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SUBJECT: Responds to NRC Bulletin 85-003,Suppl 1, "Motor-Operated Valve Common Mode Failures during Plant Transients due...."

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Iowa Electric Light and Power Company

February 21, 1989

NG-89-0319

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Response to NRC Bulletin 85-03, Supplement 1:
Motor-Operated Valve Common Mode Failures During
Plant Transients Due to Improper Switch Settings

Reference:
1) Letter, W. Rothert, to A. Bert Davis, "Response to Bulletin 85-03, Supplement 1: Motor Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings", NG-88-2842, August 15, 1988
2) Letter, W. Rothert to A. Bert Davis "Final Report Pursuant to IE Bulletin 85-03" NG-88-0001, January 15, 1988

File: A-101a, A-107a

Dear Dr. Murley:

Supplement 1 to Bulletin 85-03 requires that licensees review their programs under Bulletin 85-03 to ensure that certain safety-related valves in selected systems can overcome the maximum-expected differential pressure even if the valves are inadvertently mispositioned.

We responded to the Supplement with Reference 1, identifying the HPCI and RCIC valves covered by the Supplement and stating the maximum-expected differential pressures during opening and closing which have been recalculated.

Reference 1 also indicated the schedule for completion of actions required by the Supplement.

Enclosed is the final report in response to Bulletin 85-03 and Supplement. This report replaces Reference 2 and describes our MOV program including the program modifications developed from MOV operator, maintenance and testing experience gained during the last two refueling outages and made since Reference 2 was submitted. Significant changes from Reference 2 are marked by revision bars.

The summaries of the findings as to valve operability provided in Reference 2 Tables B through I have been updated to reflect current valve status and the testing performed during the Cycle 9/10 refuel outage. Testing data from the Cycle 8/9 outage has also been provided for historical purposes.

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Dr. Thomas E. Murley
February 21, 1989
NG-89-0319
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Please contact this office if there are any questions concerning this matter.

This letter is true and accurate to the best of my knowledge and belief.

IOWA ELECTRIC LIGHT AND POWER COMPANY

By Daniel L. Mineck

Daniel L. Mineck
Manager, Nuclear Division

Subscribed and sworn to before me on this 21st day of February, 1989.

Kathleen M. Furman

Notary Public in and for the State of Iowa

WCR/PMB/pjv+

Enclosures: Iowa Electric Light and Power Company Duane Arnold Energy Center (DAEC) Final Report Pursuant to IE Bulletin 85-03 and Supplement 1 thereto.

cc: P. Bessette
L. Liu
L. Root
R. McGaughy
J. R. Hall (NRC-NRR)
A. Bert Davis (Region III)
NRC Resident Office
Commitment Control No. Reference: 850344, 860223, 880147

Iowa Electric Light and Power Company
DUANE ARNOLD ENERGY CENTER (DAEC)
Final Report Pursuant to IE Bulletin 85-03 and Supplement 1 Thereto*

REFERENCES:
1) Letter, W. Rothert to A. Bert Davis "Final Report Pursuant to IE Bulletin 85-03", NG-88-0001, January 15, 1988
2) Letter, W. Rothert, to A. Bert Davis, "Response to Bulletin 85-03, Supplement 1: Motor Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings", NG-88-2842, August 15, 1988

For safety-related motor-operated valves in the high pressure coolant injection/core spray and reactor core isolation cooling system that are required to be tested for operational readiness in accordance with 10 CFR 50.55a(g), develop and implement a program to ensure that valve operator switches are selected, set and maintained properly. This should include the following:

Bulletin Item a)

Review and document the design basis for operation of each valve. This documentation should include the maximum differential pressure expected during both opening and closing the valve for both normal and abnormal events to the extent that these valve operations and events are included in the existing, approved design basis, (i.e., the design basis documented in pertinent licensee submittals such as FSAR analyses and fully-approved operating and emergency procedures, etc.). In addition, when determining the maximum differential pressure for valves that can be inadvertently mispositioned, the fact that the valve must be able to recover from such mispositioning should be included.

Iowa Electric Response to Item a

Iowa Electric Light and Power Company has considered the motor-operated valves (MOVs) in the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) Systems of the Duane Arnold Energy Center (DAEC) in response to Bulletin 85-03 and Supplement 1 thereto. The DAEC Inservice Testing Program for Pumps and Valves (Rev. 6) delineates which MOVs in the HPCI and RCIC systems are subject to 10 CFR 50.55a requirements.

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*This report replaces NG-88-0001, "Final Report Pursuant to IE Bulletin 85-03", January 15, 1988

Originally, maximum-expected differential pressures during opening and closing were calculated for each valve based on the methodology developed in the BWR Owner's Group (BWROG) report, NEDC-31322, "BWR Owner's Group Report on the Operational Design Basis of Selected Safety-Related Motor-Operated Valves," September 1986. The DAEC Technical Specifications, the Updated Final Safety Analysis Report, Piping and Instrumentation Drawings, Surveillance Test Procedures, Operating Instructions, and Emergency Operating Procedures were utilized in the design basis review for each valve and for verification of the BWROG methodology used in calculation of the maximum-expected differential pressures. Normal differential pressures for opening and closing were not included based on BWROG methodology. The DAEC design basis review for each valve verified the BWROG methodology and confirmed that the referenced valves have no active safety action under normal operating conditions or events. Hence a normal differential pressure is not applicable. These valves and pressures were included in Table A of Reference 1.

