used to provide an adequate test basis for a conservative open and close valve factor assumption. It was determined that an open and close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and EPRI's in-situ testing for Anchor Darling flex wedge gate valves. Upon this test basis, an open and close valve factor assumption of 0.60 is justified for Group 9.

Group 10: 6 Inch Anchor Darling Flex Wedge Gate Valve - 900 Lb. ANSI Class

Thirty-two MOVs at PVNGS meet the specific criteria for being included in Group 10:

1JSGNHV1142
1JSGNHV1144
1,2,3JSGAUV0134
1,2,3JSGAUV0138
1,2,3JAFAUV0034
1,2,3JAFBUV0035
1,2,3JAFCUV0036
1,2,3JAFAUV0037
1,2,3JSGEHV0041
1,2,3JSGEHV0042
1,2,3JSGEHV0043
1,2,3JSGEHV0044

Fourteen of these MOVs have been dynamically tested under flowing conditions. Twelve open and close valve factor values have been determined from the test data (two open and close tests were disqualified). Thus, Method 1 can be employed for validating the open and close valve factor assumptions for this group.

From the twelve open valve factor values determined for this group, the average open valve factor was 0.44 and the highest valve factor determined was 0.59. Thus, an open valve factor of 0.60 bounds the highest valve factor measured of this group's test data. Upon this test basis, an open valve factor assumption of 0.60 is justified for Group 10.

From the twelve close valve factor values determined for this group, the average close valve factor was 0.49 and the highest valve factor determined was 0.55. Thus, a close valve factor of 0.60 bounds the highest valve factor measured of this group's test data. Upon this test basis, a close valve factor assumption of 0.60 is justified for Group 10.

Group 11: 10 Inch Anchor Darling Flex Wedge Gate Valve -150 Lb. ANSI Class

Nine MOVs at PVNGS meet the specific criteria for being included in Group 11:

1,2,3JWCBUV0061
1,2,3JWCAUV0062
1,2,3JWCBUV0063

All of these MOVs have been dynamically tested under flowing conditions. Nine open and close valve factor values have been determined from the test data. As well, test data from MOV #25 (10 inch Anchor Darling 1500 Lb. flex wedge gate) acquired as part of EPRI's Phase II In-Situ testing program (Ref.4) provides an additional test basis. Thus, Method 1 can be employed for validating the open and close valve factor assumptions for this group.

From the ten open valve factor values determined for this group, the average open valve factor was 0.23 and the highest valve factor determined was 0.44. Thus, an open valve factor of 0.50 bounds the highest valve factor measured of this group's test data. Upon this test basis, an open valve factor assumption of 0.50 is justified for Group 11.
From the ten close valve factor values determined for this group, the average close valve factor was 0.32 and the highest valve factor determined was 0.48. Thus, a close valve factor of 0.50 bounds the highest valve factor measured of this group's test data. Upon this test basis, a close valve factor assumption of 0.50 is justified for Group 11.

Group 12: 10 Inch Anchor Darling Flex Wedge Gate Valve - 600 Lb. ANSI Class

One MOV at PVNGS meets the specific criteria for being included in Group 12:

1JSIAHV0684

1JSIAHV0684 has been dynamically tested under hydrostatic conditions, and an open valve factor value of 0.25 has been determined from the test data, thus Method 1 can be employed for validating the open valve factor assumption for this MOV. For conservatism, an open valve factor of 0.50 will be applied to this MOV. Upon this test basis, an open valve factor assumption of 0.50 is justified for Group 12.

Because this MOV was tested under hydrostatic conditions, a close valve factor could not be determined from the test data. Therefore, Method 2 must be used to ensure an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 0.60 bounds all of the measured values acquired at PVNGS and in EPRI's in-situ testing for Anchor Darling flex wedge gate valves. Upon this test basis, a close valve factor assumption of 0.60 is justified for Group 12.

Group 13: 6 Inch Pacific Flex Wedge Gate Valve - 900 Lb. ANSI Class

Four MOVs at PVNGS meet the specific criteria for being included in Group 13:

2,3JSGNHV1142
2,3JSGNHV1144

All of these MOVs have been dynamically tested under flowing conditions. Four open and close valve factor values have been determined from the test data. Thus, Method 1 can be employed for validating the open and close valve factor assumptions for this group.

