

# ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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 AUTH.NAME AUTHOR AFFILIATION  
 SMITH,R.E. Rochester Gas & Electric Corp.  
 RECIP.NAME RECIPIENT AFFILIATION  
 STAHL,C. NRC - No Detailed Affiliation Given

*See Rpt*

SUBJECT: Forwards summary rept required by IE Bulletin 85-003 re properly set switch settings on motor-operated valves.

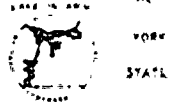
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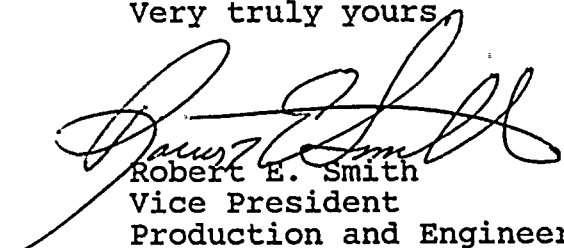
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Attn: Mr. Carl Stahle  
PWR Project Directorate No. 1  
Washington, D.C. 20555

Subject: IE Bulletin 85-03  
Report Summarizing Program Completion  
R.E. Ginna Nuclear Power Plant  
Docket No. 50-244

Dear Mr. Stahle:

Attached is the summary report required by IE Bulletin 85-03 dated November 15, 1985 which requested that licensees develop and implement a program to ensure that switch settings on motor-operated valves in the high pressure coolant injection and emergency feedwater systems are set properly. This fulfills the requirements of IEB 85-03.

Very truly yours

  
Robert E. Smith  
Vice President  
Production and Engineering

Attachment

xc: U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

xc: Ginna Senior Resident Inspector

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## ATTACHMENT 1

### REPORT ON COMPLETION OF PROGRAM IE BULLETIN 85-03

#### INTRODUCTION

On November 15, 1985, the NRC Office of Inspection and Enforcement issued IE Bulletin 85-03: "Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings". The purpose of the Bulletin was to request licensees to develop and implement a program to ensure that switch settings on motor-operated valves in the high pressure coolant injection and emergency feedwater systems are selected, set and maintained correctly to accommodate the maximum differential pressures expected on these valves during both normal and abnormal events within the design basis. IE Bulletin 85-03 required a 180 day response which was transmitted by our letter dated May 14, 1986. IE Bulletin 85-03 also required a written report within 60 days of completion of the program. As stated in our letter dated December 4, 1987, the program was scheduled for completion within 60 days of startup from the 1988 refueling outage. The program was completed as scheduled and this report provides the required information.

#### VERIFICATION OF PROGRAM COMPLETION

The 1988 refueling outage ended on March 9, 1988 and the program described in Attachment 2 was completed by May 8, 1988. The Attachment 2 program and Ginna procedures ensure that switch settings of the motor-operated valves (MOVs) listed in the program are selected, set and maintained correctly to accommodate the maximum differential pressures expected on these valves during both normal and abnormal events within the design basis throughout the life of the plant. An administrative procedure addresses use of the above program in preventive maintenance and prescribes testing activities to be performed on a periodic basis. Maintenance procedures are then used to implement maintenance and testing activities by providing explicit instructions for maintenance and specifying what testing is required after certain types of maintenance are performed to ensure valve operability. The test interval as described in the Attachment 2 Program may be altered based both on industrial experience or in-plant data.



### SUMMARY OF AS-FOUND CONDITION

Table 1 presents a summary of the findings as to valve operability prior to any adjustments as a result of the Bulletin. Prior to the use of the program described in Attachment 2, valve operability was based on the following parameters:

- stroke time; open and close
- verification of correct valve position indication
- acceptable motor currents

Based on these parameters, all valves in the program were operable.

The program using MOVATS methodology and equipment provided additional parameters by which valve operability could be assessed. Table 1 presents the as-found valve operability as judged by the program criteria and the reason for the finding. It should be noted that these abnormalities did not necessarily make the valve inoperable. The following is a summary of the significant MOV abnormalities found.

### SUMMARY OF SIGNIFICANT MOV ABNORMALITIES

<u>Abnormality</u>	<u>No.</u>	<u>%</u>
Bypass switch improperly set	14	47
Incorrect thrust	20	67
Unbalanced torque switch	28	93
Valve backseating	2	7
Unbalanceable torque switches	19	63
Torque switch abnormalities	4	13.
Miscellaneous abnormalities	51*	--

The total number of valves tested was 30.

\*Number represents sum of miscellaneous abnormalities.



SUMMARY OF DATA OBTAINED FROM VALVE OPERABILITY PROGRAM

Table 2 describes the valve and operator. Table 3 contains a summary of the data obtained during the testing of the valve listed on Table 2. Table 4 provides the justification, based on the program in Attachment 2, that the valve will operate properly at its design basis.