Supplement 1 to Bulletin 85-03 required that licensees review their programs under Bulletin 85-03 to ensure that certain safety-related valves in selected systems can overcome the maximum-expected differential pressure even if the valves are inadvertently mispositioned. These valves were identified in NEDC-31322, Supplement 1, "BWR Owner's Group Report On the Operational Design Basis of Selected and Safety-Related Motor Operated Valves." The maximum expected differential pressures during opening and closing were recalculated for the selected valves based on the BWROG methodology.

Table A of this final report lists all valves and their differential pressures included in the program in response to Bulletin 85-03 and Supplement 1. The maximum-expected differential pressures identified in Table A reflect the Supplement 1 requirements.

<u>Bulletin Item b)</u>

Using the results from item a) above, establish the correct switch settings. This shall include a program to review and revise, as necessary, the methods for selecting and setting all switches (i.e., torque, torque bypass, position limit, overload) for each valve operation (opening and closing).

<u>Iowa Electric Response to Item b</u>

The DAEC's E-200 drawings designate the 24 MOVs which are controlled by Iowa Electric's diagnostic signature trace program. The drawing provides information such as the maximum-expected differential pressure, required thrust, maximum allowed seating current, and torque switch setting ranges. A Caution Note on the drawing states that no switch settings for these valves may be changed beyond the range specified on the E-200 drawing without performance of an engineering evaluation. This Caution Note has been revised to allow adjustment of torque switches, within the specified range, as necessary to meet thrust requirements and the seating current limitations. Installed torque switch setting data has been removed from the E-200 drawings to ensure that valve operability is based on thrust requirements. Installed torque switch settings will, however, be available on maintenance documents if required for reference.

Engineering Design Guide DGC-E108 was developed and used for calculating the required valve stem thrust to overcome maximum-expected differential pressure and for determining the corresponding torque switch, limit switch, bypass switch and thermal overload switch settings. For the Cycle 8/9 and 9/10 refuel outages, Iowa Electric used the MOVATS, Inc. methodology to assist in determining, establishing and maintaining correct switch settings for the valves in the program responsive to Bulletin 85-03 and Supplement 1. Engineering Design Guide DGC-E108 incorporates the MOVATS methodology for setting torque switches. However, alternate state-of-the-art methodology for valve testing and switch setting is being evaluated and may be implemented as an alternative or replacement to MOVATS when technically warranted. If an alternate technology is implemented, it will be incorporated into DGC-E108.

Eight maintenance procedures provide the instructions for disassembly, maintenance and adjustment of torque, bypass and limit switch settings for each of the specific types and sizes of Limitorque operators used at the Duane Arnold Energy Center. These maintenance procedures (VALVOP-L200-001 through -008) refer to the controlled drawing E-200 to identify which MOVs are subject to diagnostic signature trace testing requirements in order to maintain compliance with Bulletin 85-03 and Supplement 1. In addition, a note on each MOV logic diagram references drawing E-200 for the appropriate torque switch setting range.

The Design Engineering Department Procedure 1203.32, titled "Second Level Review", requires an additional review of any proposed design changes that could affect MOV switch settings. Procedure 1203.11, titled "Design Requirements Listing", includes an evaluation of any design change that affects MOV mechanical and electrical parameters that could impact MOV operability.

There is a training program at DAEC covering MOV operators for maintenance personnel. Topics covered include fundamentals of operation, inspections, trouble shooting, valve position indicating circuits and maintenance procedures. Specialized training on diagnostic signature trace testing is also provided.

Bulletin Item c)

Individual valve settings shall be changed, as appropriate, to those established in item b) above. Whether the valve setting is changed or not, the valve will be demonstrated to be operable by testing the valve at the maximum differential pressure determined in item a) above with the exception that testing motor-operated valves under conditions simulating a break in the line containing the valve is not required. Otherwise, justification should be provided for any cases where testing with the maximum differential pressure cannot practically be performed. This justification should include the alternative to maximum differential pressure testing which will be used to verify the correct settings.

NOTE: This bulletin is not intended to establish a requirement for valve testing for the condition simulating a break in the line containing the valve. However, to the extent that such valve operation is relied upon in the design basis, a break in the line containing the valve should be considered in the analyses prescribed in items a) and b) above. The resulting switch settings for pipe break conditions should be verified, to the extent practical, by the same methods that would be used to verify other settings (if any) that are not tested at the maximum differential pressure.

Each valve shall be stroked tested, to the extent practical, to verify that the settings defined in item b) above have been properly implemented even if testing with differential pressure can not be performed.