From the four open valve factor values determined for this group, the average open valve factor was 0.51 and the highest valve factor determined was 0.57. Thus, an open valve factor of 0.60 bounds the highest valve factor measured of this group's test data. Upon this test basis, an open valve factor assumption of 0.60 is justified for Group 13.

From the four close valve factor values determined for this group, the average close valve factor was 0.54 and the highest valve factor determined was 0.57. Thus, a close valve factor of 0.60 bounds the highest valve factor measured of this group's test data. Upon this test basis, a close valve factor assumption of 0.60 is justified for Group 13.

Group 14: 1 Inch Borg-Warner UTS Globe Valve -1500 Lb ANSI Class

Twelve MOVs at PVNGS meet the specific criteria for being included in Group 14:

1,2,3JRCEHV0430
1,2,3JRCEHV0431
1,2,3JRCEHV0432
1,2,3JRCEHV0433

None of these MOVs were tested under differential pressure conditions. As well, there were no 1 inch, 1500 lb class Borg-Warner UTS globe MOVs tested as part of EPRI's test programs. Therefore, Method 2 must be used to ensure an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 2.0 bounds all of the measured values acquired at PVNGS and in EPRI's in-situ testing for Borg-Warner UTS globe valves. Upon this test basis, a close valve factor assumption of 2.0 is justified for Group 14.

Because the design basis DP condition assists the valve in opening, an incorrectly assumed valve factor will have no impact upon the calculated thrust required to open the valve. Therefore, validation of an open valve factor assumption is not required for Group 14.

Group 15: 2 Inch Borg-Warner UTS Globe Valve -1500 Lb ANSI Class

Forty-eight MOVs at PVNGS meet the specific criteria for being included in Group 15. Within this group, the design basis differential pressure varies significantly between MOVS 1,2,3-SI-616/617/626/627/636/637/646/647/666/667 (~ 1,900 psid) and 1,2,3-SI-664/665/668/669 (~ 200 psid) as well as the differential pressures at which they were tested. In-situ test data for these MOVs indicate that the valve factors vary in relation to the test differential pressure. Therefore, the MOVs in Group 15 will be further divided into two sub-groups based upon their design basis differential pressure requirements:

Thirty MOVs meet the specific criteria for being included in Group 15a:

1,2,3JSIBUV0616	1,2,3JSIBUV0626
1,2,3JSIAUV0617	1,2,3JSIAUV0627
1,2,3JSIBUV0636	1,2,3JSIBUV0646
1,2,3JSIAUV0637	1,2,3JSIAUV0647
1,2,3JSIAUV0666	
1,2,3JSIBUV0667	

Eighteen MOVs meet the specific criteria for being included in Group 15b:

1,2,3JSIAUV0664	1,2,3JCHBHV0255
1,2,3JSIBUV0665	1,2,3JCHAHV0524

1,2,3JSIBUV0668
1,2,3JSIAUV0669

All thirty of the MOVs in Group 15a have been dynamically tested under flowing conditions, and twenty-five close valve factor values have been determined from the test data, thus Method 1 can be employed for validating the close valve factor assumption for this sub-group. From the twenty-five close valve factor values determined for this group, the average close valve factor was 0.99 and the highest valve factor determined was 1.36. Thus, a close valve factor of 1.37 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, a close valve factor assumption of 1.37 is justified for Group 15a.

Twelve of the MOVs in Group 15b have been dynamically tested under flowing conditions, and six close valve factor values have been determined from the test data, thus Method 1 can be employed for validating the close valve factor assumption for this sub-group. From the six close valve factor values determined for this group, the average close valve factor was 1.25 and the highest valve factor determined was 1.56. Thus, a close valve factor of 1.60 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, a close valve factor assumption of 1.60 is justified for Group 15b.

Because the design basis DP condition assists the valve in opening, an incorrectly assumed valve factor will have no impact upon the calculated thrust required to open the valve. Therefore, validation of an open valve factor assumption is not required for Group 15.

Group 16: 3 Inch Borg-Warner UTS Globe Valve - 300 Lb ANSI Class

Three MOVs at PVNGS meet the specific criteria for being included in Group 14:

1,2,3JCHNUV0514

None of these MOVs were tested under differential pressure conditions. As well, there were no 3 inch, 300 lb class Borg-Warner UTS globe MOVs tested as part of EPRI's test programs. Therefore, Method 2 must be used to provide an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 2.0 bounds all of the measured values acquired at PVNGS and in EPRI's in-situ testing for Borg-Warner UTS globe valves. Upon this test basis, a close valve factor assumption of 2.0 is justified for Group 16.

