



Consumers
Power
Company

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October 6, 1983

81-01 #13

Mr J G Keppler, Regional Administrator
US Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

MIDLAND NUCLEAR COGENERATION PLANT
DOCKET NOS 50-329 AND 50-330
UNDERRATED TERMINAL STRIPS ON LIMITORQUE VALVE OPERATORS
FILE: 0.4.9.47 SERIAL: 23813

References: J W Cook letters to J G Keppler, same subject:

- 1) Serial 11190, dated February 13, 1981
- 2) Serial 11976, dated April 24, 1981
- 3) Serial 12041, dated July 8, 1981
- 4) Serial 13665, dated September 11, 1981
- 5) Serial 14617, dated November 20, 1981
- 6) Serial 14690, dated February 12, 1982
- 7) Serial 17503, dated June 4, 1982
- 8) Serial 17565, dated August 6, 1982
- 9) Serial 19070, dated October 22, 1982
- 10) Serial 20680, dated January 30, 1983
- 11) Serial 20729, dated March 16, 1983
- 12) Serial 22219, dated June 7, 1983

This letter is a final 10CFR50.55(e) report concerning terminal strips on Limitorque valve operators. Attachment 1 describes corrective action taken to resolve these problems.

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Since the last interim report, Consumers Power Company has notified your staff of an additional concern involving terminal block mounting brackets that had not been seismically qualified. During the telephone conversation, Consumers Power Company stated that the use of these brackets resulted from a need for auxiliary terminal blocks that appeared to be unique to Midland. Further investigation has not been able to confirm this statement; the use of unqualified mounting brackets may not be limited to the Midland project. Midland project resolution has been as described in Attachment 1.

James W. Cook

JWC/WRB/cd

Attachment 1: MCAR 46, Final Report, "Qualification Concerns for Various Components on Limitorque Valve Operators," dated September 16, 1983.

CC: R J Cook, NRC, Midland
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SUBJECT: MCAR 46 (issued 1/15/81)
Qualification Concerns for Various Components on
Limitorque Valve Operators

FINAL REPORT

DATE: September 16, 1983

PROJECT: Consumers Power Company
Midland Plant Units 1 and 2
Bechtel Job 7220

Introduction

Environmental- and nonenvironmental-related deficiencies have been separated into two groups for clarity from previous reports; thus, the report has been rewritten in its entirety. The safety evaluation performed to determine the safety concern due to the existence of seismically unqualified L-brackets used for mounting terminal blocks is also discussed in this report.

Description of Deficiency

The following deficiencies are covered by MCAR 46.

1. Nonenvironmental

a. Use of Underrated Terminal Blocks in Limitorque Operators

While replacing a damaged terminal block on a Limitorque operator, Bechtel determined that some of the terminal blocks used for the termination of the leads from the 460 V motor were rated less than 460 V. These Limitorque operators, when used on safety-related valves, must function on an emergency core cooling actuation signal (ECCAS). In addition to being a personnel safety hazard, the potential exists for a short circuit/flashover, which could render the valves inoperative.

b. Use of Unqualified Space Heaters for Class 1E Systems

Space heaters are required for nontemperature-controlled environments according to Limitorque; however, the supplied space heaters were not qualified for use in Class 1E equipment.

c. A generic corrective action report identified four operators with L-brackets for mounting terminal blocks that were not seismically qualified. Failure of the L-bracket in a safety-related valve operator during an earthquake could cause an electrical short circuit, which could render the valve inoperable.

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2. Environmental

- 1) Terminal block qualification tests do not envelope Midland's inside-containment parameters. In addition, some terminal block types used in outside-containment units were not included in the terminal block qualification tests performed by Limitorque.
- 2) Some ac motor operators on inside-containment units have not been tested for inside-containment conditions. These units have motors with Class B insulation and actuators with limit switch, gear frame, and cover materials not recommended for use inside containment.
- 3) Qualification of dc motors for their service environments has not yet been established.
- 4) Drain plug positions vary among units and are not in accordance with the configuration tested in the Limitorque qualification tests.
- 5) Some units have terminal blocks or control circuit jumper wires that cannot be identified as the types tested by Limitorque.