Iowa Electric response to Item c

All 24 MOVs listed in Table A underwent diagnostic signature trace testing during the Cycle 9/10 refuel outage. These valves were retested due to revised MOVATS target thrust values and differential pressure requirements identified in Supplement 1. The results of the Cycle 9/10 MOV testing are reported in Table I of this report.

The justification for MOV operability during the past two refuel outages was based on MOVATS methodology, provided in the Attachment to Ref. 1 "Synopsis of USNRC IEB 85-03 Program for DAEC" (MOVATS Synopsis). The MOVATS Synopsis includes the methodology for testing and supporting bases for justifying valve operability. MOVATS has demonstrated, based on accumulated test data, that its setpoint methodology is conservative and that valves set up based on the MOVATS setting are capable of functioning at maximum-expected differential pressure requirements with a 90% confidence band. The MOVATS test data base continues to grow as MOVATS completes additional differential pressure testing. Expansion of the MOVATS Data base provided refined thrust values which were used during the Cycle 9/10 refueling outage.

The present torque switch settings for three valves, however, are such that less thrust is developed by the MOV in the closing direction than the thrust needed to meet the MOVATS 90% confidence band. The revised MOVATS confidence bands for these valves under reduced closing thrust conditions are as follows:

MOV	Revised MOVATS Confidence Band
2312	75 - 80%
2401	85 - 90%
2512	85 - 90%

Iowa Electric has decided not to adjust the torque switch settings for these valves at this time for the following lessons:

1) Use of the MOVATS-recommended settings for these valves would require exceeding the maximum seating current available to the valve operator under worst case conditions. These current values are self-imposed restrictions which reflect valve capabilities during accident conditions which include reduced voltage and increased temperature.

2) The conservatism built into the MOVATS target thrust values, as demonstrated by actual testing results discussed below, provides additional confidence that these valves will function properly under maximum-expected differential pressure conditions.

3) The MOVATS test data base continues to grow. This increase in the data base may again substantiate decreasing the MOVATS target thrust requirements due to data base refinements as was the case during the last operating cycle.

An engineering evaluation is in progress to review the MOV test data and operating criteria in order to improve valve performance during all operating conditions. Any recommended modifications resulting from this evaluation will be implemented prior to startup from the next scheduled refueling outage, presently scheduled for the Spring of 1990.

During the Cycle 8/9 refuel outage, we performed the opening differential pressure (d/p) tests on 6 of the MOVs listed in Table I of Ref. 1 to verify that MOVATS setpoints ensured MOV operability. The 6 d/p tests demonstrated that each valve opened at less than the target thrust. In all cases, the test d/p was equal to or greater than the maximum-expected d/p. To demonstrate the conservatism of the MOVATS setpoint methodology, the following Table compares the target thrust calculated by the MOVATS methodology as necessary to overcome test d/p and the thrust actually measured during d/p testing for each of the 6 MOVs.

MOV	Test D/P (psid)	MOVATS Target Thrust	Measured Thrust during* d/p Testing (lbs)
2202	1110	53,157	15,020
2312	1289	88,994	50,000
2318	1416	13,238	0**
2322	123	11,575	10,750
2512	1417	11,393	<5,260***
2517	128	2,470	2,080

During the Cycle 9/10 refuel outage, we performed opening d/p tests on 3 MOVs. The following table compares the target thrust calculated by the MOVATS methodology as necessary to overcome the test d/p and the thrust actually measured during the d/p testing for each of the 3 MOVs.

MOV	Test D/P (psid)	MOVATS Target Thrust	Measured Thrust during d/p Testing (lbs)
2311	1339	67,082	<20,631***
2312	1339	67,059	<26,000***
2516	122	5,538	2,819

Measured thrust values obtained during full d/p testing replaced the MOVATS data as the opening target thrust values where appropriate.

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* Thrust values differ from those previously reported in the Enclosure to Ref. 1 due to MOVATS re-evaluation of test data during 1988.

** MO-2318 is a globe value. System pressure assisted in opening the valve.

*** The required thrust to operate against the specified differential pressure is less than the spring pack preload. Therefore, the preload value is provided.

Bulletin Item d)

Prepare or revise procedures to ensure that correct switch settings are determined and maintained throughout the life of the plant.* Ensure that applicable industry recommendations are considered in the preparation of these procedures.

Iowa Electric Response to Item d

The MOV maintenance procedures (VALVOP-L200-001 through -008) refer to drawing E-200, which is a controlled design document to identify the MOVs which are in the diagnostic signature trace program. The maintenance procedures delineate what maintenance items impact the switch settings on the MOVs set up by diagnostic signature trace methods. In addition, preventative maintenance work packages which are part of the Preventative Maintenance Action Request (PMAR) program, ensure that these MOVs are inspected and maintained in an acceptable configuration. These PMARS have replaced the surveillance test procedure (STP NS 13G002) which was previously described in Reference 1.

The criteria for reperforming diagnostic signature trace testing are available in the plant repair procedures for Limitorque motor-operators and in the diagnostic signature trace procedure. The criteria in these procedures define maintenance activities that could affect MOV operability and which could therefore require further diagnostic signature trace testing. Maintenance Engineering uses these procedures to determine the required post maintenance tests including diagnostic signature testing where applicable.

