ELECTRIC OPERATOR ORDERING DATA SHEET

CUSTOMER: STONE & WEBSTER PROJECT: NIAGARA MOHAWK SHEET 1 OF 1

AN ORDER: P2-7026 ITEMS: 38 QTY: 4

NOS: 2CCP-MOV 14A, 14B, 18A, 18B

PER SPEC. NMP2-P304B REV ___ PREVIOUSLY FORWARDED [ ] ATTACHED [X] TO FOLLOW [ ]

VALVE DESC.: 12" 150# B.B GATE C/S

NUCL. CLASS: 3 ORIFICE DIA: 11.125

STEM DIA.: 2 THD., 1/4 P., 1/4 L.

STEM LIFT: 12 1/8 STEM SPEED: 10.801 IN/MIN

OPER. OR DESIGN 200 OR 100 MAX. DIFF.

PRESS. 250 PSIG PRESS. 150 PSIG

MAX. TEMP: 160°, POSS. VOLT. DROP: 20%

OPER. CURRENT: 575 VOLT., 3 PH., 60 CYCLES

OPERATOR: SMB 0 MOTOR 25 FT/LBS

MOTOR RPM: 1700, CONTROL VOLTAGE: 120/1/60

DUTY MINS.: 5 [ ], 15 [X], 30 [ ], CONT. [ ]

TOR INSULATION: CLASS B [ ], CLASS H [ ]

CLASS RAD H [X], C/CHAMB CLASS [X].

MOTOR HEATER [ ], MOTOR DRAIN [X]

LIM. SW. HEATER [X], LIM. SW. DRAIN [ ]

2-TGLS [ ], 4-TGLS [X], LARGE L.S. COVER [ ]

~~20~~ 11 PT. T.B [X], 30 PT. T.B [ ], 40PT. T.B [ ]

M.D.P.I. [ ] SLIDE WIRE TRANSMITTER [ ]

SPECIAL WIRE MARKERS: ___

SPECIAL PAINT/FINISH: ___

UNIT TO HAVE SELF-LOCKING GEAR RATIO [X]

DRIVE NUT WILL BE THREADED BY VELAN [X]

STEM THRUST 9776 LBS. STEM TORQUE 152 FT/LB

O/A RATIO 39.11 MOTOR CALC. TORQUE 10.7 FT/LB

TORQUE SPRING NO.: 60-600-0017-1

TORQUE SWITCH SETTINGS:

NORMAL: 1 3/4 MAX.: 3 3/16 FAIL: —

STALLED TORQUE: 749 FT/L.

HANDWHEEL DIA.: 12 " RATIO: 21.1

ADDED HANDWHEEL SPUR GEAR: —

VALVE MAX TORQUE: 2052 FT/L

MAX. ALLOW. H'WHEEL TORQUE 326 FT/

VALVE SURVIVES STALLED TORQUE: YES

SPECIAL REQUIREMENTS

1-Furnish certified sepias & prints for approval as follows: 2 sepias and 5 prints.

2-All Dwgs. must show Velan Order No. as well as Tag Nos.

3-SEE ATTACHED QUOTE FOR ADDITIONAL DETAILS

BB1901180017- DS

0 REV.	1	2	3	4	5	6	7
Compiled By: LW MAY 3/78							
Approved By: RG 5.5.78							
Ins. Rev. By: JM 8.05.78							

REF- P2-7026-MD-35

Subject: Motor S... 14B, 18A, 18B
P.O. No. or Project: NIAGARA MOHAWK
PAGE 2 OF 3
Customer Name: STONE AND WEBSTER

Velan No.: P2-7026 Items: 38 Velen Dwg. No.:
Valve Desc.: 12 " 150 lbs. B.B Gate C/S FORGED NB

Line Press.: 100 PSI
Orif. Dia.: 11.125 Orif. Area: 97.16 ΔP @ Temp.: 150 PSI @ 160 °F
Stem Dia.: 2 Stem Area: 3.14 Thd: 1/4 - 1/4 L Lift = 12 7/8"

Stem Thrust = O.A. x ΔP x Seat Fact. = 97.16 x 150 x 0.3 = 4372
Line Press. x S.A. = 3.14 x 100 = 314
Packing Friction Load = 5090
Total Stem Thrust = 9776

Stem Torque = Stem Thrust x Thd. Fact. = 9776 x 0.01552 = 152

O/A or Unit Ratio = Motor Design R.P.M. / (Stem Speed in./min. / Thread Lead) = 1700 / (10.86 / 1/4) = = 39.11

Motor Calc. Torque (100% VOLTAGE) = Stem Torque / (Pull out eff. x appl. fact. x O/A ratio) = 152 / (.4 x .9 x 39.11) = 10.7

Motor calc. Torque @ Reduced Voltage = (100% VOLTAGE) / (% Volt.)^2 = 10.7 / 0.64 = 16.85
N.B. If DC supply, do not Sq. % V.

Stalled Torque = Mot. Stall Torque x St. Eff. % x O/A Ratio =
STALL TORQ @ 110% VOLT = 29 x 55 x 39.11 = 624 *
624 X 1.2 = 749 Ft.Lbs.

H/W Pull = 2 x Stem Torque / (H/W Ratio x Unit Eff. x H/W Dia.) = 2x 152 / (21.1 x .3 x 1) = 48

Max. Torq. Sw. Setting = Mot. Torq. x P/O Eff. x App. Factor x O/A Rati
= 25 x .4 x .9 x 39.11 = 352

Max. H/Wheel Torque = H'W PULL x MAX. Torq. x H'W Rad. (ft) / Stem Torque
48 x 2062 / 152 x .5 = 326

Operating Time = (60 x Lift) / Stem Speed = 68~71 Sec's.

SMB - 0 Operator with 25 ft.# Motor. Max. Thrust = 24000
Max. Stem Torque = 550 #. O/A Ratio Range = 26.4 - 150.8
H/W Ratio = 21.1 :1 + Add gear — :1 Max. Stem Dia.: 2 3/8
Current Supply 575 Volts 3PH 60CY Must Operate at 80 % Voltage

0. REV.		1	2	3	4	5	6	7
Compiled By:	LW APR 18, 1978							
Approved By:	RFC 18.4.78							
Ind. Rev. By:	[illegible]							

REF - P2-7026-MD-38

VELAN ORDER: P2-7026-N

VALVE ITEM: 38

(A) Stall Thrust of Motor Operator @ 110% Volt =

Stall Torque of Operator @ 110% Volt ÷ Stem Factor =

749 ÷ 0.01552 = 48260 lbs. (thrus

(B) Allowable Thrust on Valve (Before Failure) =

Valve Max. Torque ÷ Stem Factor =

2062 ÷ 0.01552 = 132861 lbs. (thrus

STONE & WEBSTER ENGINEERING CORPORATION
3 EXECUTIVE CAMPUS, P. O. BOX 5200
CHERRY HILL, N. J. 08034

DATE	January 19, 1982
J. O. NO.	12177
P. O. NO.	NMP2-P801H
LTR. NO.	T-42 842
REF.	File P801H (enc)

VIA

TO

Mr. C. D. Terry
Manager - Project Engineering
Niagara Mohawk Power Corporation
300 Erie Boulevard West
Syracuse, New York 13202

DEAR SIRS:

THE FOLLOWING ARE [X] ATTACHED: [ ] SENT SEPARATELY:

1 COPIES ___ PRINTS ___ REPRODUCIBLES ___ MICROFILM APERTURE CARDS
EACH OF
[ ] DRAWINGS [X] SPECIFICATIONS
[ ] DOCUMENTS [ ] NOTES OF CONFERENCE

STATUS		PLEASE NOTE		SENT FOR YOUR	
[ ] FINAL	[X] APPROVED	[ ] REVISIONS	[ ] OMISSIONS	[ ] APPROVAL	[ ] COMMENT
[ ] PRELIMINARY	[ ] APPROVED AS REVISED (AS DEFINED IN SPECIFICATION)	[ ] ADDITIONS	[ ] CORRECTIONS	[X] USE	[X] INFORMATION
[ ] NO COMMENT	[ ] UNACCEPTABLE	[ ] COMMENTS	[ ]	[X] FILES	[ ] CONCURRENCE
[ ] SUGGESTIONS AS NOTED	[ ]			[ ]	

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[ ] PLEASE SUBMIT ___ PRINTS ___ REPRODUCIBLES ___ MICROFILM APERTURE CARDS OF [ ] DOCUMENTS [ ] DRAWINGS [ ] SHOP DETAIL

[ ] PLEASE RETURN ONE COPY EACH OF THIS MATERIAL BEARING YOUR APPROVAL OR COMMENTS.

[ ] PLEASE ACKNOWLEDGE RECEIPT OF THIS MATERIAL BY SIGNING AND RETURNING THE ENCLOSED COPY OF THIS FORM.

[ ] WE TRUST THAT THESE NOTES ARE IN ACCORDANCE WITH YOUR UNDERSTANDING; IF NOT, PLEASE ADVISE US.

IMPORTANT SHOULD ANY REVISION TO DOCUMENTS OR DRAWINGS RETURNED HEREWITH INVOLVE A PRICE INCREASE, THE SUPPLIER MUST NOTIFY STONE & WEBSTER PURCHASING DEPARTMENT WITHIN TEN (10) DAYS EVEN THOUGH A DEFINITE ESTIMATE CANNOT BE GIVEN AT THE TIME, OTHERWISE, THE PURCHASER WILL CONSIDER THE REVISIONS MADE WITHOUT COST.

ENGINEERING SERVICES SCOPE OF WORK NO. NMP2-P801H
DYNAMIC TESTING OF MOTOR OPERATORS
NINE MILE POINT NUCLEAR STATION - UNIT 2

Enclosed please find one (1) "Approved" copy of Addendum 2 to Engineering Services Scope of Work (ESSOW) No. NMP2-P801H, "Dynamic Testing of Motor Operators", dated January 19, 1982, for your use, files, and information.

Very truly yours,

ORIGINAL
SIGNED FOR
C. C. Zappile
Project Engineer

PS:MK

Copies to: CDTerry (enc)
RANorman (enc)
TELempges (2-enc)
PStipcevich (enc)
KMWhite (enc)
Document Control Systems/Site (enc)
Document Control/CHOC
ADColeman
MKrautheim

A029.5G

COPY
A 024-27A

STONE & WEBSTER ENGINEERING CORPORATION

NOTED JAN 1 9 1982 M. HELMS

Copy to:

SFManno(encl)	MADurka	ABlum(encl)	Job Book G51(encl)
WARumberger(encl)	SMFeldman	RABerry	P801H(encl)
CDTerry(encl)	SCChow	LFFendo	WP ~~C5Y~~/6522/XXX
ERKlein(encl)	CCZappile	JJPanchison	NAMuni(encl)
DLPracht(encl)	WPHennessy	RJMcMorland	
	CECrocker	JMGwinn(encl)(Boston)	
	PStipcevich(encl)	GHEast(Boston)	
	AWChan	ARJoyce(Boston)	
	RPiha	JJSorrentino(Boston)	
		JRHall(Boston)	

Mr. C. D. Terry
Manager - Project Engineering
Niagara Mohawk Power Corporation
300 Erie Boulevard West
Syracuse, NY 13202

January 19, 1982
J.O. No. 12177
9M2-11,609

Dear Mr. Terry:

PURCHASE ORDER NO. NMP2-P801H
DYNAMIC TESTING OF MOTOR OPERATORS
NINE MILE POINT NUCLEAR STATION - UNIT 2

This letter summarizes the results of the supplementary Phase I tests of two Limitorque operators performed between November 9, 1981, and December 22, 1981. A detailed test report will be issued by National Technical Systems during the last week of January 1982.

Summary of Test Results

1. Limitorque Operator SHB-0-25

   Successfully completed the following tests without chatter exceeding 2 milliseconds:

   a. Vibration aging (paragraph 3.1*)

   b. Random multifrequency biaxial test (paragraph 3.2) with ZPA $\geq$ 12 g's

   c. Single axis sine beat tests (paragraph 3.3) up to 6 g's

   d. Fragility tests (paragraph 3.4) up to 11 g's.

      Fourteen g's with chatter less than 5 milliseconds

*All referenced paragraphs from ESSOW No. NMP2-P801H, Attachment 1

2. Limitorque Operator SMB-000-5

Successfully completed the following tests without chatter exceeding 2 milliseconds:

a. Vibration aging

b. Random multifrequency biaxial test with ZPA ≥ 6 g's

c. Single axis sine beat tests up to 6 g's

Note: At 100 Hz, chatter exceeding 2 milliseconds but below 5 milliseconds was observed throughout this test.

d. Fragility tests up to 14 g's

Notes: (1) Chatter exceeding 2 milliseconds, but below 5 milliseconds was observed throughout this series of tests.

(2) At 8 g's, between 15.9 Hz and 25 Hz, torque switch chatter resulted in incomplete strokes. Limitorque representative corrected this problem by adjusting the contactor gap in accordance with Attachment 5 of the specification.

Please note that the maximum attainable accelerations, due to test table limitations during the sine beat tests, ranged from 8 g's at 5.0 Hz to 12-14 g's at 20 Hz. Also, during the course of the test, the following significant changes to the specification were made:

1. ZPA of the RRS for Operator SMB-000-5 was lowered from 10 g's to 6g's in order to prevent possible damage to the operator.

2. The number of sine beats for the fragility tests at frequencies 10, 12.6, and 15.9 Hz was reduced from 20 to 6. This change is acceptable, consistent with paragraph 3.3.1, and resulted in a considerable time saving.

A copy of the specification addendum, reflecting these and other minor changes, is enclosed. For additional information, please contact Mr. N. A. Muni at Telephone No. (609) 482-3148.

Very truly yours,
ORIGINAL
SIGNED FOR
C. C. Zappile
Project Engineer

Enclosure

NM:SRJ

xc: SFManno(encl)
WARumberger(encl)
CDTerry(encl)
ERKlein(encl)
DLPracht(encl)

JBDrab(Limitorque Corporation)(encl)
JJEnders(Limitorque Corporation)
SIsbitsky(Velan Engineering Company)
JStrohm(Bechtel Power Corporation)(encl)
RTjernlund(Sargent & Lundy)
JPEtzweiler(Long Island Lighting Company)(encl)
JMollick(Philadelphia Electric Company)(encl)
MRahman(Gulf States Utilities Company)(encl)
JSullivan(Washington Public Power Supply System)
GRCrane(Commonwealth Edison Company)
DJFrederic(Cincinnati Gas & Electric Company)

NOTED JAN 19 1982

Stone & Webster Engineering Corporation
Cherry Hill Operations Center
Cherry Hill, New Jersey

I

NUCLEAR SAFETY RELATED

J.O. No. 12177 | Addendum 2
Spec. No. NMP2-P801H | Page A2-1 of 5

January 19, 1982

Addendum 2
Specification for

ENGINEERING SERVICES SCOPE OF WORK FOR DYNAMIC TESTING OF MOTOR OPERATORS

Nine Mile Point Nuclear Station - Unit 2
Niagara Mohawk Power Corporation
Scriba, New York

Seller:
National Technical Services, Incorporated
9551 Canoga Avenue
Chatsworth, California

APPROVAL

	SIGNATURE	DATE
Preparer:	[illegible]	1/15/82
Specialist:	[illegible]	1/18/82
Lead Engineer:	[illegible]	1/18/82
Engineering Assurance:	[illegible]	1/18/82
Project Engineer:	CE [illegible]	1/19/82

This Addendum 2 includes changes to the Engineering Service Scope of Work dated October 29, 1981, agreed to by the Seller and the Engineers.

Item	Change to Specification	
1	Page:	5
	Delete:	Line 5.44
	Reason:	Specification change
2	Page:	2, Attachment 1, line 1.10/63
	Add:	- The number of accelerometers may be reduced to 12 for the fragility test. -
	Reason:	Specification change
3	Page:	3, Attachment 1, line 1.10/111
	Delete:	- During stroking, the sine sweep motion is to be replaced with a "white noise" vibration input in frequency range 5 to 200 Hz, superimposed over a 60 Hz sine wave input, with a maximum combined acceleration of 0.75 g. At the end of the operational period, the sine sweep test is to be resumed. -
	Reason:	Specification change
4	Page:	4, Attachment 1, line 1.10/141
	Delete:	- corresponding -
	Reason:	Specification change
5	Page:	5, Attachment 1, line 1.10/155
	Delete:	- 1.5 seconds or greater as necessary -
	Add:	- sufficient -
	Reason:	Specification change
6	Page:	7, Attachment 1, line 1.10/277
	Delete:	- 1.5 seconds or greater as necessary -
	Add:	- sufficient -
	Reason:	Specification change

Item	Change to Specification	
7	Page:	8, Attachment 1, 1.10/293 through 1.10/295
	Delete:	

- Test Frequency	No. of Beats	Oscillations per Beat
10.0	20	15
12.6	20	15
15.9	20	15 -

Add:

- Test Frequency	No. of Beats	Oscillations per Beat
10.0	6	15
12.6	6	15
15.9	6	15 -

Item		
	Reason:	Specification change
8	Pages:	9 and 10, Attachment 1
	Delete:	Existing Figures 1 and 2 of Attachment 1
	Add:	Attached Figures 1 (Page A2-4 of 5) and 2 (Page A2-5 of 5)
	Reason:	Specification change
9	Page:	Attachment 6
	Delete:	

- Operator Mounting Screw Torque
SMB-000-5: 5/16 inch screw 16.5 ft-lbs -

Add:

- Operator Mounting Screw Torque
SMB-000-5: 5/16 inch screw 25 ft-lbs unlubricated -

Reason: Specification change

FIGURE 1

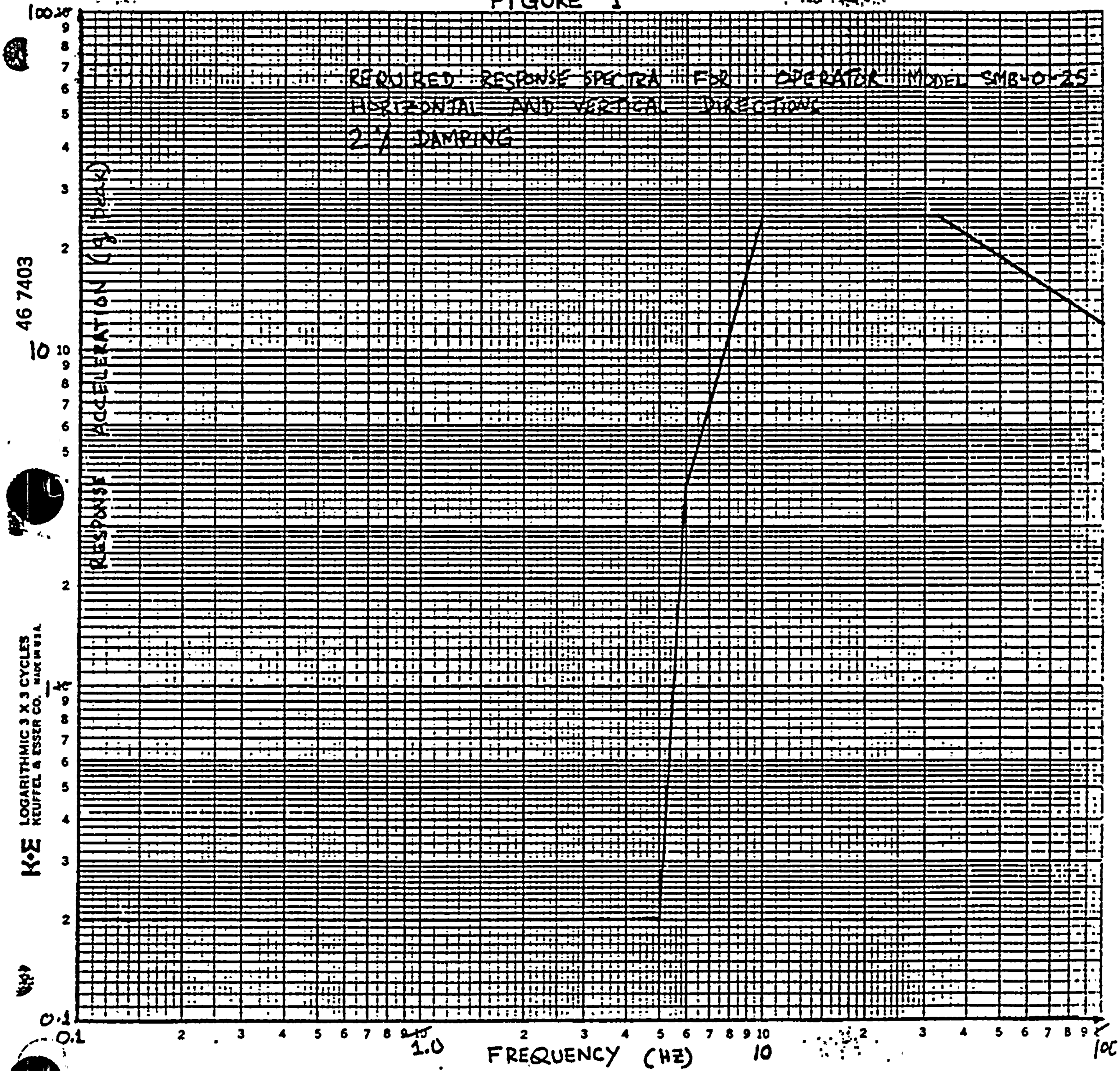
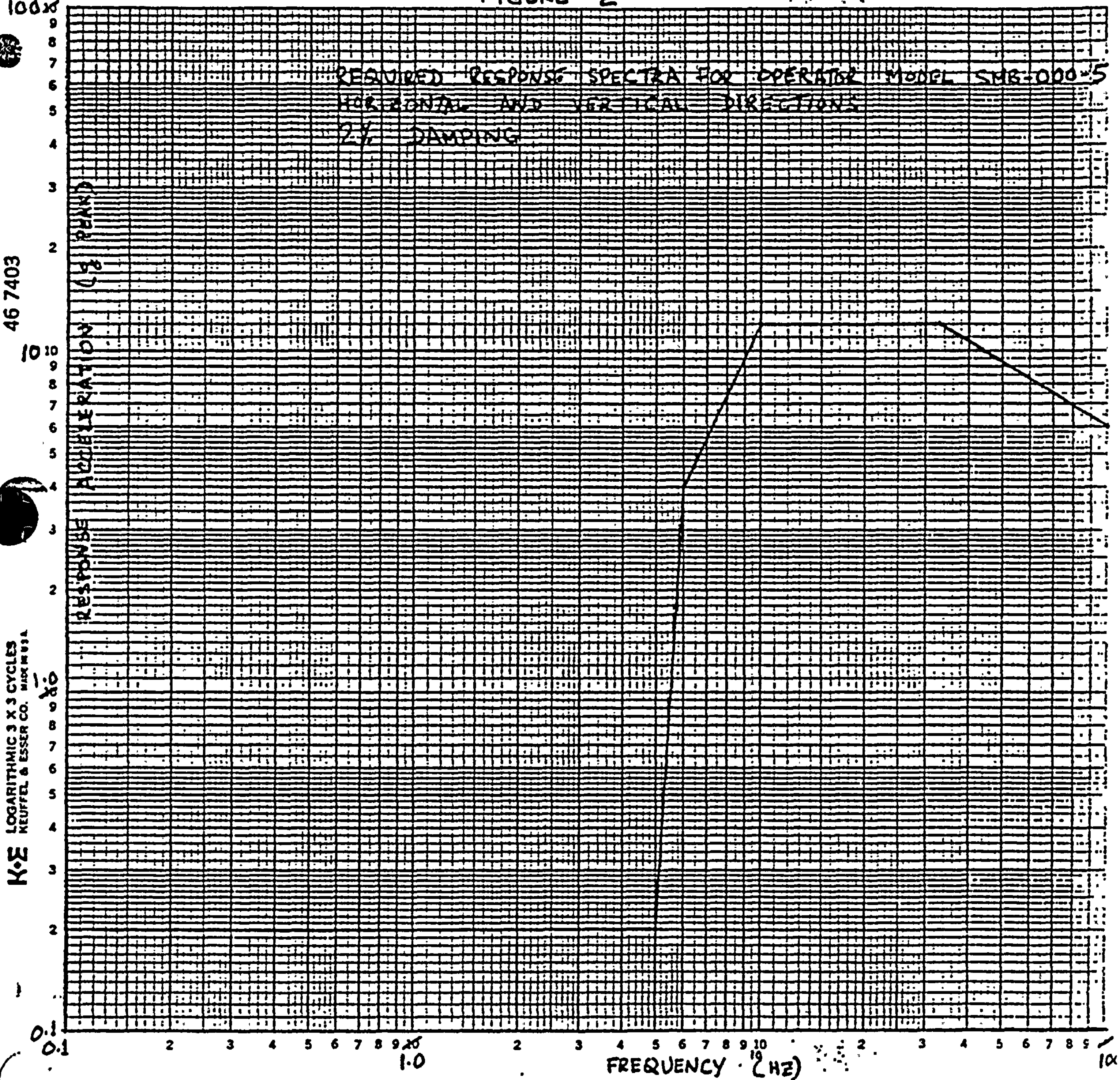

REQUIRED RESPONSE SPECTRA FOR OPERATOR MODEL SMB-0-25
HORIZONTAL AND VERTICAL DIRECTIONS
2% DAMPING
RESPONSE ACCELERATION (g peak)
FREQUENCY (HZ)
0.1
1.0
10
100
K+E LOGARITHMIC 3 X 3 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7403

FIGURE 2


REQUIRED RESPONSE SPECTRA FOR OPERATOR MODEL SMB-000-5
HORIZONTAL AND VERTICAL DIRECTIONS
2% DAMPING
RESPONSE ACCELERATION (g PEAK)
FREQUENCY (HZ)
0.1
1.0
10
100
K+E LOGARITHMIC 3 X 3 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7403

STONE & WEBSTER ENGINEERING CORPORATION
3 EXECUTIVE CAMPUS, P. O. BOX 5200
CHERRY HILL, N. J. 08034

DATE	June 10, 1982
J. O. NO.	12177
P. O. NO.	NMP2-P801H
LTR. NO.	T-47, 622
REF.	FILE P801H (enc)

VIA

TO National Technical Systems Inc.
26525 Golden Valley Road
Saugus, California 91350

Attn: Ms. Terry Hampton

DEAR SIRS:

THE FOLLOWING ARE ☒ ATTACHED: ☐ SENT SEPARATELY:

1 COPIES ___ PRINTS ___ REPRODUCIBLES ___ MICROFILM APERTURE CARDS
EACH OF
☐ DRAWINGS ☐ SPECIFICATIONS
☒ DOCUMENTS ☐ NOTES OF CONFERENCE

STATUS		PLEASE NOTE	SENT FOR YOUR
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PURCHASE ORDER NO. NMP2-P801H
DYNAMIC TESTING OF MOTOR OPERATORS
NINE MILE POINT NUCLEAR STATION-UNIT 2
NIAGARA MOHAWK POWER CORPORATION

548-9291	Test Report	Rev. 2	5/25/82

Very truly yours,
ORIGINAL SIGNED FOR

M. A. Durka
Lead Mechanics Engineer

PS:JM

Copies to: RWHammelmann (enc)
DLPracht (enc)
MJCarrington (enc)
GMSchierberg/GLVolpe-3 245/5
KMWhite
Document Control Systems/Site (enc)
Document Control/CHOC
PStipcevich (enc)
JMartin

A029.5G

STONE & WEBSTER ENGINEERING CORPORATION
REVIEW OF SUPPLIER'S TECHNICAL DOCUMENT

▲5040.51B

PAGE 1 OF 1

SUPPLIER	P.O.NO.	DOCUMENT TITLE	DOC.ID. NO.	REV.	DATE
NATIONAL TECHNICAL SYSTEMS	P801H	TEST REPORT	548-9291	2	5/27/82

DATE RECIEVED	SPEC.NO./DATE	REV.	ADDEN.	SPEC. TITLE
☐ NEW SUBMITTAL ☒ RESUBMITTAL	P801H	—	2	DYNAMIC TESTING OF MOTOR OPERATORS

GOVERNING CODE(S) & DATE(S)	SPECIAL REQUIREMENTS	DWG REFERENCE(S) S&W SUPPLIER
—	—	—

SPECIALIST	PROJECT	J.O.NO.	RESPONSIBLE ENG	LOCATION	EXT.	DATE.
A.CHAN	NMPC	12177	P. STIRCEVICH	1B	3640	6/7/82

COMMENTS:

NATIONAL TECHNICAL SYSTEMS TEST REPORT #548-9291 REVISION 2, DATED 5/25/82 IS APPROVED.

Stone & Webster Engineering Corporation

☑ APPROVED AS DEFINED IN THE SPECIFICATIONS
☐ UNACCEPTABLE
☐ APPROVED AS REVISED AS DEFINED IN THE SPEC.
☐ REVIEWED

J.O. No. 12177
SPEC. No. P801H
DATE 6/8/82
BY P. STIRCEVICH

RESUBMITTAL REQUIRED ☐ YES ☒ NO

REVIEWER	DEPT./DIV.	DATE	LOCATION	EXTENSION
P. STIRCEVICH	ENGINEERING EQ. MECHANICS	6/7/82	1B	3640

National Technical Systems

Report 548-9291, Rev. 2

REVISION SUMMARY

Revision	Date	Page(s) Affected	Paragraph(s) Affected
2	5-24-82	12	Paragraph 5.2.3 - Change Test Numbers 1 through 9; Under "Test Duration" column change "27" to "35"; Under "Observations" column add: "Report of Test 1", change "Repeat of Test 1" to "Repeat of Test 2", change "Repeat of Test 5 ..." to "Repeat of Test 6 ..."
2	5-24-82	D-1	Add Natural Frequencies Chart
2	5-24-82	D-1a	Renumber page
2	5-24-82	F-1 - F-29	Appendix F - Correct typo - "...@ 002 sec" to "...@.002 sec"
2	5-24-82	G-1 - G-36	Appendix G - Correct typo - "...@ 002 sec" to "...@.002 sec"
2	5-24-82	2	Paragraph 3.2 - Add "... response..."; 3.2A - Change "6 g's" to "6 g"; 3.2B - Change "12 g's" to "12 g"

These Revisions Reviewed and Approved By:

for A Frodiane Date: 5/25/82

PUBLICATIONS MANAGER, Theresa Hampton

David P. Bame Date: 5-25-82

PROJECT MANAGER, David P. Bame

Robert A. Ely Date: May 25, 1982

QUALITY ASSURANCE MANAGER, Robert A. Ely

Stone & Webster Engineering Corporation
- [x] APPROVED AS DEFINED IN THE SPECIFICATIONS
- [ ] UNACCEPTABLE
- [ ] APPROVED AS REVISED AS DEFINED IN THE SPEC
- [ ] REVIEWED

J.O. No. 12177
SPEC. No P801H
DATE 6/8/82
BY P. STIREJKA

369

2.0 REFERENCES

2.1 National Technical Systems Test Procedure Number 548-9291, Revision A, dated October 29, 1981.

2.2 Stone & Webster Engineering Corporation's Engineering Services Scope of Work for Dynamic Testing of Motor Operators, ESSOW Number NMP2-P801H and Addenda 1 and 2.

3.0 SUMMARY

3.1 VIBRATION AGING TEST

Limitorque motor operators, types SMB-000-5 and SMB-0-25, were subjected to 90 minutes of vibration aging in each axis in accordance with IEEE-392-1980 and maintained performance consistant with pretest baseline measurements.

No chatter exceeding two milliseconds was recorded on the limit switch contacts.

3.2 RANDOM MULTIFREQUENCY BIAXIAL TEST

Operators, types SMB-000-5 and SMB-0-25, were subjected to a minimum of 105 seconds of random biaxial multifrequency input motion with a frequency content of 1 Hz to 100 Hz. These tests were performed in accordance with the requirements of Reference 2.2, for the 105 seconds, in two test orientations at the levels listed below. Typical response plots are shown in Figures 1, 2, and 3.

A. Operator SMB-000-5 - minimum ZPA of 6 g

B. Operator SMB-0-25 - minimum ZPA of 12 g

The performance of each operator was consistant with its pretest baseline values. No chatter exceeding two milliseconds was recorded on the limit switch contacts.

6.2.2.1 At approximately 27 seconds after the start of the test, the operator was observed to have come loose. The test was stopped immediately. Examination of the operator revealed that the operator mounting screws had come loose and that there was a considerable amount of localized deformation of the aluminum mounting plate under the bolt heads.

The Customer's representative determined that a combination of the small bearing area under the socket head mounting bolts and the low bearing capacity of the aluminum mounting plate had resulted in excessive deformation of the mounting plate under the bolt head, which in turn caused loosening of the bolts. In oearing area under the socket head mounting bolts and the low bearing capacity of the aluminum mounting plate had resulted in excessive deformation of the mounting plate under the bolt head, which in turn caused loosening of the bolts. In order to properly distribute the bot loads, 3/16 inch thick steel washers were placed under the bolts and the test was continued.