Summary of Investigation and Historical Background

1. Nonenvironmental

a. Underrated Terminal Blocks

- 1) The manufacturer's name was the only form of identification found on a damaged terminal block. To order a replacement for the damaged terminal block, it was therefore necessary to measure the block's critical dimensions and compare them with those for blocks listed in Marathon Catalog 10M79. This comparison indicated that the terminal blocks used for the termination of the leads from the 460 V motor could have been rated less than 460 V. Eighteen Limitorque operators on Bechtel Purchase Order (P.O.) 7220-M-132-AC were inspected, and eight were

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found to have underrated terminal blocks (Marathon 100 Series and Cinch Jones 140 Series). Bechtel determined that some terminal blocks in Limitorque valve operators may be underrated for their intended function. The other ten operators inspected had Marathon 300 Series terminal blocks that are correctly rated for the intended service. Purchase Order 7220-M-132 is with Henry Pratt Company for the supply of nuclear service butterfly valves.

- 2) Representatives from Limitorque and Henry Pratt visited the Midland jobsite on January 31, 1981. After inspecting the terminal blocks, they confirmed the results of Bechtel's investigation.
- 3) Vendors supplying Limitorque operators for the Midland project were reminded of their legal and contractual obligation under 10 CFR 21 in March 1981 to report nonconforming conditions that could affect the safe operation of their product (closes Recommended Action Item 5, MCAR 46, Rev 2).
- 4) Bechtel identified eleven purchase orders with seven different vendors covering all Q-listed, safety-related Limitorque operators. Based on this list, Bechtel developed a random inspection plan. Random inspection was performed by Limitorque during the week of May 11, 1981, to establish the magnitude of the presence of the underrated terminal blocks in the Limitorque operators. After review of the inspection reports submitted by Limitorque, Bechtel determined that underrated terminal blocks were not used on any Q-listed purchase orders except P.O. 7220-M-132(Q) (closes Recommended Action Item 1, MCAR 46, Rev 2).
- 5) Seven different types of terminal blocks were identified (Buchanan 0222, 0524, and 0824; Marathon 300 Series; Beau 7500; Kulka 622; and General Electric EB-5) during the random inspection referred to in Item 4 above. All seven types are acceptable for 460 V service.
- 6) The following 18 new Limitorque operators were identified under open purchase order items for valves with Limitorque operators. Each operator was inspected at the jobsite upon receipt from the vendor for verification of the

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acceptable type of terminal block (closes Recommended Action Item 4, MCAR 46, Rev 2).

<u>P.O. Number</u>	<u>Item (Quantity)</u>	<u>Terminal Block (TB)</u>
7220-J-255A(Q)	23(8)	TB Kulka 622
7220-M-117(Q)	5.1(1)	TB Marathon 300
7220-M-117(Q)	5.2(1)	TB Marathon 300
7220-M-117(Q)	5.3(1)	TB Marathon 300
7220-M-117(Q)	5.4(1)	TB Marathon 300
7220-M-168(Q)	1.5(1)	TB Buchanan 0222
7220-M-398(Q)	1.1(1)	TB Kulka 622
7220-M-398(Q)	1.2(1)*	TB Kulka 622
7220-M-398(Q)	3.1(1)*	TB Kulka 622
7220-M-398(Q)	3.2(1)*	TB Kulka 622
7220-M-398(Q)	3.3(1)	TB Kulka 622

- a) All operators listed above are located outside containment and in mild environments except those identified by an asterisk, which are located in harsh environments.
 - b) The terminal blocks' voltage ratings are acceptable. Marathon 300 and Buchanan 0222 terminal blocks are environmentally qualified for harsh environment location, while the Kulka 622 terminal block is acceptable for mild environment location only.
- 7) Replacement of all underrated terminal blocks (Marathon 100 series and Cinch Jones 140 series) on Purchase Order 7220-M-132(Q) was undertaken by Bechtel under the supervision of Limitorque service engineering during the second week of June 1982. The replacement work is now complete; all 71 operators on P.O. 7220-M-132(Q) have been inspected (closes Recommended Action Item 3, MCAR 46, Rev 2).
 - 8) Bechtel has received the inspection/replacement report from Limitorque for the work described in Item 1.a.7 above.
 - 9) Limitorque's letter dated June 25, 1981 (Ref: MCAR 46, Interim Report 4, Item A.1), states that terminal block types Buchanan 0524 and Peau 7600 were previously rated

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for 600 V service using the breakdown voltage method of rating. A concern was raised because no documents were available at Bechtel to support this statement. Limitorque has now provided additional documentation showing that the terminal blocks in question were previously rated at 750 V and 600 V, respectively.

b. Unqualified Space Heaters

During a meeting held in Lynchburg, Virginia on July 17, 1981, Limitorque stated that space heaters are not considered to be Class 1E equipment. Currently, space heaters are wired into safety-related, Class 1E circuitry. Because they are not qualified for Class 1E service, they are postulated to fail. Bechtel requested Limitorque's resolution in its letter dated July 25, 1983.