TABLE 1

Page 1 of 4

## SUMMARY OF AS-FOUND VALVE OPERABILITY

Valve ID	Function	<u>As-Found Operability</u>		<u>Reason for Potential Inoperability (As-Found)</u>
		<u>Based on Pre-Program Criteria*</u>	<u>Based on Program Criteria</u>	
MOV-825A**	SI Pump Suction	Yes	No	Underthrusting in closed direction, may not have closed against design basis Delta P.
MOV-825B**	SI Pump Suction	Yes	No	Underthrusting in closed direction, may not have closed against design basis Delta P.
MOV-826A**	SI Pump Suction	Yes	No	Underthrusting in closed direction, may not have closed against design basis Delta P.
MOV-826B	SI Pump Suction	Yes	No	Underthrusting in closed direction, may not have closed against design basis Delta P.
MOV-826C	SI Pump Suction	Yes	Yes	N/A
MOV-826D	SI Pump Suction	Yes	No	Underthrusting in closed direction, may not have closed against design basis Delta P.
MOV-871A	SI Pump Discharge	Yes	No	Underthrusting in open direction and closed direction, may not have operated in either direction against design basis Delta P.
MOV-871B	SI Pump Discharge	Yes	No	Underthrusting in open direction, may not have operated against design basis Delta P.
MOV-1815A**	SI Pump Suction	Yes	No	Underthrusting in closed direction, may not have closed against design basis Delta P.
MOV-1815B	SI Pump Suction	Yes	No	Underthrusting in closed direction, may not have closed against design basis Delta P.

TABLE 1 (Cont'd)

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Valve ID	Function	<u>As-Found Operability</u>		<u>Reason for Potential Inoperability (As-Found)</u>
		<u>Based on Pre-Program Criteria*</u>	<u>Based on Program Criteria</u>	
MOV-3504A**	TDAFWP Steam Admission	Yes	Yes	N/A
MOV-3505A	TDAFWP Steam Admission	Yes	No	Valve found to be backseating - potential for failure. Underthrusting in open direction, may not have opened against design basis Delta P since open torque switch bypass not wired into circuit.
MOV-3996	TDAFWP Discharge	Yes	No	Valve found to be backseating - potential for failure.
MOV-4000A	MDAFWP Discharge Crosstie	Yes	No	Overthrusting in closed direction - potential for failure. Open T.S. bypass set at 3.49%-potential for failure on opening against design basis Delta P.
MOV-4000B	MDAFWP Discharge Crosstie	Yes	No	If opening during design basis Delta P, potential for failure due to open T.S. bypass set at 3.84%. Underthrusting in closed direction, may not have operated against design basis Delta P.
MOV-4007	A-MDAFWP Discharge	Yes	No	Potential for failure in open direction due to open T.S. bypass at 3.55%.
MOV-4008	B-MDAFWP Discharge	Yes	No	Underthrusting in closed direction, may not have operated against design basis Delta P.
MOV-4013	TDAFWP Service Water	Yes	No	Underthrusting in open direction, may not have operated against design basis Delta P.
MOV-4027**	A-MDAFWP Service Water	Yes	No	Underthrusting in closed direction, may not have operated against design basis Delta P.

TABLE 1 (Cont'd)

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<u>Valve ID</u>	<u>Function</u>	<u>As-Found Operability</u>		<u>Reason for Potential Inoperability (As-Found)</u>
		<u>Based on Pre-Program Criteria*</u>	<u>Based on Program Criteria</u>	
MOV-4028	B-MDAFWP Service Water	Yes	Yes	N/A
MOV-4615**	Service Water Header Valve	Yes	No	Underthrusting closed, may not have operated against design basis Delta P.
MOV-4616	Service Water Header Valve	Yes	No	Underthrusting in both directions - potential failure in open direction due to open T.S. bypass set at 1.97%, may not have operated closed against design basis Delta P.
MOV-9629A	C-SAFWP Service Water Suction	Yes	Yes	N/A
MOV-9629B	D-SAFWP Service Water Suction	Yes	No	Potential failure due to open T.S. bypass set (A.F.) at 4.1%.
MOV-9701A	C-SAFWP Discharge	Yes	No	Potential opening failure due to open T.S. bypass set at 2.8%.
MOV-9701B**	D-SAFWP Discharge	Yes	Yes	N/A
MOV-9703A	SAFWP Discharge Crosstie	Yes	No	Potential opening failure due to open T.S. bypass set at 4.61%.
MOV-9703B	SAFWP Discharge Crosstie	Yes	No	Underthrusting in both directions - potential opening failure due to open T.S. bypass set at 4.88% - may not have closed at design basis Delta P.