Because the design basis DP condition assists the valve in opening, an incorrectly assumed valve factor will have no impact upon the calculated thrust required to open the valve. Therefore, validation of an open valve factor assumption is not required for Group 16.

Group 17: 3 Inch Borg-Warner OTS Globe Valve - 1500 Lb ANSI Class

Six MOVs at PVNGS meet the specific criteria for being included in Group 17:

1,2,3JSICHV0321
1,2,3JSIDHV0331

All six of the MOVs in Group 17 have been dynamically tested under flowing conditions, and six open valve factor values have been determined from the test data, thus Method 1 can be employed for validating the open valve factor assumption for this sub-group. From the six open valve factor values determined for this group, the average open valve factor was 0.86 and the highest valve factor determined was 1.14. Thus, an open valve factor of 1.20 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, an open valve factor assumption of 1.20 is justified for Group 17.

Because the design basis DP condition assists the valve in closing, an incorrectly assumed valve factor will have no impact upon the calculated thrust required to close the valve. Therefore, validation of a close valve factor assumption is not required for Group 17.

Group 18: 10 Inch Borg-Warner UTS Globe Valve - 300 Lb ANSI Class

Twelve MOVs at PVNGS meet the specific criteria for being included in Group 18:

1,2,3JSIAHV0306
1,2,3JSIBHV0307
1,2,3JSIAUV0690
1,2,3JSIBUV0691

All twelve of the MOVs in Group 18 have been dynamically tested under flowing conditions, and twelve close valve factor values have been determined from the test data, thus Method 1 can be employed for validating the close valve factor assumption for this sub-group. From the twelve close valve factor values determined for this group, the average close valve factor was 1.34 and the highest valve factor determined was 1.74. Thus, a close valve factor of 1.80 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, a close valve factor assumption of 1.80 is justified for Group 18.

Because the design basis DP condition assists the valve in opening, an incorrectly assumed valve factor will have no impact upon the calculated thrust required to open the valve. Therefore, validation of an open valve factor assumption is not required for Group 18.

Group 19: 12 Inch Borg-Warner UTS Globe Valve - 1500 Lb ANSI Class

Twelve MOVs at PVNGS meet the specific criteria for being included in Group 19:

1,2,3JSIBUV0615
1,2,3JSIBUV0625
1,2,3JSIAUV0635
1,2,3JSIAUV0645

All twelve of the MOVs in Group 19 have been dynamically tested under flowing conditions, and ten close valve factor values have been determined from the test data, thus Method 1 can be employed for validating the close valve factor assumption for this sub-group. From the ten close valve factor values determined for this group, the average close valve factor was 1.75 and the highest valve factor determined was 1.99. Thus, a close valve factor of 2.0 bounds the highest valve factor measured during testing any MOV of this group. Upon this test basis, a close valve factor assumption of 2.0 is justified for Group 19.

Because the design basis DP condition assists the valve in opening, an incorrectly assumed valve factor will have no impact upon the calculated thrust required to open the valve. Therefore, validation of an open valve factor assumption is not required for Group 19.

Group 20: 1-1/2 Inch Dresser UTS Globe Valve - 600 Lb ANSI Class

Three MOVs at PVNGS meet the specific criteria for being included in Group 20:

1,2,3JGRAUV0001

None of these gas-media MOVs were tested under differential pressure conditions. As well, there were no 1-1/2

inch, 600 lb class Dresser UTS globe gas-media MOVs tested as part of EPRI's test programs. Therefore, Method 2 must be used to provide an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 2.0 is conservative for all of the measured values acquired at PVNGS and in EPRI's test programs for globe valves. Upon this test basis, a close valve factor assumption of 2.0 is justified for Group 20.

Because the design basis DP condition assists the valve in opening, an incorrectly assumed valve factor will have no impact upon the calculated thrust required to open the valve. Therefore, validation of an open valve factor assumption is not required for Group 20.