To resolve the problem of unqualified space heaters in Class 1E circuits, Limitorque suggested in a August 23, 1983, letter that the space heaters be deleted (disconnected from the circuitry) and that periodic inspection for condensation damage be performed for those operators located in an uncontrolled temperature area (resolves Item B.8 of additional deficiencies, MCAR 46, Rev 2).

c. L-Brackets

Corrective Action Report (CAR) X02-E-022 identified that the terminal block mounting brackets (L-brackets) on Limitorque operators 1MO-1210A and B and 2MO-1310A and B may not have been seismically qualified. Because of insufficient room to directly mount an auxiliary terminal block within the actuator, L-shaped sheet metal brackets were used by Limitorque to mount the second terminal block. The referenced CAR questioned whether these brackets were seismically qualified.

Limitorque confirmed in its letter dated February 4, 1983, that L-brackets are not seismically qualified and recommended that these and the auxiliary terminal blocks be removed. Limitorque identified 40 Limitorque operators that could have unqualified L-brackets.

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2. Environmental

During the project effort to qualify electrical equipment in a harsh environment, several concerns arose. The valve vendors were contacted, Limitorque was requested to perform a detailed records search showing component types and materials, and various inspections were performed as the environmental concerns were addressed. The results of this effort are as follows:

- a. Limitorque performed the terminal block tests described in Test Report B0119. The test included the following blocks: Marathon 300 and 1600; Buchanan 0222 and 0524; General Electric EB-5; and Curtis Type L. However, the test did not include Buchanan 0824, Kulka 522, or Beau 7600, which are used on some Limitorque operators, but are acceptable for mild-environment locations.

Bechtel's review of test and vendor data determined that tested types are acceptable for use outside containment in harsh environments. The terminal block types not tested will be replaced with tested types.

Because the test parameters do not envelop Midland's inside-containment parameters, all terminal blocks on inside-containment units will be removed. Terminations will be made by direct attachment or by use of qualified splices or lugs.

- b. Limitorque indicated that units with Class B motors have not undergone testing for inside-containment conditions and contain limit switch, gear frame, and cover materials not recommended for use inside containment.

These motors and actuators are being replaced with units tested for inside-containment use having proper Class H insulated motors rated for 50C ambient and the component materials recommended for use inside containment. It was determined that all existing Class H motors are also acceptable for the 50C ambient conditions inside containment (resolves Items B.1, B.2, and B.6 of additional deficiencies, MCAR 46, Rev 2).

- c. Actuators with dc motors have been tested by Limitorque in Test Report B0009. An analysis is presently being performed

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to show that Limitorque test parameters exceed the service conditions of the motors.

- d. Some actuator drains are not installed in the lowest position or are missing. Limitorque has stated that test units for both inside- and outside-containment use had actuator drain holes plugged and that the inside-containment motors had T-drains installed in the lowest position. Safety-related units in harsh environments will be inspected to ensure the same drain-plug configuration as the tested units (resolves Item B.5 of additional deficiencies, MCAR 46, Rev 2).
- e. Initial information obtained from purchase order files, quality verification documentation package (QVDP) files, and early inspections of unit nameplates did not always agree. However, the discrepancies have been resolved and identification made of serial numbers, component types, and ratings for each unit, except certain units in which the terminal block and control wire type could not be identified from the available documentation. These units will be inspected and the terminal blocks and control wire replaced if they cannot be identified as qualified types (resolves Item B.3 and B.7 of additional deficiencies, MCAR 46, Rev 2).
- f. Motor operators in the plant are mounted in various orientations. It has been determined that safety-related units in a harsh environment are mounted in positions less severe than the positions used in the qualification tests and are therefore acceptable (resolves Item B.4 of additional deficiencies, MCAR 46, Rev 2).
- g. It was determined that O-rings do not perform a safety function in operators mounted in positions in accordance with Limitorque's recommendations.
- h. Unidentified terminal blocks (nonpower lead connectors inside the operators) were observed in some Limitorque operators. Bechtel has used walkdown data and vendor-supplied information to identify these terminal blocks.

Bechtel has reviewed all available information and, based on this review, has initiated purchase of qualified components and Limitorque operators to replace those that are unqualified directly from Limitorque Corporation.

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Safety Implications and Reportability

1. Nonenvironmental

- a. Seven of the eight valve operators having underrated terminal blocks are located in the component cooling water and service water systems and are used on safety-related valves. These valves must function on an emergency core cooling actuation signal. The potential exists for a short circuit/flashover, which could render the valves inoperative.