TABLE 1 (Cont'd)

Page 4 of 4

<u>Valve ID</u>	<u>Function</u>	<u>As-Found Operability</u>		<u>Reason for Potential Inoperability (As-Found)</u>
		<u>Based on Pre-Program Criteria*</u>	<u>Based on Program Criteria</u>	
MOV-9704A	C-SAFWP Containment Isolation	Yes	No	Underthrusting in open direction - potential failure due to open T.S. bypass set (A.F.) at 2.6%. Underthrusting in closed direction - may not have operated against design basis Delta P.
MOV-9704B	D-SAFWP Containment Isolation	Yes	No	Underthrusting in open direction - potential failure due to open T.S. bypass set (A.F.) at 2.22%. Underthrusting in closed direction - may not have operated against design basis Delta P.

\*Criteria - stroke time, proper position indication, and acceptable motor currents

\*\*The identified MOVs were found to be underthrusting in the open direction, but were not considered inoperable since the open torque switch bypass switch was set to bypass the open peak thrust.



TABLE 2

## DESCRIPTION OF VALVE AND OPERATOR

<u>VALVE</u>				<u>OPERATOR</u>				Gear Ratio (Overall)	Output RPM
<u>I.D.</u>	<u>Manufacturer</u>	<u>Type</u>	<u>Size</u>	<u>Manufacturer</u>	<u>Type</u>	<u>Size</u>	<u>Motor RPM</u>		
MOV-825A	ALOYCO	GATE	8"	LIMITORQUE	SMB	00-15	1700	17.32/1	98.15
MOV-825B	ALOYCO	GATE	8"	LIMITORQUE	SMB	00-15	1760	17.32/1	98.15
MOV-826A	ALOYCO	GATE	8"	LIMITORQUE	SMB	00-15	1750	17.32/1	101.04
MOV-826B	ALOYCO	GATE	8"	LIMITORQUE	SMB	00-15	1750	24.8/1	70.56
MOV-826C	ALOYCO	GATE	8"	LIMITORQUE	SMB	00-15	1750	24.8/1	70.56
MOV-826D	ALOYCO	GATE	8"	LIMITORQUE	SMB	00-15	1750	17.32/1	101.04
MOV-871A	VELAN	GATE	3"	LIMITORQUE	SMB	00-10	1750	31.9/1	54.86
MOV-871B	VELAN	GATE	3"	LIMITORQUE	SMB	00-15	1700	31.9/1	53.29
MOV-1815A	ALOYCO	GATE	4"	LIMITORQUE	SMB	000-5	1750	33.83/1	51.73
MOV-1815B	ALOYCO	GATE	4"	LIMITORQUE	SMB	000-5	1750	33.83/1	51.73
MOV-3504A	ANCHOR DARLING	GATE	6"	LIMITORQUE	SB	0	1900	33.11/1	57.38
MOV-3505A	ANCHOR DARLING	GATE	6"	LIMITORQUE	SB	0	1900	33.11/1	57.38
MOV-3996	ROCKWELL	GLOBE	5"	LIMITORQUE	SMB	1-40	1900	40.15/1	47.32
MOV-4000A	ROCKWELL	GLOBE	3"	LIMITORQUE	SMB	00	1700	72.0/1	23.61
MOV-4000B	ROCKWELL	GLOBE	3"	LIMITORQUE	SMB	00	1700	72.0/1	23.61
MOV-4007	ROCKWELL	GLOBE	3"	LIMITORQUE	SMB	00-10	3400	72.0/1	47.22
MOV-4008	ROCKWELL	GLOBE	3"	LIMITORQUE	SMB	00-10	3400	72.0/1	47.22
MOV-4013	CRANE	GATE	4"	LIMITORQUE	SMB	000-2	1725	65.0/1	26.54
MOV-4027	CRANE	GATE	4"	LIMITORQUE	SMB	000-2	1725	65.0/1	26.54
MOV-4028	CRANE	GATE	4"	LIMITORQUE	SMB	000-2	1725	65.0/1	26.54
MOV-4615	CRANE	GATE	20"	LIMITORQUE	SMB	2-60	1750	43.99/1	39.78
MOV-4616	CRANE	GATE	20"	LIMITORQUE	SMB	2-60	1750	43.99/1	39.78
MOV-9629A	BORG WARNER	GATE	4"	LIMITORQUE	SMB	00-10	1700	23/1	73.91
MOV-9629B	BORG WARNER	GATE	4"	LIMITORQUE	SMB	00-10	1700	23/1	73.91
MOV-9701A	FISHER	GLOBE	3"	LIMITORQUE	SMB	00-S-E	1700	41/1	41.46
MOV-9701B	FISHER	GLOBE	3"	LIMITORQUE	SMB	00-5	1700	41/1	41.46
MOV-9703A	ROCKWELL	GLOBE	3"	LIMITORQUE	SMB	00	1700	72.0/1	23.61
MOV-9703B	ROCKWELL	GLOBE	3"	LIMITORQUE	SMB	00	1700	72.0/1	23.61
MOV-9704A	ROCKWELL	GLOBE	3"	LIMITORQUE	SMB	00-10	1700	72.0/1	23.61
MOV-9704B	ROCKWELL	GLOBE	3"	LIMITORQUE	SMB	00-10	1700	72.0/1	23.61