6.2.3 Operator SMB-000-5

Test Number	Direction of Loading	TRS Figure (Appendix E)	Test Duration (seconds)	Operating Voltage (% of nominal)	Stroke Time (sec.) Open to Close	Close to Open	Chatter > 2 milliseconds	Osbervations
1	X & Z	-	-	-	-	-	-	Mounting Bolts Broke See 6.2.3.1 Report of Test 1
2	X & Z	1 & 2	35	80	10	10	No	
3	X & Z	3 & 4	35	100	10	10	No	
4	X & Z	5 & 6	35	110	10	10	No	
5	X & Z	7 & 8	35	80	10	10	No	Repeat of Test 2
6	X & Y	9 & 10	35	80	10	10	No	ZPA Lower than required
7	X & Y	11 & 12	35	100	10	10	No	
8	X & Y	13 & 14	35	110	10	10	No	
9	X & Y	15 & 16	35	80	10	10	No	Repeat of Test 6 with Higher ZPA

APPENDIX D

X-Y Transmissibility Plots

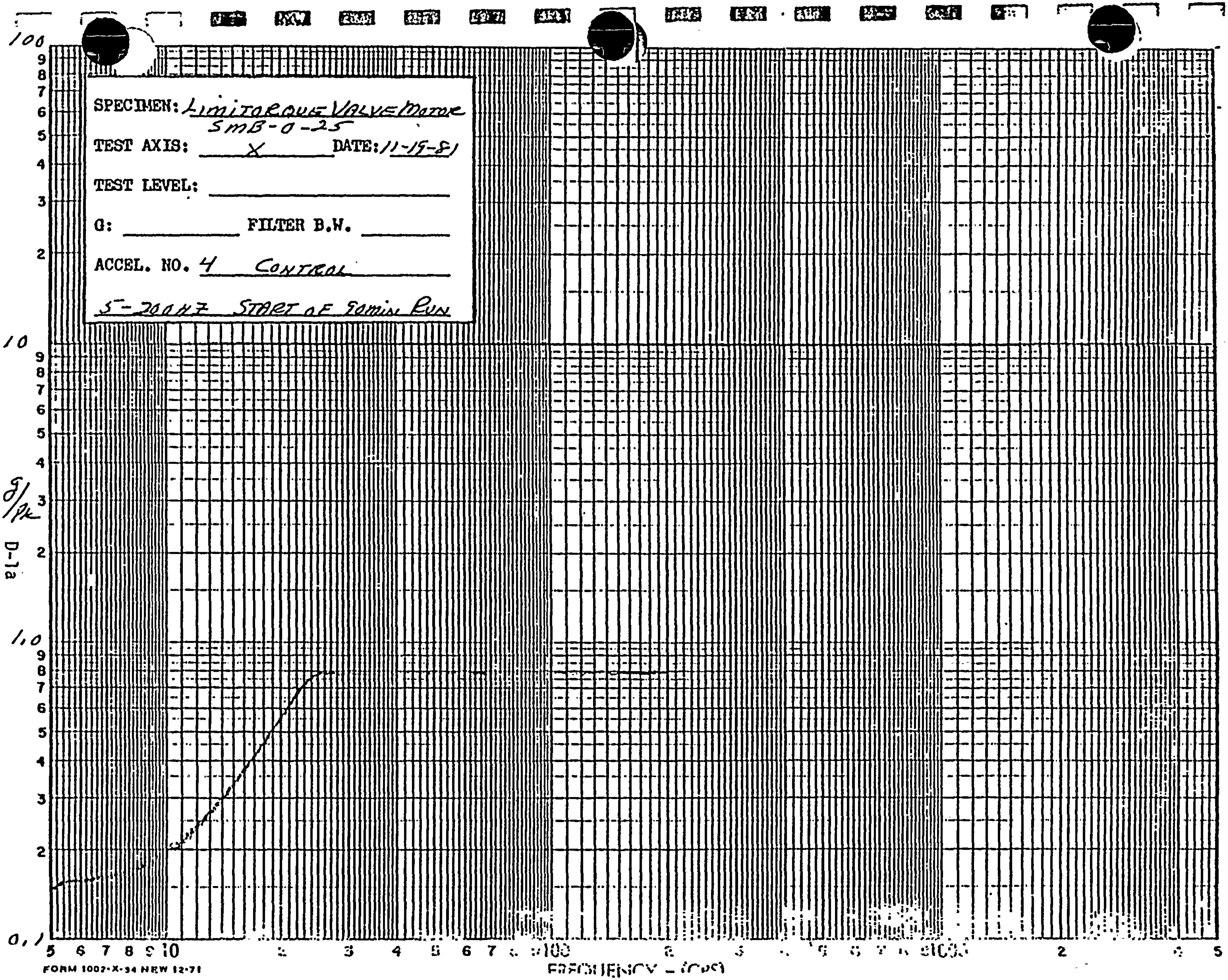
NATURAL FREQUENCIES

OPERATOR SMB-0-25

Frequency	Gross Structure/Component
64 Hz	Motor
130 Hz	Gross Structure
140 Hz	Gross Structure
150 Hz	Limit Switch
165 Hz	Limit Switch

OPERATOR SMB-000-5

Frequency	Gross Structure/Component
90 Hz - 100 Hz	Gross Structure
125 Hz - 145 Hz	Gross Structure
180 - 200 Hz	Gross Structure


SPECIMEN: LIMITORQUE VALVE MOTOR SMB-0-25
TEST AXIS: X DATE: 11-19-81
TEST LEVEL:
G: FILTER B.W.
ACCEL. NO. 4 CONTROL
5-200HZ START OF 90min RUN
100
10
1.0
0.1
g/pk
FREQUENCY – CPS
FORM 1002-X-34 NEW 12-71

D-1a

APPENDIX F

Seismic Sine Beat Test Data Sheets

National Technical Systems

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SINE BEAT

National Technical Systems - Chatsworth

3.3.1 "X" Axis (Vertical) SMB-0-25 12/4/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	6.0	5.1	-	55	7	-	
6.3	6	6.0	-	5^+	55	6	-	
7.9	6	6.0	5.1	-	55	2	-	
10.0	6	6.0	-	5	55	6	-	

National Techanical Systems - Los Angeles 12/13/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
[illegible].6	6	6.0	-	5.32	-	3	No	1408
[illegible]5.9	6	6.0	5.25	-	-	3	No	1412
20.0	6	6.0	-	5.32	-	2	No	1415
25.0	6	6.0	5.25	-	-	2	No	1420
30.0	6	6.0	-	5.4	-	3	No	1422
35.0	6	6.0	5.25	-	-	3	No	1425
			Pretest 5.18	5.32				

SINE BEAT

National Technical Systems - Chatsworth

3.3.1 "Y" Axis (Horizontal) SMB-0-25 12/4/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	6.0	-	(Stroke not run)	100	3	No	
6.3	6	6.0	-	5.5	100	6	No	
7.9	6	6.0	4.1	-	50	4	No	
10.0	6	6.0	-	5.1	55	5	No	
National Techanical Systems - Los Angeles 12/12/1 P.M.								
[illegible].6	6	6.0	5.35	-	-	5	No	1536
15.9	6	6.0	-	5.48	-	5	No	1540 Note (1)
20.0	6	6.0	5.35	-	-	6	No	1550
25.0	6	6.0	-	5.43	-	4	No	1552
30.0	6	6.0	5.31	-	-	7	No	1554
35.0	3 first try	6.0	-	5.42	-	2	No	1556
	3 second try					3		
			Los Angeles Pretest 5.27	5.37				

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SINE BEAT

National Technical Systems - Chatsworth

3.3.1 "Z" Axis (Horizontal) SMB-0-25 12/4/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	6.0	5.0	-	55	5	No	
6.3	6	6.0	-	5.0	55	2	No	
7.9	6	6.0	5.0	-	55	0	No	
10.0	6	6.0	-	5.1	55	3	No	

National Techanical Systems - Los Angeles 12/12/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
[illegible].6	6	6.0	5.38	-	-	4	No	2029
15.9	6	6.0	-	5.55	-	2	No	2032
20.0	6	6.0	5.26	-	-	2	No	2053
25.0	6	6.0	-	5.36	-	4	No	2055
30.0	6	6.0	5.23	-	-	2	No	2057
35.0	6	6.0	-	5.34	-	2	No	2058

SINE BEAT

National Technical Systems - Los Angeles

3.3.2 "X" Axis (Vertical) SMB-0-25 12/13/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks 3.3.2, 3.3.3 3.3.4 run concurrently by frequency
10.0	10	4.6	5.37	-	-	4	No	1436
12.6	10	4.6	5.31	-	-	3	No	1444
15.9	10	4.6	-	5.37	-	2	No	1458
20.0	10	4.6	5.22	-	-	5	No	1509
25.0	10	4.6	-	5.42	-	4	No	1514
30.0	10	4.6	5.28	-	-	5	No	1520
[illegible].0	10	4.6	-	5.32	-	4	No	1528
40.0	10	4.6	5.29	-	-	6	No	1534
45.0	20	4.6	-	5.38	-	3	No	1538
50.0	20	4.6	5.29	-	-	5	No	1542
55.0	20	4.6	-	5.32	-	4	No	1546
60.0	20	4.6	5.17	-	-	5	No	1551
70.0	10	4.6	-	5.28	-	3	No	1555
85.0	10	4.6	5.20	-	-	2	No	1558
100.0	10	4.6	-	5.28	-	2	No	1600

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SINE BEAT

National Technical Systems - Los Angeles

3.3.2 "Y" Axis (Horizontal) SMB-0-25 12/12/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	10	4.6	5.41	-	-	5	No	1605
12.6	10	4.6	-	5.39	-	5	No	1611
15.9	10	4.6	5.38	-	-	3	No	1613
20.0	10	4.6	-	5.44	-	4	No	1615
25.0	10	4.6	5.38	-	-	5	No	1617
30.0	10	4.6	-	5.42	-	6	No	1619
[illegible]5.0	10	4.6	5.31	-	-	3	No	1622
[illegible].0	10	4.6	-	5.42	-	3	No	1624
45.0	20	4.6	5.31	5.47	-	3	No	1626
50.0	20	4.6	5.31	5.41	-	4	No	1627
55.0	20	4.6	5.29	5.40	-	2	No	1629
60.0	20	4.6	5.28	5.37	-	4	No	1631
70.0	13	4.6	5.37	-	-	3	No	1633
85.0	10	4.6	-	5.33	-	2	No	1635
100.0	10	4.6	5.25	-	-	3	No	1636

SINE BEAT

National Technical Systems - Los Angeles

3.3.2 "Z" Axis (Horizontal) SMB-0-25 12/12/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks 3.3.2, 3.3.3 3.3.4 run concurrently
10.0	10	4.6	5.27	-	-	2	No	2119
12.6	10	4.6	-	5.45	-	5	No	2128
15.9	10	4.6	5.27	-	-	3	No	2136
20.0	10	4.6	-	5.33	-	4	No	2145
25.0	10	4.6	5.17	-	-	2	No	2152
30.0	10	4.6	-	5.4	-	2	No	2208
[illegible].0	10	4.6	5.20	-	-	2	No	2214
40.0	10	4.6	-	5.31	-	2	No	2219
45.0	20	4.6	5.33	-	-	6	No	2225
50.0	20	4.6	-	5.28	-	2	No	0937
55.0	20	4.6	5.24	-	-	4	No	0943
60.0	20	4.6	-	5.31	-	4	No	0947
70.0	10	4.6	5.16	-	-	1	No	0952
85.0	10	4.6	-	5.41	-	3	No	0956
100.0	10	4.6	5.18	-	-	3	No	1001

SINE BEAT

National Technical Systems - Los Angeles

3.3.3 "X" Axis (Vertical) SMB-0-25 12/13/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks Run concurrently by freq. with 3.3.2
10.0	40	3.5	5.27	5.29	-	2	No	1436
12.6	40	3.5	5.20	5.34	-	1	No	1444
15.9	40	3.5	5.26	5.33	-	1	No	1458
20.0	40	3.5	5.23	5.42	-	1	No	1509
25.0	40	3.5	5.19	5.37	-	1	No	1515
30.0	40	3.5	5.15	5.41	-	2	No	1521
[illegible].0	40	3.5	5.26	5.42	-	2	No	1528
40.0	40	3.5	5.25	5.37	-	1	No	1534
45.0	40	3.5	5.19	5.40	-	2	No	1538.
50.0	40	3.5	5.16	5.34	-	1	No	1543
55.0	40	3.5	5.25	5.32	-	1	No	1547
60.0	40	3.5	5.35	5.43	-	3	No	1551
70.0	5	3.5	5.16	-	-	2	No	1555
85.0	5	3.5	-	5.29	-	1	No	1558
100.0	5	3.5	5.21	-	-	1	No	1600

SINE BEAT

National Technical Systems - Los Angeles

3.3.3 "Y" Axis (Horizontal) SMB-0-25 12/12/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	40	3.5	5.33	5.55	-	2	No	1649
12.6	40	3.5	5.4	5.5	-	3	No	1838
15.9	40	3.5	5.34	5.43	-	2	No	1845
20.0	40	3.5	5.27	5.41	-	2	No	1851
25.0	40	3.5	5.24	5.51	-	2	No	1858
30.0	40	3.5	5.36	5.36	-	3	No	1904
[illegible]5.0	40	3.5	5.35	5.39	-	3	No	1910
[illegible].0	40	3.5	5.31	5.43	-	2	No	1915
45.0	40	3.5	5.44	5.49	-	2	No	1919
50.0	40	3.5	5.22	5.33	-	3	No	1936
55.0	40	3.5	5.22	5.42	-	2	No	1941
60.0	40	3.5	5.18	5.35	-	3	No	1946
70.0	5	3.5	5.28	-	-	2	No	1950
85.0	5	3.5	-	5.22	-	1	No	1952
100.0	5	3.5	5.18	-	-	2	No	1954

SINE BEAT

National Technical Systems - Los Angeles

3.3.3 "Z" Axis (Horizontal) SMB-0-25 12/12/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks (Run concurrently with 3.3.2)
10.0	40	3.5	5.29	5.29	-	1	No	2120
12.6	40	3.5	5.26	5.39	-	1	No	2129
15.9	40	3.5	5.3	5.44	-	2	No	2137
20.0	40	3.5	5.24	5.36	-	1	No	2146
25.0	40	3.5	5.23	5.22	-	1	No	2153
30.0	40	3.5	5.31	5.29	-	1	No	2209
[illegible].0	40	3.5	5.22	5.30	-	2	No	2215
40.0	40	3.5	5.16	5.31	-	2	No	2219
45.0	40	3.5	5.19	5.34	-	1	No	2226
50.0	40	3.5	5.18	5.37	-	1	No	0938
55.0	40	3.5	5.20	5.37	-	0	No	0944
60.0	40	3.5	5.22	5.32	-	0	No	0948
70.0	5	3.5	-	5.34	-	0	No	0953
85.0	5	3.5	5.24	-	-	0	No	0956
100.0	5	3.5	-	5.27	-	0	No	1001

SINE BEAT

National Technical Systems - Los Angeles

3.3.4 "X" Axis (Vertical) SMB-0-25 Extra 12/13/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks (Run concurrently with 3.3.3)
10.0	103	2.0	-	5.31	-	1	No	1438 1443
12.6	104	2.0	5.21	5.29	-	2	No	1446 1450
15.9	106	2.0	5.25	5.38	-	1	No	1500 1504
20.0	103	2.0	5.20	5.44	-	1	No	1510 1513
25.0	101	2.0	5.22	5.30	-	4	No	1516 1518
30.0	100	2.0	5.32	5.29	-	3	No	1521 1524
[illegible].0	103	2.0	5.14	5.38	-	1	No	1530 1532
40.0	102	2.0	5.21	5.35	-	1	No	1535 1537
45.0	102	2.0	(Post Vib.) 5.16	5.40	-	3	No	1539 1541
50.0	100	2.0	5.17	5.32	-	4	No	1544 1545
55.0	101	2.0	5.16	5.36	-	4	No	1548 1550
60.0	100	2.0	5.16	5.28	-	2	No	1552 1554
70.0	20	2.0	-	5.31	-	1	No	1556 1557
85.0	20	2.0	5.17	-	-	1	No	1559
100.0	20	2.0	-	5.29	-	2	No	1601
			Post Test 5.16	5.29				

SINE BEAT

National Technical Systems - Los Angeles

3.3.4 "Y" Axis (Horizontal) SMB-0-25 12/12/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks (Done concurrently with 3.3.3 by frequency)
10.0	103	2.0	5.31	5.39	-	0	No	1650
12.6	101	2.0	5.32	5.39	-	1	No	1840 1843
15.9	102	2.0	5.28	5.37	-	1	No	1846 1849
20.0	101	2.0	5.36	5.43	-	2	No	1853 1856
25.0	101	2.0	5.38	5.36	-	2	No	1859 1901
30.0	100	2.0	-	5.32	-	2	No	1906 1908
45.0	100	2.0	5.44	5.36	-	2	No	1911 1914
40.0	101	2.0	5.32	5.27	-	2	No	1916 1918
45.0	101	2.0	5.21	5.34	-	2	No	1920 1923
50.0	100	2.0	5.27	5.33	-	2	No	1937 1939
55.0	101	2.0	5.28	5.35	-	1	No	1942 1944
60.0	100	2.0	5.21	5.32	-	2	No	1947 1949
70.0	20	2.0	-	5.38	-	1	No	1950 1951
[illegible].0	20	2.0	5.36	-	-	1	No	1953
100.0	20	2.0	-	5.39	-	1	No	1954
			Post Test 5.29	5.3				

SINE BEAT

National Technical Systems - Los Angeles

3.3.4 "Z" Axis (Horizontal) SMB-0-25 Extra 12/12/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks (Run concurrently with 3.3.3)
10.0	104	2.0	5.22	5.4	-	1	No	2121 2125
12.6	102	2.0	5.28	5.34	-	2	No	2131 2134
15.9	102	2.0	5.23	5.3	-	3	No	2138 2142
20.0	104	2.0	5.17	5.31	-	1	No	2148 2151
25.0	105	2.0	5.19	5.44	-	2	No	2154 2159
[illegible].0	105	2.0	5.25	5.4	-	2	No	2210 2212
35.0	104	2.0	5.33	5.34	-	2	No	2215 2217
40.0	104	2.0	5.17	5.38	-	2	No	2220 2222
45.0	102	2.0	5.17	5.34	-	1	No	2227 2229
50.0	106	2.0	5.22	5.32	-	1	No	12/13/1 A.M. 0939 0941
55.0	104	2.0	5.32	5.30	-	2	No	0945 0946
60.0	100	2.0	5.19	5.34	-	1	No	0949 0950
70.0	20	2.0	5.19	-	-	1	No	0953
[illegible]0	20	2.0	-	5.34	-	1	No	0957
[illegible].0	20	2.0	5.31	-	-	1	No	1002
			Post Test 5.21	5.35				

SINE BEAT

National Technical Systems - Chatsworth

3.3.1 "X" Axis (Vertical) SMB-000-5 12/5/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	6.0	11.1	-	55	5	No	
6.3	6	6.0	-	12.5	55	0	No	
7.9	6	6.0	11.8	-	55	1	No	
10.0	6	6.0	-	12.2	55	1	No	

National Techanical Systems - Los Angeles 12/10/1 A.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
[illegible].6	6	6.0	11.88	-	70	5	Yes (on piggy back units)	(See Note 1) high g input-30 g
15.9	6	6.0	-	11.88	-	3	No	
20.0	6	6.0	11.92	-	-	6	No	
25.0	6	6.0	-	11.90	-	2	No	
30.0	6	6.0	11.91	-	-	7	No	
35.0	6	6.0	-	11.93	-	8	No	

Note 1: Modified limit switch - chatter
Operator limit switch - no chatter

SINE BEAT

National Technical Systems - Chatsworth

3.3.1 "Y" Axis (Horizontal) SMB-000-5 12/5/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	6.0	11.0	-	-	2	No	
6.3	6	6.0	-	12.7	-	2	No	
7.9	6	6.0	11.4	-	-	2	No	
10.0	6	6.0	-	12.1	-	3	No	
National Techanical Systems - Los Angeles 12/9/1 A.M.								
[illegible].6	6	6.0	11.92	-	-	4	No	Rattle in motor - does not effect operation
15.9	6	6.0	-	11.84	-	5	No	
20.0	6	6.0	11.86	-	-	5	No	
25.0	6	6.0	-	11.90	-	5	No	
30.0	6	6.0	11.87	-	-	3	No	
35.0	6	6.0	-	11.93	-	3	No	

SINE BEAT

National Technical Systems - Chatsworth

3.3.1 "Z" Axis (Horizontal) SMB-000-5 12/5/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	6.0	12.0	-	-	4	No	
6.3	6	6.0	-	12.0	-	3	No	
7.9	6	6.0	11.0	-	-	0	No	
10.0	6	6.0	-	11.0	-	3	No	
			National Techanical Systems - Los Angeles				12/9/1 A.M.	
[illegible].6	6	6.0	(Time not obtained)	-	50	12	No	
15.9	6	6.0	-	11.75	60	17	No	
20.0	6	6.0	11.88	-	-	11	No	
25.0	6	6.0	-	11.96	-	6	No	
30.0	6	6.0	11.95	-	-	12	No	
35.0	6	6.0	-	11.87	-	4	No	

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SINE BEAT

National Technical Systems - Los Angeles

3.3.2 "X" Axis (Vertical) SMB-000-5 12/10/1 A.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	10	4.6	11.87	11.90	-	6	No	
12.6	10	4.6	11.83	11.88	-	12	No	
15.9	10	4.6	11.85	11.88	-	10	No	#3 Accel. lost; wire connection fixed
20.0	10	4.6	11.87	11.87	-	9	No	
25.0	10	4.6	11.84	11.89	-	4	No	
[illegible].0	10	4.6	11.83	11.82	-	3	No	
[illegible]5.0	10	4.6	11.93	-	-	12	No	
40.0	10	4.6	11.84	11.88	-	7	No	Accels. 11, 12, 13, 14, 15, 19 showed increased response
45.0	20	4.6	11.82	11.86	-	5	No	
50.0	9 2nd Try	4.6	8.7	9.1	-	14	No	Rotors checked for setting * - changed stroke time - First time - going from closed to open - actuator did not complete stroke - All accels put on 30 g range before run
	11 1st Try		11.81	4.34		11	No	
55.0	20	4.6	-	8.6	-	4	No	
[illegible]0	20	4.6	8.9	8.6	-	2	No	
[illegible]0.0	10	4.6	-	8.8	-	3	No	

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SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.3.2 "X" Axis (Vertical) SMB-000-5 12/10/1 A.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
85.0	10	4.6	8.7	-	-	3	No	
100.0	10	4.6	-	8.9	-	3	No	

* Note: Operator did not complete stroke. Improper contact in limit switch was thought to be the cause at first. Limit switch was slightly adjusted, resulting in shorter stroke time. Operator again did not complete stroke. A short circuit in the control circuit was the cause.

SINE BEAT

National Technical Systems - Los Angeles

3.3.2 "Y" Axis (Horizontal) SMB-000-5 12/10/1 A.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	10	4.6	-	8.75	-	6+1	No	2150
12.6	10	4.6	8.65	-	-	6	No	2154
15.9	10	4.6	-	8.84	-	9	No	2159
20.0	10	4.6	Timing not obtained >6.1	-	-	6	No	2205 See Note (1)
25.0	10	4.6	-	8.78	-	2	No	2209
[illegible].0	10	4.6	8.7	-	-	2	No	2210
35.0	10	4.6	-	8.75	-	3	No	2213
40.0	10	4.6	8.6	-	-	0	No	2215
45.0	20	4.6	-	8.9	-	2	No	2218
50.0	20	4.6	8.8	-	-	6	No	2220
55.0	20	4.6	-	8.75	-	4	No	2222
60.0	20	4.6	8.67	-	-	7	No	2236
70.0	10	4.6	-	8.65	-	2	No	2238
85.0	10	4.6	8.69	-	-	2	No	2239
100.0	10	4.6	-	8.75	-	5	Yes	2241 (1)
100.0	10	4.6	-	-	-	3	Yes	Rerun for (2) contact chatter monitor 2245

(1) Chatter - > 2 msec
(2) No chatter above 3 msec

National Technical Systems

SINE BEAT

National Technical Systems - Los Angeles

3.3.2 "Z" Axis (Horizontal)　　SMB-000-5　　12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	10	4.6	8.69	-	-	11	No	1315
12.6	10	4.6	-	8.82	-	8	No	1318
15.9	10	4.6	8.69	-	-	5	No	1321
20.0	10	4.6	-	8.90	-	5	No	1324
25.0	10	4.6	8.75	-	-	5	No	1326
30.0	10	4.6	-	8.74	-	4	No	1328
[illegible].0	10	4.6	8.7	-	-	3	No	1329
40.0	10	4.6	-	8.82	-	4	No	1331
45.0	20	4.6	8.71	-	-	3	No	1333
50.0	20	4.6	-	8.86	-	2	No	1337
55.0	20	4.6	8.6	-	-	4	No	1339
60.0	20	4.6	-	8.82	-	3	No	1341
70.0	10	4.6	8.59	-	-	3	No	1343
85.0	10	4.6	-	8.8	-	3	No	1344
100.0	10	4.6	8.59	-	-	4	No	1346

SINE BEAT

National Technical Systems - Los Angeles

3.3.3 "X" Axis (Vertical) SMB-000-5 12/10/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	40	3.5	not timed	8.85	-	18	No	(1520 Hours) Stroke started at beat 8
12.6	40	3.5	8.7	8.85	-	14	No	1526 Hours
15.9	40	3.5	8.6	8.84	-	12	No	1532 Hours
20.0	40	3.5	8.6	8.8	-	~10	No	1540 Hours
25.0	40	3.5	8.6	8.8	-	11	No	1541 Hours
[illegible].0	40	3.5	8.55	8.8	-	7	No	1546
[illegible].0	40	3.5	8.6	8.8	-	8	No	1549
40.0	40	3.5	8.65	8.75	-	9	No	1552
45.0	40	3.5	8.6	8.85	-	11	No	1555
50.0	40	3.5	8.55	8.8	-	10	No	1614
55.0	40	3.5	8.65	8.8	-	6	No	1617 Taped engage lever to hand wheel
60.0	40	3.5	8.65	8.76	-	6	No	1621
70.0	5	3.5	8.62	-	-	4	No	1626
85.0	5	3.5	-	Not Stroked	-	0	No	1628
100.0	5	3.5	-	8.72	-	2	No	1629

SINE BEAT

National Technical Systems - Los Angeles

3.3.3 "Y" Axis (Horizontal) SMB-000-5 12/10/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	40	3.5	8.6	8.77	-	5	No	Start 2256 Stop 2259
12.6	40	3.5	8.94	8.82	-	4	No	Start 2300 Stop 2302
15.9	40	3.5	Lost time 8.6 Post Vib.	7.9	-	8+1	No	Start 2304 See Stop 2306 Note (1)
20.0	40	3.5	8.69	8.84	-	3	No	Stop 2312
[illegible].0	40	3.5	8.6	8.82	-	3	No	Start 2315 Stop 2316
30.0	40	3.5	8.62	8.84	-	3	No	Start 2318 Stop 2319
35.0	40	3.5	8.7	8.85	-	4	No	Start 2335 Stop 2336
40.0	40	3.5	8.64	8.83	-	8	No	Start 2348 Stop 2349
45.0	40	3.5	8.63	8.83	-	2	No	Start 2350 Stop 2351
50.0	40	3.5	8.61	8.76	-	2	No	Start 2352 Stop 2354
55.0	40	3.5	8.62	8.75	-	2	No	Start 2355 Stop 2356
60.0	40	3.5	8.60	8.82	-	3	No	Change o'graph paper Start 2400 Stop 2402
[illegible]	5	3.5	-	8.81	-	4	No	Stop 2405

SINE BEAT (Continued)

National Technical Systems - Los Angeles

3.3.3 "Y" Axis (Horizontal) SMB-000-5 12/10/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
85.0	5	3.5	8.64	-	-	3	No	Start 2407 Stop 2408
100.0	5	3.5	-	8.78 Pre Vib. not run during Vib.	-	-	Yes	Start 2410 Stop 2411 See Note (2)

Notes: (1) Chatter > 2 msec
(2) No chatter above 3 msec

SINE BEAT

National Technical Systems - Los Angeles

3.3.3 "Z" Axis (Horizontal) SMB-000-5 12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	40	3.5	8.61	8.95	-	5	No	1348 Accel #3. bad charge amp out-detected
12.6	40	3.5	8.57	8.9	-	4	No	Start 1426 Stop 1429 Acce #1 bad
15.9	40	3.5	8.57	8.79	-	4 1st try +3 2nd try	No	Start 1441 Stop 1443 See Note (1)
[illegible].0	40	3.5	8.66	8.91	-	3	No	1500
25.0	40	3.5	8.6	8.9	-	4	No	1504
30.0	40	3.5	8.61	8.78	-	3	No	1511
35.0	40	3.5	8.5	8.75	-	3	No	Start 1512 Stop 1513
40.0	40	3.5	8.5	8.82	-	4	No	Start 1514 Stop 1515
45.0	40	3.5	8.59	8.84	-	4	No	Start 1516 Stop 1517
50.0	40	3.5	8.57	8.82	-	3	No	Start 1523 Stop 1524
55.0	40	3.5	8.56	8.75	-	4	No	Start 1525 Stop 1526
60.0	40	3.5	8.59	8.8	-	5	No	Start 1527 Stop 1528
[illegible]0	5	3.5	-	8.8	-	3	No	1530
[illegible]0	5	3.5	8.55	-	-	4	No	1531
100.0	5	3.5	-	8.86	-	3	No	1543

SINE BEAT

National Technical Systems - Los Angeles

3.3.4 "X" Axis (Vertical) SMB-000-5 12/10/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec.		Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
			Closed-Open	Open-Closed				
10.0	103	2.0	8.62	8.85	-	2	No	Start 1639 Stop 1644
12.6	102	2.0	8.6	8.8	-	3	No	Start 1646 Stop 1651
15.9	101	2.0	8.7	8.9	-	4	No	Start 1655 Stop 1659 Put use on slower paper speed
[illegible].0	100	2.0	8.6	8.9	-	5	No	Start 1702 Stop 1706
25.0	101	2.0	8.7	8.85	-	4	No	Start 1709 Stop 1712
30.0	101	2.0	8.75	8.8	-	4	No	Start 1714 Stop 1718
35.0	101	2.0	8.55	8.9	-	4	No	Start 1719 Stop 1722
40.0	104	2.0	8.6	8.8	-	1	No	Start 1724 Stop 1727
45.0	101	2.0	8.65	8.85	-	4	No	Start 1729 Stop 1731
50.0	101	2.0	8.7	8.9	-	4	No	Start 1732 Stop 1735
55.0	102	2.0	8.8	8.9	-	3	No	Start 1742 Stop 1744
60.0	100	2.0	8.75	8.85	-	5	No	Start 1745 Stop 1747 (Change tapes)

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.3.4 "X" Axis (Vertical) SMB-000-5 12/10/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec.		Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
			Closed-Open	Open-Closed				
70.0	21	2.0	8.7	-	-	4	No	Start 1816 Stop 1817
85.0	23	2.0	-	8.85	-	2	No	Start 1818 Stop 1819
100.0	22	2.0	8.77	-	-	3	No	Start 1820 Stop 1821

SINE BEAT

National Technical Systems - Los Angeles

3.3.4 "Y" Axis (Horizontal) SMB-000-5 12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	100	2.0	8.72	8.81	-	5	No	Start 1007 Stop 1012
12.6	100	2.0	8.64	8.69	-	(Post) 5+2	No	Start 1056 Stop 1100
15.9	100	2.0	8.8	8.77	-	5	No	Start 1103 Stop 1107
20.0	103	2.0	8.69	8.73	-	2	No	Start 1109 Stop 1113
[illegible].0	102	2.0	8.85	Not Stroked During Test	-	3	No	Stroked post test closed-no time
30.0	102	2.0	8.80	8.77	-	3	No	Start - Stop 1123
35.0	100	2.0	8.47	8.63	-	5	No	Start 1125 Stop 1128
40.0	101	2.0	8.68	8.64	-	4	No	Start 1129 Stop 1132
45.0	101	2.0	8.34	8.67	-	4	No	Start 1138 Stop 1142
50.0	100	2.0	8.68	8.64	-	5	No	Start 1143 Stop 1145
55.0	101	2.0	8.6	8.88	-	4	No	Start 1146 Stop 1149
60.0	100	2.0	8.59	8.86	-	5	No	Start 1150 Stop

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.3.4 "Y" Axis (Horizontal) SMB-000-5 12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
70.0	20	2.0	8.62	-	-	3	No	Start 1154 Stop 1154:30
85.0	20	2.0	-	8.78	-	2	No	Start 1156 Stop 1156:30
100.0	20	2.0	-	-	-	3	No	Start 1157 Stop 1158 See Note (1)

Note: (1) Chatter > 2 msec
No chatter above 3 msec

SINE BEAT

National Technical Systems - Los Angeles

3.3.4 "Z" Axis (Horizontal)   SMB-000-5   12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
10.0	102	2.0	8.86	8.94	-	3	No	Start 1559 Stop 1604 Set amps at 10 g range were 30 g range
12.6	102	2.0	8.69	8.85	-	3	No	Start 1606 Stop 1612
15.9	101	2.0	8.74	8.78	-	4	No	Start 1634 Stop 1638
[illegible].0	103	2.0	8.66	8.84	-	2	No	Start 1640 Stop 1645
25.0	103	2.0	8.59	8.75	-	2	No	Start 1656 Stop 1659
30.0	102	2.0	8.62	8.75	-	3	No	Start 1700 Stop 1703
35.0	103	2.0	8.56	8.76	-	2	No	Start 1704 Stop 1706
40.0	102	2.0	8.53	8.83	-	3	No	Start 1707 Stop 1710
45.0	103	2.0	8.57	8.83	-	2	No	Start 1711 Stop 1713
50.0	104	2.0	8.57	8.54	-	1	No	Start 1714 Stop 1716
55.0	103	2.0	8.54	8.73	-	2	No	Start 1716:30 Stop 1718
[illegible]0	103	2.0	8.85	8.75	-	2	No	Start 1719 Stop 1720

National Technical Systems

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.3.4 "Z" Axis (Horizontal) SMB-000-5 12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
70.0	20	2.0	8.64	-	-	3	No	1721
85.0	20	2.0	-	8.75	-	2	No	1722
100.0	20	2.0	8.56	-	-	2	No	1724

National Technical Systems

APPENDIX G

Fragility Test Data Sheets

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "X" Axis (Vertical) SMB-0-25 Fragility Test 8 g 12/15/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	8.0	5.3	-	-	-	No	*1400 (*Table limits)
6.3	6	8.0	-	5.4	-	-	No	
7.9	6	8.0	5.4	-	-	-	No	
10.0	20	8.0	5.4	5.4	-	-	No	
12.6	20	8.0	5.2	5.4	-	-	No	

National Technical Systems - Los Angeles

12/13/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
15.9	20	8.0	5.33	5.31	-	5	No	1700
20.0	20	8.0	5.35	5.35	-	5	No	1657
25.0	20	8.0	5.25	5.39	-	4	No	1655
30.0	20	8.0	5.4	5.39	-	5	No	1651
35.0	20(6) (14)	8.0	5.36	5.34	-	5+3	No	1648
40.0	20	8.0	5.19	5.34	-	6	No	1620
45.0	15	8.0	5.19	-	-	5	No	1623
50.0	15	8.0	-	5.32	-	4	No	1625
55.0	15	8.0	5.29	-	-	3	No	1627
60.0	15	8.0	-	5.35	-	4	No	1629
70.0	15	8.0	5.39	-	-	3	No	1631
[illegible]0	15	8.0	-	5.40	-	2	No	1633
[illegible]0.0	15	8.0	5.28	-	-	3	No	1635
		Post Test	5.18	5.37				

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Y" Axis (Horizontal) SMB-0-25 Fragility Test 8 g 12/15/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	8.0+	-	5.3	-	6+	No	*1300 (*Table limits)
6.3	6	8.0+	5.3	-	-	6+	No	
7.9	6	8.0+	-	5.4	-	-	No	
10.0	20	8.0	5.2	5.3	-	-	No	
12.6	20	8.0	5.2	5.3	-	-	No	
			Post Test 5.28	5.38				

National Technical Systems - Los Angeles

12/15/81 A.M.
12/14/81 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
15.9	20	8.0	5.36	5.33	-	2	No	1317
20.0	20	8.0	5.22	5.26	-	2	No	1315
25.0	20	8.0	5.23	5.33	-	3	No	1313
30.0	20	8.0	5.21	5.47	-	3	No	1311
35.0	20	8.0	5.20	5.49	-	3	No	1309
40.0	20	8.0	5.23	5.32	-	2	No	1329
45.0	15	8.0	-	5.33	-	2	No	1332
50.0	15	8.0	5.21	-	-	3	No	1333
55.0	15	8.0	-	5.36	-	3	No	1334
60.0	15	8.0	5.22	-	-	4	No	1335
0	15	8.0	-	5.30	-	3	No	1336

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "Y" Axis (Horizontal) SMB-0-25 Fragility Test 8 g 12/15/81 A.M. 12/14/81 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
85.0	15	8.0	5.28	-	-	2	No	1338
100.0	15	8.0	-	5.30	-	2	No	1339
			Pre Test					
			5.27	5.39				
	Los Angeles		5.20	5.28				
			Post Test					
			5.21	5.30				

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Z" Axis (Horizontal) SMB-0-25 Fragility Test 8 g 12/15/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	8.0	5.2	-	-	-	No	1620
6.3	6	8.0	-	5.3	-	-	No	
7.9	6	8.0	5.3	-	-	-	No	
10.0	20	8.0	5.3	5.3	-	-	No	
12.6	20	8.0	5.4	5.4	-	-	No	

National Technical Systems - Los Angeles 12/14/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
15.9	20	8.0	5.35	5.42	-	4	No	1044
20.0	20	8.0	5.35	5.41	-	4	No	1042
25.0	20	8.0	5.28	5.31	-	7	No	1040
30.0	20	8.0	5.26	5.38	-	7	No	1038
35.0	20	8.0	5.22	5.40	-	9	No	1035
40.0	20	8.0	5.32	5.28	-	4	No	1104
45.0	15	8.0	5.22	-	-	5	No	1106
50.0	15	8.0	-	5.36	-	5	No	1107
55.0	15	8.0	5.18	-	-	4	No	1109
60.0	15	8.0	-	5.31	-	3	No	1110
70.0	15	8.0	5.22	-	-	2	No	1112

National Technical Systems

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "Z" Axis (Horizontal) SMB-0-25 Fragility Test 8 g 12/15/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
85.0	15	8.0	-	5.34	-	2	No	1113
100.0	15	8.0	5.20	-	-	2	No	1115
	Los Angeles		Pre Test 5.26	5.34				
			Post Test 5.18	5.32				