Bulletin Item e)

Bulletin 85-03 required the submittal of a written report on (1) the results of Item a) and (2) the program to accomplish Items b) through d) with the schedule for completing them. Supplement 1 required submittal of a written report that, for any additional valves: (1) provides the revised results of item a) and (2) contains a schedule for completion of items b) through d).

Iowa Electric Response to Item e

The maximum-expected d/p's during opening and closing were recalculated for the selected valves based on the methodology developed in the BWR Owner's Group Report NEDC-31322 Supplement 1, July 1988. The revised d/p's were provided in Reference 2) and reported in Table A of this report. All actions required by Bulletin 85-03 Supplement 1 were completed during the Cycle 9/10 refuel outage in accordance with the schedule provided in Reference 2).

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* This item is intended to be completely consistent with action item 3.2, "Post-Maintenance Testing (All Other Safety-Related Components)," of Generic Letter 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events." These procedures should include provisions to monitor valve performance to ensure the switch settings are correct. This is particularly important if the torque or torque bypass switch setting has been significantly raised above that required.

Bulletin Item f)

Bulletin 85-03 required submittal of a written report on completion of the program including (1), (2) and (3). Supplement 1 required revision of the report to include any additional valves.

Iowa Electric Response to Item f

Tables A through I, previously submitted in Ref. 1, have been revised to incorporate information required by Supplement 1 and the results of Cycle 9/10 refuel outage diagnostic signature trace testing results. The revised Tables are attached.

The following listing identifies each attached table.

Table	Summary Information
A	Revised Valve Maximum-Expected Differential Pressures
B	Valve Information
C	Operator Information
D*	Deleted
E & F**	Valve Test d/p and Switch Settings Prior to Adjustment
G	Final Switch Settings
H**	As Found Valve Operability
I	Test Method Description/Justification

* Deleted due to redundancy with Table A
** Provided for Historical Purposes Only

TABLE A
Revised Valve Maximum-Expected Differential Pressures

MAXIMUM-EXPECTED DIFFERENTIAL PRESSURES FOR THE
DAEC 10 CFR 50.55a(g) INSERVICE TESTING PROGRAM
HPCI AND RCIC SYSTEM MOTOR-OPERATED VALVES

		MAXIMUM-EXPECTED DIFFERENTIAL PRESSURE (PSID)	
Valve	Function	Valve Opening	Valve Closing
MO-2202	HPCI Steam Supply Valve	1110	1110
MO-2238	HPCI Inboard Steam Line Isolation	1110	1110
MO-2239	HPCI Outboard Steam Line Isolation	1110	1110
MO-2247	HPCI Lube Oil Cooling Valve	45	47
MO-2290A	HPCI/RCIC Exhaust Vacuum Breaker Isolation	0	43
MO-2290B	HPCI/RCIC Exhaust Vacuum Breaker Isolation	0	43
MO-2300	HPCI Pump Suction From CST	37	22
MO-2311	HPCI Outboard Pump Discharge	1339	1316
MO-2312	HPCI Inboard Pump Discharge	1339	1316
MO-2316	HPCI Full Flow Test/Redundant Shutoff	700	700
MO-2318	HPCI HPCI Minimum Flow Bypass	1416	1429
MO-2321	HPCI Inboard Pump Suction From Torus	123	45
MO-2322	HPCI Outboard Pump Suction From Torus	123	45
MO-2400	RCIC Inboard Steam Line Isolation	1110	1110
MO-2401	RCIC Outboard Steam Line Isolation	1110	1110
MO-2404	RCIC Steam Supply	1110	1110
MO-2405	RCIC Trip Throttle Valve	1110	1110
MO-2426	RCIC Lube Oil Cooling	1357	45
MO-2500	RCIC Pump Suction From CST	37	23
MO-2510	RCIC Minimum Flow Bypass	1354	1428
MO-2511	RCIC Outboard Pump Discharge	1277	1312
MO-2512	RCIC Inboard Pump Discharge	1277	1312
MO-2516	RCIC Inboard Pump Suction From Torus	122	45
MO-2517	RCIC Outboard Pump Suction From Torus	122	45

TABLE B
Valve Information

Valve Component ID	Manufacturer	Type	Model	Size in.	Rating psig
MO-2202	Anchor	Gate	Flex Wedge	10	600
MO-2238	Anchor	Gate	Flex Wedge	10	900
MO-2239	Anchor	Gate	Flex Wedge	10	900
MO-2247	Velan	Globe	Standard	2	1500
MO-2290A	Velan	Gate	Solid Wedge	2	1500
MO-2290B	Velan	Gate	Solid Wedge	2	1500
MO-2300	Anchor	Gate	Flex Wedge	14	150
MO-2311	Anchor	Gate	Flex Wedge	12	600
MO-2312	Anchor	Gate	Flex Wedge	12	900
MO-2316	Anchor	Gate	Flex Wedge	8	600
MO-2318	Anchor	Globe	Standard	4	600
MO-2321	Anchor	Gate	Flex Wedge	14	150
MO-2322	Anchor	Gate	Flex Wedge	14	150
MO-2400	Anchor	Gate	Flex Wedge	4	900
MO-2401	Anchor	Gate	Flex Wedge	4	900
MO-2404	Anchor	Globe	Standard	4	600
MO-2405	Schutte & Koerting	Globe	Throttletrip	3	900
MO-2426	Velan	Globe	Standard	2	1500
MO-2500	Anchor	Gate	Flex Wedge	6	150
MO-2510	Velan	Globe	Standard	2	1500
MO-2511	Anchor	Gate	Flex Wedge	4	600
MO-2512	Anchor	Gate	Flex Wedge	4	900
MO-2516	Anchor	Gate	Flex Wedge	6	150
MO-2517	Anchor	Gate	Flex Wedge	6	150