TABLE 3

## SUMMARY OF PROGRAM DATA

VALVE I.D.	DESIGN BASIS Δ P OPEN/CLOSE (psi)	TEST Δ P OPEN      CLOSE (psi)		AS-FOUND T.S.S. OPEN/CLOSE 4/	AS-LEFT T.S.S. OPEN/CLOSE 4/	AS-FOUND OPEN T.S. BYPASS SETTING (%)	AS-LEFT OPEN T.S. BYPASS SETTING (%)	AS-FOUND T.S.S. THRUST OPEN/CLOSE (lbs.) 4/	REQUIRED T.S.S. THRUST OPEN/CLOSE (lbs.)	AS-LEFT T.S.S. THRUST OPEN/CLOSE (lbs.) 4/	COMMENT
MOV-825A	35/35	1/	1/	1.75/1.75	1.75/2.125	10.45	8.4	2860/2840	5510/5430	6120/11345	
MOV-825B	35/35	1/	1/	2.0/2.0	1.6/1.8	11.76	6.2	5487/3780	6720/6350	7287/8356	
MOV-826A	13/13	11.4	11.4	2.25/1.5	2.0/2.0	13.29	9.0	2140/4300	4340/4000	5790/5175	
MOV-826B	13/13	14.5	8.8	1.25/1.25	1.5/2.0	10.84	8.2	4640/2460	3760/4600	4680/5220	
MOV-826C	13/13	10.8	10.8	2.0/1.5	1.75/2.0	10.83	9.9	*	3180/3260	6040/4780	
MOV-826D	13/13	14.4	14.4	1.5/1.5	1.5/2.0	8.53	8.5	*	2850/2925	4140/3620	
MOV-871A	1535/1535	2/	2/	1.0/1.5	2.0/2.25	0	6.0	2160/2060	8503/8225	9135/8941	
MOV-871B	1535/1535	2/	2/	1.25/1.0	1.25/1.25	2.04	6.7	9700/8700	9099/6345	9776/7494	
MOV-1815A	140/140	149	130/150	1.0/1.0	2.5/1.5	11.26	6.2	3200/3540	3025/3325	3620/3760	
MOV-1815B	140/140	149	79/93	1.0/2.0	1.5/2.5	10.53	9.8	1680/2640	1310/2490	2640/2940	
MOV-3504A	1118/1118	700/720	700/690	2.0/1.5	2.0/2.0	7.46	7.6	9982/6500	16943/5727	14907/14068	3/
MOV-3505A	1118/1118	720/730	730/740	2.0/2.5	2.25/2.25	0	9.3	10930/13306	12888/2844	15412/14510	
MOV-3996	1644/1644	670/1400	670/728	2.25/2.0	2.5/2.5	9.10	8.3	44124/39821	40514/35958	31683/41909	3/
MOV-4000A	1475/1475	1280/1460	720/750	1.5/1.5	1.0/1.25	3.49	8.0	*	9760/13700	7980/15506	3/
MOV-4000B	1475/1475	1330/1440	520/690	2.0/1.0	1.5/1.875	3.84	6.7	*	16240/16930	14355/18643	3/
MOV-4007	1475/1475	1380	1210	2.0/2.0	1.0/2.0	3.55	7.3	*	6380/4080	9424/10660	
MOV-4008	1475/1475	460/655	465/655	2.0/1.75	1.5/1.75	6.39	7.3	*	36157/13920	17440/17080	3/
MOV-4013	75/75	77	75.5	1.0/2.0	2.0/2.0	0	6.8	1261/2239	2600/1830	2920/2640	
MOV-4027	75/75	75	75	1.0/1.0	2.0/2.0	7.27	9.6	2020/1920	1800/1860	2360/2460	
MOV-4028	75/75	81	81	1.0/1.0	2.0/2.0	9.18	9.1	1383/2467	811/571	860/1660	
MOV-4615	75/75	2/	2/	2.0/1.875	2.5/2.5	6.68	6.7	19050/18650	22919/18795	22450/23800	3/
MOV-4616	75/75	2/	2/	2.25/2.7	2.0/2.0	1.97	8.4	*	24269/23763	17560/25420	3/
MOV-9629A	75/75	135	135	2.0/1.5	2.0/1.5	12.61	8.4	6009/7133	3130/2063	5420/7812	
MOV-9629B	75/75	135	135	1.5/1.5	1.5/1.5	4.13	7.0	3413/5120	3000/2280	3260/4936	
MOV-9701A	1441/1441	30/710	300/580	1.25/1.5	2.0/1.5	2.80	6.2	5980/3080	5060/2410	9204/5360	
MOV-9701B	1441/1441	570/620	620/675	1.5/1.5	1.75/1.75	9.04	7.95	5540/7644	8230/5470	9720/7800	
MOV-9703A	1055/1168	1370	1370	1.5/1.5	1.25/1.25	4.61	7.4	*	10300/10300	9700/11120	3/
MOV-9703B	1055/1168	1360	1360	1.0/1.25	1.0/1.0	4.88	8.9	13728/17159	16165/17219	12603/18799	3/
MOV-9704A	1441/1441	570/580	590/625	1.5/1.5	1.0/1.5	2.60	8.9	*	35761/14361	12889/17691	3/
MOV-9704B	1441/1441	590/600	730/760	1.0/1.0	1.5/1.25	2.22	8.8	*	28429/17029	13090/18879	3/