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "X" Axis (Vertical) SMB-0-25 Fragility Test 10 g 12/15/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	-	-	-	-	-	-	-	
6.3	6	8+	-	5.5	-	-	No	Table limit
7.9	6	8+	5.2	-	-	-	No	Table Limit
10.0	13	10+	5.2	5.4	-	-	No	
12.6	17	10+	5.2	5.6	-	-	No	
15.9	18	10+	5.3	5.3	-	-	No	

NTS National Technical Systems

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "X" Axis (Vertical) SMB-0-25 Fragility Test 12 g 12/15/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	-	-	-	-	-	-	-	
6.3	-	-	-	-	-	-	-	
7.9	-	-	-	-	-	-	-	
10.0	9	11+	-	5.3	-	-	No	
12.6	6	11+	-	-	-	-	No	
15.9	8	11+	5.3	-	-	-	No	
		Post Test	5.2	5.28				Completed 1800

National Technical Systems - Los Angeles

12/21/81 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20	12	5.19	5.27	-	3	No	1616
25.0	20	12	5.28	5.37	-	5	No	1620
30.0	20	12	5.18	5.36	-	4	No	1623
35.0	20	12	5.20	5.32	-	4	No	1626
40.0	20	12	5.30	5.44	-	5	No	1658
45.0	15	12	5.23	-	-	3	No	1700
50.0	15	12	-	5.44	-	3	No	1702
55.0	15	12	5.22	-	-	4	No	1703
60.0	15	12	-	5.33	-	3	No	1705
70.0	15	12	5.28	-	-	4	No	1706
85.0	15	12	-	5.32	-	3	No	1707
.0	15	12	5.19	-	-	4	No	1709
		Pre Test	5.26	5.33				
		Post Test	5.22	5.30				

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Y" Axis (Horiztontal) SMB-0-25 Fragility Test 10 g 12/15/1 A.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	-	-	-	-	-	-	-	
6.3	6	8+	5.3	-	-	-	No	Table Limits
7.9	6	8+	-	5.3	-	-	No	Table Limits
10.0	10	10+	5.3	5.3	-	-	No	
12.6	8	10+	5.4	5.3	-	-	No	
15.9	10	10+	5.2	5.3	-	-	No	
		Post Test	5.18	5.32				Test Completed 1938

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Y" Axis (Horizontal) SMB-0-25 Fragility Test 12 g 12/15/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	-	-	-	-	-	-	-	
6.3	-	-	-	-	-	-	-	
7.9	-	-	-	-	-	-	-	
10.0	10	11+	-	-	-	-	No	Test run in conjunction with 10 g test - these are table limits
12.6	12	11+	-	-	-	-	No	
15.9	10	11+	-	-	-	-	No	
National Technical Systems - Los Angeles								12/21/81 P.M.
20.0	20	12	5.25	5.30	-	4	No	1447
25.0	20	12	5.25	5.43	-	4	No	1449
30.0	20	12	5.25	5.45	-	3	No	1451
35.0	20	12	5.22	5.32	-	3	No	1453
40.0	20	12	5.20	5.28	-	4	No	1422
45.0	15	12	-	5.32	-	3	No	1426
50.0	15	12	5.15	-	-	5	No	1427
55.0	15	12	-	5.35	-	3	Yes	1428 Note (1)
60.0	15	12	5.28	-	-	5	Yes	1430 Note (1)
70.0	15	12	-	5.31	-	5	Yes	1432 Note (2)

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "Y" Axis (Horizontal) SMB-0-25 Fragility Test 12 g 12/15/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
85.0	15+6	12	5.26	-	-	5	Yes	1433 Note (2)
100.0	15+6	.12	-	5.33	-	5	Yes	1435 Note (1)
		Pre Test	5.16	5.35				
		Post Test	5.22	5.30				

Notes: (1) Chatter > 2 msec; under 4 msec
(2) Chatter > 2 msec; under 2.5 msec

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Z" Axis (Horizontal) SMB-0-25 Fragility Test 10 g 12/15/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	9	5.2	-	-	-	No	Table Limits
6.3	6	9	-	5.4	-	-	No	
7.9	6	9	5.5	-	-	-	No	
10.0	12	10+	5.2	5.4	-	-	No	
12.6	12	10+	5.2	5.3	-	-	No	
15.9	14	10+	5.1	5.3	-	-	No	
		Post Test	-	-				

National Technical Systems - Los Angeles 12/21/1

Freq. (Hz)	No. of Beats	Level (g)	Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20				-			
25.0	20				-			
30.0	20				-			
35.0	20				-			
40.0	20				-			
45.0	15				-			
50.0	15				-			
55.0	15				-			
60.0	15				-			
70.0	15				-			
[illegible]0	15				-			
100.0	15				-			
		Post Test						

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Z" Axis (Horizontal) SMB-0-25 Fragility Test 12 g 12/15/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	-	-	-	-	-	-	-	
6.3	-	-	-	-	-	-	-	
7.9	-	-	-	-	-	-	-	
10.0	8	11+	-	-	-	-	No	Run in conjunction with 10 g test. These are table limits.
12.6	8	11+	-	-	-	-	No	
15.9	6	11+	-	-	-	-	No	
		Post Test	-	-				
			National Technical Systems - Los Angeles					12/21/1 A.M.
20.0	20	12	5.25	5.39	-	2 + 6	No	1119
25.0	20	12	5.30	5.36	-	20 + 5	No	1143
30.0	20	12	5.29	5.39	-	3	No	1224
35.0	20	12	5.27	5.36	-	4	No	1306
40.0	20	12	5.23	5.39	-	4	No	1319
45.0	15	12	5.25	-	-	5	No	1326
50.0	15	12	-	5.42	-	4	No	1327
55.0	15	12	5.22	-	-	3	No	1328
60.0	15	12	-	5.34	-	3	No	1329
70.0	15	12	5.37	-	-	4	No	1330
85.0	15	12	-	5.39	-	4	No	1337
0	15	12	5.24	-	-	4	No	1339
		Pre Test	5.25	5.25				
		Post Test	-	-				

SINE BEAT

National Technical Systems - Los Angeles

3.4.1 "X" Axis (Vertical) SMB-0-25 Fragility Test 14 g 12/21/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20	14	5.25	5.34	-	4	No	1757
25.0	20	14	5.23	5.32	-	4	No	1753
30.0	20	14	5.25	5.34	-	4	No	1750
35.0	20	14	5.28	5.39	-	4	No	1747
40.0	20	14	5.25	5.31	-	6	No	1720
45.0	15	14	-	5.31	-	4	No	1724
[illegible].0	15	14	5.17	-	-	4	No	1726
[illegible]5.0	15	14	-	5.26	-	4	No	1728
60.0	15	14	5.26	-	-	4	No	1730
70.0	15	14	-	5.31	-	3	No	1733
85.0	15	14	5.17	-	-	4	No	1734
100.0	15	14	-	5.43	-	3	No	1735
	Post Test							

SINE BEAT

National Technical Systems - Los Angeles

Fragility Test
55 to 100 Hz

3.4.1 "Y" Axis (Horizontal) SMB-0-25 No Chatter Level Test *

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
55.0	24	8 to 12	5.29			4	No chatter @ 11.0 g	
60.0	27	8 to 12	5.28			6	No chatter @ 11.0 g	
70.0	14	8 to 12	5.28			4	No chatter @ 11.0 g	
[illegible].0	18	8 to 12	5.23			3	No chatter @ 11.0 g	
[illegible]0.0	31	8 to 12	5.31			3	No chatter @ 11.0 g	

* Chatter exceeding 2 milliseconds was detected during the 12 g's Fragility Test. This test was performed to establish input level at which there is no chatter in excess of 2 milliseconds.

NTS National Technical Systems

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SINE BEAT

National Technical Systems - Los Angeles

3.4.1 "Y" Axis (Horizontal) SMB-0-25 Fragility Test 14 g

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	9** 20	14	5.34	5.45	-	4	No	
25.0	20	14	5.32	5.42	-	3	No*	
30.0	20	14	5.25	5.41	-	4 + 3	No	
35.0	20	14	5.32	5.48	-	3	Yes	
40.0	20	14	5.38	5.42	-	7	Yes	No chatter @ 5.0 msec
45.0	15	14	5.30	-	-	4	Yes	
[illegible].0	15	14	-	5.34	-	3	No	
55.0	15 + 12	14	5.32	5.40	-	-	Yes (N.O.)	No chatter @ 5.0 msec
60.0	15 + 6	14	-	5.41	-	-	Yes (N.O.)	
70.0	15 + 6	14	-	5.40	-	-	Yes (N.O.)	No chatter @ 2.5 msec
85.0	15 + 6	14	-	5.34	-	-	Yes (N.O.)	
100.0	15 + 7	14	-	5.41	-	-	Yes (N.C.)	No chatter @ 4.0 msec

* Normally open circuit indicated a short circuit on the chatter monitor. A check with an ohmmeter indicated that there was no short in limit switch. Chatter monitor had developed a fault internally. New channel was used.

** Test stopped due to shaker table support imbalance.

Pre Test	5.28	5.32	9:40 A.M. 12/22/81
Post Test	5.22	5.34	12:22 P.M. 12/22/81

SINE BEAT

National Technical Systems - Los Angeles

3.4.1 "Z" Axis (Horizontal) SMB-0-25 Fragility Test 14 g 1:50 P.M. 12/22/81

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20	14	5.18	5.31	-	3	No	14.28
25.0	20	14	5.20	5.32	-	4		14.26
30.0	20	14	5.19	5.46	-	3		14.18
35.0	20	14	5.26	5.35	-	3		14.16
40.0	20	14	5.25	5.42	-	5		13.59
45.0	15	14	-	5.28	-	2		14.02
[illegible]0	15	14	5.18	-	-	2		14.03
[illegible].0	15	14	-	5.31	-	3		14.04
60.0	15	14	5.20	-	-	2		14.06
70.0	15	14	-	5.36	-	4		14.07
85.0	15	14	5.20	-	-	3		14.09
100.0	15	14	-	5.30	-	3		14.11
		Pre Test	5.43	5.43	13:50			
		Post Test	5.30	5.32	14:30			

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "X" Axis (Vertical) SMB-000-5 Fragility Test 8 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	8	8.7	-	-	-	No	
6.3	6	8	-	8.9	-	-	No	Post Test Open 8.7 Close 8.8
7.9	6	8	8.7	-	-	-	No	
10.0	14	8	8.7	8.9	-	-	No	
12.6	7	8	8.7	8.8	-	-	No	
15.9	6+	8	8.7	8.8	-	-	No	
[illegible].0	20	8	8.6	8.9	-	-	No	
[illegible]5.0	20	8	8.7	8.8	-	-	No	
National Technical Systems - Los Angeles 12/18/1								
30.0	20*	8	8.69	8.72	-	3	No	
30.0	20	8	8.72	8.76	-	5	No	
35.0	20	8	8.59	8.81	-	4	No	
40.0	20	8	8.58	8.78	-	8	No	
45.0	15	8	-	8.77	-	4	No	
50.0	15	8	8.72	-	-	2	No	1458
55.0	15	8	-	8.78	-	3	No	1502
60.0	15	8	8.71	-	-	2	No	1504
70.0	15	8	-	8.75	-	1	No	1507
[illegible].0	15	8	8.69	-	-	1	No	1508
[illegible]00.0	15	8	-	8.74	-	4	No	1509

* Test repeated - below 8 g level

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Y" Axis (Horizontal) SMB-000-5 Fragility Test 8 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	9+	-	8.9	-	-	No	
6.3	6	9+	8.7	-	-	-	No	
7.9	5 3	8+ 9+	-	8.9	-	-	No	
10.0	11 9	8+ 9+	8.6	8.9	-	-	No	
12.6	6+	9+	8.7	8.9	-	-	No	
15.9	6 11	8+ 9+	8.7	8.9	-	-	No	

National Technical Systems - Los Angeles 12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
15.9	20	8	Stopped mid-stroke	8.8	-	6	No	2204
20.0	20	8 (No Vib.)	- 8.55	4.5 8.8	-	4	No	2201 Note (4
25.0	20	8 (No Vib.)	6.0 8.6	5.4 8.8	-	6	No	2108
30.0	20	8	7.67	7.39	-	6	No	2106
35.0	20	8	9.2	8.85	-	3	No	2103
40.0	20	8	8.62	-	-	7	No	2038
45.0	15	8	-	8.82	-	4	No	2040
50.0	15	8	8.56	-	-	5	No	2042
[illegible]0	15	8	-	8.76	-	4	No	2044
[illegible].0	15	8	8.7	-	-	4	No	2046

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "Y" Axis (Horizontal) SMB-000-5 Fragility Test 8 g 12/11/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
70.0	15 +7 See Note (1)	8	-	8.88	-	6	Yes	2047 Note (1)
85.0	15	8	-	-	-	3	Yes	2050 Note (2)
100.0	15	8	-	8.8	-	4	Yes	2054 Note (3)

Notes: (1)(2)(3) Chatter exceeding 2 msec., No chatter above 4 msec.
(4) Operator failed to complete stroke @ 25, 20 and 15.9 Hz.
Test stopped to investigate and correct the problem.

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Y" Axis (Horizontal) SMB-000-5 Fragility Test 8 g 12/16/1
Repeat of Problem Frequencies

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
15.9	20	8	8.7	8.9	-	-	No	
20.0	20	8	8.6	8.9	-	-	No	
25.0	20	8	8.7	8.9	-	-	No	

* After proper gapping of the torque switch contacts by Limitorque representative, 8 g level tests @ the above frequencies were repeated. There was no gap between the stationary "L" bracket and the contact finger. This may have resulted in inadequate contact pressure and excessive contact chatter.

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Z" Axis (Horizontal) SMB-000-5 Fragility Test 8 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	4	9+	-	8.8	-	-	No	
6.3	6	9+	8.7	-	-	-	No	(Post Test
7.9	5	9+	-	8.8	-	-	No	Open 8.7 Closed 8.8)
10.0	6+	9+	8.6	8.8	-	-	No	
12.6	6+	9+	8.6	8.8	-	-	No	
15.9	6+	9+	8.7	8.8	-	-	No	

National Technical Systems - Los Angeles

12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
15.9	20	8	8.72	8.87	-	6	No	1834 1836
20.0	20	8	8.73	8.85	-	8	No	1831 1833
25.0	20	8	8.57	8.81	-	7	No	1828 1830
30.0	20	8	8.67	8.81	-	4	No	1825 1827
35.0	20	8	8.56	8.74	-	3	No	1820↑ ↓1822
40.0	20	8	8.7	8.75	-	3	No	1852 1854
45.0	15	8	8.51	8.75	-	4	No	1856 1857
[illegible]0	15	8	8.5	8.8	-	4	No	1858 1859

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "Z" Axis (Horizontal) SMB-000-5 Fragility Test 8 g 12/11/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
55.0	15	8	-	8.6	-	5	No	2004 2005 See Note (2)
60.0	15 (8) (7)	8	8.9	-	-	5 + 4	No	2007 2009 See Note (3)
70.0	15	8	-	8.75	-	2	No	2010
85.0	15	8	8.55	-	-	3	No	2011
100.0	15	8	-	8.74	-	3	No	2014
Los Angeles Post Test			8.65	8.78				

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "X" Axis (Vertical) SMB-000-5 Fragility Test 10 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	-	-	-	-	-	-	Table limits reached in 8 g test for freq. below 10 Hz
6.3	6	-	-	-	-	-	-	
7.9	6	-	-	-	-	-	-	
10.0	6 6	10+ 9	-	8.8	-	-	No	Table limits
12.6	6 6	10 9	-	-	-	-	No	Table limits
[illegible].9	7 5	10+ 9	-	-	-	-	No	Table limits
National Technical Systems - Los Angeles 12/18/1 P.M.								
20.0	20	10	8.75	8.82	-	8	No	1546
25.0	20	10	8.66	8.77	-	5	No	1550
30.0	20	10	8.63	8.77	-	2	No	1553
35.0	20	10	8.63	8.81	-	3	No	1554
40.0	20	10	8.63	8.79	-	7	No	1514
45.0	15	10	8.66	-	-	5	No	1519
50.0	15	10	-	8.70	-	5	No	1520
55.0	15	10	8.69	-	-	1	No	1522
60.0	15	10	-	8.83	-	2	Yes	Open Operator contacts - 2.5 ms setting - OK

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "X" Axis (Vertical) SMB-000-5 Fragility Test 10 g 12/18/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
70.0	15	10	8.65	-	-	2	No	Open Operator contacts - 2.5 ms setting - OK
85.0	15	10	-	8.80	-	3	No	Reset to 2 ms on open contacts
100.0	15	10	8.66	-	-	3	No	Reset to 2 ms on open contacts

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Y" Axis (Horizontal) SMB-000-5 Fragility Test 10 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	-	-	-	-	-	-	Table limits reached in previous test
6.3	6	-	-	-	-	-	-	
7.9	5	10	8.7	-	-	-	No	
10.0	3 2	10 11	-	8.8	-	-	No	
12.6	6+	10+	-	-	-	-	No	Only 1 test run - results noted by g level
15.9	5 2	10+ 11	8.7	-	-	-	No	

National Technical Systems - Los Angeles 12/18/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20	10	8.65	8.81	-	6	No	1712
25.0	20	10	8.58	8.78	-	4	No	1715
30.0	20	10	8.66	8.83	-	2	No	1717
35.0	20	10	8.71	8.85	-	2	No	1719
40.0	20	10	-	8.81	-	3	No	1722
45.0	15 + 4	10	8.69	-	-	4	No	1734
50.0	15	10	-	8.84	-	3	No	1736
55.0	15	10	8.70	-	-	4	No	1737
[illegible].0	15	10	-	8.94	-	4	Yes	1739

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "Y" Axis (Horizontal) SMB-000-5 Fragility Test 10 g 12/18/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
70.0	15	10	8.63	-	-	3	Yes	1740 See Note (1)
85.0	15 + 9	10	-	8.95	-	3	Yes	1743 See Note (1)
100.0	26	10	8.76	-	-	2	Yes	1746 See Note (1)
	Los Angeles		Pre Test 8.62	8.77				
			Post Test 8.66	8.83				

Note: (1) Chatter > 2 msec, < 5 msec.

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Z" Axis (Horizontal) SMB-000-5 Fragility Test 10 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	2	10	-	-	-	-	No	One Test series run results noted by g level
6.3	6	10+	-	-	-	-	No	
7.9	1	10	-	-	-	-	No	
10.0	6+	10+	-	-	-	-	No	
12.6	8+	10+	-	-	-	-	No	
15.9	6+	10+	-	-	-	-	No	

National Technical Systems - Los Angeles 12/18/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20	10	8.71	8.84	-	8	No	1954
25.0	20	10	8.62	8.83	-	4	No	2003
30.0	20	10	8.62	8.83	-	3	No	2006
35.0	20	10	8.67	8.84	-	4	No	2013
40.0	20	10	8.56	8.81	-	4	No	1852
45.0	15	10	-	8.83	-	4	No	1854
50.0	15	10	8.67	-	-	5	No	1856
55.0	15	10	-	8.86	-	5	No	1858
60.0	15	10	8.87	-	-	4	No	1900
70.0	15	10	-	8.81	-	6	No	1938
85.0	15	10	8.68	-	-	4	No	1940
[illegible].0	15 +16	10	-	8.81	-	3	Yes <5 msec.	1942
	Los Angeles		Pre Test 8.69 Post Test	8.83				

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "X" Axis (Vertical) SMB-000-5 Fragility Test 12 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	-	-	-	-	-	-	Table limits reached in previous test except as noted
6.3	6	-	-	-	-	-	-	
7.9	6	-	-	-	-	-	-	
10.0	1	13	-	-	-	-	No	
12.6	6	-	-	-	-	-	-	
15.9	6	-	-	-	-	-	-	
National Technical Systems - Los Angeles								12/19/1 P.M.
20.0	20	12	8.63	8.88	-	4	No	1355
25.0	20	12	8.60	8.84	-	4	No	1352
30.0	20	12	8.74	8.85	-	5	No	1350
35.0	20	12	8.62	8.79	-	4	No	1340
40.0	20	12	8.60	8.76	-	3	No	1404
45.0	15	12	8.60	-	-	2	No	1405
50.0	15	12	-	8.85	-	2	No	1406
55.0	15	12	8.60	-	-	2	Yes	1408 Note (1)
60.0	15	12	-	8.85	-	2	Yes	1410
70.0	15	12	8.70	-	-	2	No	1411
0	15	12	-	-	-	4	No	1413

National Technical Systems

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "X" Axis (Vertical) SMB-000-5 Fragility Test 12 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
Repeat 85.0	15	12	8.68	8.87	-	5	No	
100.0	15 + 3	12	-	8.89	-	3	-	
			Pre 8.60	Test 8.86				

Note: (1) Chatter > 2 msec, < 5 msec.

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Y" Axis (Horizontal) SMB-000-5 Fragility Test 12 g 12/16/1 .

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	-	-	-	-	-	-	One test run - results noted by "g" level
6.3	6	-	-	-	-	-	-	
7.9	6	-	-	-	-	-	-	
10.0	3	12	-	-	-	-	No	
12.6	6	-	-	-	-	-	No	
15.9	3	12+	-	-	-	-	No	
National Technical Systems - Los Angeles								12/19/1 A.M.
20.0	20	12	8.66	8.85	-	4	No	1136
25.0	20	12	8.64	8.87	-	4	No	1135
30.0	20	12	8.65	8.82	-	4	No	1133
35.0	20	12	8.62	8.86	-	6	No	1130
40.0	20	12	8.63	8.75	-	3	No	1049
45.0	15	12	-	8.89	-	3	No	1051
50.0	15 + 7	12	8.63	-	-	3	Yes	1055 Note (1)
55.0	15 + 3	12	-	8.85	-	1	No	1057
60.0	15	12	8.60	-	-	1	No	1059
70.0	15 + 5	12	-	8.84	-	1	Yes	1100 Note (1)

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "Y" Axis (Horizontal) SMB-000-5 Fragility Test 12 g 12/19/1 A.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
85.0	15 + 5	12	8.71	-	-	2	Yes	1103 Note (1)
100.0	15 + 14	12	-	8.88	-	2	Yes	1105 Note (1)
			Pre Test					
	Los Angeles		8.65	8.75				
			Post Test					
			8.60	8.83				

Note: (1) Chatter > 2 msec., < 5 msec.

SINE BEAT

National Technical Systems - Chatsworth

3.4.1 "Z" Axis (Horizontal) SMB-000-5 Fragility Test 12 g 12/16/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
5.0	6	-	-	-	-	-	-	One test run - results noted by "g" level
6.3	6	-	-	-	-	-	-	
7.9	6	-	-	-	-	-	-	
10.0	6	-	-	-	-	-	-	
12.6	6	-	-	-	-	-	-	
15.9	not noted	12	-	-	-	-	No	
National Technical Systems - Los Angeles								12/19/1 A.M.
20.0	20	12	8.64	8.85	-	5	No	2025
25.0	20	12	8.64	8.79	-	3	No	2029
30.0	20	12	8.65	8.79	-	3	No	2031
35.0	20	12	8.69	8.80	-	2	No	2033
40.0	20	12	8.63	8.85	-	4	No	2055
45.0	15	12	8.81	8.84	-	3	No	2057
50.0	15	12	8.65	-	-	3	No	2058
55.0	15	12	-	8.80	-	3	No	2101
60.0	15	12	8.71	-	-	3	No	2103
70:0	15	12	-	8.82	-	4	No	2104

SINE BEAT

National Technical Systems - Los Angeles (Continued)

3.4.1 "Z" Axis (Horizontal) SMB-000-5 Fragility Test 12 g 12/18/1

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
85.0	15	12	8.78	-	-	2	No	2105
100.0	15 +11	12	-	8.83	-	3	Yes	2107 Note (1)
	Los Angeles		Post Test 8.68	8.78				

Note: (1) Chatter > 2 msec., < 5 msec.

SINE BEAT

National Technical Systems - Chatsworth Extra

3.4.1 "X" Axis (Vertical) SMB-000-5 Fragility Test 14 g 12/19/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20	-	-	-	-	-	-	Note: Limit reached previous test
25.0	20	14	8.64	8.88	-	5	No	1512
30.0	10 10.	14	8.60	8.90	-	4 5	No	1510 1441
35.0	20	14	8.65	8.84	-	4	No	1438
[illegible].0	20	14	-	8.81	-	6	No	1432
[illegible].0	15	14	8.63	-	-	4	No	1430
50.0	15 + 3	14	-	8.85	-	3	Yes	1428 Note (1)
55.0	15	14	8.77	-	-	2	Yes	1427 Note (1)
60.0	15	14	-	8.85	-	2	Yes	1425 Note (1)
70.0	15	14	8.62	-	-	3	Yes	1423 Note (1)
85.0	15	14	-	8.95	-	4	No	1422
100.0	15	14	8.60	-	-	4	No	1420
			Pre Test 8.63	8.86				

Note: (1) > 2 msec., < 5 msec.

SINE BEAT

National Technical Systems - Los Angeles

3.4.1 "Y" Axis (Horizontal) SMB-000-5 Fragility Test 14 g 12/19/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20	-	-	-	-	-	-	Test not run
25.0	20 + 4	14	8.62	8.91	-	5	Yes	1616 Note (1)
30.0	20	14	8.66	8.80	-	4	No	1614
35.0	20	14	8.62	8.83	-	5	No	1611
40.0	20	14	8.66	8.86	-	3	No	1636
45.0	15	14	-	8.82	-	4	Yes	1638 Note (1)
[illegible].0	15	14	8.69	-	-	5	Yes	1639 Note (1)
[illegible]5.0	15	14	-	8.82	-	4	Yes	1642 Note (1)
60.0	15	14	8.67	-	-	3	No @ 4 msec.	1644
70.0	15	14	-	8.83	-	3	No @ 4 msec.	1645
85.0	15	14	8.73	-	-	1	Yes	1646 Note (1)
100.0	15	14	-	8.81	-	2	Yes	1648 Note (1)
			Pre Test					
			8.59	8.85				
			Post Test					
			8.63	8.87				

Note: (1) > 2 msec., < 5 msec.

SINE BEAT

National Technical Systems - Los Angeles

3.4.1 "Z" Axis (Horizontal) SMB-000-5 Fragility Test 14 g 12/19/1 P.M.

Freq. (Hz)	No. of Beats	Level (g)	Time - Sec. Closed-Open	Time - Sec. Open-Closed	Control Signal Filter - Hz	No. of Setup Beats	Chatter Indicated @.002 sec	Remarks
20.0	20	-	-	-	-	-	-	Test not run
25.0	20	14	8.75	8.81	-	3	No	1726
30.0	20	14	8.71	8.84	-	2	Yes	1724 Note (1)
35.0	20	14	8.85	8.89	-	4	No @ 4 msec.	1722
40.0	20	14	8.61	8.86	-	5	No	1703
45.0	15	14	8.70	-	-	4	No	1705
50.0	15	14	-	8.82	-	2	Yes	1707 Note (1)
55.0	15	14	8.71	-	-	4	Yes	1708 Note (1)
60.0	15	14	-	8.91	-	2	No @ 3 msec.	1710
70.0	15	14	8.69	-	-	5	No @ 3 msec.	1712
85.0	15	14	-	8.87	-	6	Yes	1714 Note (1)
100.0	15	14	8.69	-	-	4	Yes	1717 Note (1)
			Pre Test					
			8.71	8.81				
			Post Test					
			8.60	8.80				

Note: (1) > 2 msec., < 5 msec.

STONE & WEBSTER ENGINEERING CORPORATION
3 EXECUTIVE CAMPUS, P. O. BOX 5200
CHERRY HILL, N. J. 08034

DATE	June 10, 1982
J. O. NO.	12177
P. O. NO.	NMP2-P801H
LTR. NO.	T-47, 612
REF.	FILE P801H (enc)

VIA

TO

National Technical Systems Inc.
26525 Golden Valley Road
Saugus, California 91350

Attn: Ms. Terry Hampton

DEAR SIRS:

THE FOLLOWING ARE [X] ATTACHED: [ ] SENT SEPARATELY:

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PURCHASE ORDER NO. NMP2-P801H
DYNAMIC TESTING OF MOTOR OPERATORS
NINE MILE POINT NUCLEAR STATION-UNIT 2
NIAGARA MOHAWK POWER CORPORATION

548-9291	Test Report	Rev. 1	4/12/82

NOTE: SWEC is in receipt of Rev. 2.

Very truly yours,

ORIGINAL
SIGNED FOR

M. A. Durka
Lead Mechanics Engineer

PS:JM

Copies to: RWHammelmann (enc)
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STONE & WEBSTER ENGINEERING CORPORATION
REVIEW OF SUPPLIER'S TECHNICAL DOCUMENT

5040.51B

SUPPLIER	P.O.NO.	DOCUMENT TITLE	DOC.I.D. NO.	REV.	DATE
NATIONAL TECHNICAL SYSTEMS	P801H	TEST REPORT	548-9291	1	

DATE RECIEVED	SPEC.NO. / DATE	REV.	ADDEN.	SPEC. TITLE
☐ NEW SUBMITTAL ☑ RESUBMITTAL	P801H	—	2	DYNAMIC TESTING OF MOTOR OPERATORS

GOVERNING CODE(S) & DATE(S)	SPECIAL REQUIREMENTS	DWG REFERENCE(S) S&W / SUPPLIER
—	—	—

SPECIALIST	PROJECT	J.O.NO.	RESPONSIBLE ENG	LOCATION	EXT.	DATE.
A CHAN	NMP2	12177	P. STIPCEVICH	1B	3640	6/7/82

COMMENTS:

NATIONAL TECHNICAL SYSTEMS TEST REPORT #548-9291 REVISION 1, DATED APRIL 12 1982, HAS BEEN REVIEWED AND IS MARKED "APPROVED AS REVISED". THE FOLLOWING COMMENTS ARE TO BE INCORPORATED INTO THE REPORT

1) ADD NATURAL FREQUENCY TABLE
2) ADD CERTIFICATE OF COMPLIANCE
3) CORRECT TABLE 6.2.3 TO COMPLY WITH THE ATTACHED.
4) CORRECT CHATTER DURATION INDICATED IN APPENDICIES F&G TO READ 0.002 SECONDS
5) CORRECT PARAGRAPH 3.2, PAGE 2 FROM "TYPICAL TRS PLOTS ARE SHOWN IN FIGURES 1&2" TO "TYPICAL TRS PLOTS ARE SHOWN IN FIGURES 1,2 AND 3"

Stone & Webster Engineering Corporation
☐ APPROVED AS DEFINED IN THE SPECIFICATIONS
☐ UNACCEPTABLE
☑ APPROVED AS REVISED AS DEFINED IN THE SPEC.
☐ REVIEWED
J.O. No. 12177
SPEC. No. P801H
DATE 6/7/82
BY P STIPCEVICH

RESUBMITTAL REQUIRED ☑ YES ☐ NO

REVIEWER	DEPT./DIV.	DATE	LOCATION	EXTENSION
P. STIPCEVICH	EQ. / ENGINEERING MECHANICS	6/7/82	1B	3646

6.2. Operator SMB-000-5

Test Number	Direction of Loading	TRS Figure (Appendix E)	Test Duration (seconds)	Operating Voltage (% of Nominal)	Stroke time (sec.) Open to Close	Close to Open	Chatter >2 msecs.	Observation
1	X&Z	—	—	—	—	—	—	MOUNTING BOLTS BROKE SEE 6.2.3.1
2	X&Z	1&2	35	80	10	10	NO	REPEAT OF TEST 1
3	X&Z	3&4	35	100	10	10	NO	
4	X&Z	5&6	35	110	10	10	NO	
5	X&Z	7&8	35	80	10	10	NO	REPEAT OF TEST 2
6	X&Y	9&10	35	80	10	10	NO	ZPA LOWER THAN REQUIRED
7	X&Y	11&12	35	100	10	10	NO	
8	X&Y	13&14	35	110	10	10	NO	
9	X&Y	15&16	35	80	10	10	NO	REPEAT OF TEST 6 WITH HIGHER ZPA

NTS

Volume I of III

Report Number 548-9291, Revision 1
Dynamic Testing
of
Limitorque Operators
and
Modified Limit Switches

12 April 1982

Stone & Webster
Engineering Corporation

- [ ] APPROVED AS DEFINED IN THE SPECIFICATIONS
- [ ] UNACCEPTABLE
- [x] APPROVED AS REVISED AS DEFINED IN THE SPEC.
- [ ] REVIEWED

J.O. No. 12177
SPEC. No. P801H
DATE 6/7/82
BY P. STIPCEVICH

TESTED FOR:

STONE & WEBSTER ENGINEERING CORP.
3 Executive Campus
P.O. Box 5200
Cherry Hill, NJ 08034

TESTED BY:

NATIONAL TECHNICAL SYSTEMS
Testing Division
20988 West Golden Triangle Road
Canyon Country, CA 91350
(805) 259-8184

National Technical Systems

Report 548-9291, Rev. 1

REVISION SUMMARY

Revision	Date	Page(s) Affected	Paragraph(s) Affected
1	4/12/82	All	All

These revisions were reviewed and approved by:

Prepared By: Theresa Hampton
PUBLICATIONS, Theresa Hampton
Date: April 29, 1982

Approved By: David P. Bame
PROJECT MANAGER, David P. Bame
Date: 4-30-82

Approved By: Robert A. Ely
QUALITY ASSURANCE MANAGER, Robert A. Ely
Date: April 30, 1982

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

1.0 PURPOSE

The purpose of this report is to present the results of the tests performed on the following test articles in accordance with Stone and Webster Engineering Corporation's ESSOW Number NMP2-P801 H (Reference 2.2) and National Technical Systems Procedure Number 548-9291 (Reference 2.1). Tests were performed during the period of November 9, 1981 through December 22, 1981.

	Test Articles	Model Number or Designation
Group 1: A.	Limitorque motor operator	SMB-000-5 Serial Number 293417
*B.	Modified limit switch (outboard) with vibration resistant screws, RTV gasket and a bracket	3B
*C.	Modified limit switch (outboard) with vibration resistant screws	3C
Group 2: A.	Limitorque motor operator	SMB-0-25 Serial Number 301059
*B.	Modified limit switch (outboard) with vibration resistant screws, RTV gasket and a bracket	12B
*C	Modified limit switch (outboard) with vibration resistant screws	12C

* Modified limit switches are tested only as a replacement of the operator internal limit switches, should the latter fail prior to the completion of the test program. Since no failure of the internal limit switches was observed, the outboard limit switches were not substituted into the operators and, at customer's request, test details are not included herein. However, outboard limit switch accelerometer readings have been recorded on magnetic tape and are available.

2.0 REFERENCES

2.1 National Technical Systems Test Procedure Number 548-9291, Revision A, dated October 29, 1981.

2.2 Stone & Webster Engineering Corporation's Engineering Services Scope of Work for Dynamic Testing of Motor Operators, ESSOW Number NMP2-P801H and Addenda 1 and 2.

3.0 SUMMARY

3.1 VIBRATION AGING TEST

Limitorque motor operators, types SMB-000-5 and SMB-0-25, were subjected to 90 minutes of vibration aging in each axis in accordance with IEEE-392-1980 and maintained performance consistant with pretest baseline measurements.

No chatter exceeding two milliseconds was recorded on the limit switch contacts.

3.2 RANDOM MULTIFREQUENCY BIAXIAL TEST

Operators, types SMB-000-5 and SMB-0-25, were subjected to a minimum of 105 seconds of random biaxial multifrequency input motion with a frequency content of 1 Hz to 100 Hz. These tests were performed in accordance with the requirements of Reference 2.2, for the 105 seconds, in two test orientations at the levels listed below. Typical TRS plots are shown in Figures 1 and 2.

A. Operator SMB-000-5 - minimum ZPA of 6 g's

B. Operator SMB-0-25 - minimum ZPA of 12 g's

The performance of each operator was consistant with its pretest baseline values. No chatter exceeding two milliseconds was recorded on the limit switch contacts.