TABLE C
Operator Information

Valve Component ID	Operator Manufacturer	Model	Motor RPM	Output Speed RPM
MO-2202	Limitorque	SMB-2	1900	45.8
MO-2238	Limitorque	SB-2	3400	72.9
MO-2239	Limitorque	SB-3	1900	43.3
MO-2247	Limitorque	SMB-000	1900	19
MO-2290A	Limitorque	SMB-000	1725	35.5
MO-2290B	Limitorque	SMB-000	1725	35.5
MO-2300	Limitorque	SMB-00	1900	20.2
MO-2311	Limitorque	SMB-3	1900	35.4
MO-2312	Limitorque	SMB-3	1900	31.6
MO-2316	Limitorque	SMB-0	1900	24.1
MO-2318	Limitorque	SMB-0	1900	24.2
MO-2321	Limitorque	SMB-00	1900	20.5
MO-2322	Limitorque	SMB-00	1900	20.2
MO-2400	Limitorque	SMB-00	1700	47
MO-2401	Limitorque	SMB-00	1900	46.4
MO-2404	Limitorque	SMB-0	1900	12
MO-2405	Limitorque	SMB-000	1900	35
MO-2426	Limitorque	SMB-000	1900	23.2
MO-2500	Limitorque	SMB-000	1900	39.8
MO-2510	Limitorque	SMB-00	1900	63.3
MO-2511	Limitorque	SMB-00	1900	72.3
MO-2512	Limitorque	SMB-00	1900	34.1
MO-2516	Limitorque	SMB-000	1900	47.5
MO-2517	Limitorque	SMB-000	1900	39.8

TABLE D

DELETED
(See Table A)

TABLES E AND F*
Valve Test d/p and Switch Settings Prior To Adjustment

Valve Component ID	Test d/p, psid	Torque Opening Setting (1)	Torque Closing Setting	Limit Opening %	Limit Closing % (2)	Bypass Opening % (3)	Bypass Closing % (4)
MO-2202	1110 (o)	3 1/2	3 1/2	97	N/A	N/A	6.5
MO-2238		2 3/4	2 3/4	100	N/A	N/A	10.4
MO-2239		1 1/2	1 1/2	72	N/A	N/A	3.4
MO-2247		2	2	81	N/A	N/A	27.0
MO-2290A		1 1/2	1	85	N/A	N/A	11.5
MO-2290B		1 1/2	1 1/2	93	N/A	N/A	9.4
MO-2300		2	1 1/2	96	N/A	N/A	2.1
MO-2311		2	2	100	N/A	N/A	8.8
MO-2312	1289(o)	2	2	94	N/A	N/A	3.0
MO-2316	700(o&c)	3 3/4	4	86	N/A	N/A	2.1
MO-2318	1416 (o)	3	3 1/2	95	N/A	N/A	8.1
MO-2321		1 1/2	1 1/2	95	N/A	N/A	5.2
MO-2322	123(o)	1	1	93	N/A	N/A	2.3
MO-2400		2	1	92	N/A	N/A	3.1
MO-2401		2	2	94	N/A	N/A	0.7
MO-2404		1 1/2	1 1/2	83	N/A	N/A	3.7
MO-2405		2	3	92	N/A	N/A	8.8
MO-2426		1	1	98	N/A	N/A	14.8
MO-2500		2	1 1/4	96	N/A	N/A	2.5
MO-2510		1	1	95	N/A	N/A	17.6
MO-2511		2	1	100	N/A	N/A	4.1
MO-2512	1417(o)	1 1/2	1	87	N/A	N/A	6.3
MO-2516		2	2	96	N/A	N/A	2.1
MO-2517	128(o)	3 1/2	4	97	N/A	N/A	2.6

(o) - opening direction
(c) - closing direction
(1) This is provided for information only. The opening torque switch is jumpered out, therefore the opening torque applied during unseating is the maximum the the operator is capable of producing.
(2) Not used on these valves; the operator is controlled by the closing torque switch.
(3) The opening torque switches are jumpered out for all valves listed. Therefore no adjustment or setting is applicable to the torque switch bypass switches for these valves.
(4) Closing torque switch bypass has no significant affect because there is no hammer blow or thrust rise when the valve is in the open position.