TABLE 3

Additional Information

Legend:

T.S.S. = Torque Switch Setting

T.S. = Torque Switch

Notes:

- 1/ Required  $\Delta P$  was obtained by extrapolating  $\Delta P$  test data from MOV-826 A,B,C and D that are the same as MOV-825A and B.
- 2/ Required  $\Delta P$  was obtained through MOVATS database.
- 3/ Acceptable because open T.S. bypass switch set to bypass the open peak thrust.
- 4/ The relationship between T.S.S. and thrust changes when maintenance is performed on the spring pack or T.S. Therefore, the AS-FOUND T.S.S. vs. thrust may differ from the AS-LEFT T.S.S. vs. thrust.
- \* To prevent overthrusting, the open torque switch was set to a minimum before opening the valve into the load cell. The thrust at the torque switch minimum setting was extrapolated to the as-found torque switch setting and was found to exceed manufacturers rating.

TABLE 4

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-825A

Due to inability to Delta P test, data was obtained from the Delta P tests performed on four valves of the same type and size. This data was plotted and extrapolated to obtain the required thrust values in the open and closed directions. The extrapolated thrusts were added to the running load thrusts and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(4850 \text{ lbs} + 660 \text{ lbs}) 1.083 = 5967 \text{ lbs}$$

As-left open torque switch operated at 6120 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(5050 \text{ lbs} + 380 \text{ lbs}) 1.083 = 5881 \text{ lbs}$$

As-left closed torque switch operated at 11345 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-825B

Due to inability to Delta P test, data was obtained from the Delta P tests performed on four valves of the same type and size. This data was plotted and extrapolated to obtain the required thrust values in the open and closed directions. The extrapolated thrusts were added to the running load thrusts and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(4850 \text{ lbs} + 1870 \text{ lbs}) 1.078 = 7244 \text{ lbs}$$

As-left open torque switch operated at 7287 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(5050 \text{ lbs} + 1300 \text{ lbs}) 1.078 = 6845 \text{ lbs}$$

As-left closed torque switch operated at 8356 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-826A

A single Delta P test was performed at 11.4 psid in the open and closed directions using the head of water against the seat. The open and closed design Delta P thrust values were obtained by extrapolating to the required 13 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(2400 \text{ lbs} + 1940 \text{ lbs}) 1.25 = 5425 \text{ lbs}$$

As-left open torque switch operated at 5790 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(1900 \text{ lbs} + 2100 \text{ lbs}) 1.25 = 5000 \text{ lbs}$$

As-left closed torque switch operated at 5175 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-826B

A single Delta P test was performed at 14.5/8.8 psid in the open and closed directions respectively, using the head of water against the seat. The open and closed design Delta P thrust values were obtained by interpolation/extrapolation to the required 13 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(1780 \text{ lbs} + 1980 \text{ lbs}) 1.13 = 4249 \text{ lbs}$$

As-left open torque switch operated at 4680 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(2780 \text{ lbs} + 1820 \text{ lbs}) 1.12 = 5152 \text{ lbs}$$

As-left closed torque switch operated at 5220 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-826C

A single Delta P test was performed at 10.8 psid in the open and closed directions using the head of water against the seat. The open and closed design Delta P thrust values were obtained by extrapolating to the required 13 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(1740 \text{ lbs} + 1440 \text{ lbs}) 1.25 = 3975 \text{ lbs}$$

As-left open torque switch operated at 6040 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(1860 \text{ lbs} + 1400 \text{ lbs}) 1.25 = 4075 \text{ lbs}$$

As-left closed torque switch operated at 4780 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-826D

A single Delta P test was performed at 14.4 psid in the open and closed directions using the head of water against the seat. The open and closed design Delta P thrust values were obtained by interpolating to the required 13 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(1570 \text{ lbs} + 1280 \text{ lbs}) 1.25 = 3563 \text{ lbs}$$

As-left open torque switch operated at 4140 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(1645 \text{ lbs} + 1280 \text{ lbs}) 1.159 = 3390 \text{ lbs}$$

As-left closed torque switch operated at 3620 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-871A