Group 21: 2 Inch Dresser UTS Globe Valve - 600 Lb ANSI Class

Eighteen MOVs at PVNGS meet the specific criteria for being included in Group 21:

1,2,3JHPAUV0001
1,2,3JHPBUV0002
1,2,3JHPAUV0003
1,2,3JHPBUV0004
1,2,3JHPAUV0005
1,2,3JHPBUV0006

None of these gas-media MOVs were tested under differential pressure conditions. As well, there were no 2 inch, 600 lb class Dresser UTS globe gas-media MOVs tested as part of EPRI's test programs. Therefore, Method 2 must be used to ensure an adequate test basis for a conservative close valve factor assumption. It was determined that a close valve factor of 2.0 is conservative for all of the measured values acquired at PVNGS and in EPRI's test programs for globe valves. Upon this test basis, a close valve factor assumption of 2.0 is justified for Group 21.

Because the design basis DP condition assists the valve in opening, an incorrectly assumed valve factor will have no impact upon the calculated thrust required to open the valve. Therefore, validation of an open valve factor assumption is not required for Group 21.

References:

1. *EPRI MOV Performance Prediction Program Topical Report*, Electric Power Research Institute, EPRI TR-103237.

2. *EPRI MOV Performance Prediction Program Gate Valve Model Report*, Electric Power Research Institute, EPRI TR-103229.

3. *EPRI MOV Performance Prediction Program Phase I In Situ Test Report*, Electric Power Research Institute, EPRI TR-103220.

4. *EPRI MOV Performance Prediction Program Phase II In Situ Test Report*, Electric Power Research Institute, EPRI TR-103238.

5. *EPRI MOV Performance Prediction Program High Pressure Cold and Hot Water Blowdown Facility Test Report, Volume 5: Test Results for MOV #7*, Electric Power Research Institute, EPRI TR-103674-V5.

6. *EPRI MOV Performance Prediction Program Cold Water Pumped Flow Loop Test Report, Volume 6: Test Results for MOV #8*, Electric Power Research Institute, EPRI TR-103190-V6.

7. *EPRI MOV Performance Prediction Program High Pressure Cold and Hot Water Blowdown Facility Test Report, Volume 13: Test Results for MOV #9*, Electric Power Research Institute, EPRI TR-103674-V13.

8. *EPRI MOV Performance Prediction Program Intermediate Pressure Cold Water Pumped Flow Simulation Facility Test Report, Volume 7: Test Results for MOV #10*, Electric Power Research Institute, EPRI TR-103239-V7.

9. *EPRI MOV Performance Prediction Program High Pressure Cold and Hot Water Blowdown Facility Test Report, Volume 12: Test Results for MOV #44*, Electric Power Research Institute, EPRI TR-103674-V12.

10. *EPRI MOV Performance Prediction Program High Pressure Cold and Hot Water Blowdown Facility Test Report, Volume 6: Test Results for MOV #1*, Electric Power Research Institute, EPRI TR-103674-V6.

11. *EPRI MOV Performance Prediction Program Cold Water Pumped Flow Loop Test Report, Volume 9: Test Results for MOV #2*, Electric Power Research Institute, EPRI TR-103190-V9.

12. *EPRI MOV Performance Prediction Program High Pressure Cold and Hot Water Blowdown Facility Test Report, Volume 11: Test Results for MOV #3*, Electric Power Research Institute, EPRI TR-103674-V11.

13. *EPRI MOV Performance Prediction Program Intermediate Pressure Cold Water Pumped Flow Simulation Facility Test Report, Volume 3: Test Results for MOV #4*, Electric Power Research Institute, EPRI TR-103239-V3.

14. *EPRI MOV Performance Prediction Program High Pressure Water and Steam Blowdown Facility Test Report, Volume 3: Test Results for MOV #5*, Electric Power Research Institute, EPRI TR-103678-V3.

15. *EPRI MOV Performance Prediction Program High Pressure Water and Steam Blowdown Facility Test Report, Volume 2: Test Results for MOV #6*, Electric Power Research Institute, EPRI TR-103678-V2.

16. *EPRI MOV Performance Prediction Program High Pressure Cold and Hot Water Blowdown Facility Test Report, Volume 7: Test Results for MOV #16*, Electric Power Research Institute, EPRI TR-103674-V7.

ENCLOSURE 2

Description of Trending Program

Introduction

The enclosed Maintenance Department Guideline, Motor Operated Valve Performance Monitoring and Failure Data Trending (MDG-39INS-001) was approved on March 29, 1996. The development of this guideline was based on PVNGS experience and was benchmarked against trending programs from two Best Practice utilities.