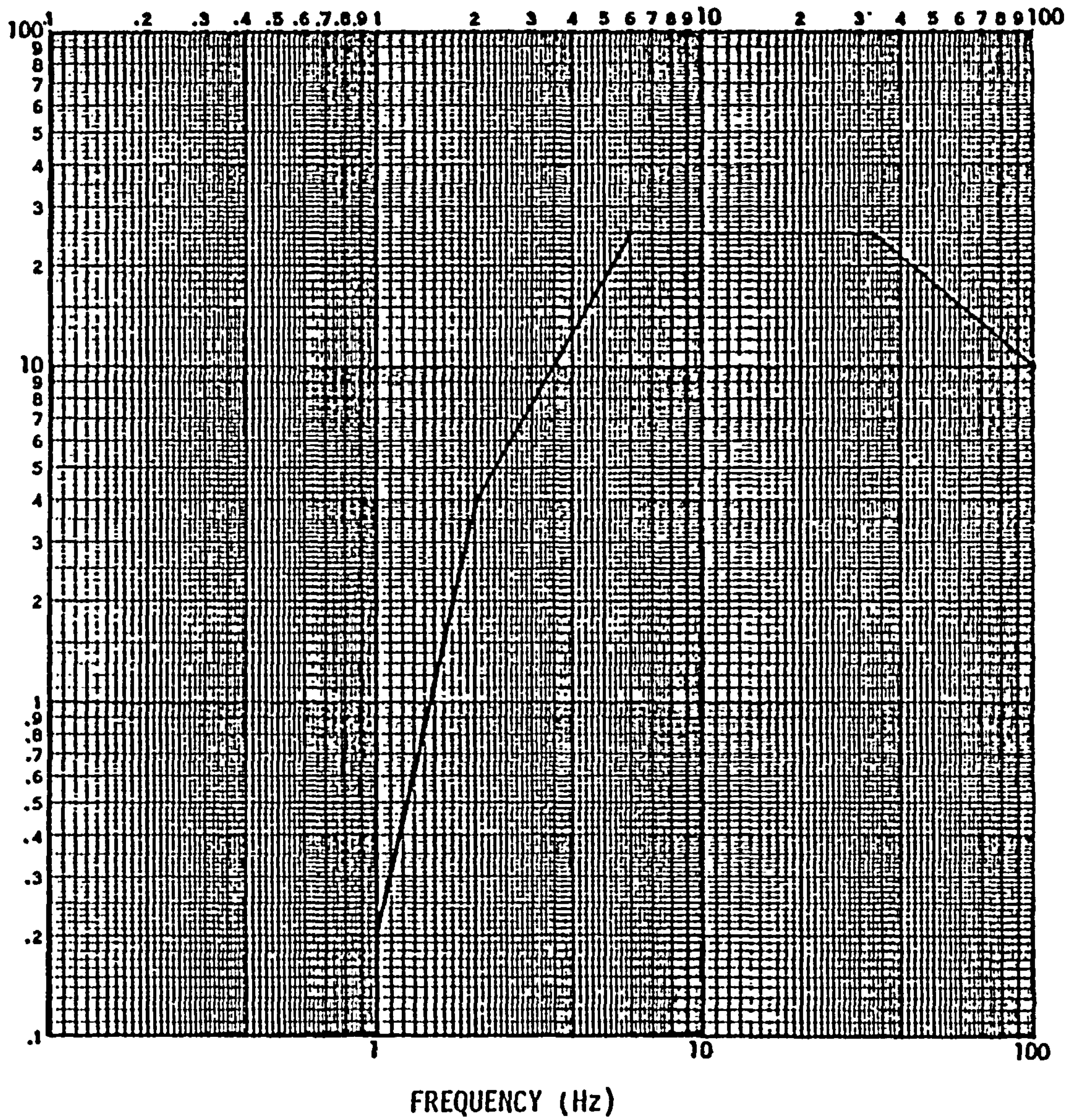


FIGURE 1. (TRS) Test Response Spectra

National Technical Systems

EARTHQUAKE RESPONSE SPECTRA Biaxial (72x72)

SPECTRUM HORIZ ☒ VERT ☐

EVENT OBE ☐ SSE ☐

OTHER Max. Capability

PERCENT DAMPING 2%

ANALYSIS BAND

CUSTOMER
Stone & Webster Eng. Corp.

MJO
548-9291

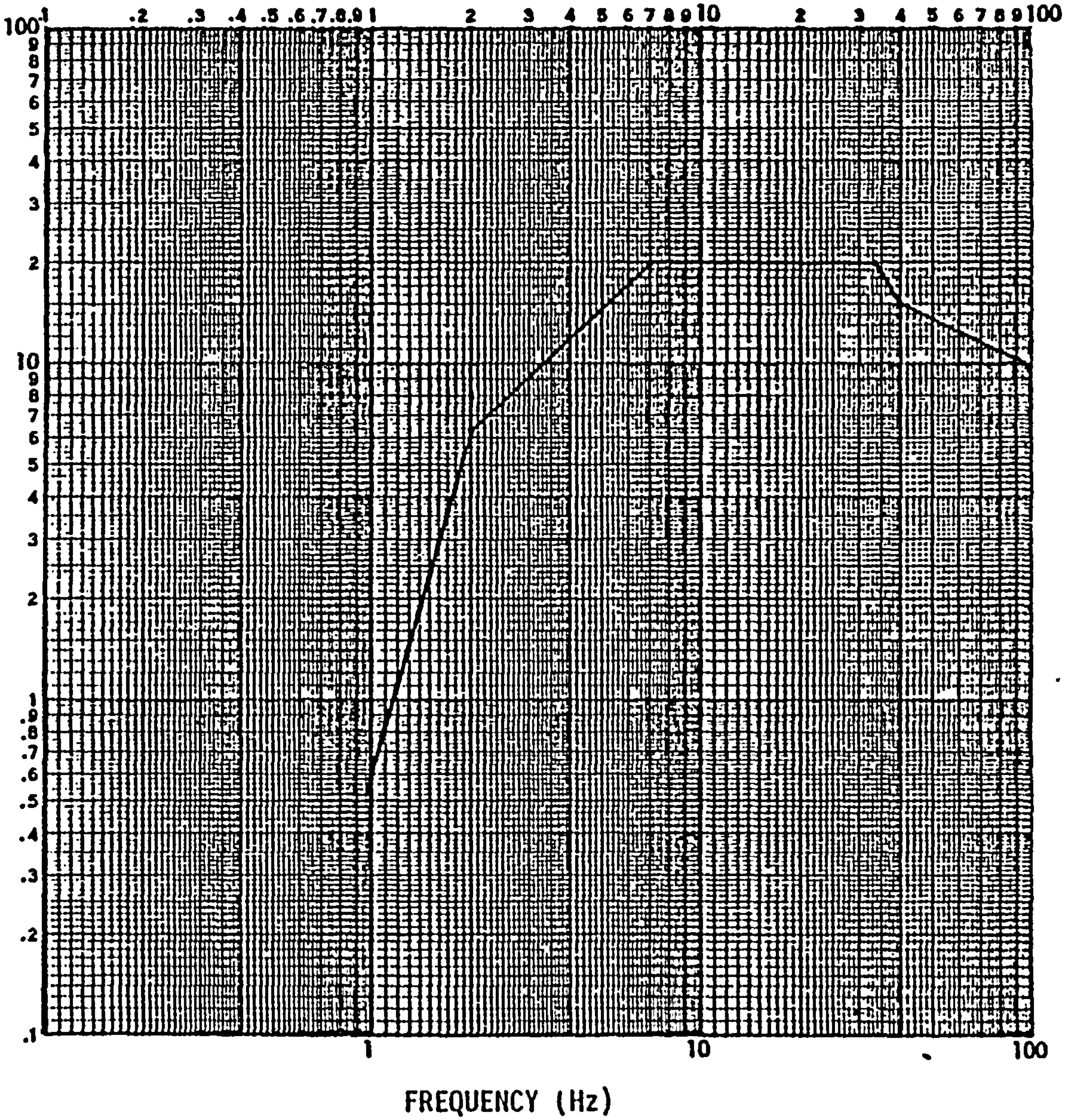
ITEM
Limitorque Operators
Model SMB-000-5 & SMB-0-25

P/N

S/N

AXIS X-Y ☐ Y-Z ☐

369



EARTHQUAKE RESPONSE SPECTRA Biaxial (72x72)

SPECTRUM HORIZ ☐ VERT ☒

EVENT OBE ☐ SSE ☐

OTHER Max. Capability

PERCENT DAMPING 2%

ANALYSIS BAND

CUSTOMER

Stone & Webster Eng. Corp.

MJO

548-9291

ITEM

Limitorque Operators
Model SMB-000-5 & SMB-0-25

P/N

S/N

AXIS X-Y ☐ Y-Z ☐

NTS National Technical Systems

FIGURE 2. (TRS) Test Response Spectra

3.3 SINGLE AXIS SINE BEAT TEST

Operators SMB-000-5 and SMB-0-25 were subjected to a series of sine beats in the frequency range of 5 Hz to 100 Hz at input levels of up to 6 g in accordance with Reference 2.2.

The performance of operator SMB-000-5 was consistant with pre-test baseline values except that at 100 Hz, limit switch contact chatter, exceeding two milliseconds but below five milliseconds, was observed.

The performance of operator SMB-0-25 was consistant with pretest values. No limit switch contact chatter exceeding two milliseconds was recorded.

3.4 FRAGILITY TEST

3.4.1 Operator SMB-0-25 was subjected to fragility tests in the frequency range from 5 Hz to 100 Hz at input levels of up to 14 g. The performance of the operator remained consistant with baseline values up to 11 g. Limit switch contact chatter not exceeding five milliseconds was observed at 14 g.

3.4.2 Operator SMB-000-5 was subjected to fragility tests in the frequency range from 5 Hz to 100 Hz at input levels up to 14 g. The performance of the operator was consistant with baseline values except that limit switch contact chatter exceeding two milliseconds, but below five milliseconds, was observed during these tests.

Operator SMB-000-5 experienced torque switch contact chatter resulting in incomplete operator strokes at 8 g's between the frequencies of 15.9 Hz and 25 Hz. After adjusting the torque switch contacts in accordance with Attachment Number 5 of Reference 2.2, the fragility tests in the frequency range of 5 Hz to 100 Hz were completed without torque switch chatter up to 14 g.

4.0 TEST CONDITIONS AND TEST EQUIPMENT

4.1 TEST CONDITIONS

Unless otherwise specified herein, all tests were performed at room ambient conditions defined as a temperature of 73 ±18°F (23 ±10°C), a relative humidity of 50 ±30 percent, and a barometric pressure of 28.5 +2.0, -3.0 inches of mercury absolute (725 +50, -75 mm of mercury absolute).

4.2 TEST EQUIPMENT

The test equipment tabulated in Appendix A was calibrated, as required, in accordance with MIL-C-45662A and is traceable to the National Bureau of Standards (NBS). The NBS traceability records are maintained on file in the NTS Quality Assurance Office.

5.0 TEST PROCEDURES AND TEST RESULTS

5.1 SPECIMEN PREPARATION

5.1.1 An examination of the specimens indicated that, with the exception of the SMB-000-5 operator limit switch, all the external bolts and screws were tight. The limit switch assembly and mounting screws of the SMB-000-5 operator were loose.

5.1.2 The limit switch contacts were inspected and adjusted in accordance with Exhibit I of Appendix B. Records of inspection and adjustments are presented in Exhibit II of Appendix B. Approximately 15 percent of the contacts required adjustment.

At the request of the customer's representative, one contact (numbered 9 on the limit switch) on each limit switch was readjusted for only a 0.005 inch gap. The purpose of introducing this out-of-specification gap was to enable the customer to determine the need for contact adjustment.

5.1.3 All the limit switch screws were tightened at the customer's direction to the values shown in Exhibit II of Appendix B. Screw identification and the corresponding torque values are also presented in Appendix B. Lower torque values were used for some screws, as noted in the data sheets, either to avoid possible damage to the plastic fingerbase or as limited by the capacity of the slotted screw heads used.

During the tightening process, a fingerbase of the SMB-0-25 operator was slightly damaged under a screw head which had a star washer. At the customer's request the damaged fingerbase was replaced with one removed from a spare limit switch.

5.2 BASELINE TEST

5.2.1 Specimens in each group were individually mounted on the customer furnished fixtures. The fixtures were capable of simulating seating torque on the operators. The modified limit switches were rigidly mounted on the fixtures such that their heights and orientations were identical to the switch position in the operators.

5.2.2 Operator mounting bolts were torqued as follows:

Operator	Number and Size of Bolt	Torque
SMB-000-5	4 x 5/16" diameter	16.5 ft/lbs (lubricated)
SMB-0-25	4 x 3/4" diameter	138 ft/lbs (lubricated)

5.2.3 All the limit switches were set by Limitorque personnel to provide a stroke of approximately 1-3/4 inches.

5.2.4 Operators were wired in accordance with the wiring diagram of Reference 2.2. Each operator was stroked through a complete cycle at 80, 100 and 110 percent of the nominal voltage. Stroke times were recorded and are presented in Appendix C.

5.2.5 All the limit switch screws, as well as the operator mounting and motor mounting bolts, were torque-striped to provide a visual indication of screw looseness.

6.0 DYNAMIC TEST PROGRAM

The operators and modified limit switches were mounted on a test fixture plate supplied by the customer as described in Paragraph 5.2. The mounting bolts were torqued to the values in Reference 2.2. An operator stem was also supplied by the customer for the tests and were used in conjunction with the mounting plate to allow the operator to develop seating loads.

The operators were wired in accordance with Reference 2.2. The lower (spare) contacts of the limit switch were monitored for chatter on two channels. One channel monitored all the normally open contacts, connected in series. The other channel monitored all the normally closed contacts, connected in series. The interval of chatter being monitored by the test equipment ranged from two microseconds to 100 milliseconds. The chatter interval was set at two milliseconds.

The tests were performed on the shaker tables listed below for the following tests:

Test	Shake Table
Vibration Aging	Electrodynamic
Random Multifrequency Biaxial	Hydraulic
Sine Beat and Fragility	The tests performed at the Chatsworth facility were performed on the hydraulic shake table and those performed at the LAX facility were performed on the electrodynamic table. Test logs in Appendices F and G indicate the facility where the tests were conducted.

Twenty-three accelerometers were used to monitor the dynamic response during the vibration aging, random multifrequency and the sine beat tests. Twelve accelerometers were used during the fragility tests.

Accelerometer locations are shown in Appendix C. Accelerometer data were recorded on strip recorders and on magnetic tapes.

6.1 VIBRATION AGING

6.1.1 Operators SMB-0-25 and SMB-000-5 were exposed to sinusoidal motion at the level of 0.75 g or 0.025 inch double amplitude displacement with the frequency sweeping from 5 Hz to 200 Hz at a rate of two-octaves per minute. Ninety minutes of vibration was applied in each orthogonal axis. The operators were stroked every 7-1/2 minutes to change state.

6.1.2 Transmissibility plots (Response Acceleration/Input Acceleration versus Frequency) are provided in Appendix D. Stroke times observed throughout the test were consistant with those recorded in the Baseline tests, Paragraph 5.2.

6.1.3 No chatter was observed during this test. Examination of the torque stripes and comparisons of acceleration response at the start of the test and at the end of the test did not indicate loose screws.

6.2 RANDOM MULTIFREQUENCY BIAXIAL TEST

6.2.1 Operators SMB-0-25 and SMB-000-5 were subjected to several random multifrequency input motions applied biaxially along one principal horizontal axis and the vertical axis simultaneously. Operators, mounted on the test fixtures, were rotated 90° in the horizontal plane and the tests repeated. The input motions in the two axes were phase independent with frequencies from 1 Hz to 100 Hz. Amplitudes of the 1/12-octave frequency bands were adjusted to obtain the desired TRS of the horizontal and vertical input motions. Test Response Spectra (TRS) are provided in Appendix E. The number of tests, test directions, axes of loadings and results are described below.

6.2.2 Operator SMB-0-25

Test Number	Direction of Loading	TRS Figure	Test Duration (seconds)	Operating Voltage (% of nominal)	Shake Time Open to Close	Shake Time Close to Open	Chatter > 2 milliseconds	Osbervations
1	X	1	35	80	5	5	No	No Z Input
2	X & Z	2 & 3	35	80	5	5	No	
3	X & Z	4 & 5	35	100	5	5	No	
4	X & Z	6 & 7	35	110	5	5	No	
5	X & Y	8 through 12	27	80	5	5	No	Mounting Bolts came Loose. See 6.2.2.1
6	X & Y	13 & 14	35	100	5	5	No	
7	X & Y	15 & 16	35	110	5	5	No	
8	X & Y	17 through 21	35	80	5	5	No	

6.2.2.1 At approximately 27 seconds after the start of the test, the operator was observed to have come loose. The test was stopped immediately. Examination of the operator revealed that the operator mounting screws had come loose and that there was a considerable amount of localized deformation of the aluminum mounting plate under the bolt heads.

The Customer's representative determined that a combination of the small bearing area under the socket head mounting bolts and the low bearing capacity of the aluminum mounting plate had resulted in excessive deformation of the mounting plate under the bolt head, which in turn caused loosening of the bolts. In order to properly distribute the bolt loads, 3/16 inch thick steel washers were placed under the bolts and the test was continued. The results are described below.

6.2.3 Operator SMB-000-5

Test Number	Direction of Loading	TRS Figure (Appendix E)	Test Duration (seconds)	Operating Voltage (% of nominal)	Stroke Time (sec.) Open to Close	Close to Open	Chatter > 2 milliseconds	Osbervations
1	X & Z	1 & 2	35	80	10	10	No	Mounting Bolts Broke See 6.2.3.1
2	X & Z	3 & 4	35	100	10	10	No	
3	X & Z	5 & 6	35	110	10	10	No	
4	X & Z	7 & 8	35	80	10	10	No	Repeat of Test 1
5	X & Y	9 & 10	27	80	10	10	No	ZPA Lower than required
6	X & Y	11 & 12	35	100	10	10	No	
7	X & Y	13 & 14	35	110	10	10	No	
8	X & Y	15 & 16	35	80	10	10	No	Repeat of Test 5 with Higher ZPA

6.2.3.1 Just before the table motion was brought to full level, the operator was observed to have come loose. The test was stopped immediately.

Examination of the operator revealed that two of the four mounting bolts had sheared off and the other two were loose. Also, there was a considerable amount of local deformation of the aluminum base plate under the bolt (mounting) heads as well as on the walls of the bolt holes.

The Customer's representative concluded that the cause of the bolt failure was due to insufficient bearing capacity of the aluminum mounting plate. Steel washers 3/16 inch thick were placed under the bolt heads and the bolts were tightened to 24 ft/lbs torque (dry) instead of the previously used torque of 16 ft/lbs (lubricated). Also, the test input levels were reduced to envelope the RRS of Figure 3.

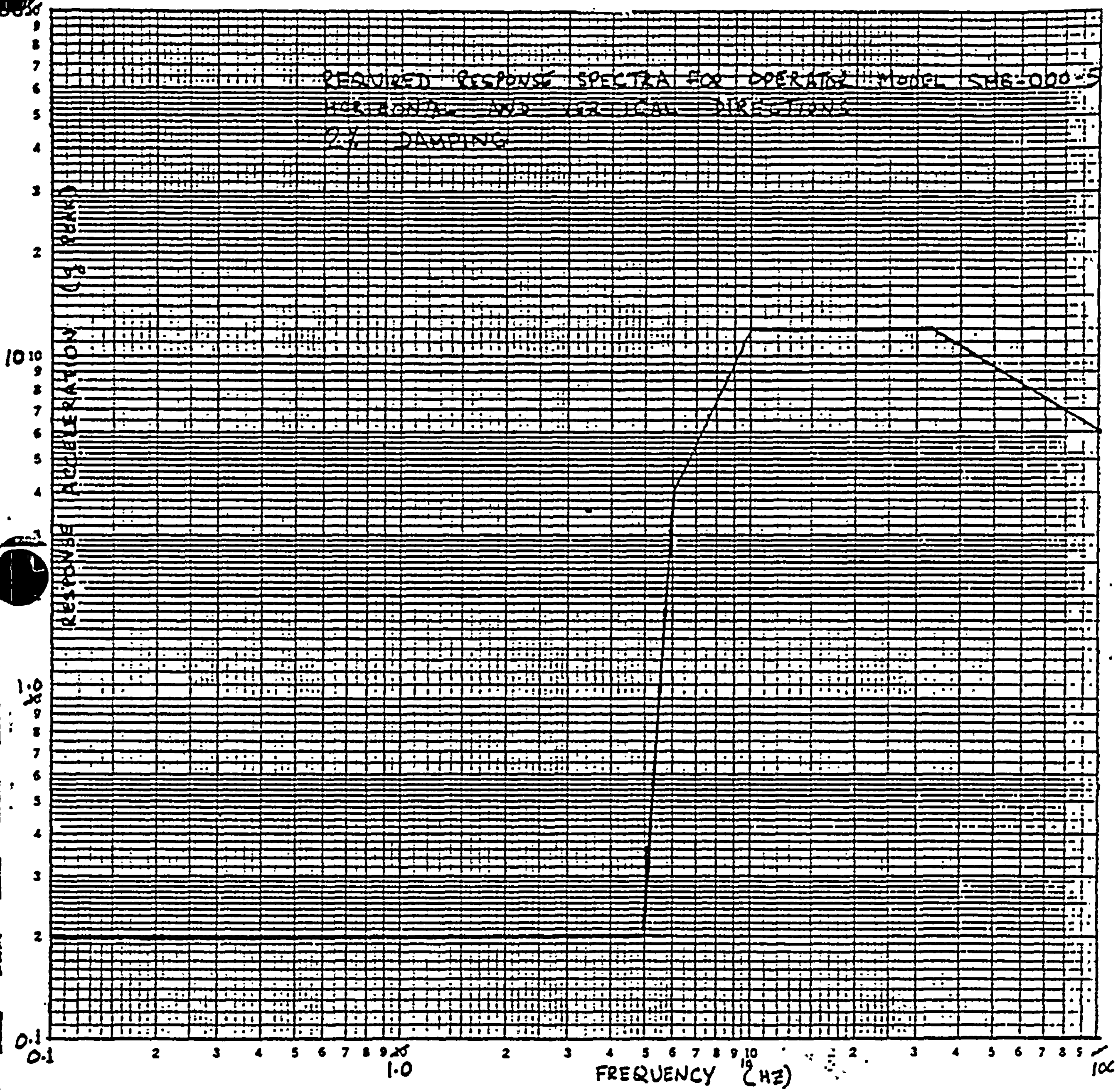


FIGURE 3. Required Response Spectra

6.2.4 Post-test examinations did not indicate any physical damage to the operators. All the screws and mounting bolts were tight. Operators were stroked at the nominal voltage and the stroke times were consistent with those recorded in the baseline tests.

6.3 SINE BEAT TESTS

Operators SMB-0-25 and SMB-000-5 were subjected to a series of sine beat tests in accordance with Table I. Initially, at least a 1.5 second pause between beats was used. After examining the response acceleration traces and confirming that the response decayed much more rapidly at higher frequencies, the minimum pause between beats was reduced as follows:

Frequency Range	Pause Time
5 Hz to 25 Hz	1.5 second
30 Hz to 50 Hz	1.0 second
55 Hz to 100 Hz	0.75 second

A detailed log of the test is provided in Appendix F.

TABLE I

SINE BEAT WAVEFORM CHARACTERISTICS

The input acceleration magnitude shall produce a peak response of 6.0 g for each beat at the operator base.

Test Frequency (Hz)	Number of Beats	Oscillations Per Beat
5.0	6	15
6.3	6	15
7.9	6	15
10.0	6	15
12.6	6	15
15.9	6	15
20.0	6	15
25.0	6	15
30.0	6	15
35.0	6	15

The input acceleration magnitude shall produce a peak response of 4.6 g for each beat at the operator base.

Test Frequency (Hz)	Number of Beats	Oscillations Per Beat
10.0	10	10
12.6	10	10
15.9	10	10
20.0	10	10
25.0	10	10
30.0	10	10
35.0	10	10
40.0	10	10
45.0	10	10
50.0	10	10
55.0	10	10
60.0	10	10
70.0	10	10
85.0	10	10
100.0	10	10

TABLE I (Continued)

SINE BEAT WAVEFORM CHARACTERISTICS

The input acceleration magnitude shall produce a peak response of 3.5 g for each beat at the operator base.

Test Frequency (Hz)	Number of Beats	Oscillations Per Beat
10.0	40	10
12.6	40	10
15.9	40	10
20.0	40	10
25.0	40	10
30.0	40	10
35.0	40	10
40.0	40	10
45.0	40	10
50.0	40	10
55.0	40	10
60.0	40	10
70.0	5	10
85.0	5	10
100.0	5	10

The input acceleration magnitude shall produce a peak response of 2.0 g for each beat at the operator base.

Test Frequency (Hz)	Number of Beats	Oscillations Per Beat
10.00	100	10
12.6	100	10
15.9	100	10
20.0	100	10
25.0	100	10
30.0	100	10
35.0	100	10
40.0	100	10
45.0	100	10
50.0	100	10
55.0	100	10
60.0	100	10
70.0	20	10
85.0	20	10
100.0	20	10

6.3.1 Operator SMB-0-25

The operator was functional throughout the test and maintained a consistant stroke time. There was no chatter exceeding two milliseconds observed during this test.

6.3.2 Operator SMB-000-5

The operator was functional throughout the test and maintained a consistant stroke time. Except at 100 Hz, there was no chatter exceeding two milliseconds observed. At 100 Hz chatter was observed to be within five milliseconds.

6.4 FRAGILITY TESTS

Operators SMB-0-25 and SMB-000-5 were subjected to a series of sine beat tests in each axis at incremental acceleration levels. The test frequencies, number of beats at each test frequency, and oscillations per beat at each acceleration level are described in Table II. Tests were performed at each of the following acceleration levels.

SMB-0-25: 8 g 12 g and 14 g

SMB-000-5: 8 g 10 g 12 g and 14 g

Due to test table limitations, the highest input accelerations ranged from 9 g . to 12 g in the frequency range of 5 Hz to 15.9 Hz. Detailed records are provided in the test log in Appendix G. Significant observations are listed herein.

6.4.1 SMB-0-25

Operator SMB-0-25 was tested up to an acceleration level of 14 g. Operator performance was consistant with the baseline data. Chatter was within two milliseconds up to an input acceleration of 11 g. Between 11 g and 14 g, chatter in excess of two milliseconds, up to a maximum of five milliseconds, was observed.

6.4.2 SMB-000-5

Operator SMB-000-5 was tested up to an acceleration level of 14 g. Operator performance was consistant with baseline data. During the 8 g test at frequencies of 15.9 Hz, 20 Hz and 25 Hz the operator failed to complete the stroke. The test was temperarily suspended until an inspection of the operator could be performed. The manufacturer's representative, upon inspection, concluded that the torque switch contact pressure was insufficient, resulting in contact chatter. Contact gaps were adjusted in accordance with Exhibit I of Appendix B. Note that the torque switch contacts were not inspected or adjusted prior to the start of the test. There was no reccurrence of this condition anytime during the remainder of the test program.

Throughout this test, chatter exceeded two milliseconds. The chatter indicator interval was increased to five milliseconds. No chatter exceeding five milliseconds was observed.

6.4.3 A post test visual examination of the specimens did not reveal any physical damage. All the screws and mounting bolts were determined to be tight.

TABLE II

SINE BEAT WAVEFORM CHARACTERISTICS

Test Frequency (Hz)	Number of Beats	Oscillations Per Beat
5.0	6	15
6.3	6	15
7.9	6	15
10.0	6	15
12.6	6	15
15.9	6	15
20.0	20	15
25.0	20	15
30.0	20	15
35.0	20	15
40.0	20	15
45.0	15	10
50.0	15	10
55.0	15	10
60.0	15	10
70.0	15	10
85.0	15	10
100.0	15	10

APPENDIX A

Equipment List

National Technical Systems

SEISMIC TEST

NTS Number	D932V
Instrument	Servo Controller
Manufacturer	Shore Western Manufacturing Company
Model Number	SC 1329C
Serial Number	None
Type	Electronic single/dual loop
Range	0 to 10" stroke
Accuracy	±5% full scale
Calibration	N/A

NTS Number	D991V
Instrument	X-Y Display
Manufacturer	Spectral Dynamics Corporation
Model Number	13116
Serial Number	400
Type	Cathode Ray Tube
Linearity	3%

NTS Number	D992V
Instrument	Shock Spectrum Analyzer
Manufacturer	Spectral Dynamics Corporation
Model Number	13231 (Pare of SD321 System)
Serial Number	21
Special Note	Companion to D993V
Resolution	0 to 100 volts
Frequency Range	1 Hz to 10 kHz
Calibration	12 months (Cal. due 4-6-82)

NTS Number	D993V
Instrument	Transient Memory
Manufacturer	Spectral Dynamics Corporation
Model Number	13192 (Part of SD321 System)
Serial Number	24
Special Note	Companion to D992V
Calibration	12 months (Cal. due 4-6-82)

NTS Number	D1010V
Instrument	X-Y Plotter
Manufacturer	Esterline Angus, Inc.
Model Number	XY575
Serial Number	976142
Accuracy	±0.25% full scale
Maximum Input	±15 volts DC
Calibration	6 months (Cal. due 5-19-82)

NTS Number	D1025V
Instrument	Sweep Oscillator
Manufacturer	Unholtz-Dickie Corporation
Model Number	OSC-1
Serial Number	132
Frequency Range	2 Hz to 5,000 Hz
Calibration	6 months (Cal. due 1-15-82)
NTS Number	D1026V
Instrument	Servo Programmer
Manufacturer	Unholtz-Dickie Corporation
Model Number	SPA-7
Serial Number	107
Frequency Range	5 Hz to 10,000 Hz
Range	more than 80DB dynamic range
Special Features	7 crossovers
Calibration	6 months (Cal.due 4-14-82)
NTS Number	D1071V
Instrument	Seismic Signal Synthesizer
Manufacturer	Bird Enterprises
Model Number	None
Serial Number	102
Bandwidth	1/6 octave
Frequency Range	0.92 to 32.0 Hz
Calibration	Prior to test
NTS Number	D1204V
Instrument	Oscillograph, 18 Channel
Manufacturer	Honeywell, Inc.
Model Number	1858
Serial Number	2461 MK 74
Range	depends on plug-in used frequency response DC to 5 kHz sine, 15 kHz square wave up to 7.2 in trace amplitude
Accuracy	depends on plug-in used
Calibration	Prior to Test
NTS Number	D1221V
Instrument	Sine Beat Computer
Manufacturer	Ohio Scientific
Model Number	Challenger 8
Serial Number	None
Calibration	N/A

NTS Number	D1222V
Instrument	Disk Drive
Manufacturer	Ohio Scientific
Model Number	None
Serial Number	None
Calibration	N/A
NTS Number	D1223V
Instrument	Keyboard
Manufacturer	Ohio Scientific
Model Number	None
Serial Number	None
Calibration	N/A
NTS Number	D1225V
Instrument	Color Monitor
Manufacturer	Gold Star
Model Number	GS
Serial Number	None
Calibration	N/A
NTS Number	D1226V
Instrument	FM Tape Recorder
Manufacturer	Sangamo-Weston
Model Number	Sabre VI
Serial Number	None
Calibration	Prior to Test
NTS Number	D1227V
Instrument	Color Video Camera
Manufacturer	Panasonic
Model Number	PK-800
Serial Number	None
Calibration	N/A
NTS Number	D1228V
Instrument	Portable VCR
Manufacturer	Quasar
Model Number	VH 5300
Serial Number	SBO 2610631
Calibration	N/A
NTS Number	D1232V
Instrument	Oscillograph, 18 Channel
Manufacturer	Honeywell, Inc.
Model Number	1858
Serial Number	2209DB78
Range	Depends on plug-ins
Type	Fiber Optic
Calibration	12 months (Cal. due 7-20-82)

NTS Number	D1249V
Instrument	Accelerometer
Manufacturer	PCB Piezotronics, Inc.
Model Number	308B
Serial Number	8281
Range	50 g/5000 g max/1-3 kHz
Accuracy	0.5% to 1 kHz
Sensitivity	99.6 mV/g @ 100 Hz, 8 g's pk
Output	Bias level 11.3 volts
Calibration	6 months (Cal. due 1-8-82)

NTS Number	D1250V
Instrument	Accelerometer
Manufacturer	PCB Piezotronics, Inc.
Model Number	308B
Serial Number	8282
Range	50 g/5000 g max/1-3 kHz
Accuracy	0.5% to 1 kHz
Sensitivity	99.6 mv/g @ 100 Hz, 8 g's pk
Output	Bias level 11.2 volts
Calibration	6 months (Cal. due 1-8-82)

NTS Number	D1251V
Instrument	Charge and Voltage Amplifier
Manufacturer	PCB Piezotronics, Inc.
Model Number	464MIO
Serial Number	647
Range	1 to 50 k units/12 ranges .01 to 110 PC/Unit
Accuracy	1 and 2 (Black Scale): ±5% other ranges: ±1% Amp Linearity, ±IOV: ±0.1% DC drift: ±IMV, 8 hours
Sensitivity	.01 to 110 PC/Unit
Output	±10 V, ±50 mA Max, 2 ohms
Calibration	Prior to Test

NTS Number	D1252V
Instrument	Charge and Voltage Amplifier
Manufacturer	PCB Piezotronics, Inc.
Model Number	464 MIO
Serial Number	648
Range	1 to 50 k Units/12 ranges 0.1 to 110 PC/Units
Accuracy	1 and 2 (Black Scale): ±5% Other Ranges: ±1% Amp Linearity, ±10 V: ±0.1% DC drift: ±IMV, 8 hours
Sensitivity	.01 to 100 PC/Unit
Output	±10 V, ±50 mA Max, 2 ohms
Calibration	Prior to Test

NTS Number	E1058V
Instrument	Servo Controller
Manufacturer	Shore Western Manufacturing Company
Model Number	SC 1125SP
Serial Number	None
Range	0 to 10 inch stroke
Accuracy	±5% full scale
Calibration	N/A

NTS Number	E1078V
Instrument	Line Impedance Stabilization Network
Manufacturer	Solar Electronics Company
Model Number	None
Serial Number	7413320
Type	6338-5-TS-50N
Range	5 UH, 50 Amp: 600 Vdc maximum 285 Vac 60 cycles maximun
Calibration	Prior to Test

NTS Number	E1177V
Instrument	Oscilloscope
Manufacturer	Tektonix, Inc.
Model Number	T922
Serial Number	B010331
Calibration	6 months (Cal. due 2-15-82)

NTS Number	E1259V
Instrument	Variable Transformer
Manufacturer	AETL
Model Number	None
Serial Number	None
Range	3 phase, 30 Amp, 600 Vac
Type	440 Vac
Special Note	with motor controller
Calibration	N/A

NTS Number	G502V
Instrument	Torque Wrench
Manufacturer	Herbrand
Model Number	FJ-300-1
Serial Number	0157360
Range	0 to 300 inch-pounds
Accuracy	±3%
Calibration	12 months (Cal. due 5-5-82)

NTS Number	G599V
Instrument	Timer
Manufacturer	Standard Electric Products Company
Model Number	J5310
Serial Number	None
Range	0 to 60 minutes by 0.2 second;
Accuracy	±0.1%
Calibration	1 year (Cal. due 3-23-82)

NTS Number	G603V
Instrument	Torque Wrench
Manufacturer	S-K Tools
Model Number	74015
Serial Number	7465842
Type	Beam
Accuracy	±2%
Calibration	12 months (Cal. due 5-5-82)

NTS Number	G614V
Instrument	Closed Circuit TV Camera
Manufacturer	Panasonic
Model Number	WV-401
Serial Number	774646
Resolution	500 lines at center
Aperature	F1.6
Minimum Illumination	2-foot candles
Focal Length	16 mm
Calibration	N/A

NTS Number	G615V
Instrument	Video Monitor
Manufacturer	Panasonic
Model Number	WV-411
Serial Number	None
Calibration	N/A