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*Provided for Historical Purposes Only

TABLE G
FINAL SWITCH SETTINGS

Valve Component ID	Torque (1) Opening Setting	1987(5) Torque Closing Setting	Limit Opening %	Limit Closing	Bypass Opening	Bypass Closing % (2)	1988 Torque Closing Setting
MO-2202	N/A	3(3)	91	N/A	N/A	6.5	3 1/2
MO-2238	N/A	2 1/2	92	N/A	N/A	10.4	2 1/2
MO-2239	N/A	1 1/2	92	N/A	N/A	3.4	1 1/4
MO-2247	N/A	3	81	N/A	N/A	27.0	3
MO-2290A	N/A	1	85	N/A	N/A	11.5	1 3/4
MO-2290B	N/A	1	93	N/A	N/A	9.4	1 3/4
MO-2300	N/A	2 1/2	95	N/A	N/A	2.1	1
MO-2311	N/A	2(3)	91	N/A	N/A	8.8	1 5/8
MO-2312	N/A	2 1/2(3)	94	N/A	N/A	3.0	3
MO-2316	N/A	2 3/4	91	N/A	N/A	2.1	2 1/2
MO-2318	N/A	2 3/8	95	N/A	N/A	8.1	2 1/4
MO-2321	N/A	1 1/2	95	N/A	N/A	5.2	1 1/4
MO-2322	N/A	1	93	N/A	N/A	2.3	1
MO-2400	N/A	1 1/2(3)	92	N/A	N/A	3.1	1 1/2
MO-2401	N/A	2 1/4(3)	94	N/A	N/A	0.7	2 1/4
MO-2404(4)	N/A	2 5/8	81	N/A	N/A	1.1	2 1/4
MO-2405	N/A	3	92	N/A	N/A	8.8	2
MO-2426	N/A	3 1/2	94	N/A	N/A	14.8	3 1/2
MO-2500	N/A	2	94	N/A	N/A	2.5	3
MO-2510	N/A	1 3/4	95	N/A	N/A	17.6	2 1/4
MO-2511	N/A	1 3/4(3)	92	N/A	N/A	4.1	1 3/4
MO-2512	N/A	2 1/2(3)	92	N/A	N/A	6.3	2
MO-2516	N/A	1	94	N/A	N/A	2.1	1 1/4
MO-2517	N/A	3 1/2	94	N/A	N/A	2.6	3 1/2

Notes:

(1) Torque switch is jumpered out in the opening direction.

(2) Same as the as-found condition; no adjustments made.

(3) On October 27, 1987 MOVATS informed IELP that the MOVATS data base had expanded to the size that permitted MOVATS to perform statistical analysis to assure that the thrust requirements met the 90% confidence band. In 4 cases MOVATS recommended that the torque switch settings be raised to assure MOV operability. The MOVs affected were MO-2400, MO-2401, MO-2511 and MO-2512. With the revised d/p from Table D of Reference 1 taken into account, MOVATS determined that the torque switch setting for MO-2512 was adequate. The three other MOV torque switch settings were adjusted as follows:

TABLE G (Continued)

Notes (Continued)

MOV	Previous TSS	Final TSS
MO-2400	1 1/4	1 1/2
MO-2401	2	2 1/8
MO-2511	1 1/2	1 3/4

On November 13, 1987, MOVATS informed IELP that the torque switch settings for MOVs MO-2202, MO-2311, and MO-2312 should also be increased. IELP's engineering evaluation concluded that additional MOVATS testing of these valves was required before the torque switches could be adjusted higher. These valves underwent diagnostic signature trace testing during the Cycle 9/10 refuel outage and the torque switch settings were set accordingly.

(4) Operator replaced during Cycle 9/10 refuel outage, switch settings adjusted.

(5) Provided for historical purposes only.

TABLE H
As-Found Valve Operability*

Valve Component ID	As-Found Thrust Capability Notes	Other Findings That Could Affect As-Found Operability Notes	As-Found Operability Conclusion
MO-2202	2	7	Operable
MO-2238	1,2	8	Operable
MO-2239	1,2	9	Operable
MO-2247	1,2	10	Operable
MO-2290A	1	6	Operable
MO-2290B	1	6	Operable
MO-2300	1,2	11	Operable
MO-2311	3	12	Operable
MO-2312	3	13	Operable
MO-2316	1,2	14	Operable
MO-2318	1,2,4	15	Operable
MO-2321	1,2	6	Operable
MO-2322	1,2	6	Operable
MO-2400	1,2	16	Operable
MO-2401	1,2	17	Operable
MO-2404	1,2	18	Operable
MO-2405	1,2	6	Operable
MO-2426	1	19	Operable
MO-2500	1	6	Operable
MO-2510	5	20	Operable
MO-2511	2	21	Operable
MO-2512	2	22	Operable
MO-2516	1,2	23	Operable
MO-2517	1,2	6	Operable

Notes to Table H: *

1. As-found thrust met or exceeded the MOVATS target thrust.
2. As-found thrust met or exceeded the original Limitorque design thrust requirement.
3. As-found closing thrust was less than the original Limitorque design thrust. Due to the valve's function in the HPCI system, it is not necessary for this valve to close at maximum-expected d/p during HPCI injection. This valve did close properly during regular monthly HPCI system testing.
4. As-found thrust was 20,400 lb. The original Limitorque design thrust was 20,500 lb. This is considered within the range of instrument accuracy and repeatability.