The guideline provides for performance monitoring and failure data trending motor operated valves within the PVNGS Generic Letter 89-10 program. The first Performance Failure Trend Report, as identified in the guideline, is currently scheduled to be issued during the 3rd quarter of 1996.

MAINTENANCE DEPARTMENT GUIDELINE		Page 1 of 10
MOTOR OPERATED VALVE PERFORMANCE MONITORING AND FAILURE DATA TRENDING	MDG-39INS-001	Revision 0

PURPOSE: This procedure provides guidelines for performance monitoring and failure data trending of GL 89-10 motor operated valves.

APPLICABILITY: Applies to all MOVs listed in APPENDIX B to procedure 39PR-9ZZ01, titled "MOVs that are within the scope of the NRC G. L. 89-10 program.

CONDITION: None

M. R. Hooshmand 3/29/96

Approval Signature **Date**

G. E. Edmonds 3-8-96

Reviewer Signature **Date**

M. E. D'Haem 3-7-96

Preparer Signature **Date**

MOTOR OPERATED VALVE PERFORMANCE MONITORING AND FAILURE DATA TRENDING	MDG-39INS-001	Revision 0

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1.0 PURPOSE AND SCOPE

1.1 Purpose

1.1.1 This procedure establishes a methodology for motor operated valve, MOV, performance monitoring and failure data trending. Performance monitoring and failure data is trended with the intent to identify adverse conditions and take corrective action before equipment failure occurs.

1.1.2 This procedure details actions which will be taken in response to any noted adverse trend.

1.2 Scope

1.2.1 Applies to all MOVs listed in APPENDIX B of procedure 39PR-9ZZ01, titled "MOVs that are within the scope of the NRC G.L. 89-10 program."

2.0 RESPONSIBILITIES

2.1 Valve Services Engineering Section Leader

2.1.1 Ensures that MOV performance and failures are evaluated and a trend report is issued in accordance with the provisions of this procedure.

2.1.2 Review and approval of PFTR, Performance/Failure Trend Report.

2.1.3 Distribute PFTR to the cognizant unit manager, Director Site Maintenance and Modifications, Director Outage and Scheduling, Valve Services Department Leader, and Valve Services Maintenance Section Leader.

2.2 Valve Services Maintenance Section Leader

2.2.1 Ensures that MOV performance and failure data are documented in accordance with the provisions of this procedure.

2.2.2 Ensures that MOV testing is performed utilizing designated primary or secondary sensors.

2.2.3 Review and approval of PFTR, Performance/Failure Trend Report.

2.3 Valve Services Engineer

2.3.1 Prepare and issue a unit specific MOV Performance/Failure Trend Report. PFTR, in accordance with the provisions of this procedure.

2.3.2 Co-ordinate the MOV failure data trend analysis portion of the PFTR with Maintenance Support.

2.4 Valve Services Maintenance Work Group Leader/Designee

2.4.1 Completeness and accuracy of information entered in SIMS Work Order Closing (WMF001) and Component Trending (WMF002) screens.

3.0 PROCEDURE

3.1 Performance Trending

3.1.1 The Valve Services Technician shall enter equipment inspection and diagnostic test results into the MOV Performance Database as soon as practical following completion of work. Specific data to be inputted is as detailed in data sheets included in procedures 32MT-9ZZ56, 32MT-9ZZ49, 39MT-9ZZ03, and 39MT-9ZZ02.

3.1.2 Diagnostic testing, which due to an out of the ICMODB band condition, results in torque switch adjustment to meet ICMODB requirements shall be evaluated by the Valve Services Engineer for any significant deviation from the most current trend report. Out of the ICMODB conditions which are the consequence of an ICMODB change do not require Valve Services Engineer evaluation. This review should be completed within 90 days of the end of a refueling outage. Significant deviations shall be identified, documented, and resolved per 90AC-0IP04, Condition Reporting.

3.1.3 The Valve Services Engineer shall evaluate test data taken subsequent to the valve or actuator replacement, refurbishment, rework, or repair and determine if the test constitutes a new performance baseline. Baseline data shall be identified in the MOV Performance Database by the Valve Services Engineer. MOV's without acceptable baseline data will be so identified in the Performance Failure Trend Report (PFTR) by the Valve Services Engineer.