NTS Number	G616V
Instrument	Video Monitor
Manufacturer	Panasonic
Model Number	WV-411
Serial Number	770849
Size	9 inch
Number of Channels	3
Resolution	500 lines at center
Calibration	N/A

NTS Number	G617V
Instrument	Video Monitor
Manufacturer	Panasonic
Model Number	WV-411
Serial Number	770849
Size	9 inch
Number of Channels	3
Resolution	500 lines at center
Calibration	N/A

NTS Number	G618V
Instrument	Remove Control Box
Manufacturer	Panasonic
Model Number	WV-433
Serial Number	6Y0002
Number of Channels	3
Special Features	Controls panning heads
Calibration	N/A

NTS Number	G619V
Instrument	Pan Head
Manufacturer	Panasonic
Model Number	WV-431
Serial Number	680060
Range	300° degree panning angle
Calibration	N/A

NTS Number	None
Instrument	Seismic Simulator
Manufacturer	National Technical Systems
Model Number	None
Serial Number	None
Type	36 x 36
Calibration	N/A

VIBRATION TEST

NTS Number	D136L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242M4
Serial Number	8805
Type	Piezoelectric
Range	"Frequency" 5 to 6000 cps
	"Shock" 0 to 2000 g's
	"V.B." 0 to 1000 peak g's
Accuracy	"Frequency Response" ±5%
	"Amp. Linearity" ±1%
Calibration	6 months (Cal. due 4-19-82)
NTS Number	D144L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	D11MGV-8
Serial Number	C407
Range	Filter A: 5 kHz
	Filter B: 10 kHz
Calibration	Prior to Use
NTS Number	D145L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	D11MGV-8
Serial Number	C408
Range	Filter A: 5 kHz
	Filter B: 10 kHz
Calibration	Prior to Use
NTS Number	D146L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	D11MGV-8
Serial Number	C409
Range	Filter A: 5 kHz
	Filter B: 10 kHz
Calibration	Prior to Use
NTS Number	D147L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	D11MGV-8
Serial Number	C410
Range	Filter A: 5 kHz
	Filter B: 10 kHz
Calibration	Prior to Use

NTS Number	D149L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	D11MGV-8
Serial Number	C412
Range	Filter A: 5 kHz Filter B: 10 kHz
Calibration	Prior to Use

NTS Number	D173L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	AA53
Type	Piezoelectric
Range	"Frequency" 50 to 6000 Hz "Shock" 0 to 2000 g "Vibration" 0 to 1000 peak g
Frequency Response	±5%
Amplitude Linearity	±1%
Calibration	6 months (Cal. due 1-16-82)

NTS. Number	D201L
Instrument	Accelerometer
Manufacturer	Bruel & Kjaer
Model Number	8303
Serial Number	345037
Type	Piezoelectric
Range	200-15 kHz; 0-10 K g's
Accuracy	±2%
Calibration	3 months (Cal. due 1-30-82)

NTS Number	D289L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	AA24 (Body #428-71)
Type	Piezoelectric
Frequency Range	3 to 6 kHz "Vibration" 0 to 1 K g's "Shock" 0 to 2 K g's "Output" 10 mV/g
Accuracy	±1%
Calibration	6 months (Cal. due 1-31-82)

NTS Number	D292L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	AA32
Type	Piezoelectric
Frequency Range	3 to 6 kHz
Range	"Vibration" 0 to 1 K g's
	"Shock" 0 to 2 K g's
	"Output" 10 mV/g
Accuracy	±1%
Calibration	6 months (Cal. due 4-19-82)

NTS Number	D293L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242-M4
Serial Number	7893
Accuracy	±5.0%
Calibration	6 months (Cal. due 1-31-82)

NTS Number	D472L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	4814/42-A054
Range	"Frequency" 3-6 kHz
	"Vibration" 0-1 K g's
	"Shock" 0-2 K g's
	"Output" 10 mV/g
Accuracy	±1%
Type	Piezoelectric
Calibration	6 months (Cal. due 1-31-82)

NTS Number	D473L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	1737/42-344
Range	"Frequency" 3-6 kHz
	"Vibration" 0-1 K g's
	"Shock" 0-2 K g's
	"Output" 10 mV/g
Accuracy	±1%
Type	Piezoelectric
Calibration	6 months (Cal. due 2-3-82)

NTS Number	D474L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	8810/42-A471
Range	"Frequency" 3-6 kHz "Vibration" 0-1 K g's "Shock" 0-2 K g's "Output" 10 mV/g
Accuracy	±1%
Type	Piezoelectric
Calibration	6 months (Cal. due 1-31-82)

NTS Number	D476L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	AA20/42-A096
Range	"Frequency" 3-6 kHz "Vibration" 0-1 K g's "Shock" 0-2 K g's "Output" 10 mV/g
Accuracy	±1%
Type	Piezoelectric
Calibration	6 months (Cal. due 1-30-82)

NTS Number	D477L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	4808/42-A063
Range	"Frequency" 3-6 kHz "Vibration" 0-1 K g's "Shock" 0-2 K g's "Output" 10 mV/g
Accuracy	±1%
Type	Piezoelectric
Calibration	6 months (Cal. due 1-31-82)

NTS Number	D479L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242
Serial Number	1718/42-060
Range	"Frequency" 3-6 kHz "Vibration" 0-1 K g's "Shock" 0-2 K g's "Output" 10 mV/g
Accuracy	±1%
Type	Piezoelectric
Calibration	6 months (Cal. due 4-19-82)

NTS Number	D490L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2226C
Serial Number	CX90
Range	"Frequency Response" 2 to 5000 Hz "Vibration" 0 to 1000 g's "Shock" 0 to 2000 g's
Accuracy	±2%
Calibration	6 months (Cal. due 1-30-82)

NTS Number	D491L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2226C
Serial Number	CX77
Range	"Frequency Response" 2 to 5000 Hz "Vibration" 0 to 1000 g's "Shock" 0 to 2000 g's
Accuracy	±2%
Calibration	6 months (Cal. due 1-14-82)

NTS Number	D520L
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2224C
Serial Number	GA33
Range	0 to 1000 g
Accuracy	±5.0%
Calibration	6 months (Cal. due 1-13-82)

NTS Number	D525L
Instrument	Ensemble Averager
Manufacturer	Specral Dynamics Corporation
Model Number	SD309
Serial Number	109
Range	1 to 1024 ensembles, 10 Hz to 20 kHz
Calibration	12 months (Cal. due 1-29-82)

NTS Number	D543L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	1 to 100 g
Accuracy	±1.0%
Calibration	Prior to Use

NTS Number	D544L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	1 to 100 g
Accuracy	±1.0%
Calibration	Prior to Use
NTS Number	D549L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	1 to 100 g
Accuracy	±1.0%
Calibration	Prior to Use
NTS Number	D552L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	1 to 100 g
Accuracy	±1.0%
Calibration	Prior to Use
NTS Number	D560L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	1 to 100 g
Accuracy	±1.0%
Calibration	Prior to Use
NTS Number	D562L
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	1 to 100 g
Accuracy	±1.0%
Calibration	Prior to Use
NTS Number	D565L
Instrument	Automatic Sigma Clipper/Mixer
Manufacturer	National Technical Systems, LAX
Model Number	NTSL1
Serial Number	None
Calibration	Prior to Use

NTS Number	D532V
Instrument	Accelerometer Standard
Manufacturer	Endevco Corporation
Model Number	2215E
Serial Number	NA99
Type	Piezoelectric
Accuracy	±2%
Calibration	6 months (Cal. due 1-16-82)

NTS Number	D571V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2220C
Serial Number	RE77
Type	Piezoelectric
Range	"Maximum Acceleration" ±1000 g (sine) ±5000 g (shock) "Temperature Range" -65°F to 300°F
Frequency Range	2 to 10,000 Hz
Accuracy	±3%
Calibration	6 months (Cal. due 4-13-82)

NTS Number	D663V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2224C
Serial Number	DA09
Type	Piezoelectric
Frequency Range	2 to 6000 Hz
Maximum Acceleration	±1000 g (sine)
Accuracy	±2.5% "Maximum Shock" ±2000 g
Calibration	6 months (Cal. due 2-3-82)

NTS Number	D655V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2217 M2
Serial Number	Q851
Type	Piezoelectric
Range	"Frequency" 4 to 6000 Hz "Vibration" ±1000 peak g (sine) "Maximum Shock" ±2000 g
Frequency Response	±5%
Accuracy	±2%
Calibration	6 months (Cal. due 4-2-82)

NTS Number	D703V
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMCV
Serial Number	None
Range	1 to 100 mV or PCmB/g; 0 to 1000 g in 7 ranges
Accuracy	meter, ±2%; output voltage, ±1%
Calibration	Prior to Use

NTS Number	D768V
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMCVA
Serial Number	None
Calibration	Prior to Use

NTS Number	D919V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242M1
Serial Number	JA25 (Body No. 5247)
Range	0 to 5000 Hz
Calibration	Prior to Use

NTS Number	D920V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2211C
Serial Number	JA16 (Body No. 5209)
Type	Piezoelectric
Range	0 to 5000 Hz
Calibration	Prior to Use

NTS Number	D931V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2242C
Serial Number	Body C500
Type	Piezoelectric
Range	2 to 6000 Hz; 3.1 mV rms/g peak
Accuracy	±3%
Calibration	Prior to Use

NTS Number	D957V
Instrument	Oscilloscope
Manufacturer	Hewlett-Packard
Model Number	122AR (MB N-185)
Serial Number	521-07906 (MB 524)
Frequency Range	DC to 200 kHz
Accuracy	±5%
Calibration	Prior to Use

NTS Number	D997V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2246
Serial Number	JA12
Type	Piezoelectric
Frequency Range	0 to 4000 Hz
Accuracy	±3%
Calibration	Prior to Use

NTS Number	D1005V
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMCVA
Serial Number	None
Range	0 to 100 g in 5 ranges
Accuracy	±5%
Calibration	Prior to Use

NTS Number	D1022V
Instrument	Amplitude Servo/Monitor
Manufacturer	Spectral Dynamics Corporation
Model Number	SD105-C-1
Serial Number	627
Range	1 to 10 kHz in 2 ranges manual or automatic
Special Features	monitors accel, Vel, and Disp.
Accuracy	±4%
Calibration	6 months (Cal. due 1-3-82)

NTS Number	D1052V
Instrument	Charge and Voltage Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMCV
Serial Number	None
Range	0 to 1000 g in 7 ranges
Accuracy	output voltage, ±1%; meter ±2%
Gain	1 to 100 mV or PCmV/g
Calibration	Prior to Use

NTS Number	D1054V
Instrument	Charge and Voltage Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMCV
Serial Number	None
Range	0 to 1000 g in 7 ranges
Accuracy	output voltage, ±1%; meter ±2%
Gain	1 to 100 mV or PCmB/g
Calibration	Prior to Use

NTS Number	D1055V
Instrument	Charge and Voltage Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMCV
Serial Number	None
Range	0 to 1000 g in 7 ranges
Accuracy	output voltage, ±1%; meter ±2%
Gain	1 to 100 mV or PCmB/g
Calibration	Prior to Use

NTS Number	D1072V
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	0 to 1000 g in 7 ranges
Accuracy	±1% gain; ±1% meter
Gain	1 to 100 peak PC/peak g
Frequency Response	±1%, 10 Hz to 5 kHz
Calibration	Prior to Use

NTS Number	D1073V
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	0 to 1000 g in 7 ranges
Accuracy	±1% gain; ±1% meter
Gain	1 to 100 peak PC/peak g
Frequency Response	±1%, 10 Hz to 5 kHz
Calibration	Prior to Use

NTS Number	D1076V
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMC
Serial Number	None
Range	0 to 1000 g in 7 ranges
Accuracy	±1% gain; ±1% meter
Gain	1 to 100 peak PC/peak g
Frequency Response	±1%, 10 Hz to 5 kHz
Calibration	Prior to Use

NTS Number	D1103V
Instrument	Charge and Voltage Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMCV
Serial Number	None
Range	0 to 1000 g in 7 ranges
Accuracy	output voltage, ±1%; meter, ±2%
Gain	1 to 100 mV or PCmV/g
Calibration	Prior to Use

NTS Number	D1106V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2215C
Serial Number	LA92
Range	"Shock" ±2000 g (peak) "Vibration" ±1000 g (sinusoidal) "Frequency Range" 2 to 6000 Hz
Accuracy	"Frequency Response" ±5% "Amplitude Linearity" ±2%
Type	Piezoelectric
Body Number	8362
Calibration	6 months (Cal. due 1-14-82)

NTS Number	D1120V
Instrument	Sweep Oscillator
Manufacturer	Spectral Dynamics Corporation
Model Number	SD104A-5
Serial Number	1804
Range	0.005 Hz to 50 kHz in five 3 decade ranges
Frequency Response	±2%
Calibration	6 months (Cal. due 12-12-81)

NTS Number	D1196V
Instrument	Charge Amplifier
Manufacturer	Unholtz-Dickie Corporation
Model Number	8 PMCVA
Serial Number	None
Range	1 to 1000 g in 7 ranges 1 to 100 mV or PC
Accuracy	output voltage, ±1%; meter, ±2%
Calibration	Prior to Use

NTS Number	D1226V
Instrument	FM Tape Recorder
Manufacturer	Sangamo-Weston
Model Number	Sabre VI
Serial Number	6474
Type	3 speed, total of 15 channels
Calibration	Prior to Use

NTS Number	D1231V
Instrument	Accelerometer
Manufacturer	Endevco Corporation
Model Number	2220C
Serial Number	EU03
Accuracy	±1.8% 20 Hz to 2.5%/4000 Hz
Type	Piezoelectric
Calibration	6 months (Cal. due 12-15-81)

NTS Number	D1232V
Instrument	Oscillograph, 18 Channels
Manufacturer	Honeywell, Inc.
Model Number	1858
Serial Number	2209DB78
Range	depends on plug-ins
Type	fiber optic
Calibration	Prior to Use

NTS Number	E4482F
Instrument	Oscillograph, 18 Channels
Manufacturer	Honeywell, Inc.
Model Number	1858-T7900
Serial Number	0156BE76
Range	depends on gazvos used
Accuracy	±3%
Chart Speed	0.1 to 160 ips in 15 steps
Timing Marks	0.001 to 10 seconds
Calibration	Prior to Use

NTS Number	E398L
Instrument	Digital Multimeter-Counter
Manufacturer	Valhalla Scientific
Model Number	4440
Serial Number	7-1967
Type	LED display
Range	0 to 500 volts AC in 5 ranges; 0 to 1000 volts DC in 5 ranges; 0 to 20 megohms in 6 ranges; 0 to 2000 milliamps, AC ordc, in 5 ranges; 0 to 10 mHz in 5 ranges;
Accuracy	AC volts, ±0.25% of reading, ±0..25% F.S.; DC volts, ±0.05% of reading, ±0.025% F.S.; resistance, ±0.1% of reading, ±0.05% F.S.; AC current, ±1% of reading, ±0.1% to 10 kHz; DC current, ±0.3% of reading, ±0.05% F.S.; frequency count ±0.01% of reading, ±0.005% F.S.
Calibration	6 months (Cal. due 3-18-82)

NTS Number	G184L
Instrument	Stop Watch
Manufacturer	Junghans
Model Number	165
Serial Number	None
Range	0 to 60 seconds
Accuracy	±0.2%
Calibration	12 months (Cal. due 8-11-82)
NTS Number	None
Instrument	Voltage/Frequency Log Converter
Manufacturer	Rockwell
Model Number	Unknown
Serial Number	N 682 492
Calibration	(Cal. due 1-12-82)
NTS Number	None
Instrument	SD 129
Manufacturer	Rockwell
Model Number	Unknown
Serial Number	N 682 628
Calibration	(Cal. due 11-4-82)
NTS Number	None
Instrument	Charge Amplifier
Manufacturer	Rockwell
Model Number	Unknown
Serial Number	S260591
Calibration	(Cal. due 11-29-82)
NTS Number	None
Instrument	Charge Amplifier
Manufacturer	Rockwell
Model Number	Unknown
Serial Number	S260595
Calibration	(Cal. due 11-29-82)
NTS Number	None
Instrument	Charge Amplifier
Manufacturer	Rockwell
Model Number	Unknown
Serial Number	S260956
Calibration	(Cal. due 11-29-82)
NTS Number	None
Instrument	Charge Amplifier
Manufacturer	Rockwell
Model Number	Unknown
Serial Number	S260958
Calibration	(Cal. due 11-29-82)

APPENDIX B

Exhibit I and II and General Data Sheets

of

Torque Measurements

GEARED LIMIT SWITCH

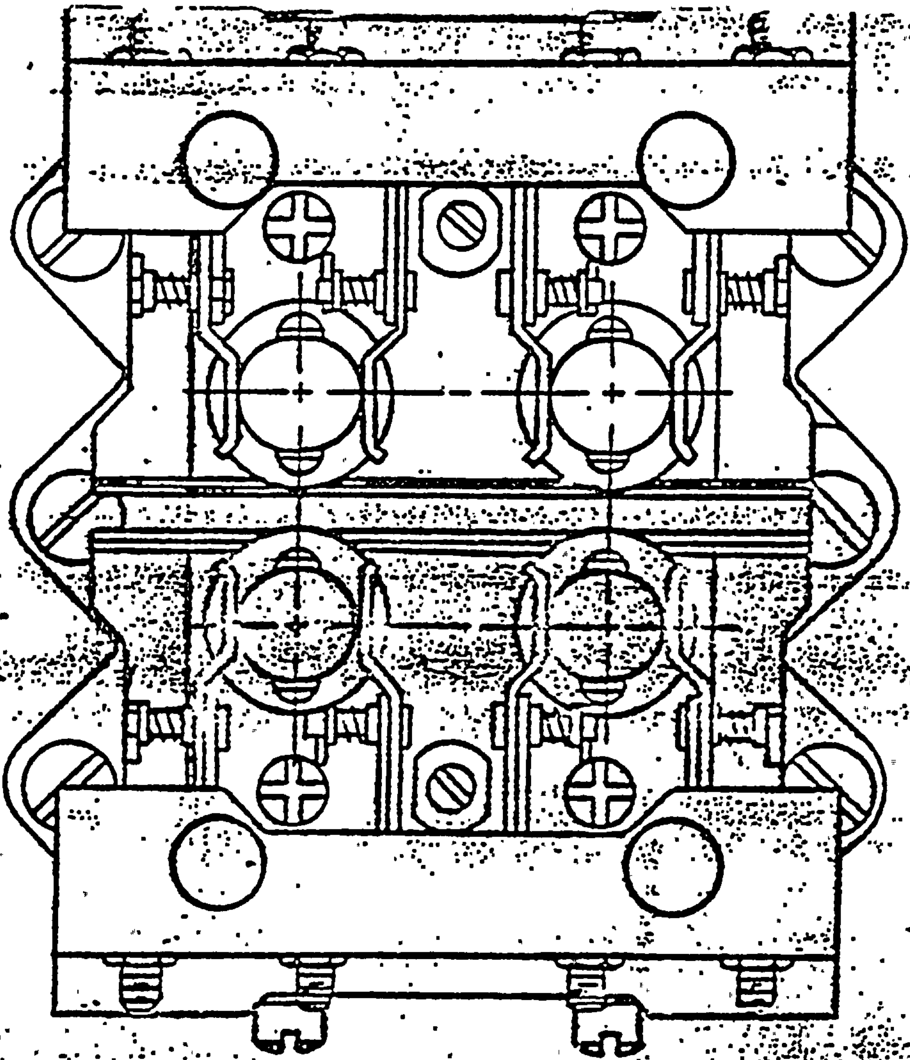
FINGER ASSEMBLY ADJUSTMENT

The Limitorque recommended procedure for checking and adjusting the geared limit finger assembly is as outlined below (ref. attached finger assembly sketch):

1. Rotate the "rotor" to the normal trip position where contact is made between the rotor and finger assembly.

2. With the finger and rotor in contact, measure the gap between the finger and "L" bracket of the finger assembly. This measurement should be made at the finger assembly spring. The normal gap, with the finger in contact with the rotor, should be .020/.040 inches.

3. If the normal gap as defined in (2) above is not .020/.040 inches, the "L" bracket of the finger assembly should be bent to achieve the normal gap.



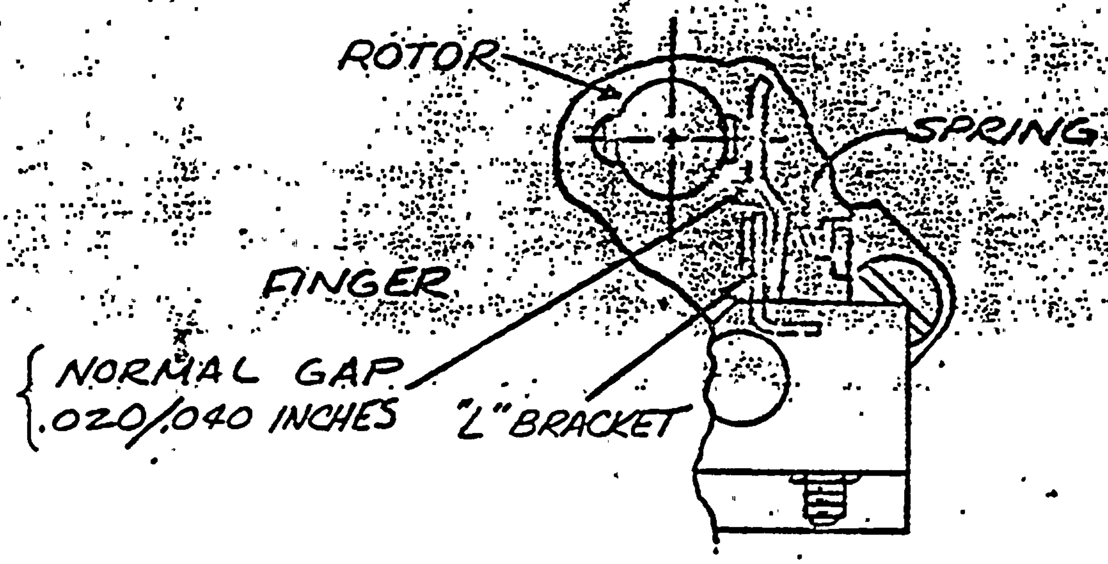

ROTOR
SPRING
FINGER
NORMAL GAP
.020/.040 INCHES
"L" BRACKET

EXHIBIT II

GEARED LIMIT SWITCH

SCREW TIGHTENING

PROCEDURE

Geared limit switch screws which require measured torque preload should be tightened to the following limits:

1/4 inch screws	9ft-lbs
5/16 inch screws	18ft-lbs
3/8 inch screws	30ft-lbs

The above torques require that the screw thread is not lubricated during the tightening process. When screw threads are lubricated, the above values should be reduced to compensate for reduced thread friction.

NOTE: Because of the unpredictability of screw joint variables, particularly thread friction, it is Limitorque policy not to tighten geared limit switch fasteners to a measured torque. Limitorque procedure requires the assembly person to tighten fasteners tight based on the feel of the threaded joint as determined by the experience of the assembly person.

OPERATOR MOUNTING

SCREW TORQUE

SMB-000-5:	5/16 inch screws	16.5 ft - lbs
SMB-0-25:	3/4 inch screws	138 ft - lbs

The above torques require lubricated screw threads.

APPROVED ENGINEERING TEST LABORATORIES

GENERAL DATA SHEET

TEST: GAP — M/O: 548-5291

CUSTOMER: STONE & WEBSTER

TEST ITEM: Limit Switch — P/N: 12"A REV — S/N:

SPECIFICATION: — PAR:

PAGE 8 OF 28

PARAMETER							
UNITS		CONTACT	.020"	.040"	CONTACT	.020"	.040"
DATE	TIME						
		1	>	> ok	5	>	> RESET
		1C	>	> ok	5C	>	<
		2	>	> ok	6	>	> ADJUST
		2C	>	> ok	6C	>	<
		3	>	<	7	>	> ok
		3C	>	> ok	7C	>	> ok
		4	>	> ok	8	>	> ok
		4C	>	> ok	8C	>	> ok
		9	>	> Adjust	13	>	> ok
		9C	< .009	> Adjust	13C	>	<
		10	>	> ok	14	>	<
		10C	< .004	> ok	14C	>	<
		11	>	<	15	>	<
		11C	>	<	15C	>	> ok
		12	>	> ok	16	>	<
		12C	>	> ok	16C	>	> ok

GENERAL TEST NOTES: < = LESS THAN. > = MORE THAN

- IF IT IS < .020 IT SHALL BE ADJUSTED
- IF IT IS > .040 IT SHALL BE CHECKED FOR SPRING

PRE TEST

TEST BY ___ DATE ___

ENGR. ___ GOV'T QAR ___

AEB PTG — 215

APPROVED ENGINEERING TEST LABORATORIES

GENERAL DATA SHEET

TEST
CUSTOMER
TEST ITEM P/N 12" A S/N
SPECIFICATION PAR

VOID

ATL QA PAGE 38 OF 38

PARAMETER								
UNITS		CONTACT	.020"	.040"		CONTACT	.020"	.040"
DATE	TIME							
		1	< .018	<		5	>	> NOTE
		1C	>	<		5C	< .010	> OK
		2	>	<		6	>	<
		2C	< .007	> OK		6C	>	<
		3	< .018	<		7	>	<
		3C	>	<		7C	>	<
		4	>	<		8	>	<
		4C	>	<		8C	>	> OK
		9	>	> OK		13	>	> OK
		9C	>	> OK		13C	< .010	<
		10	>	> OK		14	>	<
		10C	>	> OK		14C	< .018	<
		11	>	<		15	>	<
		11C	< .018	> OK		15C	>	<
		12	>	> OK		16	< .015	> OK
		12C	>	<		16C	< .007	<

GENERAL TEST NOTES: < = LESS THAN, > = MORE THAN
- IF IT IS < .020 IT SHALL BE ADJUSTED
- IF IT IS > .040 IT SHALL BE CHECKED FOR SPRING
NO. 5 STACK SPRING (REPAIRED) < .040

PRE TEST

TEST BY
ENGR.
DATE
GOV'T QAR

APPROVED ENGINEERING TEST LABORATORIES

GENERAL DATA SHEET

TEST: GAP
CUSTOMER: STONE & WEBSTER
TEST ITEM: Limit Switch
SPECIFICATION:
P/N: 12"13
S/N:
MJO: 548-5291
PAR:

SHEET 4/8 OF 4/8

PARAMETER								
UNITS		CONTACT	.020"	.040"		CONTACT	.020"	.040"
DATE	TIME							
		1	>	<		5	>	> OK
		1C	< .000	<		5C	< .017	<
		2	>	<		6	>	> OK
		2C	< .010	> OK		6C	>	<
		3	>	<		7	>	<
		3C	>	<		7C	>	> OK
		4	>	<		8	>	<
		4C	>	<		8C	>	<
		9	>	> OK		13	> .015	> OK
		9C	>	<		13C	< .015	> OK
		10	>	> OK		14	>	<
		10C	< .010	<		14C	< .015	<
		11	>	> OK		15	>	<
		11C	>	<		15C	>	> OK
		12	>	<		16	< .015	<
		12C	>	<		16C	< .015	<

GENERAL TEST NOTES: < = LESS THAN, > = MORE THAN
- IF IT IS < .020 IT SHALL BE ADJUSTED
- IF IT IS > .040 IT SHALL BE CHECKED FOR SPRING

PRE TEST

TEST BY: [signature]
ENGR.:
DATE:
GOV'T QAR:

AB PTG. — 215

APPROVED ENGINEERING TEST LABORATORIES

GENERAL DATA SHEET

TEST GAP MJO 548-9291

CUSTOMER STONE & WEBSTER

TEST ITEM Limit Switch P/N 12"-C S/N

SPECIFICATION PAR

PARAMETER							
UNITS		CONTACT	.020"	.040"	CONTACT	.020"	.040"
DATE	TIME						
		1	>	<	5	< .015	> OK
		1C	>	<	5C	>	> OK
		2	>	<	6	< .010	<
		2C	>	<	6C	>	> OK
		3	< .005	<	7	>	> OK
		3C	>	> OK	7C	>	<
		4	< .015	<	8	>	> OK
		4C	>	<	8C	>	<
		9	>	> OK	13	>	<
		9C	< .010	<	13C	< .007	<
		10	>	<	14	>	<
		10C	>	<	14C	>	<
		11	>	> OK	15	>	<
		11C	>	<	15C	>	> OK
		12	>	> OK	16	>	<
		12C	>	<	16C	>	> OK

GENERAL TEST NOTES: <= LESS THAN. > = MORE THAN

- IF IT IS < .020 IT SHALL BE ADJUSTED
- IF IT IS > .040 IT SHALL BE CHECKED FOR SPRING

PAGE 58 OF 58

TEST BY

ENGR.

DATE

GOV'T QAR

PRE TEST

B-7

APPROVED ENGINEERING TEST LABORATORIES

GENERAL DATA SHEET

TEST: PRE TESTING CHECK — AJO 546-929/

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMIT SWITCH — P/N 3'C — S/N

SPECIFICATION — PAR

PAGE 56 OF 68

TEST BY — DATE

ENGR. — GOV'T QAR

PRE TEST

PARAMETER								
UNITS		CONTACT	.020"	.040"		CONTACT	.020"	.040"
DATE	TIME							
11-9	1830	1	>	>		5	< .000	<
		1C	< .000	<		5C	>	>
		2	>	<		6	< .000	<
		2C	< .000	<		6C	>	>
		3	< .016	<		7	>	<
		3C	>	<		7C	< .000	>
		4	< .010	<		8	>	>
		4C	>	>		8C	< .000	>
		9	>	<		13	>	<
		9C	>	>		13C	< .018	<
		10	>	<		14	>	<
		10C	>	<		14C	>	<
		11	< .018	<		15	>	>
		11C	>	<		15C	>	<
		12	< .014	<		16	>	<
		12C	>	<		16C	< .014	<

GENERAL TEST NOTES: < = LESS THAN, > = MORE THAN

- IF IT IS < .020 IT SHALL BE ADJUSTED

- IF IT IS > .040 IT SHALL BE CHECKED FOR SPRING

B-8

AEB FTC — 215

APPROVED ENGINEERING TEST LABORATORIES

GENERAL DATA SHEET

TEST: PRE TESTING CHECK AJO: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: Limit switch P/N: 3" 13 S/N:

SPECIFICATION: PAR:

PARAMETER								
UNITS		CONTACT	.020"	.040"		CONTACT	.020"	.040"
DATE	TIME							
		1	>	>		5	< .003	>
		1C	>	>		5C	>	<
		2	>	>		6	< .014	>
		2C	< .005	<		6C	>	>
		3	>	<		7	< .000	<
		3C	< .000	<		7C	>	>
		4	<	<		8	< .018	<
		4C	>	<		8C	>	>
		9	>	<		13		
		9C	>	<		13C		
		10	>	<		14		
		10C	< .014	<		14C		
		11	>	<		15	>	<
		11C	>	>		15C	>	<
		12	< .016	>		16	>	<
		12C	< .018	>		16C	>	>

GENERAL TEST NOTES: < = LESS THAN, > = MORE THAN

- IF IT IS < .020 IT SHALL BE ADJUSTED
- IF IT IS > .040 IT SHALL BE CHECKED FOR SPRING

PRE TEST

TEST BY: ____ DATE: ____

ENGR.: ____ GOVT QAR: ____

AEB PTC — 215

APPROVED ENGINEERING TEST LABORATORIES

GENERAL DATA SHEET

TEST PRE TESTING CHECK W/O 548 9291

CUSTOMER STONE & WEBSTER

TEST ITEM Limit Switch P/N 3" A S/N

SPECIFICATION PAR

PARAMETER								
UNITS		CONTACT	.020"	.040"	CONTACT	.020"	.040"	
DATE	TIME							
11-9	1600	1	>	<	5	>	< Adj. DOWN	
		1C	>	<	5C	>	<	
		2	>	<	6	>	<	
		2C	>	>	6C	>	<	
		3	>	>	7	>	>	
		3C	< .012	<	7C	>	<	
		4	>	<	8	>	>	
		4C	< .005	<	8C	>	<	
		9	>	>	13	>	<	
		9C	>	<	13C	< .017	<	
		10	>	>	14	>	>	
		10C	>	<	14C	>	>	
		11	>	<	15	>	<	
		11C	>	<	15C	>	<	
		12	>	<	16	>	<	
		12C	< .001	<	16C	>	<	

GENERAL TEST NOTES: < = LESS THAN, > = MORE THAN

- IF IT IS < .020 IT SHALL BE ADJUSTED

- IF IT IS > .040 IT SHALL BE CHECKED FOR SPRING

PAGE 8 OF 8

TEST BY DATE

ENGR.

GOV'T QAR

PRE TEST

AB PTG — 215

Customer STONE & WEBSTER Job No. 543-9291
P.O. No.
Date
Amb. Temp.
Photo
Test Med.

DATA SHEET

Spec. 12"A REV.
Para.
S/N

Test Title: TORQUE

NO		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS
			"Lbs	"	"Lbs				"Lbs	"	"Lbs	
1		1	108	1/4	90	NO WASHER		13	NA			
2		2			90			14	NA			
3		3			90		LUBED	15	216	5/16	150	NO GASKET
4		4			90			16			150	
5		5			50	STAR WASHER						
6		6			50							
7		7			50							
8		8			50							
9		9	216	5/16	150	NO WASHER						
10		10			150		RTV					
11		11			150							
12		12			150							

GENERAL TEST NOTES:

Specimen Passed
Specimen Failed
N.O.D. Written

Tested By [signature] Date:
Witness Date:
Sheet No. of
Approved

B-11

Customer STONE & WEBSTER Lab. No. 542-9291
P.O. No.
Date
Amb. Temp.
Photo
Test Med.
Spec. 12"A
Para.
S/N

DATA SHEET

Test Title: TORQUE

NO		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS
			"Lbs		"Lbs							
1		1	108	1/4	81	REDUCED TORQUE DUE TO OIL HOLES		13				
2		2			81			14				
3		3			81			15			150	
4		4			81			16			175	
5		5										
6		6										
7		7										
8		8										
9		9			175							
10		10			150							
11		11			175							
12		12			175							

GENERAL TEST NOTES:

1-4 (RECHECKED AND NOW SET FOR 90"Lbs)

* NEW SHEET 12"A REV

G = GASKET SUPPLIED

Specimen Passed
Specimen Failed
N.O.D. Written

Tested By: [signature] Date:
Witness Date:
Sheet No. of
Approved

B-12

DATA SHEET

Report No. 54? 0?91
P.O. No.
Date
Amb. Temp.
Photo
Test Med.

Spec. 12!! B
Para.
S/N

Test Title: TORQUE

		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS
NO									"Lbs	"	"Lbs	
1		1	108	1/4	108	NO WASHER		13	NA			NO WASH
2		2			108		G/NY	14	NA			
3		3			108			15	216	5/16	216	N
4		4			108			16				
5		5				FLAT WASHER						
6		6					NT					
7		7			108	BLISTER IN PLASTIC						
8		8			108							
9		9	216	5/16	216	NO WASHER						
10		10					GR NY					
11		11										
12		12										

GENERAL TEST NOTES:

NY = NYLOCK INSERT
G = GASKET SUPPLIED
NT = NYLON ON THREADS
GR = GASKET OF RTV.

Specimen Passed
Specimen Failed
N.O.D. Written

Tested By DNB Date:
Witness Date:
Sheet No. of
Approved

B-13

DATA SHEET

Customer: STONE & WEBSTER Job No.: 54X-9291
P.O. No.:
Date
Spec: 12" C
Para.
Amb. Temp.
S/N
Photo
Test Med.