Based on the potential safety concerns, this item was considered reportable. This deficiency was reported by Consumers Power Company on January 14, 1981, to R. Sutfin, R. Cook, and R. Knop of the Office of Inspection and Enforcement, Region III, U.S. Nuclear Regulatory Commission, as a reportable deficiency for Midland Plant Units 1 and 2 in accordance with 10 CFR 50.55(e).

- b. Project engineering completed its safety evaluation of the seismically unqualified L-brackets on August 24, 1983, and concluded that because the mounting brackets were not seismically qualified and could not be qualified, and failure of the bracket may cause failure of the valves preventing operation of the affected systems, a safety concern exists. If the L-brackets in safety-related valve operators failed during an earthquake, they could cause an electrical short circuit that could render the valve inoperable.

In its February 4, 1983, letter, Limitorque recommended that the suspect 40 valves be inspected for the presence of L-brackets, the mounting brackets and auxiliary terminal blocks removed, and wires reterminated directly to limit switches when found. If the brackets are removed as stated above, no safety concern exists. This concern was incorporated in MCAR 46, Rev 2, and the NRC was verbally notified by Consumers Power Company on August 29, 1983.

- c. The space heaters supplied on Class 1E equipment were not qualified to meet Class 1E guidelines. Because space heaters were connected to safety-related circuits, their failure could disrupt Class 1E power supply to safety-related circuits and disable the operators. This concern was incorporated in MCAR 46, Rev 1, together with other environmental concerns as discussed in Item 2 below (closes Recommended Action Item 7, MCAR 46, Rev 2).

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2. Environmental

The environmental qualification concerns identified in this report could have potentially caused a malfunction of some Limitorque operators that would jeopardize the performance of the safety-related systems in which they operate. These concerns were incorporated in MCAR 46, Rev 1 (closes Action Item 7, MCAR 46, Rev 2).

Probable Cause

1. Non-environmental

a. Underrated Terminal Block

Limitorque states that it does not stock Marathon 100 Series terminal blocks. However, Limitorque stated in its January 21, 1981, letter that when its field service engineer visited the Midland jobsite in November 1977 to increase the number of points on the terminal blocks for 66 operators (P.O. 7220-M-132), he may have procured the subject terminal blocks locally. Limitorque further explained that an additional 20 terminal blocks (140 Series, manufactured by Cinch Jones) were shipped to Midland to make up for quantities damaged in an earlier shipment. These blocks are similar to Marathon Series 100 blocks and may have been used by the Limitorque service engineer to terminate the 460 V motor leads. According to Limitorque's July 1, 1982, letter, the root cause for the presence of underrated terminal blocks was the lack of adequate training for a newly employed field service engineer.

- b. Limitorque has supplied unqualified space heaters. Unqualified space heaters were wired into actuator safety-related control circuits without recognizing that IEEE and regulatory guide qualification would be necessary. The valve supplier and/or Limitorque did not implement procurement document requirements, and Bechtel did not identify the deficiencies during vendor print review.

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c. Unqualified L-Bracket

Limatorque operators used in the qualification test report did not use L-brackets. Limatorque used L-brackets without recognizing that seismic qualification would be required for L-brackets.

2. Environmental

These environmental concerns occurred before establishment of NUREG-0588 requirements. Probable root causes are as follows:

- a. Limatorque built some units with components different from those tested in its qualification test units, but did not indicate the change. Limatorque also did not have records for some units indicating which specific type of terminal block and wire components were used.
- b. The valve supplier and/or Limatorque did not implement procurement document requirements, and Bechtel did not identify the deficiencies during vendor print review.

Corrective Action

Bechtel has identified each Q-listed Limatorque operator and the deficiencies in each operator. The following corrective actions and schedules have been developed to correct each deficient valve operator. All activities listed below will be identified in the Remaining Work Schedule and Construction Punchlist and are scheduled for completion before the fuel load date for each Midland unit (closes Recommended Action Item 8, MCAR 46, Rev 2).

1. Nonenvironmental

a. Underrated Terminal Blocks

During Limatorque's June 1982 inspection/replacement trip to the Midland jobsite, all underrated terminal blocks (Marathon 100 series and Cinch Jones 140 series) were replaced by correctly rated Marathon 300 Series terminal blocks on

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operators purchased on P.O. 7220-M-132(Q). The reports from Limitorque and field engineering covering the inspection/replacement activities have been accepted. This deficiency is considered resolved (closes Recommended Action Item 2, MCAR 46, Rev 2).

b. Space Heater

Each safety-related operator will be inspected, and the space heater will be disconnected from the circuitry. Wiring diagrams and electrical schemes will be revised to reflect this. Operators located in nontemperature-controlled environments shall be flagged for periodic inspection for condensation damage in accordance with Limitorque's recommendations (resolves Item B.8 of additional deficiencies, MCAR 46, Rev 2).

c. L-Bracket

Each safety-related operator will be inspected for an L-bracket and, if found, the L-bracket will be removed together with the auxiliary terminal block. The wires will be terminated directly to limit switch points in accordance with Limitorque's recommendation (resolves Item B.9 of additional deficiencies, MCAR 46, Rev 2).