3.1.4 The Valve Services Engineer shall establish alert levels (*acceptance criteria*) of 10% change from the baseline adjusted for inaccuracies, i.e., *instrument, sensor, spring pack relaxation, stem lubrication degradation and torque switch repeatability as appropriate,* for the following MOV performance characteristics as determined by the Valve Services Engineer;

3.1.4.1 unseating thrust/torque,

3.1.4.2 peak in-rush motor current,

3.1.4.3 running load,

3.1.4.4 motor running current.

3.1.4.5 thrust/torque@TST,

3.1.4.6 spring pack displacement@TST,

3.1.4.7 seating thrust/torque,

3.1.4.8 motor seating current,

3.1.4.9 stroke time, and

3.1.4.10 seating/unseating thrust ratio.

3.1.5 The Valve Services Engineer shall review/evaluate MOV performance data listed in sections 3.1.4.1 - 3.1.4.10 for any trends. This evaluation shall address each valve as a single entity, and collectively in logical groupings. Groupings should be by system, actuator model, valve model, and actuator/valve model combination. The Valve Services Engineer shall also review the baseline and subsequent test traces for any trends.

3.1.6 The Valve Services Engineer shall identify and document any noted significant negative trends per 90AC-0IP04, Condition Reporting. Other issues and betterments should be addressed as recommendations in the PFTR.

3.2 Failure Trending

3.2.1 The Valve Services Maintenance Work Group Leader/Designee shall enter a "Y" in the FFI and/or CRI field on SIMS screen WMF001, "SIMS Work Order Closing", in accordance with 30DP-9WP02, Appendix M - Guidance for Reporting Functional Failures and Component Replacement. In addition to Appendix M guidelines, a "Y" shall be entered in the FFI and/ or CRI fields when;

3.2.1.1 any part is replaced (CRI), e.g., terminal block, gear, packing, bolt, bearing, wire, etc.,

3.2.1.2 the torque switch is adjusted (FFI),

3.2.1.3 any limit switch is adjusted (FFI), or

3.2.1.4 any lubricant is found unacceptable (FFI).

3.2.2 The Valve Services Maintenance Work Group Leader/Designee shall document in the work performed section of SIMS Work Order Closing screen (WMF001), per 30DP-9WP02, any part replaced, switch adjusted, and/or lubricant replaced and why that action was taken.

3.2.3 The Valve Services Engineer shall obtain from Maintenance Support FDT, per 73AC-0RA01, MOV failure data in time to support issuance of a trend report seven months prior to each unit refueling outage. The requested data should include a;

3.2.3.1 bar chart of CRDRs issued on MOVs annually for the previous five years and monthly for the current year,

3.2.3.2 tabulation of total number of FFIs and CRIs,

3.2.3.3 tabulation of number of FFIs and CRIs by EQID, system, actuator model, valve model, and actuator & valve combination,

3.2.3.4 tabulation of number each failure mode and cause by EQID, system, actuator model, valve model, and actuator & valve combination, and

3.2.3.5 Pareto charts for the data tabulated in 3.2.3.3 and 3.2.3.4 above.

3.2.4 The Valve Services Engineer shall utilize relevant MOV data contained in the annual MRule Performance and monthly MRule Trend Reports required by 30DP-9MT02, "Maintenance Rule".

3.2.5 The Valve Services Engineer shall review/evaluate MOV failures for any trends.

3.3 Trend Report

3.3.1 The Valve Services Engineer shall document the review/evaluation of MOV performance and failures in a written report, i.e., Performance Failure Trend Report (PFTR).

3.3.2 A unit specific PFTR shall be issued seven months prior to a units scheduled refueling outage.

3.3.3 The PFTR should include a bar chart of CRDRs issued on MOVs annually for the previous five years, bar chart of CRDRs issued on MOVs monthly for the previous eighteen months, Pareto charts on FFIs and CRIs by EQID, system, actuator model, valve model, actuator & valve combination, and totals, and description of the evaluation, resulting conclusions and any recommendations.

4.0 DEFINITIONS AND ABBREVIATIONS

4.1 Terms

4.1.1 Test

A static MOV test during which performance parameters are monitored to verify conformance to test acceptance criteria, i.e., ICMODB. Resultant performance data is stored on the controlled drives on Valve Services LAN in accordance with 39AC-9ZZ01. As-Found data may be used for valve trend analysis.

4.1.2 Baseline Test

Static MOV test data which has been evaluated by VSE and determined to be acceptable for use as a bases for the evaluation of performance trends.

4.1.3 Trend

A noticeable change in performance over time.