Test Title: TORQUE

NO		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS
			"Lbs	"	"Lbs				"Lbs	"	"Lbs	
1		1	108	44	108	NO GASKET	G/NY	13	NA			
2		2						14	NA			
3		3						15	216	5/16	216	NO GASKET NY
4		4						16				
5		5				FLAT WASHER	NT					
6		6										
7		7										
8		8										
9		9	216	5/16	216	NO WASHER	G NY					
10		10										
11		11										
12		12			150							

GENERAL TEST NOTES:

GR = GASKET MADE OF RTV
G = GASKET SUPPLIED
NT = NYLON ON THREADS
NY = NYLOCK INSECT

Specimen Passed
Specimen Failed
N.O.D. Written

Tested By [signature] Date:
Witness Date:
Sheet No. of
Approved

B-14

Customer STONE & WEBSTER Report No. 54X-9291
P.O. No.
Date
Spec: 3" A
Amb. Temp:
Para.
Photo
S/N
Test Med.

DATA SHEET

Test Title: TORQUE

		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS
NO			"Lbs	"	"Lbs				"Lbs	"	"Lbs	
1		1	108	1/4	108	NO WASH		13	216	5/16	150	NO
2		2			108		G	14			150	NO
3		3			108			15			165	STAR
4		4			108			16			175	STAR
5		5			108	STAR WASH						
6		6			108							
7		7			108							
8		8			108							
9		9	216	5/16	175	STAR						
10		10	150		150		G					
11		11	175		175							
12		12	150		150							

GENERAL TEST NOTES:

G = GASKET PROVIDED

Specimen Passed
Specimen Failed
N.O.D. Written

Tested By [signature] Date:
Witness Date:
Sheet No. of
Approved

Customer [illegible] Job. No. 54[illegible]-9791

3" C

Spec.

Para.

S/N

P.O. No.

Date

Amb. Temp.

Photo

Test Med.

DATA SHEET

Test Title: TORQUE

		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS
NO			"Lbs	"	"Lbs				"Lbs	SIZE	"Lbs	
1		1	108"Lbs	1/4	108"Lbs	NO WASH		13	216	5/16	216	NO
2		2					G/NY	14	↓	↓	↓	NO N1
3		3						15	NA	5/16	NA	NO
4		4						16	NA	5/16	NA	NO N1
5		5				FLAT WASH						
6		6					NT					
7		7										
8		8										
9		9	216"Lbs	5/16	216Lbs	NO WASH						
10		10					G/NY					
11		11										
12		12										

GENERAL TEST NOTES:

Specimen Passed

Specimen Failed

N.O.D. Written

Tested By DVB Date:

Witness Date:

Sheet No. of

Approved

B-16

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	Customer STONE & WEBSTER	Job No. 548-9291	
						3"13	P.O. No.	
							Date	
						Spec.	Amb. Temp.	
						Para.	Photo	
						S/N	Test Med.	

DATA SHEET

Test Title: TORQUE

NO		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS		SCREW NO.	TORQUE REQ	SCREW SIZE	TORQUE SET	REMARKS
1		1	108" Lbs	1/4	108" Lbs	NO WASH		13	216" Lbs	5/16	216" Lbs	NO NT
2		2		1/4			G/NY	14		5/16		NO
3		3		1/4				15	NA	5/16	NA	NO NY
4		4		1/4				16	NA	5/16	NA	NO
5		5		1/4		FLAT WASH						
6		6		1/4			NT					
7		7		1/4								
8		8		1/4								
9		9	216" Lbs	5/16	216" Lbs	NO WASH						
10		10		5/16			GR/NY					
11		11		5/16								
12		12		5/16								

GENERAL TEST NOTES:

Specimen Passed ____

Specimen Failed ____

N.O.D. Written ____

Tested By [signature] Date: ____

Witness ____ Date: ____

Sheet No. ____ of ____

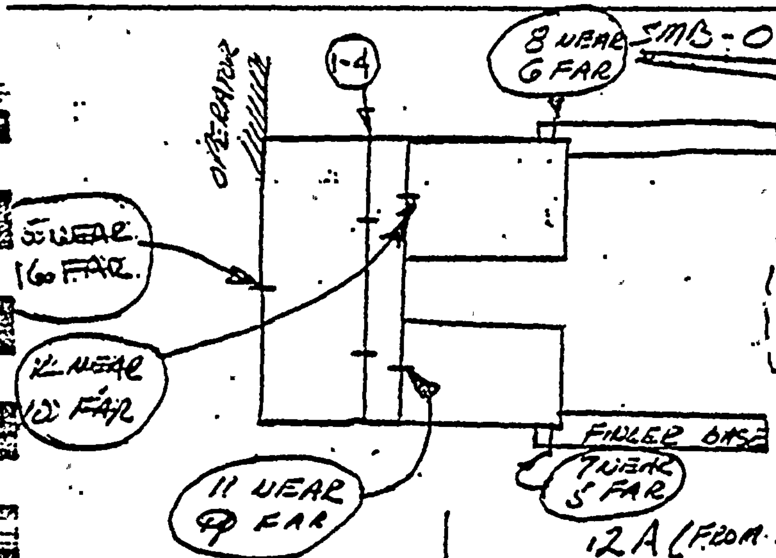
Approved ____

B-17

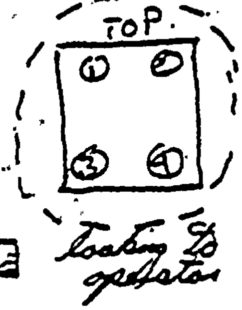
BOOK NO.______
LOCATION______ J. O. NO.______
REPORT NO.______ PG. NO.______
DATE______ BY______

SMB-0-25

operator mounting (130) 1656 IN LBS w C6A



TOP



internal GR ≡ GASKET MADE OF RTV

G ≡ GASKET SUPPLIED

NT ≡ NYLON ON THREAD

NY ≡ "NYLOCK" INSERT

BOLT #	DESCRIPTION	12A (FROM FIELD) WASHER	12A TORQUE	12B (BRACKET) WASHER	12B TORQUE	12C (SCREWS) WASHER	12C TORQUE
4	INTERNAL 1/4" 20UNC 5/8	NO G	90 IN LB (LUBRICATED)	NO G/NY	108 IN LB	NO G/NY	108 IN LB
5	1/4" 20UNC 5/8	star	50 IN LB	flat	108 IN LBS	flat	108 IN LBS
6		star		flat NT		flat NT	
7		star		flat		flat	
8		star		flat		flat	
9	5/16" 18UNC 3/4	no	150 IN LBS	no, GR NY	216 IN LBS	no, G NY	216
10		no G					216
11		no					216
12		no					150
13	NOT USED						
14	NOT USED						
15	5/16" 18UNC 1	no	150	no NY	216 IN LBS	no NY	216 IN LBS
16		no	(175) 160				

COPIES TO—1______
COPIES TO—2______

ENGINEER'S RECORD BOOK

BOOK NO. ______

LOCATION ______ J. O. NO. ______

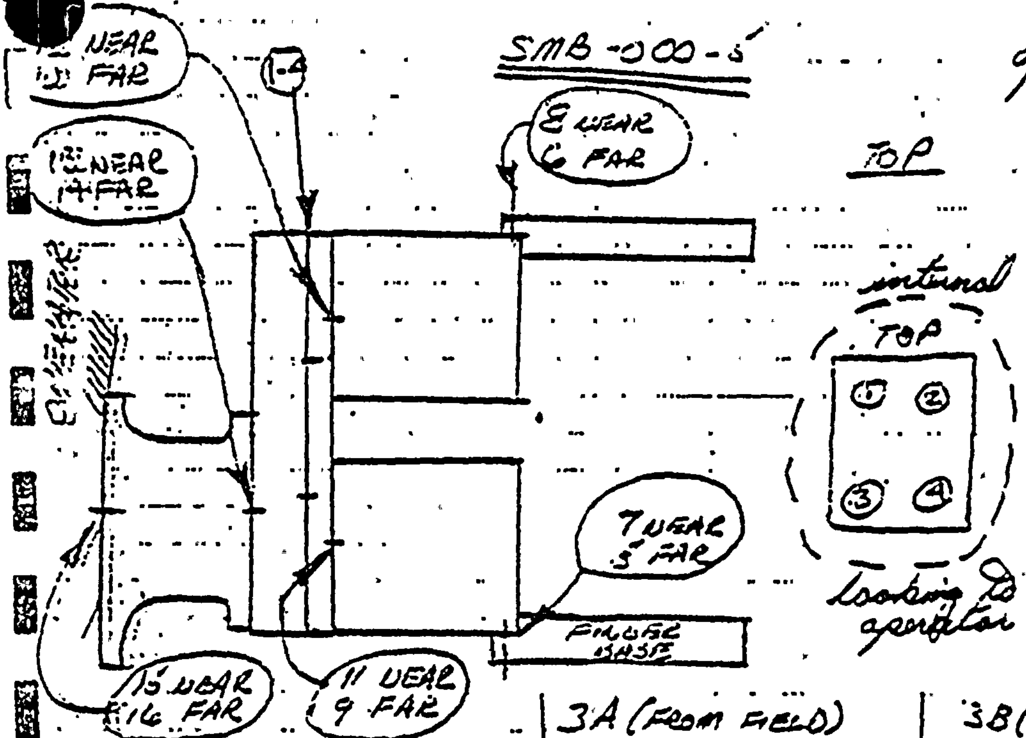
REPORT NO. ______ PG. NO. ______

DATE ______ BY ______

SMB-000-5

operator mounting 198 in lb (16.5) with CSA

TOP



GR ≡ GASKET MADE OF RTV

G ≡ GASKET SUPPLIED

NT ≡ NYLON ON THREAD

NY ≡ "NYLOCK" INSERT

BOLT #	DESCRIPTION	3A (FROM FIELD) WASHER	TORQUE	3B (BRACKET) WASHER	TORQUE	3C (SCREWS) WASHER	TORQUE
1-4	INTERNAL, (1/4" 20 UNC 5/8)	NO	108 IN LB	NO	108 IN LB	NO	108 IN LB
		G		G/NY		G/NY	
5	1/4" 20 UNC 5/8	star	108 IN LBS	flat (NT)	108 IN LBS	flat (NT)	108 IN LBS
6		star		flat		flat	
7		star		flat		flat	
8		star		flat		flat	
9	5/16" 18 UNC 3/4	star (G)	175	no (GR NY)	216 IN LBS	no (G NY)	216 IN LBS
10		star	150	no		no	
11		star	175	no		no	
12		star	150	no		no	
13	5/16" 18 UNC 3/4	no	150	no (NT)	216 IN LBS	no (NT)	216 IN LBS
14		no	160	no		no	
15	5/16" 18 UNC 1	star	165	no (NY)	216 IN LBS	no (NY)	216 IN LBS
16		star	175	no		no	

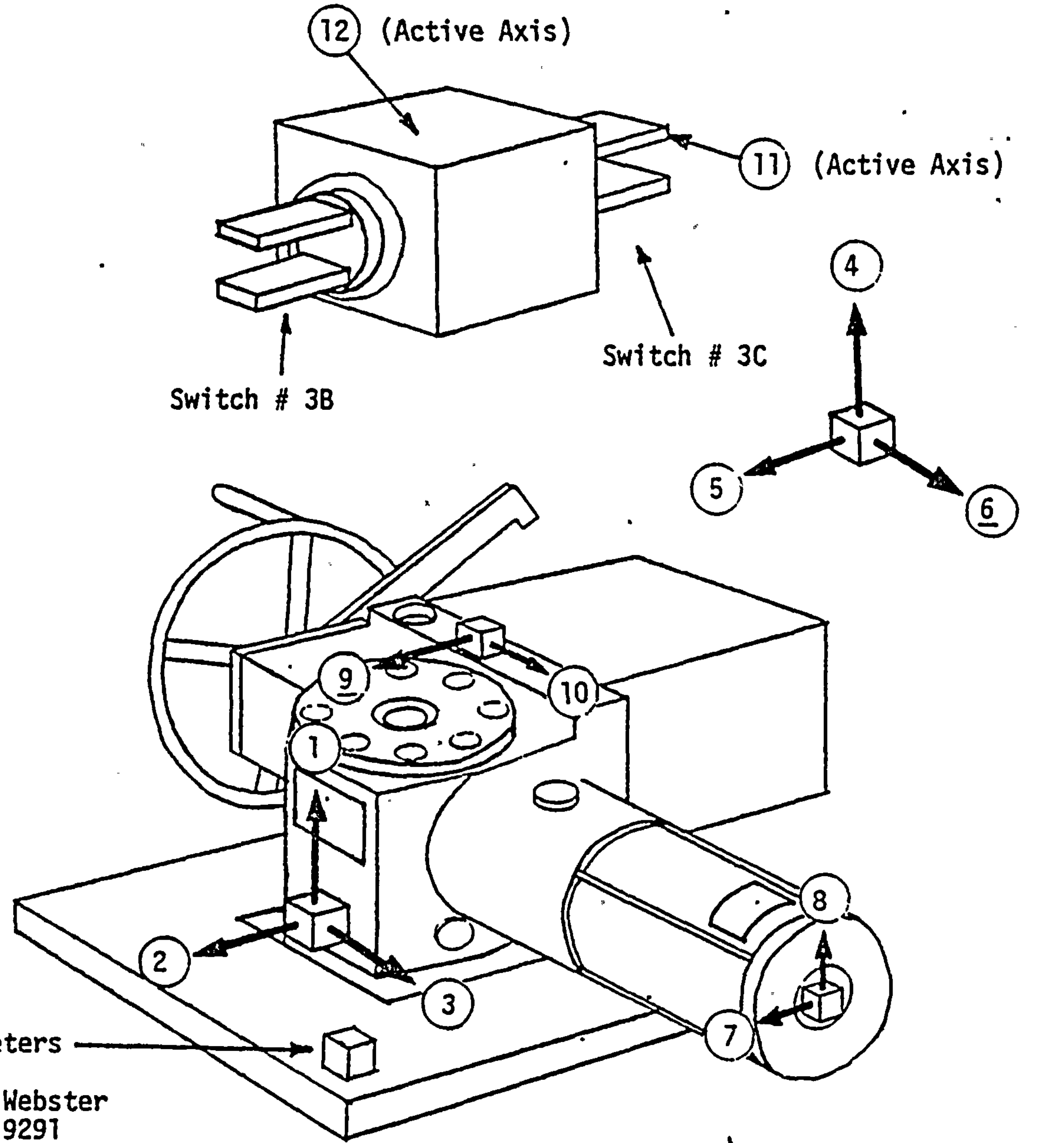
APPENDIX C

Stroke Times - Sine Beat Test

and

Accelerometer Locations

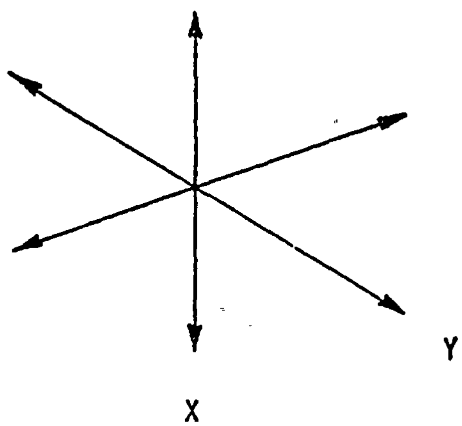
NTS



Stone and Webster
MJO # 548-9291

LIMITORQUE OPERATOR, Model # SMB-000-5
and MODIFIED LIMIT SWITCHES, P/N - 3B and 3C

RESPONSE ACCELEROMETER LOCATIONS
FOR SINE BEAT TESTING ONLY.



A&B PTG. — 207

NTS

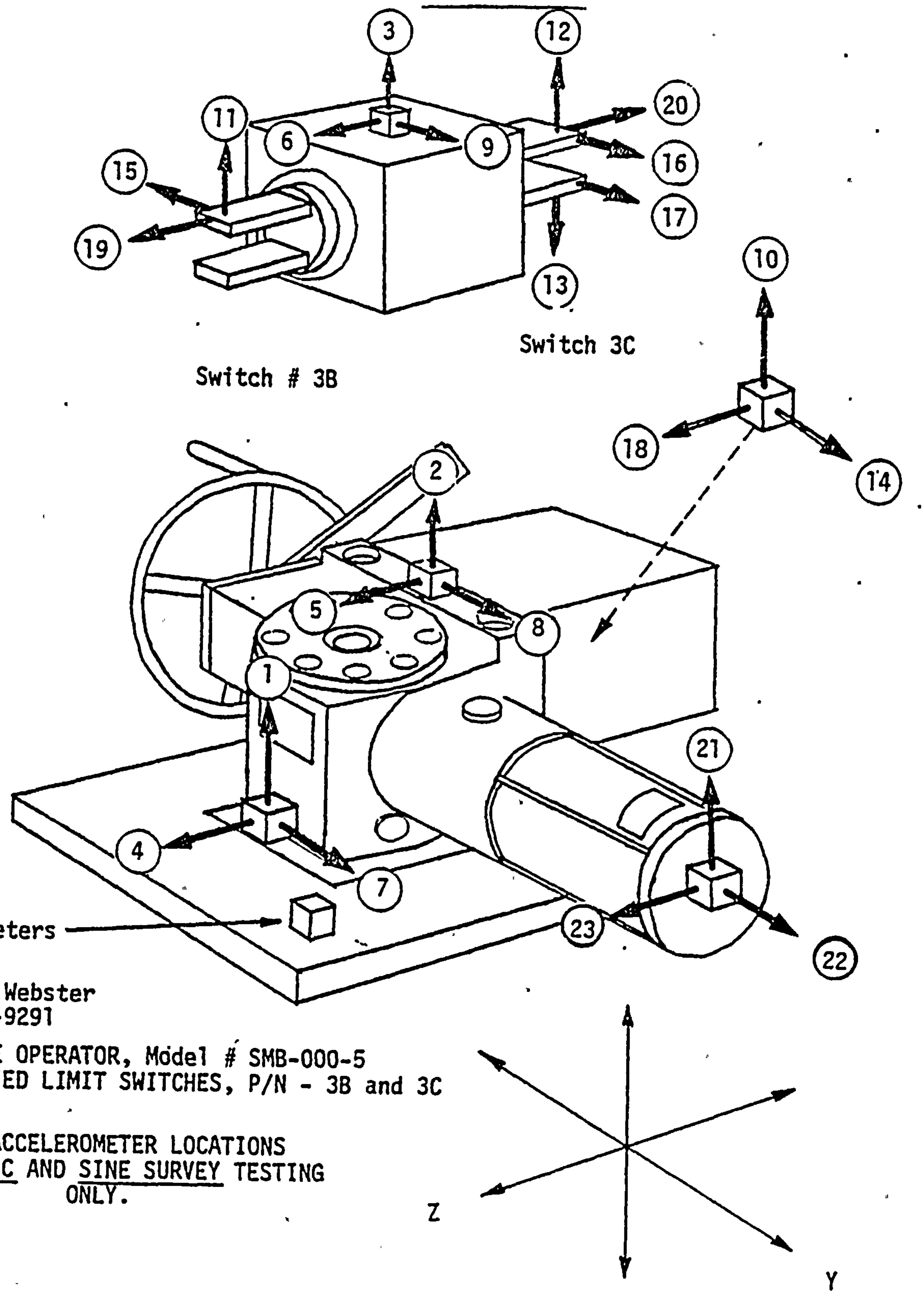
STONE AND WEBSTER
MJO # 548-9291

Specimen : LIMITORQUE OPERATOR, Model # SMB-000-5 and
MODIFIED LIMIT SWITCHES, P/N - 3B and 3C

RESPONSE ACCELEROMETER LOCATIONS

Accel. #	Location	Axis
1.-	Operator Gear Box	X
2.-	Operator Gear Box	Z
3.-	Operator Gear Box	Y
4.-	Operator Limit Switch	X
5.-	Operator Limit Switch	Z
6.-	Operator Limit Switch	Y
7.-	Operator Motor	Z
8.-	Operator Motor	X
9.-	Operator Housing	Z
10.-	Operator Housing	Y
11.-	Modified Limit Switch (3C)......	Active axis
12.-	Modified Limit Switch Block	Active axis

* These accelerometer locations are applicable to the SINE BEAT portion of the test only.



Stone and Webster
MJO # 548-9291

LIMITORQUE OPERATOR, Model # SMB-000-5
and MODIFIED LIMIT SWITCHES, P/N - 3B and 3C

RESPONSE ACCELEROMETER LOCATIONS
FOR SEISMIC AND SINE SURVEY TESTING
ONLY.

STONE AND WEBSTER
MJO # 548-9291

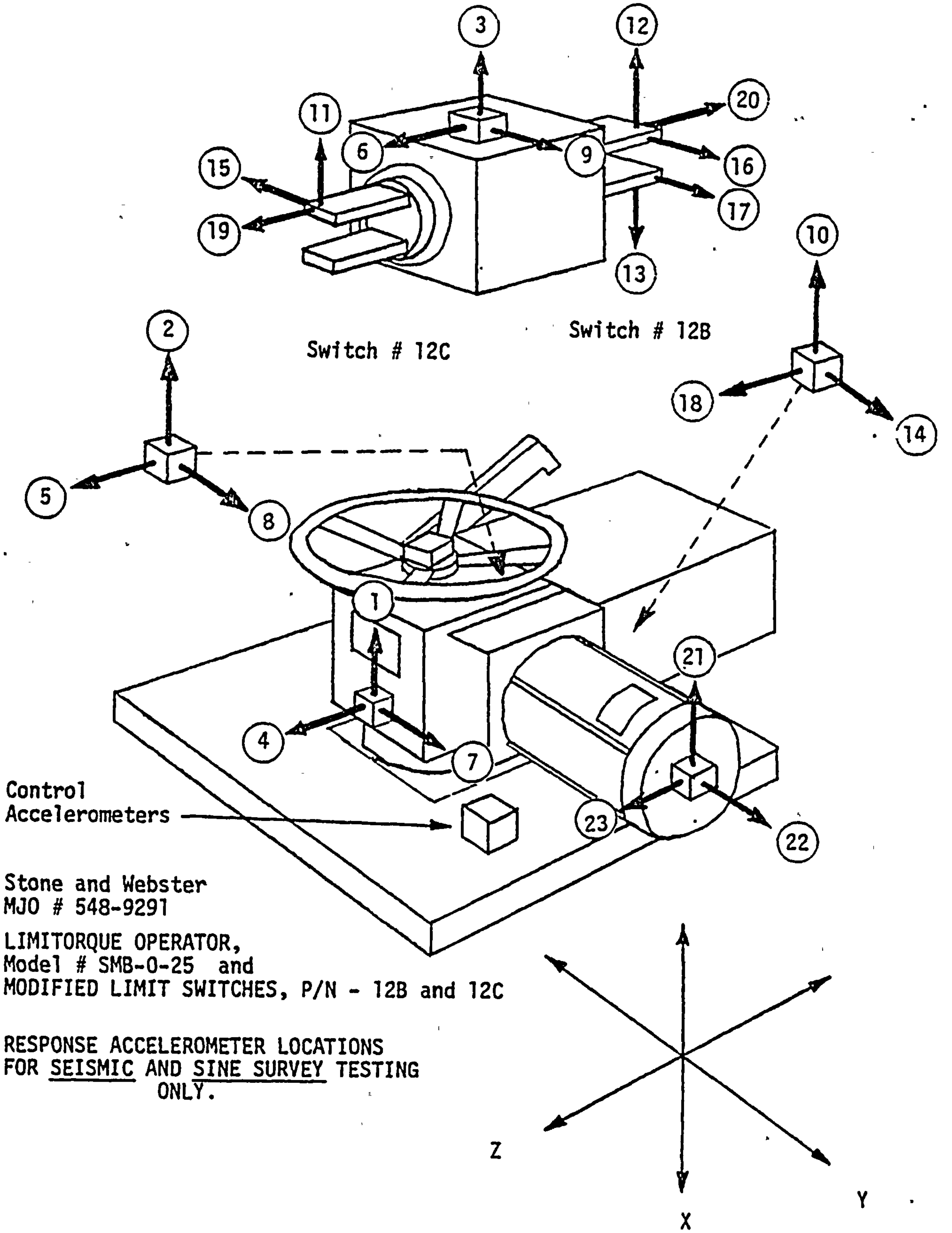
Specimen : LIMITORQUE OPERATOR, Model # SMB-000-5 and
MODIFIED LIMIT SWITCHES, P/N - 3B and 3C

RESPONSE ACCELEROMETER LOCATIONS

Accel. #	Location	Axis
1.-	Operator Gear Box	X
2.-	Operator Housing	X
3.-	Switch Block	X
4.-	Operator Gear Box	Z
5.-	Operator Housing	Z
6.-	Switch Block	Z
7.-	Operator Gear Box	Y
8.-	Operator Housing	Y
9.-	Switch Block	Y
10.-	Operator Switch	X
11.-	Switch # 3B (top)	X
12.-	Switch # 3C (top)	X
13.-	Switch # 3C (bottom)	X
14.-	Operator Switch	Y
15.-	Switch # 3B (top)	Y
16.-	Switch # 3C (top)	Y
17.-	Switch # 3C (bottom)	Y
18.-	Operator Switch	Z
19.-	Switch # 3B (top)	Z
20.-	Switch # 3C (top)	Z
21.-	Operator Motor	X
22.-	Operator Motor	Y
23.-	Operator Motor	Z

* These accelerometer locations are applicable to the SEISMIC and SINE SURVEY portion of the test only.

A&B PTG. — 207



Stone and Webster
MJO # 548-9291

LIMITORQUE OPERATOR,
Model # SMB-0-25 and
MODIFIED LIMIT SWITCHES, P/N - 12B and 12C

RESPONSE ACCELEROMETER LOCATIONS
FOR SEISMIC AND SINE SURVEY TESTING
ONLY.

NTS

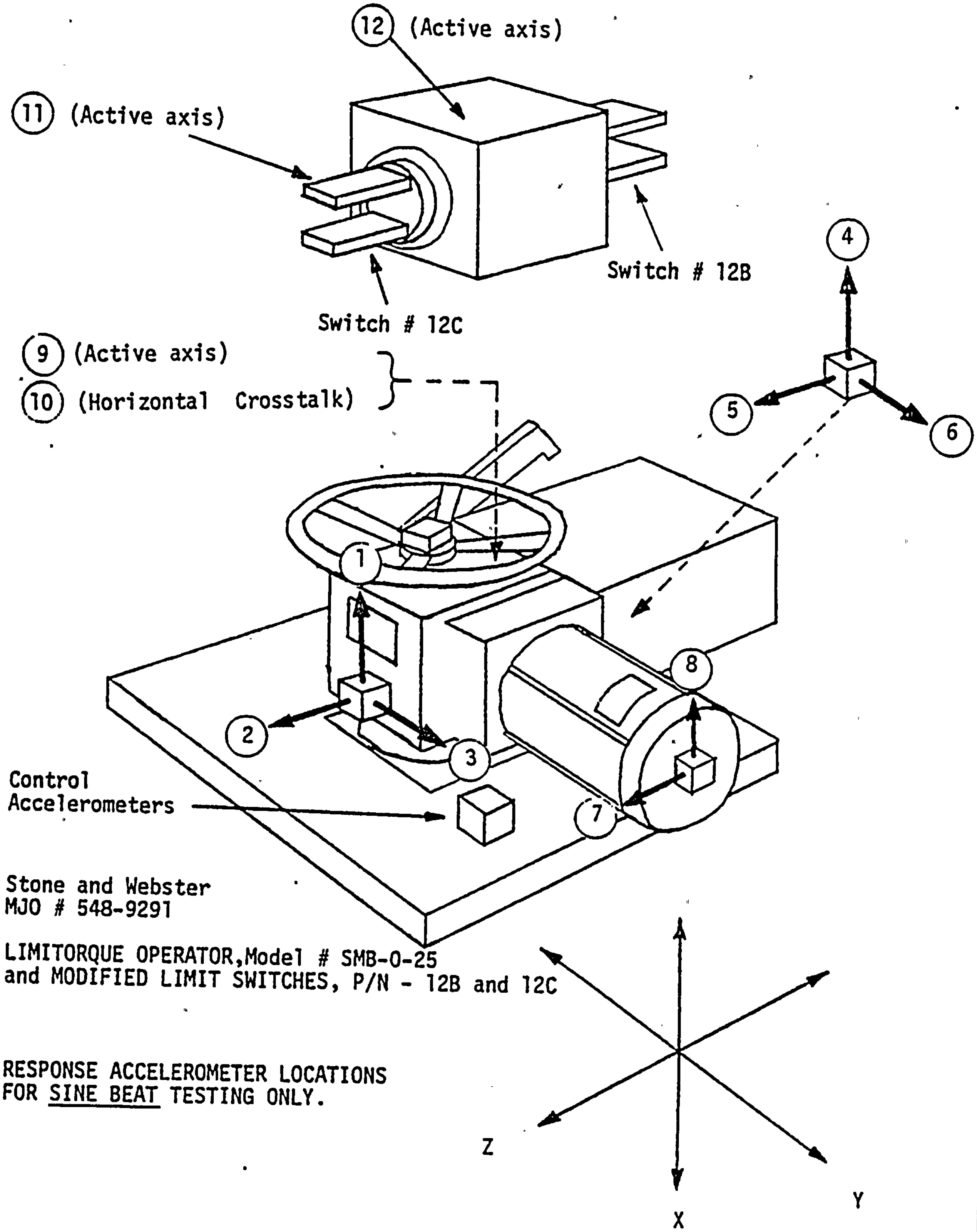
STONE AND WEBSTER
MJO# 548-9291

Specimen : LIMITORQUE OPERATOR, Model # SMB-0-25 and MODIFIED LIMIT SWITCHES, P/N - 12B and 12C

Test Date : December 3, 1981

RESPONSE ACCELEROMETER LOCATIONS

Accel. #	Location	Axis
1.-	Operator Gear Box	X
2.-	Operator Housing	X
3.-	Switch Block	X
4.-	Operator Gear Box	Z
5.-	Operator Housing	Z
6.-	Switch Block	Z
7.-	Operator Gear Box	Y
8.-	Operator Housing	Y
9.-	Switch Block	Y
10.-	Operator Switch	X
11.-	Switch # 12C (top)	X
12.-	Switch # 12B (top)	X
13.-	Switch # 12B (bottom)	X
14.-	Operator Switch	Y
15.-	Switch # 12C (top)	Y
16.-	Switch # 12B (top)	Y
17.-	Switch # 12B (bottom)	Y
18.-	Operator Switch	Z
19.-	Switch # 12C (top)	Z
20.-	Switch # 12B (top)	Z
21.-	Operator Motor	X
22.-	Operator Motor	Y
23.-	Operator Motor	Z



Stone and Webster
MJO # 548-9291

LIMITORQUE OPERATOR, Model # SMB-0-25
and MODIFIED LIMIT SWITCHES, P/N - 12B and 12C

RESPONSE ACCELEROMETER LOCATIONS
FOR SINE BEAT TESTING ONLY.

NTS

STONE AND WEBSTER
MJO # 548-9291

Specimen : LIMITORQUE OPERATOR, Model # SMB-0-25 and
MODIFIED LIMIT SWITCHES, P/N - 12B and 12C

RESPONSE ACCELEROMETER LOCATIONS

Accel. #	Location	Axis
1.-	Operator Gear Box..................	X
2.-	Operator Gear Box..................	Z
3.-	Operator Gear Box..................	Y
4.-	Operator Switch....................	X
5.-	Operator Switch....................	Z
6.-	Operator Switch....................	Y
7.-	Operator Motor.....................	Z
8.-	Operator Motor.....................	X
9.-	Operator Housing...................	Active Axis
10.-	Operator Housing...................	Horizontal Crosstalk
11.-	Switch # 12C (bottom)..............	Active axis
12.-	Switch Block.......................	Active axis

* These accelerometer locations are applicable to the SINE BEAT portion of the test only.

A&B PTG. — 207

F.M. TAPE AND OSCILLOGRAPH SET-UP

Customer STONE & WEBSTER MJO# 548-9291

Test Item LIMITORQUE VALVE MOTOR

P/N SMB-000-5 S/N Date 12-9-81

VISICORDER #1					VISICORDER #2					TAPE #1 (15 IPS)			TAPE #2 (15 IPS)		
n.	Accel	Trace	G/in	Sens.	Ch.	Accel	Trace	G/in	Sens.	Ch.	Mv/g	Accelerometer	Ch.	Mv/g	Accelerome
1	1				1	13				1		1	1		21
2	2				2	21				2		2	2		15
3	3				3	15				3		3	3		16
4	4				4	16				4		4	4		17
5	5				5	17				5		5	5		18
6	6				6	18				6		6	6		19
7	7				7	19				7		7	7		10
8	8				8	10				8		8	8		14
9	9				9	14				9		9	9		22
0	20				10	22				10		20	10		23
1	11				11	23				11		11	11		24 CONTRO
2	12				12	24				12		12	12		—
3					13					13		13	13		—
4					14					14		VOICE	14		VOICE
5					15										
6					16										
					17										
					18										

ACCELEROMETER LOCATIONS

ccel.	I.D.#	SURVEYS X	Y	Z	AXES XY	YZ	Location

Technician JIM FARRIS Date 12-9-81

NTS

A NATIONAL TECHNICAL SERVICES CO.

Report 548-9291, Rev. 1

GENERAL DATA SHEET

TEST: SINE BEAT DATE: 12-7-81 W/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-000-5 S/N:

NTS SPECIFICATION: TP# 548-9291 PAR: 7.6

Date	TEST DESCRIPTION	
12-7-81	EQUIPMENT ARRIVED FROM CHATSWORTH, SETTING UP INSTRUMENTATION.	
12-8-81	CHECKED OUT INSTRUMENTATION, RAN DYNAMIC CAL, RAN SINE BEAT (BARE SHAKER).	
12-9-81	MOUNTED TEST SPECIMEN IN "Z" AXIS & INSTALLED ACCELEROMETERS.	
TIME	SINE BEAT 15 OSC./BEAT 6 BEATS	TAPE REC. COUNTER
1817	12.6 HZ 6 g Pk CHARGE AMP. RANGE 10	000 - 240
1829	15.9 HZ " 30	240 - 466
1835	20 HZ " 30	466 - 592
1848	25 HZ " 30	592 - 724
1854	30 HZ " 30	724 - 877
1900	35 HZ " 30	877 - 975
1915	ROTATED TO "Y" AXIS	
	SINE BEAT 15 OSC./BEAT 6 BEATS	
1941	12.6 HZ 6 g Pk CHARGE AMP. RANGE 30	975 - 1132
* 1948	15.9 HZ " 30	1132 - 1264
1953	20 HZ " 30	1264 - 1374
1957	25 HZ " 30	1374 - 1474
2003	30 HZ " 30	1474 - 1565
2004	35 HZ " 30	1565 - 1631
*	NOTE: PULSE 4 AUDIBLY HIGHER WITH SAME INPUT	

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY: Jim Rice DATE:

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GENERAL DATA SHEET

TEST SINE BEAT DATE 12-9-81 W/O 548-9291

CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.6

Date	TEST DESCRIPTION	
2015	ROTATED TO "X" AXIS.	
12-10-81	SINE BEAT 15 OSC/BEAT 6 BEATS	TAPE COUNTER
0935	12.6 HZ 6g PK CHARGE AMP. RANGE 30	1631-1775
	LOST 6 ACCEL'S, RE-MOUNTED ACCEL'S.	
1025	15.9 HZ 6g PK CHARGE AMP. RANGE 30	1775-1861
1027	20 HZ " 30	1861-1969
1040	25 HZ " 30	1969-2036
1045	30 HZ " 30	2036-2119
1050	35 HZ " 30	2119-2221
	TESTING COMPLETE ON SMB-000-5 FOR 6g PK INPUT SINE BEAT. NOTE: IN "X" AXIS THE 12.6 HZ LEVEL WAS PERFORMED WITH FILTERING AT 70HZ ON THE RETURN SIGNAL FROM THE MONITOR ACCELEROMETER. THIS RESULTED IN A GREATER THAN 6.0g PK VALUE AT FREQUENCIES IN EXCESS OF 70HZ AS SEEN ON THE OSCILLOGRAPH RECORDS. CUSTOMER REQUESTS THAT FILTERING BE ELIMINATED AND THAT THIS SINE BEAT TEST AT 12.6 HZ IN THE "X" AXIS BE COUNTED AS THE FRAGILITY PORTION OF TESTING. THE 6.0g PK UNFILTERED @ 12.6 HZ IN THE "X" AXIS WILL BE PERFORMED AT A LATER TIME.	