The open and closed design Delta P thrust values were obtained from the MOVATS database for the required 1535 psid. These values were added to the as-found running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Database} & + \\ \text{Open Thrust} & \text{Running Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(6343 \text{ lbs} + 2160 \text{ lbs}) 1.073 = 9124 \text{ lbs}$$

As-left open torque switch operated at 9135 lbs which is above minimum required.

$$\left( \begin{array}{cc} \text{Database} & + \\ \text{Closed Thrust} & \text{Running Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(6345 \text{ lbs} + 1880 \text{ lbs}) 1.073 = 8825 \text{ lbs}$$

As-left closed torque switch operated at 8941 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-871B

The open and closed design Delta P thrust values were obtained from the MOVATS database for the required 1535 psid. These values were added to the as-found running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Database} & + \\ \text{Open Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(6343 \text{ lbs} + 2756 \text{ lbs}) 1.067 = 9708 \text{ lbs}$$

As-left open torque switch operated at 9776 lbs which is above minimum required.

$$\left( \begin{array}{cc} \text{Database} & + \\ \text{Closed Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(6345 \text{ lbs} + 0 \text{ lbs}) 1.076 = 6827 \text{ lbs}$$

As-left closed torque switch operated at 7494 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-1815A

A single Delta P test at 149 psid was performed in the open direction and two Delta P tests were performed in the closed direction at 130 psid and 150 psid. The open and closed design Delta P thrust values were obtained by interpolating to the required 140 psid. These values included the running load and were multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{l} \text{Interpolated Open Thrust} \\ \text{Including Running Load Thrust} \end{array} \right) \text{ Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(3025 \text{ lbs}) 1.13 = 3418 \text{ lbs}$$

As-left open torque switch operated at 3620 lbs which is above minimum required.

$$\left( \begin{array}{l} \text{Interpolated Closed Thrust} \\ \text{Including Running Load Thrust} \end{array} \right) \text{ Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(3325 \text{ lbs}) 1.13 = 3757 \text{ lbs}$$

As-left closed torque switch operated at 3760 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-1815B

A single Delta P test at 149 psid was performed in the open direction and two Delta P tests were performed in the closed direction at 79 psid and 93 psid. The open design Delta P thrust value was obtained by interpolating to the required 140 psid. The closed design Delta P thrust value was obtained by extrapolating to the required 140 psid. These values were added to the Delta P running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(670 \text{ lbs} + 640 \text{ lbs}) 1.25 = 1638 \text{ lbs}$$

As-left open torque switch operated at 2640 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(1850 \text{ lbs} + 640 \text{ lbs}) 1.159 = 2885 \text{ lbs}$$

As-left closed torque switch operated at 2940 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-3504A

Two Delta P tests were performed in the open direction at 700 psid and 720 psid and in the closed direction at 700 psid and 690 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1118 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(14000 \text{ lbs} + 2943 \text{ lbs}) 1.067 = 18078 \text{ lbs}$$

As-left open torque switch operated at 14907 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(2700 \text{ lbs} + 3027 \text{ lbs}) 1.083 = 6202 \text{ lbs}$$

As-left closed torque switch operated at 14068 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-3505A

Two Delta P tests were performed in the open direction at 720 psid and 730 psid and in the closed direction at 730 psid and 740 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1118 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Extrapolated} & + \\ \text{Open Thrust} & \text{Running Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(11500 \text{ lbs} + 1388 \text{ lbs}) 1.073 = 13829 \text{ lbs}$$

As-left open torque switch operated at 15412 lbs which is above minimum required.

$$\left( \begin{array}{cc} \text{Extrapolated} & + \\ \text{Closed Thrust} & \text{Running Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(1690 \text{ lbs} + 1154 \text{ lbs}) 1.159 = 3296 \text{ lbs}$$

As-left closed torque switch operated at 14510 lbs which is above minimum required.





TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-3996

Two Delta P tests were performed in the open direction at 670 psid and 1400 psid and in the closed direction at 670 psid and 728 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1644 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Extrapolated} & + \\ \text{Open Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(33000 \text{ lbs} + 7514 \text{ lbs}) 1.064 = 43107 \text{ lbs}$$

As-left open torque switch operated at 31683 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{cc} \text{Extrapolated} & + \\ \text{Closed Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(25500 \text{ lbs} + 10458 \text{ lbs}) 1.064 = 38259 \text{ lbs}$$

As-left closed torque switch operated at 41909 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4000A

Two Delta P tests were performed in the open direction at 1280 psid and 1460 psid and in the closed direction at 720 psid and 750 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1475 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(7400 \text{ lbs} + 2360 \text{ lbs}) 1.073 = 10472 \text{ lbs}$$

As-left open torque switch operated at 7980 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(11200 \text{ lbs} + 2500 \text{ lbs}) 1.073 = 14700 \text{ lbs}$$

As-left closed torque switch operated at 15506 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4000B