2. Environmental

- a. Terminal blocks used on operators inside containment will be removed. Termination will be made via direct attachment or use of qualified splices or lugs. Untested terminal blocks in units outside containment will be replaced with a type that was tested.

Nonconformance Report (NCR) 3780 will be assigned disposition on this basis. The NCR was generated because of existence of the unqualified Buchanan 0824 type terminal block on Limitorque operators on Purchase Order 7220-M-123A with Westinghouse Electric (Reference: Item B.1, Page 4 of Interim Report 12).

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- b. Motor operators inside containment that were not tested for postaccident conditions are being replaced with units that have Class H motor rated for 50C ambient temperature and with the actuator component materials qualified for inside-containment use. The replacement units will not have terminal blocks or space heaters (resolves Items B.1, B.2, and B.8 of additional deficiencies, MCAR 46, Rev 2).
- c. The dc motor qualification test is being reviewed to verify that it demonstrates qualification for the motors for the required service period. If these motors cannot be shown to be qualified, they will be replaced with qualified equipment.
- d. Units in a harsh environment will be inspected for location of drain holes to verify the same drain plug configuration in the motors and actuators conforms to the tested units (resolves Item B.5 of additional deficiencies, MCAR 46, Rev 2).
- e. Units that have terminal blocks or control circuit jumper wires that have not been identified as the type tested will be inspected and the unidentified components replaced (resolves Item B.3 of additional deficiencies, MCAR 46, Rev 2).
- f. Bechtel will purchase new qualified operators and components (terminal blocks and control circuit jumper wires) for replacement for activities listed in Items 2.b and 2.e above.

3. Action to Prevent Recurrence

To prevent recurrence of the above concerns, the following will be addressed (closes Recommended Action Item 8, MCAR 46, Rev 2):

- a. The purchase order requirements for new valve operators will require additional information about component types and materials used in the units to ensure applicability of Limitorque's qualification test reports.
- b. All new valve operators for use inside containment will be purchased without terminal blocks or space heaters.
- c. New replacement units will be purchased directly from the Limitorque Corporation under more stringent inspection requirement at Limitorque's shop during the manufacturing cycle.
- d. A programmatic approach to environmental qualification has been established for Midland as part of the response to NUREG-0588. The environmental qualification of safety-related

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equipment in a harsh environment is being reviewed. This program, described by the Environmental Qualification Report, has been audited by the Midland Project Quality Assurance Department and was reviewed in January 1983 by the NRC.

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(Q-listed orders only)

Limitorque's Problem Listing:PA through PM listed covered under MCAR 46

PA Underrated terminal block (power lead)
 PB Terminal block environmental qualifications (power lead and nonpower lead)
 PC Limitorque motor insulation - for Class B, temperature rise and environment qualifications not available
 PD Qualification for internal wiring not available
 PE Orientation of operators and/or gearbox/limit switch compartment down
 PF Orientation of the operator unacceptable for drainage(**)
 PG Torque switch qualification not available (for material other than Fiberite)
 PH Space heater qualification not available
 PJ O-ring qualification for the service conditions questionable
 PK Purchase order files, QVDP files information and/or installed nameplate data do not agree
 PL Limit switch qualification not available (for material other than Fiberite)
 PM Unqualified L-brackets for terminal blocks
 PN Incorrect drive motor shaft key material
 PP Gear drive lubricant unacceptable for service conditions
 PQ Nonself-locking gearing
 PR Problem transferred above, "Refer PM"
 PS Unqualified dc motors
 PT Peerless ac motors (outside containment, harsh environment units) qualification not available
 PU Later
 PV Later
 PW Later
 PX Later
 PY Later
 PZ Replace complete actuator assembly

NOTES:

- @ - Listed problem not applicable for the operator.
 \$ - Physical inspection indicates listed problem does not exist for the operator.
 X - Shows concern exists for listed operator.
 # - The problem that once existed has been resolved.
 * - The terminal block types (a, b, c, etc) exist on Limitorque operators according to the references (A, B, C, etc) listed below.