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY Jim Rice DATE

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TEST: SINE BEAT   DATE: 12-10-81   W/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR   P/N: SMB-000-5   S/N:

SPECIFICATION: NTS TP# 548-9291   PAR: 7.6

Date	"X" Axis TEST DESCRIPTION	
12-10-81	SINE BEAT · 10 OSC/BEAT 10 BEATS	TAPE COUNTER
1135	10 HZ 4.6gPk CHARGE AMPS. RANGE 10	000 - 157
1137	12.6 HZ "	157 - 317
1142	15.9 HZ "	317 - 443
1150	20 HZ "	443 - 553
1154	25 HZ "	553 - 641
1157	30 HZ "	641 - 723
1305	35 HZ "	723 - 847
1311	40 HZ "	847 - 934
1317	20 BEATS ACCEL'S 11, 12, 13, 14, 15 & 19	934 - 1072
	45 HZ 4.6gPk ON 30g RANGE	
1320	50 HZ " ABORTED AFTER 11 BEATS.	1072 - 1203
	UNIT DID NOT CYCLE PROPERLY	
1404	50 HZ 4.6gPk 9 BEATS	1203 - 1288
1420	55 HZ 4.6gPk 20 BEATS - ALL C/A ON 30	1288 - 1423
1434	60 HZ " " — MONITOR ACCEL. #24	1423 - 1541
1441	70 HZ " 10 BEATS ON 10g RANGE	1541 - 1628
1444	85 HZ " "	1628 - 1704
1446	100 HZ " "	1704 - 1790

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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TEST SINE BEAT DATE 12-10-81 M/O 548-9291

CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.6

Date	"X" Axis TEST DESCRIPTION	
12-10-81	SINE BEAT 10 OSC/BEAT 40 BEATS	TAPE COUNTER
	10-25 HZ 1500 mSEC BETWEEN BEATS	
TIME	25-100 HZ 1000 mSEC " "	--
1525	10 HZ 3.5 g PK MONITOR ACCEL. #24 ON	1790-2050
1529	12.6 HZ " 10 g RANGE. ALL	2050-2249
1536	15.9 HZ " RESPONSES ON 30 g	2249-2435
1539	20 HZ " RANGE	2435-2584
1545	25 HZ "	2584-2743
1549	30 HZ "	2743-2857
1551	35 HZ "	2857-2964
1555	40 HZ "	2964-3065
1558	45 HZ "	3065-3176
1615	50 HZ " ALL S/A ON 10 g RANGE	NEW TAPE 000-130
1620	55 HZ "	130-224
1624	60 HZ " 40 BEATS	224-314
1626	70 HZ " 5 BEATS	314-361
1628	85 HZ " "	361-
1630	100 HZ " "	-421
	SINE BEAT 10 OSC/BEAT 100 BEATS	
1643	10 HZ 2.0 g PK	421-851
1653	12.6 HZ "	851-1234
1702	15.9 HZ "	1234-1595
1707	20 HZ "	1595-1935

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CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-000-5 S/N

SPECIFICATION NTS TP#548-9291 PAR 7.6

Date	"X" Axis TEST DESCRIPTION	
12-10-81	SINE BEAT 10 OSC/BEAT 100 BEATS	TAPE COUNTER
1710	25 HZ 2.0 g Pk ALL C/A 10 g RANGE	1935-2256
1716	30 HZ "	2256-2489
1720	35 HZ "	2489-2719
1725	40 HZ "	2719-2935
1730	45 HZ " C/A #14 30 g RANGE	2935-3156
1735	50 HZ "	3156-3328
1740	55 HZ "	3328-3490
1745	60 HZ "	3490-
1817	70 HZ " 20 BEATS	NEW TAPE 000-080
1820	85 HZ " " C/A 12,13 30 g RANGE	080-137
1824	100 HZ " " C/A 19 " "	137-202
	ROTATED TO "Y" AXIS	
	SINE BEAT 10 OSC/BEAT 10 BEATS	
2150	10 HZ 4.6 g Pk ALL C/A ON 30 g RANGE	202-338
2155	12.6 HZ "	338-469
2200	15.9 HZ "	469-570
2205	20 HZ "	570-650
2208	25 HZ "	650-714
2210	30 HZ "	714-770
2212	35 HZ "	770-824
2215	40 HZ "	824-867
2216	45 HZ " 20 BEATS	867-934

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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TEST: SINE BEAT DATE: 12-10-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-000-5 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 7.6

Date	12-10-81 "Y" Axis TEST DESCRIPTION	TAPE COUNTER
2220	50 HZ 4.6 g PK 20 BEATS	934 - 1001
2222	55 HZ " "	1001 - 1066
2236	60 HZ " "	1066 - 1143
2238	70 HZ " 10 BEATS	1143 - 1189
2240	85 HZ " "	1189 - 1233
2242	100 HZ " "	1233 - 1294
	NOTE: ON 100 HZ SINE BEAT THE NORMALLY	
	CLOSED CONTACT INDICATED CHATTER AFTER	
	VALVE WAS CYCLED CLOSED. CUSTOMER	
	REQUESTS RERUN AT 100 HZ.	
2245	100 HZ 4.6 g PK 10 BEATS	1294 - 1345
	NOTE: CHATTER IN EXCESS OF 2.0 m SEC.	
	WAS NOTED AGAIN. CUSTOMER REQUESTS	
	CONTINUATION OF TESTING AT 3.5 g PK.	
	SINE BEAT 10 OSC/BEAT 40 BEATS	
2256	10 HZ 3.5 g PK ALL C/A ON 10 g RANGE	1345 - 1541
2302	12.6 HZ "	1541 - 1702
2305	15.9 HZ "	1702 - 1928
2310	20 HZ "	1928 - 2082
2316	25 HZ "	2082 - 2230
2320	30 HZ "	2230 - 2370
2325	35 HZ "	2370 - 2479
2348	40 HZ "	2479 - 2584

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TEST Sine Beat DATE 12-10-81 M/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.6

Date 12-10-81 "Y" Axis	TEST DESCRIPTION	
2352	45 HZ 3.5 g Pk 40 BEATS	2584-2678
2355	50 HZ " "	2678-2774
2400	55 HZ " "	2774-2862
0005	60 HZ " "	2862-2941
0008	70 HZ " 5 BEATS	2941-3020
0010	85 HZ " "	3020-3085
0012	100 HZ " " Accel's 17,18 on 30g	3085-3200
	Note: Customer requested 3 additional	
	pulses at 100 HZ with level increased	
	to 4.6 g Pk to monitor chatter in excess	
	of 3 m sec. No chatter was noted.	
12-11-81	Problem with P.A. - Sys repaired	
	Sine Beat 10 osc/Beat 100 Beats	New Tape
1015	10 HZ 2.0 g Pk	000-443
	Problem with Accel R-11. Bad cable &	
	Bad threads on Accel.	
1031	12.6 HZ 2.0 g Pk All S/A on 10g Range	443-825
1105	15.9 HZ "	825-1177
1115	20 HZ "	1177-1502
1120	25 HZ "	1502-1811
1125	30 HZ "	1811-2035
1130	35 HZ "	2035-2253
1135	40 HZ "	2253-2462

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CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-000-5 S/N

SPECIFICATION NTS TP#548-9291 PAR 7.6

Date	12-11-81 "Y" Axis TEST DESCRIPTION	TAPE COUNTER
1145	45 HZ 2.0 g Pk 100 BEATS	2462 - 2669
1148	50 HZ " "	2669 - 2834
1151	55 HZ " "	2834 - 2994
1153	60 HZ " "	2994 - 3150
1155	70 HZ " 20 BEATS	3150 - 3213
1157	85 HZ " "	3213 - 3270
1200	100 HZ " "	3270 - 3326
	NOTE: CHATTER IN EXCESS OF 2 m SEC	
	AT 100 HZ. NO CHATTER IN EXCESS OF 3 m SEC.	
1205	ROTATING TO "Z" AXIS	
1319	SINE BEAT 10 OSC/BEAT	NEW TAPE
1321	10 HZ 4.6 g Pk 10 BEATS	000 - 120
1324	12.6 HZ " "	120 - 194
1327	15.9 HZ " "	194 - 253
1329	20 HZ " "	253 - 316
1331	25 HZ " "	316 - 376
1333	30 HZ " "	376 - 423
1335	35 HZ " "	423 - 469
1337	40 HZ " "	469 - 515
1339	45 HZ " 20 BEATS	515 - 567
1340	*50 HZ " "	567 - 635
	* CHANGED RANGE ON C/A FROM 10 TO 30 g's	
	FOR ACCEL'S R-10, 11, 14, 15, 16, 17, 18 & 19	

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.6

Date 12-11-81	"Z" AXIS TEST DESCRIPTION	TAPE COUNTER
1342	55 HZ 4.6 g PK 20 BEATS	635-689
1344	60 HZ " "	689-741
1346	70 HZ " 10 BEATS	741-774
1348	85 HZ " "	774-810
1351	100 HZ " "	810-849
	SINE BEAT 10 OSC/BEAT 40 BEATS	
1354	10 HZ 3.5 g PK	849-1031
1359	NOTE: BAD TRACE ON "0" GRAPH FOR R-3.	
	BAD CHARGE AMP. CUSTOMER REQUSTED	
	THAT TEST CONTINUE WITHOUT R-3.	
1430	12.6 HZ 3.5 g PK	1031-1211
	NOTE: R-11 BAD AT BEGINNING OF SINE	
	BEAT. 60 HZ ON SA WITH P.A. ON.	
	CUSTOMER OK'D CONTINUING TEST	
1445	15.9 HZ 3.5 g PK 29 BEATS	1211-1328
1457	" " 11 BEATS	1328-1395
1502	20 HZ " 40 BEATS	1395-1549
1505	25 HZ " "	1549-1699
1511	30 HZ " "	1699-1814
1515	35 HZ " "	1814-1918
1517	40 HZ " "	1918-2023
1520	45 HZ " "	2023-2124
1526	50 HZ " "	2124-2223

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TEST: SINE BEAT DATE: 12-11-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-000-5 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 7.6

Date 12-11-81	"Z" AXIS TEST DESCRIPTION	TAPE COUNTER
1528	55 HZ 3.5 g Pk 40 BEATS	2223 - 2320
1531	60 HZ " "	2320 - 2419
1533	70 HZ " 5 BEATS	2479 - 2452
1538	85 HZ " "	2452 - 2484
1545	100 HZ " "	2484 - 2519
	SINE BEAT 10 OSC/BEAT 100 BEATS	
1607	10 HZ 2.0 g Pk ALL C/A ON 10 g RANGE	2519 - 2943
1615	12.6 HZ	2943 - 3320
	CHANGING MAG. TAPES	NEW TAPE
1642	15.9 HZ 2.0 g Pk	000 - 338
1647	20 HZ "	338 - 692
1700	25 HZ "	692 - 1022
1702	30 HZ "	1022 - 1253
1706	35 HZ "	1253 - 1464
1710	40 HZ "	1464 - 1675
1714	45 HZ "	1675 - 1875
1716	50 HZ "	1875 - 2043
1718	55 HZ "	2043 - 2204
1720	60 HZ "	2204 - 2364
1724	70 HZ " 20 BEATS	2364 - 2416
1726	85 HZ " "	2416 - 2465
1728	100 HZ " "	2465 - 2519

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY: Jim Farris DATE:

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F.M. TAPE AND OSCILLOGRAPH SET-UP

Customer: STONE & WEBSTER   MJO#: 5-48-9291

Test Item: LIMITORQUE VALVE MOTOR

P/N: SMB-000-5 & SMB-0-25   S/N: Date: 12-11-81

VISICORDER #1					VISICORDER #2					TAPE #1			TAPE #2		
Ch.	Accel	Trace	G/in	Sens.	Ch.	Accel	Trace	G/in	Sens.	Ch.	Mv/g	Accelerometer	Ch.	Mv/g	Accelerometer
1	1				1	13				1			1		1
2	2				2	21				2			2		2
3	3				3	15				3			3		4
4	4				4	16				4			4		5
5	5				5	17				5			5		7
6	6				6	18				6			6		8
7	7				7	19				7			7		10
8	8				8	10				8			8		14
9	9				9	14				9			9		18
10	20				10	22				10			10		21
11	11				11	23				11			11		22
12	12				12	24				12			12		23
13					13					13			13		24 CONTROL
14					14					14			14		VOICE
15					15										
					16										
					17										
					18										

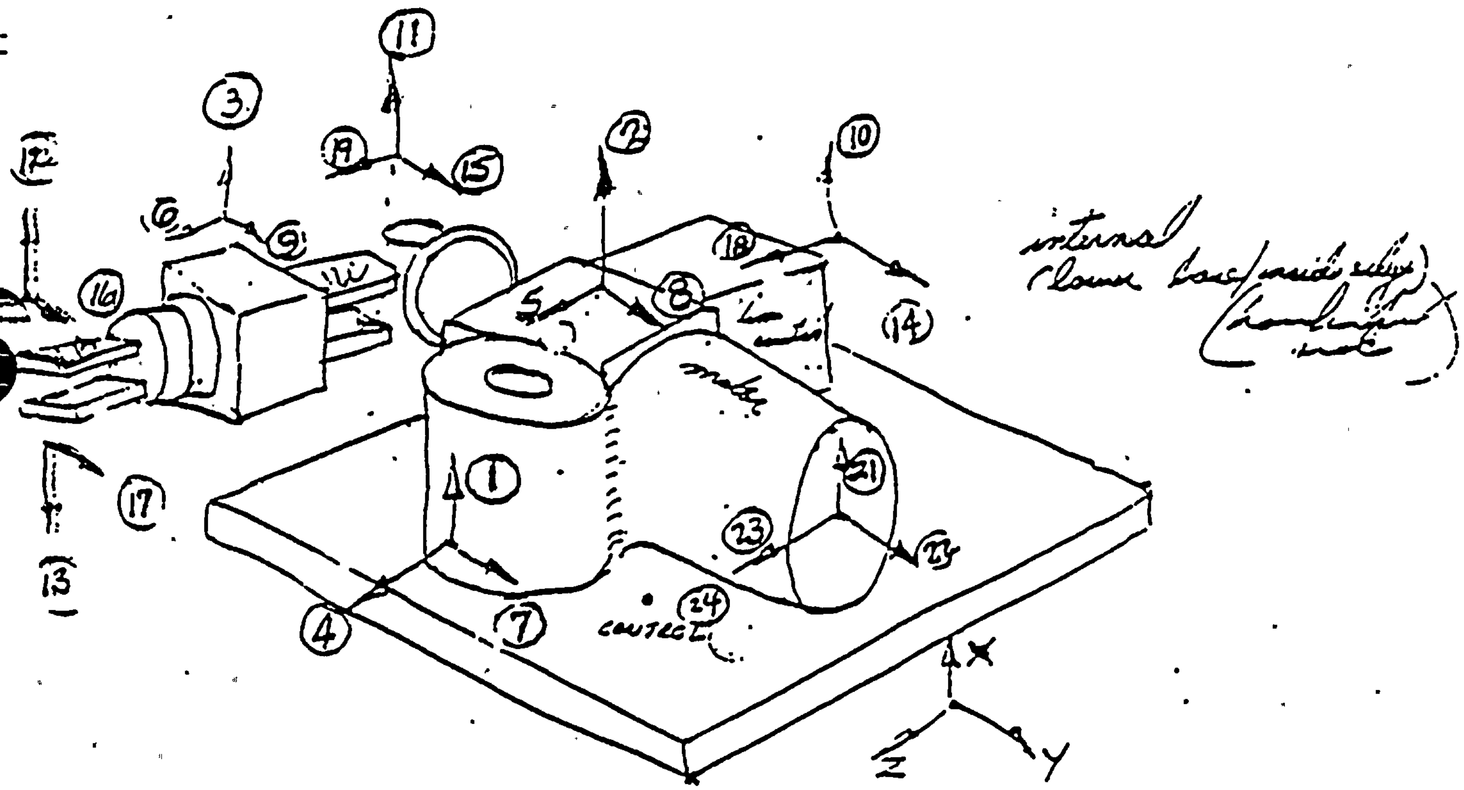
ACCELEROMETER LOCATIONS

Accel.	I.D.#	SURVEYS X	Y	Z	AXES XY	YZ	Location

Technician: JIM FARRIS   Date: 12-11-81

BOOK NO.
CLIENT LOCATION J. O. NO.
SUBJECT REPORT NO. PG. NO.
DATE BY

RANDOM & SINE BEAT TESTS



Y = ∥ to axis of motor
X = vertical
Z = ⊥ to axis of motor

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TEST Sine Beat DATE 12-11-81 M/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	"Z" Axis TEST DESCRIPTION				Tape Counter
12-11-81	Sine Beat (Fragility) 15 osc/beat				
1824	35 HZ 8g Pk 20 Beats All C/A on 10g Range				2519-2668
1827	30 HZ " " All C/A in 30g Range				2668-2838
1831	25 HZ " "				2838-3002
1833	20 HZ " "				3002-3184
1836	15.9 HZ " "				3184-3365
	Sine Beat (Fragility) 10 osc/beat				
1854	40 HZ 8g Pk 20 Beats				3365-3502
1857	45 HZ " 15 Beats				3502-3554
1900	50 HZ " "				3554-END
	Note: Tape Recorder #1 malfunctioned.				
	Moved critical accel's to tape				
	recorder #2 as follows:				
	Channel	Accel.	Channel	Accel.	
	1	1	8	14	
	2	2	9	18	
	3	4	10	21	
	4	5	11	22	
	5	7	12	23	
	6	8	13	24	
	7	10	14	Voice	

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CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-11-81	SINE BEAT (FRAGILITY) 10 OSC/BEAT	NEW TAPE
	"Z" AXIS. ACCEL'S 10, 14 & 18 ON 100g	
	RANGE. ALL OTHERS ON 30g RANGE.	--
2006	55 HZ 8g PK 15 BEATS	000-052
2008	60 HZ " "	052-155
2011	70 HZ " "	155-198
2012	85 HZ " "	198-249
2015	100 HZ " "	249-307
	CHANGE TO "Y" AXIS.	
	SINE BEAT (FRAGILITY) 10 OSC/BEAT	
2041	40 HZ 8g PK 20 BEATS. ALL CH ON 30g RANGE	307-438
2043	45 HZ " 15 BEATS.	438-493
2045	50 HZ " "	493-552
2046	55 HZ " "	552-601
2048	60 HZ " "	601-654
2049	70 HZ " "	
	NOTE: CHATTER NOTED - NOT DUE TO CONTACTS.	
2051	70 HZ 8g PK 7 BEATS	654-706
	NOTE: NO CHATTER	
2055	85 HZ 8g PK 15 BEATS	706-759
	NOTE: CHATTER AT 2 MSEC. NO CHATTER AT 4 MSEC.	
	100 HZ 8g PK 15 BEATS + 4 ADDITIONAL	759-853

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CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	"Y" Axis TEST DESCRIPTION	TAPE COUNTER
12-11-81	NOTE! AT 100 HZ CHATTER WAS NOTED	
	AT 2 MSEC + NO CHATTER AT 5 MSEC.	
	CHATTER WAS NOTED ON "3B" AT 2 MSEC.	--
	DURING THE ADDITIONAL 4 PULSES.	
	SINE BEAT (FRAGILITY) 15 OSC/BEAT	
2105	35 HZ 8g PK 20 BEATS	853 - 958
2108	30 HZ " "	958 - 1048
2125	25 HZ " "	1048 - 1203
	UNIT DID NOT COMPLETE FULL STROKE	
	DURING CYCLING. REMOVED COVER	
	TO EXAMINE UNIT.	
2200	REINSTALLED COVER. CUSTOMER REQUEST	
	RE-RUN OF 25 HZ SINE BEAT.	
2201	25 HZ 8g PK 17 BEATS	1203 - 1313
	NOTE: UNIT STILL MALFUNCTIONING. DID	
	NOT CYCLE FULLY (7.5 SEC).	
2204	20 HZ 8g PK 20 BEATS	
	NOTE: UNIT WILL NOT CYCLE FULLY (4.5 SEC)	1313 - 1410
2210	15.9 HZ 8g PK 20 BEATS	1410 - 1531
	NOTE! UNIT WILL NOT CYCLE FULLY	
	(4.5 SEC). CUSTOMER EXAMINING UNIT.	
	CHANGED CONTACTS ON SAME ROTOR.	

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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TEST Sine Beat DATE 12-11-81 W/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION	Tape Counter
12-11-81	Sine Beat 15 osc/Beat "Y" Axis	
2250	20 Hz 8g Pk 20 Beats	1531-1663
		--
	Note: Testing to be Discontinued	
	At This Time.	

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TEST: SINE BEAT DATE: 12-12-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-0-25 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 7.6

Date	TEST DESCRIPTION	TAPE COUNTER
12-12-81	SETTING UP IN THE "Y" AXIS	CONTINUED ~~ON SMB-000-5~~ TAPE
	SINE BEAT 15 OSC/BEAT G/A 30g	
1534	12.6 HZ 6.0g Pk 6 BEATS RANGE	1673-1784
1537	15.9 HZ " "	1784-1839
1545	20 HZ " "	1839-1915
1547	25 HZ " "	1915-1963
1550	30 HZ " "	1963-2029
1554	35 HZ " "	2029-2102
1606	10 HZ 4.6 g Pk 10 BEATS 10 OSC/BEAT	2102-2184
1610	12.6 HZ "	2184-2257
1612	15.9 HZ "	2251-2307
1614	20 HZ "	2307-2371
1615	25 HZ "	2371-2431
1616	30 HZ "	2431-2489
1617	35 HZ "	2489-2541
1618	40 HZ "	2541-2585
1624	45 HZ 20 BEATS	2585-2653
1626	50 HZ "	2653-2727
1627	55 HZ "	2727-2783
1628	60 HZ "	2783-2838
1632	70 HZ 10 BEATS	2838-2892
1634	85 HZ "	2892-2932
1636	100 HZ 4.6 g Pk "	2932-2971

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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TEST: SINE BEAT DATE: 12-12-81 W/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-0-25 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 7.6

Date	"Y" Axis TEST DESCRIPTION	TAPE COUNTER
12-12-81	SINE BEAT 10 OSC/BEAT S/A 10g RANGE	
1825	10 HZ 40 BEATS 3.5 g Pk	000 - 503
	" 100 BEATS 2.0 g Pk	
1830	12.6 HZ 40 BEATS 3.5 g Pk	503 - 1000
	" 100 BEATS 2.0 g Pk	
1835	15.9 HZ 40 BEATS 3.5 g Pk	1000 - 1308
	" 100 BEATS 2.0 g Pk	
1850	20 HZ 40 BEATS 3.5 g Pk	1308 - 1647
	" 100 BEATS 2.0 g Pk	
1858	25 HZ 40 BEATS 3.5 g Pk	1647 - 1963
	" 100 BEATS 2.0 g Pk	
1903	30 HZ 40 BEATS 3.5 g Pk	1963 - 2267
	" 100 BEATS 2.0 g Pk	
1908	35 HZ 40 BEATS 3.5 g Pk	2267 - 2559
	" 100 BEATS 2.0 g Pk	
1913	40 HZ 40 BEATS 3.5 g Pk	2559 - 2848
	" 100 BEATS 2.0 g Pk	
1918	45 HZ 40 BEATS 3.5 g Pk	2848 - END
	" 100 BEATS 2.0 g Pk	
1935	50 HZ 40 BEATS 3.5 g Pk	000 - 269
	" 100 BEATS 2.0 g Pk	
1940	60 HZ 40 BEATS 3.5 g Pk	269 - 476
	" 100 BEATS 2.0 g Pk	

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TEST SINE BEAT DATE 12-12-81 M/O 548-9291

CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-0-25 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.6

Date	TEST DESCRIPTION C/A 10g	TAPE COUNTER
12-12-81	SINE BEAT 10 OSC/BEAT "Y" AXIS	
1945	55 HZ 40 BEATS 3.5g Pk	476 - 691
	" 100 " 2.0g Pk	--
1947	70 HZ 5 BEATS 3.5g Pk	691 - 747
	" 20 " 2.0g Pk	
1950	85 HZ 5 BEATS 3.5g Pk	747 - 813
	" 20 " 2.0g Pk	
1954	100 HZ 5 BEATS 3.5g Pk	813 - 894
	" 20 / " 2.0g Pk	
	CHANGING TO "Z" AXIS	
	SINE BEAT 15 OSC/BEAT 4.0g Pk	
2028	12.6 HZ 6 BEATS	894 - 950
2040	15.9 HZ "	950 - 1067
2050	20 HZ "	1067 - 1125
2053	25 HZ "	1125 - 1182
2055	30 HZ "	1182 - 1229
2057	35 HZ "	1229 - 1272
	OPENED UNIT TO EXAMINE, #10 BAD	
	SINE BEAT 10 OSC/BEAT	
2117	10 HZ 4.6g Pk	1272 - 1755
	" 3.5g Pk	
	" 2.0g Pk	

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CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-0-25 S/N

SPECIFICATION NTS TP#548-9291 PAR 7.6

Date	TEST DESCRIPTION S/A 10g	TAPE COUNTER
12-12-81	SINE BEAT 10 OSC/BEAT "Z" AXIS	
2130	12.6 HZ 4.6 g Pk 10 BEATS	1755-2194
	" 3.5 g Pk 40 "	--
	" 2.0 g Pk 100 "	
2134	15.9 HZ 4.6 g Pk 10 BEATS	2194-2698
	" 3.5 g Pk 40 "	
	" 2.0 g Pk 100 "	
2140	20 HZ 4.6 g Pk 10 BEATS	2698-3175
	" 3.5 g Pk 40 "	
	" 2.0 g Pk 100 "	
2150	25 HZ 4.6 g Pk 10 BEATS	3175-END
	" 3.5 g Pk 40 "	
	" 2.0 g Pk 100 "	
2203	30 HZ 4.6 g Pk 10 BEATS	000-278
	" 3.5 g Pk 40 "	
	" 2.0 g Pk 100 "	
2217	35 HZ 4.6 g Pk 10 BEATS	278-517
	" 3.5 g Pk 40 "	
	" 2.0 g Pk 100 "	
2219	40 HZ 4.6 g Pk 10 BEATS	517-759
	" 3.5 g Pk 40 "	
	" 2.0 g Pk 100 "	

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TEST Sine Beat DATE 12-13-81 W/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-0-25 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.6

Date	TEST DESCRIPTION C/A 10g	TAPE COUNTER
12-12-81	Sine Beat 10 osc/Beat "Z" Axis	
2123	45 HZ 4.6 g Pk 20 Beats	759-1029
	" 3.5 40 "	--
	" 2.0 100 "	
12-13-81	50 HZ 4.6 g Pk 20 Beats	1029-1282
0935	" 3.5 40 "	
	" 2.0 100 "	
0940	55 HZ 4.6 g Pk 20 Beats	1282-1516
	" 3.5 40 "	
	" 2.0 100 "	
0945	60 HZ 4.6 g Pk 20 Beats	1516-1762
	" 3.5 40 "	
	" 2.0 100 "	
0950	70 HZ 4.6 g Pk 10 Beats	1762-1879
	" 3.5 7 "	
	" 2.0 20 "	
0956	85 HZ 4.6 g Pk 10 Beats	1879-1967
	" 3.5 5 "	
	" 2.0 20 "	
1000	100 HZ 4.6 g Pk 10 Beats	1967-2041
	" 3.5 5 "	
	" 2.0 20 "	
	Changing to "X" Axis	

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TEST: SINE BEAT DATE: 12-13-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-0-25 S/N:

SPECIFICATION: NTS TP # 548-9291 PAR: 2.6

Date	TEST DESCRIPTION C/A = 10g			TAPE COUNTER
12-13-81	SINE BEAT 15 OSC/BEAT "X" AXIS			
1409	12.6 HZ	6.0 g Pk	6 BEATS	2041-2159
1411	15.9 HZ	"	"	2159-2231
1412	20 HZ	"	"	2231-2285
1415	25 HZ	"	"	2285-2352
1419	30 HZ	"	"	2352-2418
1420	35 HZ	"	"	2418-2481
	SINE BEAT 10 OSC/BEAT "X" AXIS C/A 10g			
1440	10 HZ	4.6 g Pk	10 BEATS	2481-2960
	"	3.5	40 "	
	"	2.0	100 "	
1448	12.6 HZ	4.6 g Pk	10 BEATS	2960-END
	"	3.5	40 "	
	"	2.0	100 "	
1454	15.9 HZ	4.6 g Pk	10 BEATS	000-398
	"	3.5	40 "	
	"	2.0	100 "	
1505	20 HZ	4.6 g Pk	10 BEATS	398-756
	"	3.5	40 "	
	"	2.0	100 "	
1510	25 HZ	4.6 g Pk	10 BEATS	756-1087
	"	3.5	40	
	"	2.0	100	

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TEST Sine Beat DATE 12-13-81 M/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-0-25 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.6

Date	TEST DESCRIPTION				TAPE COUNTER
	Sine Beat 10 osc/beat "X" Axis C/A 10g				
1517	30 HZ	4.6 g Pk	10	Beats	1687-1350
	"	3.5	40	"	-.
	"	2.0	100	"	
1528	35 HZ	4.6 g Pk	10	Beats	1350-1596
	"	3.5	40	"	
	"	2.0	100	"	
1532	40 HZ	4.6 g Pk	10	Beats	1596-1846
	"	3.5	40	"	
	"	2.0	100	"	
1536	45 HZ	4.6 g Pk	20	Beats	1846-2092
	"	3.5	40	"	
	"	2.0	100	"	
1540	50 HZ	4.6 g Pk	20	Beats	2092-2334
	"	3.5	40	"	
	"	2.0	100	"	
1544	55 HZ	4.6 g Pk	20	Beats	2334-2571
	"	3.5	40	"	
	"	2.0	100	"	
1548	60 HZ	4.6 g Pk	20	Beats	2571-2800
	"	3.5	40	"	
	"	2.0	100	"	

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TEST Sine Beat DATE 12-13-81 M/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-0-25 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.6

Date	TEST DESCRIPTION			Tape Counter
	Sine Beat 10 osc/Beat "X" Axis C/A 10g			
1554	70 HZ	4.6 g Pk	10 Beats	2800-2906
	"	3.5	5 "	--
	"	2.0	20 "	
1556	85 HZ	4.6 g Pk	10 Beats	2906-3014
	"	3.5	5 "	
	"	2.0	20 "	
1558	100 HZ	4.6 g Pk	10 Beats	3014-3121
	"	3.5	5 "	
	"	2.0	20 "	
1619	40 HZ	8 g Pk	20 Beats C/A 30g	3121-3226
1621	45 HZ		15 Beats	3226-3293
1623	50 HZ			3293-3356
1625	55 HZ			3356-3426
1627	60 HZ			3426-3491
1629	70 HZ			3491-3556
1631	85 HZ			3556-3616
1633	100 HZ			3616-3681
1649	35 HZ	8 g Pk	20 Beats 15 osc/Beat	3681-3797
1652	30 HZ	"	"	3797-3881
1654	25 HZ	"	"	3881-3971
1657	20 HZ	"	"	3971-4071
1700	15.9 HZ	"	"	4071-End

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TEST Sine Beat DATE 12-14-81 W/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-0-25 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-14-81	Changing to "Z" Axis Cue Tape	000 - 076
	Sine Beat (Fragility) 15 osc/beat	
1020	35 HZ 8 g Pk 20 Beats C/A 30g	076 - 203
1024	30 HZ " "	203 - 298
1028	25 HZ " "	298 - 388
1030	20 HZ " "	388 - 481
1032	15.9 HZ " "	481 - 584
	Sine Beat (Fragility) 15 osc/beat	
1100	40 HZ 8 g Pk 20 Beats	584 - 650
1102	45 HZ 15	650 - 705
1104	50 HZ	705 - 753
1106	55 HZ	753 - 798
1108	60 HZ	798 - 842
1110	70 HZ	842 - 883
1112	85 HZ	883 - 922
1114	100 HZ	922 - 963
	Changing to "Y" Axis	
	Sine Beat (Fragility) 15 osc/beat	
1310	35 HZ 8 g Pk 20 Beats C/A 30g	963 - 1052
1312	30 HZ " "	1052 - 1132
1314	25 HZ " "	1132 - 1221
1316	20 HZ " "	1221 - 1308
1318	15.9 HZ " "	1308 - 1401

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CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-0-25 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-14-81	SINE BEAT 10 OSC/BEAT "Y" AXIS S/B 30g	
1330	40 HZ 8g PK. 20 BEATS	1401-1461
1332	45 HZ 15	1461-1509
1334	50 HZ	1509-1556
1336	55 HZ	1556-1604
1338	60 HZ	1604-1649
1340	70 HZ	1649-1689
1342	85 HZ	1689-1730
1344	100 HZ	1730-1775

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TEST SINE BEAT DATE 12-18-81 M/O 548-9291

CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
	NOTE: LIMITORQUE REP. ADJUSTED	
	CONTACTS ON TORQUE SWITCH 12-14-81	
12-18-81	SETTING UP IN "X" AXIS	--
	SINE BEAT (FRAGILITY) 15 OSC/BEAT C/A 30g	
1330	30 HZ 8g PK 20 BEATS (LEVEL TOO LOW)	060 - 143
1340	" " " REPEAT	143 - 201
	CHECKED ACCEL. #3 RE-CAL'D OK	
1430	35 HZ 8g PK 20 BEATS	201 - 245
1450	40 HZ 20 BEATS 10 OSC/BEAT	245 - 293
1455	45 HZ 15	293 - 318
1500	50 HZ	318 - 348
1503	55 HZ	348 - 373
1505	60 HZ	373 - 396
1507	70 HZ	396 - 418
1509	85 HZ	418 - 437
1510	100 HZ	437 - 461
1514	40 HZ 10g PK 20 BEATS	461 - 507
1519	45 HZ 15	507 - 537
1521	50 HZ	537 - 561
1523	55 HZ	561 - 584
1524	60 HZ	584 - 609
1525	70 HZ	609 - 636
1527	85 HZ	636 - 657

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TEST: SINE BEAT DATE: 12-18-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-000-5 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-18-81	SINE BEAT (FRAGILITY) "X" AXIS	
1529	100 HZ 10 g Pk 15 BEATS 10 OSC/BEAT	657-682
1547	20 HZ " 20 BEATS 15 OSC/BEAT	682-743
1550	25 HZ " " "	743-789
1553	30 HZ " " "	789-831
1555	35 HZ " " "	831-871
	NOTE: DID NOT DO SINE BEAT AT 9 g Pk	
	PER CUSTOMER REQUEST	
1600	ROTATING SHAKER TO SLIP AXIS.	
	SETTING UP IN "Z" AXIS.	
	SINE BEAT 15 OSC/BEAT C/A 30g	
1712	20 HZ 10 g Pk 20 BEATS	871-931
1715	25 HZ	931-977
1718	30 HZ	977-1019
1720	35 HZ	1019-1059
1730	40 HZ 10 OSC/BEAT	1059-1091
1734	45 HZ 15 BEATS	1091-1135
1736	50 HZ	1125-1160
1738	55 HZ	1160-1173
1740	60 HZ	1173-1187
1742	70 HZ	1197-1226
1744	85 HZ	1226-
1746	100 HZ	-1314

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CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-18-81	NOTE: SINE BEAT 10g PK "X" AXIS	
	CHATTER INDICATED AT 60 HZ 2 mSEC.	
	RESET TO 2.5 m SEC. NO CHATTER.	
	AT 70 HZ 2.5 m SEC. NO CHATTER	
	AT 85 HZ 2.0 m SEC. NO CHATTER	
	AT 100 HZ 2.0 m SEC. NO CHATTER	
	NOTE! SINE BEAT 10 g PK "Y" AXIS	
	CHATTER AT 70 HZ 2 mSEC.	
	NO CHATTER AT 3 mSEC.	
	CHATTER AT 85 HZ 2 mSEC.	
	NO CHATTER AT 4 mSEC.	
	CHATTER AT 100 HZ 2 mSEC	
	NO CHATTER AT 4 m SEC.	
1750	CHANGING TO "Z" AXIS	
	SINE BEAT 10 OSC/BEAT	
	ACCEL'S 4, 5, 6 & 11 ON 100 g RANGE	
	ALL OTHERS ON 30 g RANGE	
1853	40 HZ 10 g PK 20 BEATS	1314-1351
1855	45 HZ " 15 BEATS	1351-1379
1857	50 HZ " "	1379-1405
1859	55 HZ " "	1405-1429
1901	60 HZ " "	1429-1454

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TEST: SINE BEAT DATE: 12-18-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-000-5 S/N:

SPECIFICATION: NTS TP # 548-9291 PAR: 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-18-81	NOTE: ALL BOLTS NOT UTILIZED TO	
1903	ATTACH FIXTURE TO ADAPTER PLATE.	
	REMOVED ALL BOLTS. FIXTURE NOT	
	MATED FLAT WITH ADAPTER PLATE.	
	FILED ALL HIGH SPOTS ON ADAPTER PLATE	
	MAINLY AROUND TAPPED HOLES. FIXTURE	
	MATES BETTER WITH ADAPTER PLATE	
	BUT STILL ROCKS A LITTLE. USING ONLY	
	6 ATTACH BOLTS. OK PER CUSTOMER	
	FOR THIS AXIS.	
1939	70 HZ 10 g PK 15 BEATS 10 OSC/BEAT	1454 - 1484
1941	85 HZ " " "	1484 - 1505
1943	100 HZ " " "	1505 - 1545
1945	NOTE: 16 ADDITIONAL BEATS AT 100 HZ	
	PER CUSTOMER REQUEST	
1955	20 HZ 10 g PK 20 BEATS 15 OSC/BEAT	1545 - 1650
2004	25 HZ " " "	1650 - 1689
2008	30 HZ " " "	1689 - 1705
2013	35 HZ " " "	1705 - 1730

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TEST: SINE BEAT DATE: 12-18-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-000-5 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-18-81	SINE BEAT 15 OSC/BEAT "Z" AXIS	
2026	20 HZ 12 g PK 20 BEATS	1730 - 1783
2030	25 HZ " "	1783 - 1825
2033	30 HZ " "	1825 - 1865
2035	35 HZ " "	1865 - 1902
2055	40 HZ 12 g PK " 10 OSC/BEAT	1902 - 1936
2058	45 HZ 15 BEATS	1936 - 1960
2100	50 HZ	1960 - 1983
2102	55 HZ	1983 - 2004
2104	60 HZ	2004 - 2026
2106	70 HZ	2026 - 2048
2108	85 HZ	2048 - 2070
2110	100 HZ	2070 - 2108
	NOTE: 11 ADDITIONAL BEATS AT 100 HZ	
	CHATTER AT 100 HZ 2 mSEC.	
	NO CHATTER AT 100 HZ 4 mSEC.	
12-19-81	CHANGING TO "Y" AXIS	
	SINE BEAT 10 OSC/BEAT	
	ACCEL'S 4, 5, 6 & 11 C/A ON 100 g RANGE	
	ALL OTHERS ON 30 g RANGE	
1050	40 HZ 12 g PK 20 BEATS	2108 - 2149
1055	45 HZ " 15 BEATS	2149 - 2172
1058	50 HZ " 22 BEATS	2172 - 2200

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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TEST BY: JIM FARRIS & JIM RICE DATE:

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A&G PTG. — 221

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NTS

A NATIONAL TECHNICAL SERVICES CO.