Two Delta P tests were performed in the open direction at 1330 psid and 1440 psid and in the closed direction at 520 psid and 690 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1475 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(12300 \text{ lbs} + 3940 \text{ lbs}) 1.067 = 17328 \text{ lbs}$$

As-left open torque switch operated at 14355 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(11950 \text{ lbs} + 4980 \text{ lbs}) 1.067 = 18064 \text{ lbs}$$

As-left closed torque switch operated at 18643 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4007

A single Delta P test was performed in the open direction at 1380 psid and in the closed direction at 1210 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1475 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(5100 \text{ lbs} + 1280 \text{ lbs}) 1.078 = 6878 \text{ lbs}$$

As-left open torque switch operated at 9424 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(2100 \text{ lbs} + 1980 \text{ lbs}) 1.136 = 4635 \text{ lbs}$$

As-left closed torque switch operated at 10660 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4008

Two Delta P tests were performed in the open direction at 460 psid and 655 psid and in the closed direction at 465 psid and 655 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1475 psid. These values were added to the as-found running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(33500 \text{ lbs} + 2657 \text{ lbs}) 1.064 = 38471 \text{ lbs}$$

As-left open torque switch operated at 17440 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(11000 \text{ lbs} + 2920 \text{ lbs}) 1.067 = 14852 \text{ lbs}$$

As-left closed torque switch operated at 17080 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4013

A single Delta P test was performed at 77 psid in the open direction and at 75.5 psid in the closed direction. The open and closed design Delta P thrust values were obtained by interpolating to the required 75 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(1780 \text{ lbs} + 820 \text{ lbs}) 1.159 = 3013 \text{ lbs}$$

As-left open torque switch operated at 2920 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(1170 \text{ lbs} + 660 \text{ lbs}) 1.159 = 2121 \text{ lbs}$$

As-left closed torque switch operated at 2640 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4027

A single Delta P test was performed at the design Delta P of 75 psid in the open and closed directions. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{l} \text{Open Thrust} \\ + \\ \text{Running Load Thrust} \end{array} \right) \begin{array}{l} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{l} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(600 \text{ lbs} + 1200 \text{ lbs}) 1.159 = 2086 \text{ lbs}$$

As-left open torque switch operated at 2680 lbs which is above minimum required.

$$\left( \begin{array}{l} \text{Closed Thrust} \\ + \\ \text{Running Load Thrust} \end{array} \right) \begin{array}{l} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{l} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(780 \text{ lbs} + 1080 \text{ lbs}) 1.25 = 2325 \text{ lbs}$$

As-left closed torque switch operated at 2460 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4028

A single Delta P test was performed at 81 psid in the open and closed directions. The open and closed design Delta P thrust values were obtained by interpolating to the required 75 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(670 \text{ lbs} + 141 \text{ lbs}) 1.25 = 1014 \text{ lbs}$$

As-left open torque switch operated at 860 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(485 \text{ lbs} + 86 \text{ lbs}) 1.25 = 714 \text{ lbs}$$

As-left closed torque switch operated at 1660 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4615

The open and closed design Delta P thrust values were obtained from the MOVATS database for the required 75 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Database} & + \\ \text{Open Thrust} & \text{Running Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(14669 \text{ lbs} + 8250 \text{ lbs}) 1.067 = 24455 \text{ lbs}$$

As-left open torque switch operated at 22450 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{cc} \text{Database} & + \\ \text{Closed Thrust} & \text{Running Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(10995 \text{ lbs} + 7800 \text{ lbs}) 1.067 = 20054 \text{ lbs}$$

As-left closed torque switch operated at 23800 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-4616

The open and closed design Delta P thrust values were obtained from the MOVATS database for the required 75 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Database} & + \\ \text{Open Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Open Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(14669 \text{ lbs} + 9600 \text{ lbs}) 1.067 = 25895 \text{ lbs}$$

As-left open torque switch operated at 17560 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{cc} \text{Database} & + \\ \text{Closed Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \begin{array}{c} \text{Repeatability} \\ \text{Factor} \end{array} = \begin{array}{c} \text{Minimum Closed Torque Switch} \\ \text{Thrust Setting} \end{array}$$

$$(10995 \text{ lbs} + 12768 \text{ lbs}) 1.067 = 25356 \text{ lbs}$$

As-left closed torque switch operated at 25420 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-9629A

A single Delta P test was performed at 135 psid in the open and closed directions. The open and closed design Delta P thrust values were obtained by interpolating to the required 75 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Interpolated} & + \\ \text{Open Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(650 \text{ lbs} + 2480 \text{ lbs}) 1.136 = 3556 \text{ lbs}$$

As-left open torque switch operated at 5420 lbs which is above minimum required.

$$\left( \begin{array}{cc} \text{Interpolated} & + \\ \text{Closed Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(175 \text{ lbs} + 1888 \text{ lbs}) 1.159 = 2391 \text{ lbs}$$