4.1.4 Alert

Performance characteristic level outside the predicted range adjusted for inaccuracies introduced by the data acquisition equipment, sensor, torque switch repeatability, and spring pack relaxation.

4.2 Acronyms

4.2.1 PFTR - Performance/Failure Trend Report

4.2.2 MOV - Motor Operated Valves

4.2.3 TST - Torque Switch Trip

4.2.4 ICMODB - Interim Controlled Motor Operator Data Base

5.0 REFERENCES

5.1 Developmental References

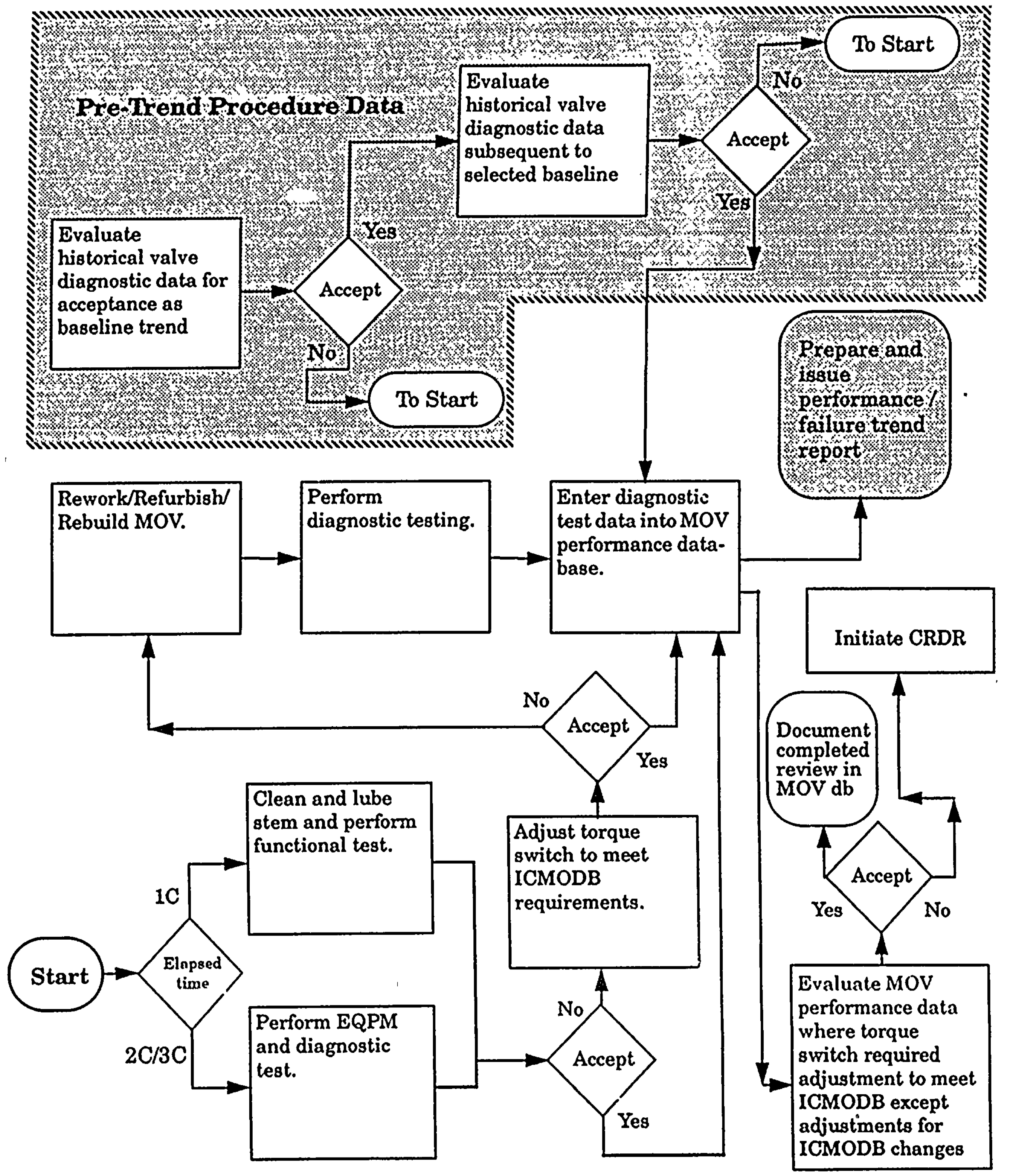
5.1.1 39PR-9ZZ01, MOV Monitoring and Test Program