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*Data represents Cycle 8/9 outage testing. Provided for historical purposes only.

TABLE H (Continued)

NOTES (continued)

5. The as-found thrust was less than the original Limitorque design thrust. As-found thrust was 3440 lb. Limitorque required thrust was 4862 lb. However, the valve functioned properly during monthly routine testing when it was required to open and close during normal RCIC pump startup and shutdown. Therefore, this valve was operable during normal monthly system testing.

6. No adverse valve conditions affecting operability were found. The as-found thrust was adequate to meet the original Limitorque design thrust and thus the valve is considered operable as-found.

7. MO-2202 spring pack was replaced due to a spring pack gap of 0.586 inch. However, the valve, in the as-found condition, developed adequate thrust with this gap to meet the original Limitorque design thrust and is therefore considered operable.

8. MO-2238 was found backseating with 42,500 lbs thrust. The valve manufacturer's analysis concluded that the backseat area should be inspected during the next refueling outage. The valve developed adequate thrust to meet the original Limitorque design thrust and thus is considered operable in the as-found condition.*

9. MO-2239 was found with a spring pack gap of 0.017 inch, slight corrosion of the torque switch and limit switch contacts. The spring pack gap and slight corrosion were considered insignificant and having no impact on valve operability. MO-2239 developed adequate thrust to meet the original limitorque design thrust and thus is considered operable in the as-found condition.

10. MO-2247 spring pack was replaced due to a spring pack gap of 0.390 inch. The drive sleeve bevel gear was found chipped and was replaced. MO-2247 developed adequate thrust to meet the original Limitorque design thrust and thus is considered operable in the as-found condition.

11. MO-2300 spring pack was replaced due to a spring pack gap of 0.302 inch. The valve still developed adequate thrust to meet the original Limitorque design thrust and thus is considered operable in the as-found condition.

12. MO-2311 spring pack was replaced due to a spring pack gap of 0.797 inch. MO-2311 was found backseating with a thrust of 21266 lbs. The valve manufacturer's analysis concluded that the backseating area should be inspected during the next refueling outage. In the as-found condition MO-2311 developed 35100 lb. of thrust in the closing direction; the original Limitorque design thrust is 36000 lb. This valve did open and close properly during regular monthly HPCI system testing. This valve has no active safety function in the closing direction, therefore this valve is considered operable in the as-found condition.*

13. MO-2312 spring pack was replaced due to a spring pack gap of 0.798 inch. The valve developed 18600 lbs of thrust in the closing direction; the original Limitorque design thrust is 32500 lb. MO-2312 is required to close for system isolation. MO-2312 opened and closed properly during regular monthly HPCI system testing. Therefore this valve is considered operable in the as-found condition.

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* The backseat area was inspected during the Cycle 9/10 refueling outage per the valve manufacturer's recommendation and no deficiencies were noted.

14. MO-2316 spring pack was replaced due to a spring pack gap of 0.629 inch. The valve was found with a corroded torque switch and a broken bolting ear on the motor end bell. The torque switch and the motor end bell were replaced. The valve developed adequate thrust to meet the original Limitorque design thrust and therefore is considered operable in the as-found condition.

15. MO-2318 spring pack was replaced due to a spring pack gap of 0.170 inch. This valve was found with a loose stem nut lock nut which was tightened and staked. The valve developed adequate thrust to meet the original Limitorque design thrust and therefore is considered operable in the as-found condition.

16. MO-2400 was found with a loose stem nut lock nut which was tightened and staked. The valve developed adequate thrust to meet the original Limitorque design thrust and therefore is considered operable in the as-found condition.

17. MO-2401 spring pack was replaced due to a spring pack gap of 0.316 inch. The valve developed adequate thrust to meet the original Limitorque design thrust and therefore is considered operable in the as-found condition.

18. MO-2404 spring pack was replaced due to a spring pack gap of 0.629 inch. The valve in the as-found condition was overthrusting with 44,000 lb. This condition was analyzed by the valve manufacturer and another engineering company; both concluded that the operator could withstand another 33 cycles. A greater in-depth analysis by an alternate engineering firm determined the operator could withstand 100 cycles. This is considered adequate for operation until a replacement operator is available. The valve manufacturer has recommended replacement of the stem clamp key and the yoke clamp and inspection of the stem keyway, the valve disc and valve yoke. This inspection and replacement were planned for the Cycle 9/10 refueling outage.*

19. MO-2426 spring pack was cleaned and a gap of 0.016 inch was reduced to 0.003 inch. Gaps of 0.016 are not detrimental to MOV operation but are adjusted where possible to optimize operator performance. Spring pack gaps of 0.005 and less are acceptable. Gaps of up to 0.015 inch are accepted when the gap can not be reduced by adjustment. The valve developed adequate thrust to meet original Limitorque design thrust and therefore the valve is considered operable in the as-found condition.