<u>Terminal Block Types</u>	<u>References</u>
a. Buchanan 0222	A Preliminary Inspection by Bechtel Field at Inception of the Terminal Block Problem Investigation
b. Buchanan 0524	B Random Inspection Report by Limitorque, 7/31/82 (Com 037836)
c. Buchanan 0724	C Inspection Report, 1/11/82 by Resident Engineering (Com 054886)
d. Buchanan 0824	D Quality surveillance Report 86, 1/13/82 for Purchase Order 7220-M-132(Q) for Fast Closing Operators
e. Curtis Type L	E Preliminary Inspection by Bechtel field of NCR 3246
f. Cinch Jones Series 146	F IOM, P.J. Corcoran to E.M. Hughes, 4/14/82 (Com 066550)
g. Marathon 100 Series	G IOM, L.E. Davis to E.M. Hughes, 7/15/82 (Com 077868)
h. Marathon 300 Series	H IOM, P.J. Corcoran to E.M. Hughes, 9/23/82 (Com 085853)
i. Beau 7600	J VP 7220-M247-1
j. Kulka 622	K VP 7220-M247-2
k. General Electric EB-5	L IOM, L.E. Davis to E.M. Hughes, 4/19/83
l. Buchanan 0514	

** - Field engineering will identify the operators during the inspection of operators for other problems.

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P.O. No., Vendor, & Total on Order	List of Limitorque Numbers	Code for Items on P.O. M-247	MR Item	Motor Operator Identifi- cation Number	Valve Location			Limitorque's Problems Listing																								* Terminal Block Type	S/U System	Remarks			
					In- side Con- tain- ment	Outside Contain- ment																															
						6	7	8																													
1	2	3	4	5	6	7	8	MCAR 46																								10	11	12	13		
									A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y				
M-123B(Q) Continued		209	11.5	1MO-0341C		X			\$	@	#	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(E)	1BGE	
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		212	11.8	2MO-0441D		X			\$	@	#	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(K)	2BGE		
		213	12.1	1MO-0328		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(K)	1BGC		
		214	12.2	2MO-0428		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(E)	2BGC		
		215	12.3	1MO-0329		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(A)	1BGC		
		216	12.4	2MO-0429		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(B)	2BGC		
		217	12.5	1MO-0330A		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(E)	1BNA		
		218	12.6	2MO-0430A		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(E)	2BNA		
M-123C(Q) Anchor/ Darling Qty 10		219	12.7	1MO-0330B		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(B)	1BNA		
		220	12.8	2MO-0430B		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(K)	2BNA		
		231	20.1	1MO-1028A		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(K)	1BCA		
		232	20.2	2MO-1128A		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(B)	2BCA		
		233	20.3	1MO-1028B		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(B)	1BCA		
		234	20.4	2MO-1128B		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(B)	2BCA		
		235	24.1	1MO-1055A		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(K)	1BCA		
		236	24.2	1MO-1055B		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(K)	1BCA		
		237	24.3	2MO-1155A		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(B)	2BCA		
		238	24.4	2MO-1155B		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(B)	2BCA		
M-125A(Q) Westing- house Electric Qty 18		239	28.1	1MO-0166	X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(J)	1BBB		
		240	28.2	2MO-0266	X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h(J)	2BBB		
		251	17.1	1MO-1203				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	Surplus Z-653		
		252	17.2	2MO-1303				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	Surplus Z-638		
		253	17.3	1MO-1204				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	Surplus Z-654		
		254	17.4	2MO-1304				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	Surplus Z-637		
		255	18.1	1MO-1228				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	Surplus Z-625		
		256	18.2	2MO-1328				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	Surplus Z-627		
		257	18.3	1MO-1229				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	Surplus Z-624		
		258	18.4	2MO-1329				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	Surplus Z-627		
M-125B(Q) Continued		259	18.5	1MO-1207A		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	h,k(B)	1BKA		
		260	18.6	2MO-1307A		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	k(K)	2BKA		
		261	18.7	1MO-1207B		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	k(K)	1BKA		
		262	18.8	2MO-1307B		X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	k(K)	2BKA		
		263	20.1	1MO-1411				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	OECE		
		264	20.2	2MO-1411				\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	OECE		
		265	25.1	1MO-1257	X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	k(J)	1BKD		
		266	25.2	2MO-1357	X			\$	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	k(J)	2BKD		

P.O. No., Vendor, & Total on Order	List of Limitorque Order Numbers	Code for Items on P.O. M-247	MR Item	Motor Operator Identi- fication Number	Valve Location			Limitorque's Problems Listing																								Terminal Block Type	S/U System	Remarks																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
					In- side Con- tain- ment	Outside Contain- ment																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
						6	7	8	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y				PZ																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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LIST OF VALVES WITH LIMITORQUE OPERATORS (Continued)