6.0 APPENDICES

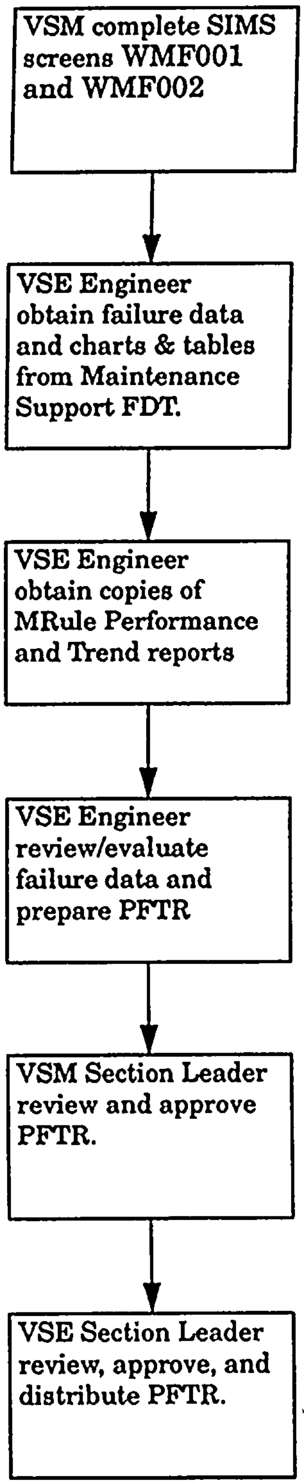
6.1 Appendix A - MOV Performance Trending

6.2 Appendix B - MOV Failure Trending

Appendix A - MOV Performance Trending



Appendix B - MOV Failure Trending



ENCLOSURE 3

Description and Status of Open Findings from PVNGS'

Generic Letter 89-10 Self-assessment

In December 1995, a self-assessment of the PVNGS program for implementing Generic Letter 89-10, "Safety-Related Motor Operated Valve Testing and Surveillance," was performed. At the time of Inspection 95-23, several of the items from the self-assessment had not been dispositioned. Each of the self-assessment open items have been resolved to the satisfaction of Nuclear Assurance as described below:

1. Trending

   In response to previous assessment open items and a recent Nuclear Assurance Evaluation, Valve Services Engineering has developed a department guideline which establishes a program for monitoring motor operated valve (MOV) performance and failure data trending. The establishment of this program addresses concerns raised by Nuclear Assurance regarding the lack of an effective program for trending diagnostic test and MOV failure data. Nuclear Assurance will perform an evaluation of the trending program during 1996 to assess the effectiveness of this program.

2. Basis for Valve Factor Assumptions

   An evaluation performed by Nuclear Assurance in December 1995, determined that the basis for valve factor assumptions was not documented or referenced in design basis documents. In response to this and other similar concerns raised by the NRC staff during Inspection 95-23 in January 1996, Valve Services has developed methodology for valve factor grouping and assumption validation. The grouping methodology was developed to validate valve factor assumptions used as input for calculating minimum required thrust for design basis conditions. The validation process was based primarily on Palo Verde's site-specific test data and the results of EPRI's test data acquired from licensee MOV programs and flow loop testing. Nuclear Assurance considers this validation methodology to be acceptable and consistent with the guidelines of Generic Letter 89-10.

3. Periodic Verification

   Palo Verde's Generic Letter 89-10 program currently utilizes static diagnostic testing to periodically validate design bases capability of each MOV every second refueling outage and preventive maintenance is performed each refueling outage. Although plans have been made to evaluate the use of dynamic diagnostic testing for periodic verification, no specific commitments have been formalized. A generic letter providing additional guidance on periodic verification of MOV design basis capability is anticipated from the NRC. Nuclear Assurance plans to perform an evaluation following the receipt and implementation of the generic letter. Pending that action, Nuclear Assurance considers current periodic verification practices acceptable.

4. Assessment Open Items

   At the time of Inspection 95-23, nine (9) items were open from ISQE Assessment 93-02, "Generic Letter 89-10 Motor-Operated Valve Programmatic Assessment."

The subject of these items included trending, periodic verification, archival of test results, and strain gage zero offset. All of these items have since been adequately addressed by Valve Services and closed out by Nuclear Assurance.