As-left closed torque switch operated at 7812 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-9629B

A single Delta P test was performed at 135 psid in the open and closed directions. The open and closed design Delta P thrust values were obtained by interpolating to the required 75 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Interpolated} & + \\ \text{Open Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(1600 \text{ lbs} + 1400 \text{ lbs}) 1.136 = 3408 \text{ lbs}$$

As-left open torque switch operated at 3260 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{cc} \text{Interpolated} & + \\ \text{Closed Thrust} & \text{Running} \\ & \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(940 \text{ lbs} + 1340 \text{ lbs}) 1.159 = 2642 \text{ lbs}$$

As-left closed torque switch operated at 4936 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-9701A

Two Delta P tests were performed in the open direction at 30 psid and 710 psid and in the closed direction at 300 psid and 580 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1441 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(4400 \text{ lbs} + 660 \text{ lbs}) 1.083 = 5480 \text{ lbs}$$

As-left open torque switch operated at 9204 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(1250 \text{ lbs} + 1160 \text{ lbs}) 1.159 = 2793 \text{ lbs}$$

As-left closed torque switch operated at 5360 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-9701B

Two Delta P tests were performed in the open direction at 570 psid and 620 psid and in the closed direction at 620 psid and 675 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1441 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(7350 \text{ lbs} + 880 \text{ lbs}) 1.076 = 8855 \text{ lbs}$$

As-left open torque switch operated at 9720 lbs which is above minimum required.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(4250 \text{ lbs} + 1220 \text{ lbs}) 1.083 = 5924 \text{ lbs}$$

As-left closed torque switch operated at 7800 lbs which is above minimum required.

TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-9703A

A single Delta P test was performed at 1370 psid in the open and closed directions. The open and closed design Delta P thrust values were obtained by interpolating to the required open 1055 psid and closed 1168 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{cc} \text{Interpolated} & + \\ \text{Open Thrust} & \text{Running Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(6600 \text{ lbs} + 3700 \text{ lbs}) 1.073 = 11052 \text{ lbs}$$

As-left open torque switch operated at 9700 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{cc} \text{Interpolated} & + \\ \text{Closed Thrust} & \text{Running Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(6600 \text{ lbs} + 3700 \text{ lbs}) 1.073 = 11052 \text{ lbs}$$

As-left closed torque switch operated at 11120 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-9703B

A single Delta P test was performed at 1360 psid in the open and closed directions. The open and closed design Delta P thrust values were obtained by interpolating to the required open 1055 psid and closed 1168 psid. These values were added to the running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(9100 \text{ lbs} + 7065 \text{ lbs}) 1.067 = 17248 \text{ lbs}$$

As-left open torque switch operated at 12603 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Interpolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(10100 \text{ lbs} + 7119 \text{ lbs}) 1.067 = 18373 \text{ lbs}$$

As-left closed torque switch operated at 18799 lbs which is above minimum required.



TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-9704A

Two Delta P tests were performed in the open direction at 570 psid and 580 psid and in the closed direction at 590 psid and 625 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1441 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(29400 \text{ lbs} + 6361 \text{ lbs}) 1.064 = 38050 \text{ lbs}$$

As-left open torque switch operated at 12889 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(8000 \text{ lbs} + 6361 \text{ lbs}) 1.067 = 15323 \text{ lbs}$$

As-left closed torque switch operated at 17691 lbs which is above minimum required.





TABLE 4 (Cont'd)

VALVE I.D.TEST METHOD DESCRIPTION/JUSTIFICATION

MOV-9704B

Two Delta P tests were performed in the open direction at 590 psid and 620 psid and in the closed direction at 730 psid and 760 psid. The open and closed design Delta P thrust values were obtained by extrapolating to the required 1441 psid. These values were added to the as-left running loads and multiplied by a repeatability factor to obtain the required thrust for the torque switch settings.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Open Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Open Torque Switch Thrust Setting}$$

$$(18700 \text{ lbs} + 9729 \text{ lbs}) 1.064 = 30248 \text{ lbs}$$

As-left open torque switch operated at 13090 lbs which is below minimum, but this is allowable since the open peak thrust is bypassed.

$$\left( \begin{array}{c} \text{Extrapolated} \\ \text{Closed Thrust} \end{array} + \begin{array}{c} \text{Running} \\ \text{Load Thrust} \end{array} \right) \text{Repeatability Factor} = \text{Minimum Closed Torque Switch Thrust Setting}$$

$$(7300 \text{ lbs} + 9729 \text{ lbs}) 1.067 = 18169 \text{ lbs}$$

As-left closed torque switch operated at 18879 lbs which is above minimum required.

ATTACHMENT 2

SAFETY RELATED MOTOR OPERATED VALVE PROGRAM

(For record keeping purposes, the Program has been generated in Design Criteria format.)