P.O. No., Vendor, & Total on Order	List of Limitorque Order Numbers	Code for Items on P.O. M-247	Motor Operator Identification Number	Valve Location		Limitorque's Problems Listing																								Terminal Block Type	S/U System	Remarks			
				In-side Containment	Outside Containment																														
						Marsh Envr	Mild Envr	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X				Y	PZ	
1	2	3	4	5	6	7	8	9																								10	11	12	13
5-132(Q) Continued	308736A	339	3.13	1MO-1610B			X																									h(D,G,A)	18GA		
	3P1488A/B	340	3.14	2MO-1710B			X																									h(D,G)	2EGA		
	393686A	341	3.15	1MO-1607B																												h(G)	1EGA		
	393686B	342	3.16	2MO-1707B																												h(G)	2EGA		
	393686C																																OEAA		
	393687A	343	7.2	2MO-1856																												h(G)	OEAA		
	393687B	344	7.4	1MO-1847																												h(G)	OEAA		
	393688	345	7.5	2MO-1848																												h(G)	OEAA		
	394135A	346	7.6	2MO-1858																												h(G)	OEAA		
	394135B	347	7.7	1MO-1857																												h(G)	OEAA		
	394135C	348	7.8	1MO-1843																												h(G)	OEAA		
	394135D	349	7.9	2MO-1852																												h(G)	OEAA		
			350	7.11	1MO-1842																											h(G)	OEAA		
			351	7.13	OMO-1820																											h(A,G)	OEAA		
			352	7.14	OMO-1819																											h(G)	OEAA		
			353	7.15	OMO-1810																											h(A,G)	OEAA		
			354	7.16	OMO-1826-1																											h(A,B)	OEAA		
			355	7.17	OMO-1826-2																											h(A,B)	OEAA		
			356	7.18	OMO-1826-3																											h(A,B)	OEAA		
			357	7.19	OMO-1826-4																											h(A,B)	OEAA		
		358	7.20	OMO-1809																											h(A,G)	OEAA			
		359	9.1	1MO-1907																											h(G)	1RAD			
		360	9.2	2MO-1937																											h(G)	1RAD			
		361	9.7	2MO-1943	X																										h(G)	2EAC			
		362	9.8	2MO-1940	X																										h(G)	2EAC			
		363	9.9	2MO-1938	X																										h(G)	2EAC			
		364	9.10	2MO-1941	X																										h(G)	2EAC			
		365	9.11	2MO-1950	X																										h(G)	2EAC			
		366	9.12	2MO-1947	X																										h(G)	2EAC			
		367	9.13	2MO-1948	X																										h(G)	2EAC			
		368	9.14	2MO-1945	X																										h(G)	2EAC			
		369	9.17	1MO-1903	X																										h(G)	1RAD			
		370	9.18	2MO-1933																											h(G)	2EAD			
		371	9.19	1MO-1918	X																										h(G)	1EAC			
		372	9.20	1MO-1915	X																										h(G)	1EAC			
		373	9.21	1MO-1920	X																										h(G)	1EAC			
		374	9.22	1MO-1917	X																										h(G)	1EAC			
		375	9.23	1MO-1911	X																										h(G)	1EAC			
		376	9.24	1MO-1908	X																										h(G)	1EAC			
		377	9.25	1MO-1913	X																										h(G)	1EAC			
		378	9.26	1MO-1910	X																										h(G)	1EAC			
		379	10.1	2MO-1984																											h(G)	2EAD			
		380	10.2	2MO-1985																											h(G)	2EAD			