20. MO-2510 spring pack was replaced due to a spring pack gap of 0.321 inch. The valve in the as-found condition developed less thrust than the original Limitorque design thrust. However, the valve functioned properly during regular monthly RCIC testing. Therefore, the valve is considered operable in the as-found condition.

21. MO-2511 developed adequate thrust to meet the original Limitorque design thrust and thus is considered operable in the as-found condition. The valve was also found backseating with 1717 lb. of thrust and with a loose stem nut lock nut. The valve manufacturer evaluated the backseating condition and determined that adjustment of the limit switch to stop the backseating was the only action needed. The limit switch was adjusted as part of the maintenance program. No inspection of the backseat area was required. The stem nut lock nut was tightened and staked.

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*During the outage, the yoke clamp was replaced and the other keys were inspected with no apparent damage observed. The torque switch was replaced because it was found with a bad roll pin. The valve developed adequate thrust to meet the original Limitorque design thrust and, therefore, is considered operable in the as-found condition.

22. MO-2512 developed thrust adequate to meet the original Limitorque design thrust, therefore this valve is considered operable in the as-found condition.

23. MO-2516 developed adequate thrust to meet the original Limitorque design thrust, therefore this valve is considered operable in the as-found condition. The spring pack had grease in it and the drive sleeve bevel gear was worn. The spring pack was cleaned and the drive sleeve bevel gear was replaced.

TABLE I*
Test Method Description/Justification

Valve Component ID	Test Method Codes Opening	Closing	Notes
MO-2202	S,D,HP	NASF; S,D	4, 2, 3, 1, 6
MO-2238	NASF; S,D	S,D	1, 3
MO-2239	NASF; S,D	S,D	1,3
MO-2247	S,D	S,D	1,3
MO-2290A	NASF; S,D	S,D	1,3
MO-2290B	NASF; S,D	S,D	1,3
MO-2300	S,D	S,D	1,3
MO-2311	S,D,HP	NASF; S,D	5, 3, 1, 2
MO-2312	S,D, HP	S,D	5, 2, 3, 7
MO-2316	NASF,S,D,OP	NASF,S,D, OP	1, 2, 3
MO-2318	S,D,HP	S,D	1, 2, 3
MO-2321	S,D,TT2322	S,D	1, 3
MO-2322	S,D,HP	S,D	1, 2, 3
MO-2400	NASF; S,D	S,D	1, 3
MO-2401	NASF; S,D	S,D	4, 3, 8
MO-2404	S, D, TT2318	S,D	1, 3
MO-2405	S,D	S,D	1, 3
MO-2426	S,D	S,D	1, 3
MO-2500	S,D	S,D	1, 3
MO-2510	S,D	S,D	1, 3
MO-2511	S,D	S,D	1, 3
MO-2512	S,D,HP	S,D	2, 3, 8
MO-2516	S,D,HP	S,D	1, 3, 2
MO-2517	S,D,HP	S,D	1, 2, 3

Notes to Table I

- S — Valve stroke test
- D — Diagnostic Signature Trace Testing and Analysis
- HP — Hydrostatic Pressure Testing In Opening Direction
- OP — Operational Pressure Testing In Closing and Opening Directions
- TT — Type Test to Another Valve (e.g., TT2318=type testing to valve MO-2318)
- NASF — No Active Safety Function

1. The Torque switch setting yields a thrust greater than MOVATS target thrust requirement for 90% confidence band such that these valves will function at the maximum-expected differential pressure in the closing direction.

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*Data represents cumulative test data from Cycle 8/9 and Cycle 9/10 outage testing.

2. The present torque switch setting is capable of yielding thrust greater than the thrust required to overcome differential pressure as measured at valve opening and/or closing during actual DP testing.

3. The opening Torque switch is jumpered out of the control circuit. Therefore these operators will develop thrust up to the operator's design capability in order to open the valve.

4. In 1987, the torque switch setting developed a thrust greater than the MOVATS target thrust requirement for the 80 to 85% confidence band such that these valves will function at the maximum-expected differential pressure in the closing direction (Iowa Electric response to Item c, page 4 of reference 1).

5. In 1987, the torque switch setting developed a thrust greater than the MOVATS target thrust requirement for the 70 to 75% confidence band such that these valves will function at maximum-expected differential pressure in the closing direction (Iowa Electric response to Item c, page 4 of Reference 1).

6. In 1988, the MOVATS target thrust was decreased due to an updated statistical analysis of the MOVATS database. The torque switch was adjusted to meet the new 90% confidence band.

7. In 1988, the MOVATS target thrust was decreased due to an updated statistical analysis of the MOVATS database. The torque switch was adjusted to meet the new requirement. However, due to plant-imposed restrictions, the MOV meets the 75-80% confidence band.

8. In 1988, the MOVATS target thrust decreased due to an updated statistical analysis of the MOVATS database. The torque switch was adjusted to meet the new requirement. However, due to plant-imposed restrictions, the MOV meets the 85-90% confidence band.