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P.O. No., Vendor, & Total on Order	List of Limitorque Order Numbers	Code for Items on P.O. M-247	MR Item	Motor Operator Identifi- cation Number	Valve Location				Limitorque's Problems Listing																								Terminal Block Type	S/U System	Remarks			
					In- side Con- tain- ment	Outside Contain- ment		Harsh Envr	Mild Envr	MCAR 46												PZ																
						A	B			C	D	E	F	G	H	I	J	K	L	M	N		O	P	Q	R	S	T	U	V	W	X				Y		
1	2	3	4	5	6	7	8																										10	11	12	13		
M-132(Q) Continued		381	10.3	2MO-1982			X																												h(G)	2EAD		
		382	10.4	2MO-1983			X																												h(G)	2EAD		
		383	10.5	1MO-1978			X																													h(G)	1EAD	
		384	10.6	1MO-1979			X																													h(G)	1EAD	
		385	10.7	1MO-1980			X																													h(G)	1EAD	
		386	10.8	1MO-1981			X																													h(G)	1EAD	
		387	12.1	1MO-1685A			X																													h(G)	1EGA	
		388	12.2	1MO-1687			X																													h(G)	1EGA	
		389	12.3	1MO-1685B			X																													h(G)	1EGA	
		390	12.4	1MO-1623A			X																													h(A,D,G)	1EGA	
		391	12.5	1MO-1623B			X																													h(D,G)	1EGA	
		392	12.6	2MO-1723A			X																													h(D,G)	2EGA	
		393	12.7	2MO-1723B			X																													h(D,G)	2EGA	
		394	12.8	2MO-1785B			X																													h(G)	2EGA	
		395	12.9	2MO-1785A			X																													h(G)	2EGA	
		396	12.10	2MO-1787			X																													h(G)	2EGA	
		397	14.1	OMO-3893A		X																														h(G)	2EAD	New 1MO-3893A1
		398	14.2	OMO-3893B		X																														h(G)	2EAD	New 1MO-3893A2
		399	14.3	OMO-3993A		X																														h(G)	2EAD	New 2MO-3993A1
		400	14.4	OMO-3993B		X																														h(G)	2EAD	New 2MO-3993B1
		401	14.5	OMO-3932		X																														h(G)	2EAD	New 2MO-3993A2
M-134(Q) Tufline Qty 2	384281	411	6.0	1MO-0315			X																												b(B)	1BGA		
		412	6.0	2MO-0416				X																											1BGA			
M-154(Q) Pacific Air Products Qty 20	3C1889A 3C1889B 3C1889C 3C1889D 3F8770	421	4	OMO-6501A			X																													OGLH		
		422	4	OMO-6501B			X																													OGLH		
		423	4	OMO-6502A			X																														OGLH	
		424	4	OMO-6502B			X																														OGLH	
		425	4	OMO-6548			X																														OGLH	
		426	4	OMO-6549			X																														OGLH	
		427	8	OMO-6546A			X																														OGLH	
		428	8	OMO-6546B			X																														OGLH	
		429	8	OMO-6547A			X																														OGLH	
		430	8	OMO-6547B			X																														OGLH	
		431	9	OMO-6544A			X																														OGLH	
		432	9	OMO-6544B			X																														OGLH	
		433	9	OMO-6545A			X																														OGLH	
		434	9	OMO-6545B			X																														OGLH	

LIST OF VALVES WITH LIMITORQUE OPERATORS (Continued)

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LIST OF VALVES WITH LIMITORQUE OPERATORS (Continued)

P.O. No., Vendor, & Total on Order	List of Limitorque Order Numbers	Code for Items on P.O. M-247	MR Item	Motor Operator Identifi- cation Number	Valve Location		Limitorque's Problems Listing																			* Terminal Block Type	S/U System	Remarks		
					In- side Con- tain- ment	Outside Contain- ment	MCAR 46																							
							Harsh Envr	Mild Envr	P A	P B	P C	P D	P E	P F	P G	P H	P J	P K	P L	P M	P N	P P	P Q	P R	P S				P T	P U
1	2	3	4	5	6	7	8	9																			10	11	12	13
J-258(Q) Fisher Controls Qty 12	3B6103	521	2.A	1MO-1013A		X		\$	@	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	@	@	h(B)	1BCA	128708
	3B8816A	522	2.A	2MO-1113A		X		@	@	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	@	h(K)	2BCA		
	3B8816B	523	2.A	1MO-1013B		X		@	@	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	h(K)	1BCA			
	3C8036A	524	2.A	2MO-1113B		X		@	@	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	h(K)	2BCA			
		525	2.B	1MO-1014A		X		\$	@	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	h(B)	1BCA			
		526	2.B	2MO-1114A		X		@	@	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	h(K)	2BCA			
		527	2.B	1MO-1014B		X		@	@	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	h(X)	1BCA			
		528	2.B	2MO-1114B		X		@	@	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	h(K)	2BCA			
		529	4	1MO-1024A		X		\$	X	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	@	j(B)	1BCA		
		530	4	1MO-1024B		X		@	X	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	@	j(K)	1BCA		
		531	4	2MO-1124A		X		@	X	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	@	j(K)	2BCA		
		532	4	2MO-1124B		X		@	X	@	@	@	X	@	#	@	@	@	@	@	@	@	@	@	@	@	j(K)	2BCA		
Grand Total 276 (includes 18 surplus operators)					54	90	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	Total number of operators so far identified for a particular problem. Zero (0) indicates that the problem has been completely resolved.		