GENERAL DATA SHEET

TEST: SINE BEAT DATE: 12-19-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-000-5 S/N:

SPECIFICATION: NTS TP # 548-9291 PAR: 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-19-81	SINE BEAT 10 OSC/BEAT "Y" AXIS	
1100	55 HZ 12 g PK 18 BEATS	2200-2228
1104	60 HZ " 15	2238-2250
1106	70 HZ " 20	2250-2276
1108	85 HZ " 20	2276-2304
1110	100 HZ " 29	2304-2339
	NOTE: ADDITIONAL BEATS AT 50, 55, 70,	-
	85 & 100 HZ PER CUSTOMER REQUEST.	
	50 HZ - CHATTER 2 m SEC NO CHATTER 3 mSEC	
	55 HZ " " " "	
	85 HZ " " " 4 mSEC	
	100 HZ " " " 6 mSEC.	
	SINE BEAT 15 OSC/BEAT	
1130	35 HZ 12 g PK 20 BEATS	2339-2379
1134	30 HZ " "	2379-2425
1136	25 HZ " "	2425-2469
1138	20 HZ " "	2469-2514
	CHANGING TO "X" AXIS	
	SINE BEAT 15 OSC/BEAT	
1346	35 HZ 12 g PK 20 BEATS	2514-2566
1349	30 HZ " "	2566-2609
1352	25 HZ " "	2609-2654
1355	20 HZ " "	2654-2705

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY: Jim Rice DATE:

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TEST: SINE BEAT DATE: 12-19-81 M/O: 548-9291
CUSTOMER: STONE & WEBSTER
TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-000-5 S/N:
SPECIFICATION: NTS TP # 548-9291 PAR: 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-19-81	SINE BEAT 10 OSC/BEAT "X" AXIS	
	C/A 4, 5, 6 & 11 ON 100g RANGE. ALL OTHERS 30g	
1400	40 HZ 12 g PK 20 BEATS	2705-2744
1404	45 HZ 15	2744-2768
1406	50 HZ 15	2768-2790
1407	55 HZ 15	2790-2813
1409	60 HZ 20	2813-2839
1410	70 HZ 15	2839-2859
1412	85 HZ 15	2859-2883
1414	85 HZ 15	2883-2902
1416	100 HZ 18	2902-2926
	NOTE: 60 HZ CHATTER AT 2 MSEC NO CHATTER 3 MSEC.	
	70 HZ " " " "	
1420	100 HZ 14 g PK 15 BEATS 10 OSC/BEAT	2926-2955
1422	85 HZ "	2955-2984
1423	70 HZ "	2984-3011
1424	60 HZ "	3011-3038
1426	55 HZ "	3038-3064
1428	50 HZ 18 BEATS	3064-3097
1430	45 HZ 15	3097-3121
1432	40 HZ 20	3121-3160
1439	35 HZ 20 15 OSC/BEAT	3160-3202
1441	30 HZ 10 "	3202-3232

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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GENERAL DATA SHEET

TEST Sine Beat DATE 12-19-81 M/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-000-5 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-19-81	SINE BEAT "X" AXIS	
1510	30 HZ 14 g PK 10 BEATS 15 OSC/BEAT	3232 - 3259
1513	25 HZ " 20 " "	3259 - 3304
	NOTE: 70 HZ CHATTER AT 2 msec NO CHATTER 3 msec	
	55 HZ " " " 4 msec	
	50 HZ " " " 4 msec	
	CHANGING TO "Y" AXIS	
	SINE BEAT C/B 4,5,6,11 ON 100 g RANGE	
	ALL OTHERS ON 30 g RANGE	
1605	35 HZ 14 g PK 20 BEATS 15 OSC/BEAT	3304 - 3346
1615	30 HZ " " "	3346 - 3380
1618	25 HZ " " "	3380 - 3430
1636	40 HZ 14 g PK 20 BEATS 10 OSC/BEAT	3430 - 3465
1638	45 HZ 15 BEATS	3465 - 3495
1640	50 HZ	3495 - 3526
1642	55 HZ	3526 - 3550
1643	60 HZ	3550 - 3579
1645	70 HZ	3579 - 3606
1647	85 HZ	3606 - 3631
1648	100 HZ	3631 - 3657

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TEST BY Jim Rice DATE

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A NATIONAL TECHNICAL SERVICES CO.

Report 548-9291, Rev. 1

GENERAL DATA SHEET

TEST: Sine Beat DATE: 12-19-81 W/O: 548-9291

CUSTOMER: Stone & Webster

TEST ITEM: Limitorque Valve Motor P/N: SMB-000-5 S/N:

SPECIFICATION: NTS TP # 548-9291 PAR: 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-19-81	Sine Beat "Y" Axis 14 g Pk	
	Note: 25 HZ Chatter at 2 msec No Chatter at 4 msec	
	50 HZ " " " "	--
	55 HZ " " " "	
	85 HZ " 4 msec " 5 msec	
	100 HZ " " " "	
	Changing to "Z" Axis	
	C/A 4,5,6,11 on 100 g Range, All others 30 g	
1704	40 HZ 14 g Pk 20 Beats 10 osc/Beat	3657-3694
1706	45 HZ 15 Beats	3694-3723
1707	50 HZ	3723-3753
1708	55 HZ	3753-3786
1710	60 HZ	3786-3816
1712	70 HZ	3816-3855
1714	85 HZ	3855-3888
1716	100 HZ	3888-3922
	Note: 50 HZ Chatter at 2 msec No Chatter at 3 msec	
	55 HZ " " " "	
	85 HZ " 3 msec " 4 msec	
1722	35 HZ 14 g Pk 20 Beats 15 osc/Beat	3922-3961
1724	25 HZ " " "	3961-3999
1726	20 HZ " " "	3999-End

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY: Jim Rice DATE:

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NTS

F.M. TAPE AND OSCILLOGRAPH SET-UP

Customer STONE & WEBSTER MJO# 548-9291

Test Item LIMITORQUE VALVE MOTOR

P/N SMB-000-5 & SMB-0-25 S/N Date 12-21-81

7½ IPS

VISICORDER #1					VISICORDER #2					TAPE #1			TAPE #2		
Ch.	Accel	Trace	G/in	Sens.	Ch.	Accel	Trace	G/in	Sens.	Ch.	Mv/g	Accelerometer	Ch.	Mv/g	Accelerometer
1	R1				1					1		R1	1		
2	R2				2					2		R2	2		
3	R3				3					3		R3	3		
4	R4				4					4		R4	4		
5	R5				5					5		R5	5		
6	R6				6					6		R6	6		
7	R7				7					7		R7	7		
8	R8				8					8		R8	8		
9	R9				9					9		R9	9		
10	R10				10					10		R10	10		
11	R11				11					11		R11	11		
12	R12				12					12		R12	12		
13	R13	CONTROL			13					13		R13 CONTROL	13		
14					14					14		VOICE	14		
15					15										
					16										
					17										
					18										

ACCELEROMETER LOCATIONS

Accel.	I.D.#	SURVEYS X	Y	Z	AXES XY	YZ	Location

Technician Date

BOOK NO.

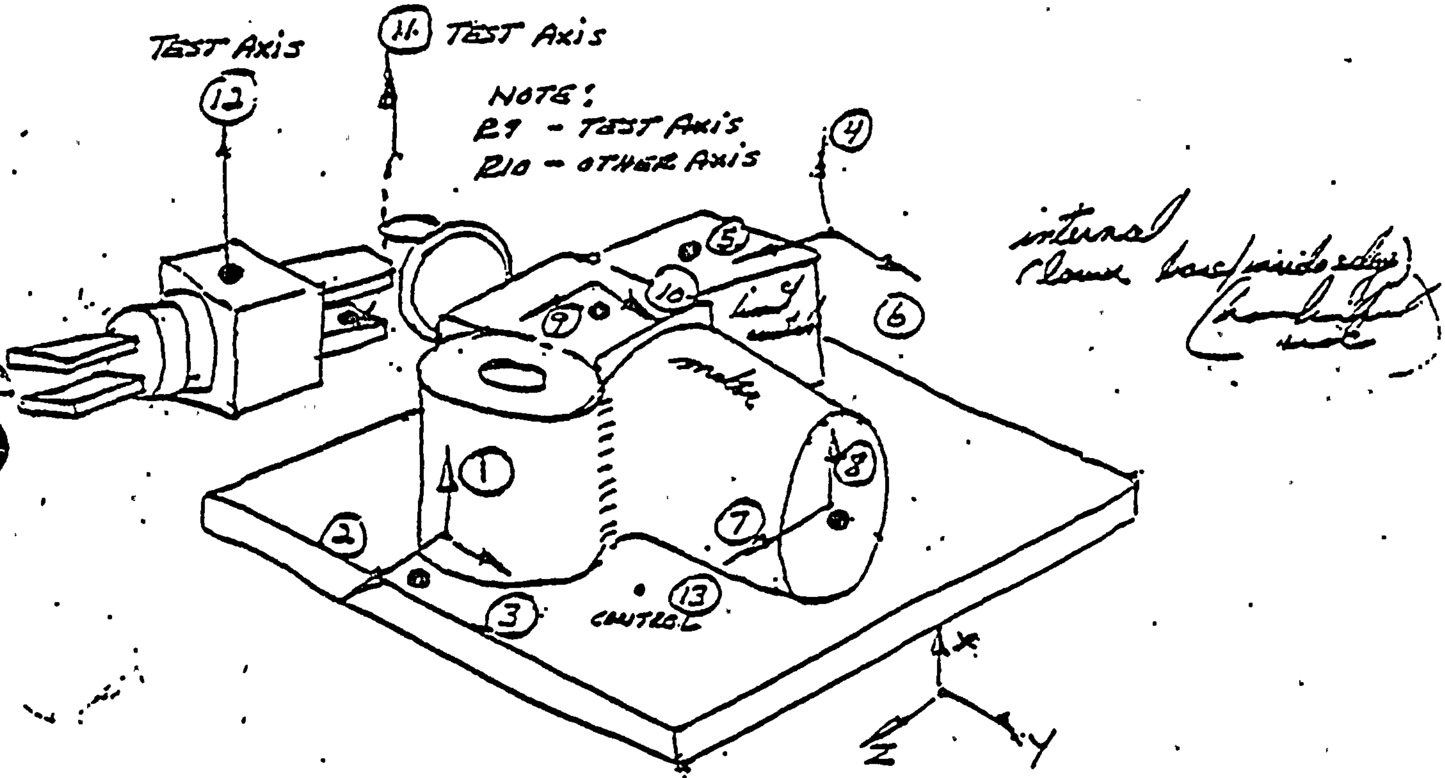
LOCATION J. O. NO.

SUBJECT REPORT NO. PG. NO.

DATE BY

SINE BEAT

"C"



Y ≡ ∥ to axis of motor

X ≡ vertical

Z ≡ ⊥ to axis of motor

COPIES TO—1

COPIES TO—2

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Report 548-9291, Rev.1

GENERAL DATA SHEET

TEST: SINE BEAT DATE: 12-21-81 M/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-0-25 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-21-81	SETTING UP IN "Z" AXIS	7 1/2 IPS
	S/A 4,5,6,11 ON 100g RANGE. ALL OTHERS 30g.	
	SINE BEAT CUE TAPE	000-054
1117	20 HZ 12 g PK 20 BEATS 15 OSC/BEAT	054-112
1124	CHECKED ACCEL'S 8 & 12	
1144	25 HZ 12 g PK 20 BEATS	112-158
	ENCOUNTERED A HOLLOW SOUNDING NOISE	
	AT APPROX. 8 g PK. REPLACED BLOCK	
	UNDER LEG OF STEEL BASE PLATE.	
1202	30 HZ 12 g PK 20 BEATS	158-206
	STILL TOO HIGH AN INDICATION ON ACCEL #12.	
	CHECKED LIMIT SWITCH MOUNTING BLOCK.	
	RAN DYNAMIC CAL ON ACCEL #12. OK	
1305	35 HZ. 12 g PK 20 BEATS	206-252
1317	40 HZ " " 10 OSC/BEAT	252-292
	MOVED ACCEL #7 TO SAME LOCATION AS	
	ACCEL #12. SAME INDICATION ON BOTH	
	ACCEL'S. MOVED ACCEL #7 BACK TO	
	ORIGINAL LOCATION. CUSTOMER FELT	
	THAT ACCEL #12 WAS INDICATING TOO HIGH	
	A LEVEL AND WANTED VERIFICATION	
	THAT THE ACCEL. & CHARGE AMP. WERE	
	OK.	

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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TEST BY: Jim Farris DATE: ____

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GENERAL DATA SHEET

TEST SINE BEAT DATE 12-21-81 W/O 548-9291

CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-0-25 S/N

SPECIFICATION NTS TP# 548-9291 PAR 2.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-21-81	SINE BEAT "Z" AXIS 10 OSC/BEAT	7 1/2 IPS
1324	45 HZ 12 g PK 15 BEATS	292 - 319
1326	50 HZ	319 - 343
1328	55 HZ	343 - 366
1329	60 HZ	366 - 389
1330	70 HZ	389 - 412
1335	85 HZ	412 - 437
1340	100 HZ	437 - 460
	CHANGING TO "Y" AXIS	
	SINE BEAT "Y" AXIS 10 OSC/BEAT	
1420	40 HZ 12 g PK 20 BEATS	460 - 496
1425	45 HZ 15 BEATS	496 - 529
1426	50 HZ "	529 - 556
1427	55 HZ "	556 - 580
1429	60 HZ "	580 - 606
1431	70 HZ "	606 - 631
1433	85 HZ 21 BEATS	631 - 664
1435	100 HZ 20 BEATS	664 - 706
	NOTE: 55 HZ NO CHATTER AT 3 MSEC	
	60 HZ " "	
	70 HZ " "	
	85 HZ " "	
	100 HZ " "	

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY JIM FARRIS DATE

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GENERAL DATA SHEET

TEST Sine Beat DATE 12-21-81 M/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-0-25 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION		TAPE COUNTER
12-21-81	Sine Beat "Y" Axis 15 osc/Beat		7½ IPS
1447	20 HZ 12 g Pk 20 Beats		706 - 757
1449	25 HZ " "		757 - 802
1451	30 HZ " "		802 - 845
1453	35 HZ " "		845 - 888
	Changing to "X" Axis		
	Sine Beat "X" Axis 15 osc/Beat		
1615	20 HZ 12 g Pk 20 Beats		888 - 940
1620	25 HZ " "		940 - 990
1623	30 HZ " "		990 - 1034
1626	35 HZ " "		1034 - 1075
	Replaced Charge Amp. #9. Ran Dynamic		
	Cal. Set up Galvo & Tape output.		
1700	Sine Beat 10 osc/Beat		1075 - 1113
1702	40 HZ 12 g Pk 20 Beats	/	1113 - 1142
1704	45 HZ 15 Beats	/	1142 - 1174
1705	50 HZ	/	1174 - 1202
1706	55 HZ	/	1202 - 1224
1707	60 HZ	/	1224 - 1246
1708	70 HZ	/	1246 - 1266
1710	85 HZ	/	1266 - 1290
1711	100 HZ	/	
	Note: C/A #11 on 30 g Range 20 HZ - 100 HZ		

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY Jim Farris DATE

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GENERAL DATA SHEET

TEST: SINE BEAT DATE: 12-21-81 W/O: 548-9291

CUSTOMER: STONE & WEBSTER

TEST ITEM: LIMITORQUE VALVE MOTOR P/N: SMB-0-25 S/N:

SPECIFICATION: NTS TP# 548-9291 PAR: 2.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-21-81	NOTE: C/A #11 CHANGED FROM 30 TO 100g RANGE	7 1/2 IPS
	SINE BEAT "X" AXIS 10 OSC/BEAT	
1720	40 HZ 14 g PK 20 BEATS	1290 - 1325
1724	45 HZ 15 BEATS	1325 - 1351
1726	50 HZ	1351 - 1380
1728	55 HZ	1380 - 1403
1730	60 HZ	1403 - 1434
1732	70 HZ	1434 - 1458
1734	85 HZ	1458 - 1480
1736	100 HZ	1480 - 1501
	SINE BEAT 15 OSC/BEAT	
1747	35 HZ 14 g PK 20 BEATS	1501 - 1546
1750	30 HZ " "	1546 - 1589
1754	25 HZ " "	1589 - 1632
1758	20 HZ " "	1632 - 1674
1830	CHECKED "0" GRAPH TRACES	
12-22-81	CHANGING TO "Y" AXIS	
	SINE BEAT "Y" AXIS 10 OSC/BEAT	
1005	40 HZ 14 g PK 20 BEATS	1674 - 1737
1007	45 HZ " 18 "	1737 - 1771
1010	50 HZ " 15 "	1771 - 1797
	NOTE: AT 45 HZ NO CHATTER AT 2.4 MSEC	

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

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TEST BY: Jim Farris DATE:

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GENERAL DATA SHEET

TEST Sine Beat DATE 12-22-81 M/O 548-9291

CUSTOMER Stone & Webster

TEST ITEM Limitorque Valve Motor P/N SMB-0-25 S/N

SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-22-81	Sine Beat "Y" Axis 10 osc/Beat	7½ IPS
1015	55 HZ 8 g Pk 6 Beats	1797-1885
	" 10 5 "	--
	" 12 21 "	
	" 10 8 "	
	" 11 11 "	
	" 14 27 "	
	Note: No chatter at 11 g Pk 5 msec.	
1020	60 HZ 8 g Pk 7 Beats	1885-1955
	" 10 14 "	
	" 12 14 "	
	" 10 7 "	
	" 14 21 "	
	Note: No chatter at 10, 12 & 14 g Pk	
	at 5 msec.	
1025	70 HZ 8 g Pk 5 Beats	1955-2008
	" 10 4 "	
	" 11 16 "	
	" 14 22 "	
	Note: No chatter at 11 & 14 g Pk	
	at 2.5 msec.	

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY Jim Farris DATE

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TEST SINE BEAT DATE 12-22-81 M/O 548-9291
CUSTOMER STONE & WEBSTER
TEST ITEM LIMITORQUE VALVE MOTOR P/N SMB-0-25 S/N
SPECIFICATION NTS TP# 548-9291 PAR 7.7

Date	TEST DESCRIPTION	TAPE COUNTER
12-22-81	SINE BEAT "Y" AXIS 10 OSC/BEAT	7½ IPS
1030	85 HZ 8 g PK 5 BEATS	2008 - 2057
	" 10 3 "	--
	" 11 14 "	
	" 14 18 "	
	NOTE: NO CHATTER AT 11 & 14 g PK 2.5 mSEC	
1035	100 HZ 8 g PK 7 BEATS	2057 - 2109
	" 11 24 "	
	" 14 22 "	
	NOTE: NO CHATTER AT 11 & 14 g PK AT 4 mSEC.	
	SINE BEAT 15 OSC/BEAT	
1042	35 HZ 14 g PK 20 BEATS	2109 - 2154
1045	30 HZ " 11 "	2154 - 2183
	NOTE: NO CHATTER AT 35 HZ AT 5 mSEC.	
	SHUT DOWN AFTER 11 BEATS AT 30 HZ TO	
	CHECK LEG ON STEEL BASE PLATE.	
	ADJUSTED BASE PLATE AND CHECKED FOR	
	PROPER CLEARANCE BETWEEN SLIP PLATE	
	& BASE PLATE.	
1110	30 HZ 14 g PK 9 BEATS	2183 - 2211
1115	25 HZ " 20 "	2211 - 2264

AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE	AETL ID	CALIB DUE DATE

TEST BY Jim Farris DATE

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A NATIONAL TECHNICAL SERVICES CO.

GENERAL LOG SHEET

TEST: SEISMIC   M/O: 548-9291

CUSTOMER: STONE + WEBSTER

TEST ITEM: LIMITORQUE OPERATOR + MODIFIED LIMIT SWITCHES 12B + 12C   P/N: SMB-0-25   S/N:

SPECIFICATION: PAR:

DATE	TIME	LOG ENTRIES	INITIAL
12-2-81		EQUALIZED SIMULATOR, CALIBRATED 23 RESPONSE ACCELS + 2 CONTROL ACCELS ONTO FM TAPE + OSCILLOGRAPH. CHATTER SHALL BE MONITORED ACROSS THE SWITCH CONTACTS DURING THE TEST @ 2 MS. MOUNTED THE OPERATOR TO THE SIMULATOR * IN THE XZ AXES, AND ATTACHED 23 RESPONSE ACCELS TO SPECIMEN AS DESCRIBED BY THE SKETCH. A.C. Power is connected to the operator motor.	JH
12-3-81	0800	Re-calibrated control accelerometers.	JH
	1300	RAN XZ axes seismic @ 80% power (468 volts) to operator motor, 35 seconds duration. NOTE — No response from the Horizontal control accel due to a bad cable. The cable was replaced, and this run shall be repeated.	JH
	1515	Repeated XZ axes seismic @ 80% power (468 volts). During this run, accel #19, located on switch 12C in Z axis, broke loose. Following this run, accel #15 was re-located from switch 12B (Z) to 12C (Y).	JH
	1607	Ran XZ axes seismic @ 100% power (575 volts), 35 seconds duration.	JH
	1620	Ran XZ axes seismic @ 110% power (633 volts), 35 seconds duration.	JH
	1630	Rotated specimen 90° around its vertical centerline to the XY axes.	JH

* which operator

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TEST BY: Jay R. Hall   DATE: 12-3-81

ENGR.: Richard E. Forbus   GOV'T QAR:

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GENERAL LOG SHEET

TEST SEISMIC M/O 548-9291

CUSTOMER STONE + WEBSTER

TEST ITEM LIMITORQUE OPERATOR P/N SMB-0-25 S/N

SPECIFICATION PAR

DATE	TIME	LOG ENTRIES	INITIAL
12-3-81	1745	Ran XY axes seismic @ 80% power (468 volts) At approximately 26 seconds into this run, the operator came loose due to the loosening of the 4 mounting bolts (from under the fixture). These bolts were re-torqued.	JH
	1838	Ran XY seismic @ 100% power (575 volts). At 1 second into this run, chatter on switch 12B - Possibly due to an accelerometer breaking loose and hitting the contacts of switch 12B. We repaired the loose accel, and will re-run this run.	JH
	1842	Ran XY seismic #2 @ 100% power. Chatter is still present on switch 12B. The chatter detector will be switched from 2 ms to 10 ms.	JH
	1850	Ran XY seismic @ 110% power. Chatter is still present on switch 12B (10 ms). Accelerometers 12, 16, + 20 (TRIAXIAL) fell off during this run.	JH
	1908	Repeated XY seismic @ 80% power, as directed by the customers. Switch 12B still shows chatter @ 10 ms.	JH
12-4-81	0800	Removed operator *SMB-0-25. Prior to mounting*, we fabricated and installed steel washers in the fixture to prevent the bolts from pulling through the magnesium fixture. *(operator # SMB-000-5)	JH
	1100	Ran XY axes seismic @ 80% power. Stopped @ 5 seconds - the operator came loose. 2 Bolts broke off, 1 loosened, and	JH

TEST BY Jay R Hall DATE 12-4-81

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GENERAL LOG SHEET

TEST SEISMIC MJO 548-9291

CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE OPERATOR P/N SMB-000-5 S/N

SPECIFICATION PAR

DATE	TIME	LOG ENTRIES	INITIAL
12-4-81		the bolt with the load washer was tight. It was the customers decision at this time to discontinue testing on this operator. The specimen was removed.	JH
X	1200	Mounted the specimen (SMB-0-25 and limit switches 12B+12C) in XY axes. Mounted accelerometers.	JH
	1950	Ran Y axis sine beat (HORIZ) @ 100% power of 575 volts. Beat frequency is 15 hz, test frequency is 5.0 hz. Table input is 6g's peak, for a total of 6 beats. 3 seconds between beats. Note – the switch block was loose, causing high spikes in the control's response data. The block was tightened, and another attempt was made at this level. The 2ND try showed identical spikes. The control accelerometers were recalibrated, and this level was repeated. It was decided by the customers to measure the levels at the peak of the spikes.	JH
	2138	Ran sine beat @ 6.3 hz, 6g peak, 6 beats. Level is achieved by slowly bringing up the level until 6g's peak is achieved.	JH
	2251	Ran 7.9 hz sine beat, 6g peak, 6 beats.	JH
	2300	Ran 10.0 hz sine beat, 6g peak, 6 beats.	JH
	2316	Ran sine beat @ 5.0 hz in X axis (VERT). Operator voltage is 575 volts (100%)	JH

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TEST BY Jay P Hall DATE 12-4-81

ENGR. Richard E Jenkins GOV'T QAR

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GENERAL LOG SHEET

TEST SEISMIC M/O 548-9291

CUSTOMER STONE + WEBSTER

TEST ITEM LIMITORQUE OPERATOR P/N SMB-0-25 S/N

SPECIFICATION PAR

DATE	TIME	LOG ENTRIES	INITIAL
12-4-82	2325	Ran sine beat @ 6.3 hz, 6g's peak, 6 beats.	JH
	2330	Ran sine beat @ 7.9 hz, 6g's peak, 6 beats.	JH
	2335	Ran sine beat @ 10.0 hz, 6g's peak, 6 beats.	JH
	2340	Rotated specimen 90° around it's vertical	JH
		centerline to the XZ axes.	
	0100	Ran sine beat @ 5.0 hz, 6g's peak, 6 beats.	JH
	0104	Ran sine beat @ 6.3 hz, 6g's peak, 6 beats	JH
	0106	Ran sine beat @ 7.9 hz, 6g's peak, 6 beats	JH
	0110	Ran sine beat @ 10.0 hz, 6g's peak, 6 beats	JH
12-5-81	1242	Ran XZ axes seismic @ 80% power on	JH
		#SMB-000-5, 35 seconds duration.	
	1257	Ran XZ seismic @ 100% power, 35 secs.	JH
	1315	Ran XZ seismic @ 110% power.	JH
	1321	Ran XZ seismic @ 80% power.	JH
	1417	Ran Z axis sine beat @ 5.0 hz, 6g's peak,	JH
		6 beats.	
	1419	Ran Z sine beat @ 6.3 hz, 6g's peak, 6 beats.	JH
	1421	Ran Z sine beat @ 7.9 hz, 6g's peak, 6 beats	JH
	1423	Ran Z sine beat @ 10.0 hz, 6g's peak, 6 beats.	JH
	1425	Began rotating specimen 90° around it's	JH
		vertical centerline to the X-Y axes.	
	1550	Ran X-Y axes seismic @ 80% power.	JH
	1551	Ran X-Y axes seismic @ 100% power	JH
	1552	Ran X-Y axes seismic @ 110% power	JH
	1625	Ran X-Y axes seismic @ 80% power, repeat	JH
	1638	Ran Y sine beat @ 5.0 hz, 6 g's peak, 6 beats	JH
	1640	Ran Y sine beat @ 6.3 hz, 6 g's peak, 6 beats	JH
	1641	Ran Y sine beat @ 7.9 hz, 6 g's peak, 6 beats	JH

TEST BY Jay R. Hall DATE 12-5-81

PAGE 4 OF 8 ENGR. Richard E. Forbes GOV'T QAR

A&B PTG — 211

NTS

A NATIONAL TECHNICAL SERVICES CO.

GENERAL LOG SHEET

TEST: SEISMIC   MJO: 548-9291

CUSTOMER: STONE + WEBSTER

TEST ITEM: LIMITORQUE OPERATOR   P/N: SMB-0-25   S/N:

SPECIFICATION: PAR:

DATE	TIME	LOG ENTRIES	INITIAL
12-5-81	1643	Ran Y sine beat @ 10.0 Hz, 6 g's peak, 6 beats.	JH
	1645	Ran X sine beat @ 5 hz, 6 g's peak, 6 beats.	JH
	1647	Ran X sine beat @ 6.3 hz, 6 g's peak, 6 beats.	JH
	1649	Ran X sine beat @ 7.9 hz, 6 g's peak, 6 beats.	JH
↓	1651	Ran X sine beat @ 10.0 hz, 6 g's peak, 6 beats.	JH
12-15-81	0800	Mounted operator # SMB-0-25, + the modified limit switches P/N - 12B + 12C	JH
	1300	Ran Y sine beat @ 5 Hz, 4 g's peak, 6 beats.	JH
	1304	Ran Y sine beat @ 6.3 Hz, 4 g's peak, 6 beats	JH
	1306	Ran Y sine beat @ 7.9 hz, 4 g's peak, 6 beats	JH
	1310	Ran Y sine beat @ 10.0 hz, 4 g's peak, 20 beats.	JH
	1313	Ran Y sine beat @ 12.6 hz, 4 g's peak, 20 beats.	JH
	1322	Ran X sine beat @ 5 hz, 4 g's pk, 6 beats.	JH
	1324	Ran X sine beat @ 6.3 hz, 4 g's pk, 6 beats.	JH
	1326	Ran X sine beat @ 7.9 hz, 4 g's pk, 6 beats	JH
	1329	Ran X sine beat @ 10 hz, 4 g's pk, 20 beats.	JH
	1333	Ran X sine beat @ 12.6 hz, 4 g's pk, 20 beats.	JH
	1405	Ran X sine beat @ 5 hz, 8 g's pk, 6 beats	JH
	1408	Ran X sine beat @ 6.3 hz, 8 g's pk, 6 beats	JH
	1411	Ran X sine beat @ 7.9 hz, 8 g's pk, 6 beats	JH
	1415	Ran X sine beat @ 10 hz, 8 g's pk, 20 beats	JH
	1421	Ran X sine beat @ 12.6 hz, 8 g's pk, 20 beats.	JH
	1426	Ran Y sine beat @ 5 hz, 8 g's pk, 6 beats	JH
	1430	Ran Y sine beat @ 6.3 hz, 8 g's pk, 6 beats	JH
	1440	Ran Y sine beat @ 7.9 hz, 8 g's pk, 6 beats	JH
	1447	Ran Y sine beat @ 10 hz, 8 g's pk, 20 beats	JH
	1450	Ran Y sine beat @ 12.6 hz, 8 g's pk, 20 beats	JH
↓	1620	Ran Z sine beat @ 5 hz, 8 g's peak, 6 beats	JH

TEST BY: Jay R Hall   DATE: 12-15-81

PAGE 5 OF 8   ENGR.: Richard E Forbes   GOV'T QAR:

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NTS

A NATIONAL TECHNICAL SERVICES CO.

GENERAL LOG SHEET

TEST SEISMIC M/O 548-9291

CUSTOMER STONE & WEBSTER

TEST ITEM LIMITORQUE OPERATOR P/N SMB-0-25 S/N

SPECIFICATION PAR

DATE	TIME	LOG ENTRIES	INITIAL
12-15-81	1639	Ran Z sine beat @ 6.3 hz, 8 g's pk, 6 beats	JH
	1641	Ran Z sine beat @ 7.9 hz, 8 g's pk, 6 beats	JH
	1644	Ran Z sine beat @ 10 hz, 8 g's pk, 20 beats	JH
	1646	Ran Z sine beat @ 12.6 hz, 8 g's pk, 20 beats	JH
	1652	Ran Z sine beat @ 5 hz, 10 g's pk, 6 beats.	JH
		Note - The level achieved was the maximum	JH
		capability of the seismic simulator, hereafter	
		indicated as *	
	1655	Re-Ran Z sine beat @ 5 hz, 10 g's pk *, 6 beats	JH
	1657	Ran Z sine beat @ 6.3 hz, 10 g's pk *, 6 beats	JH
	1659	Ran Z sine beat @ 7.9 hz, 10 g's pk, *, 6 beats	JH
	1702	Ran Z sine beats @ 10.0 hz, 10 g's pk *, 20 beats	JH
	1705	Ran Z sine beat @ 12.6 hz, 10 g's pk *, 20 beats	JH
	1720	Ran X sine beat @ 6.3 hz, 10 g's pk * 6 beats	JH
	1723	Ran X sine beat @ 7.9 hz, 10 g's pk * 6 beats	JH
	1727	Ran X sine beats @ 10 hz, 10 g's pk *, 20 beats	JH
	1731	Ran X sine beat @ 12.6 hz, 10 g's pk *, 20 beats	JH
	1735	Ran 6 additional beats, X axis @ 12.6 hz, 10 g's	JH
		pk *, per the customer's request.	
	1744	Ran X sine beat @ 15.9 hz, 10 g's pk *, 20 beats	JH
	1750	Rotated fixture/specimens 90° around it's	JH
		Vertical centerline to the XY axes.	
		Note - Per customer's request, we will delete	
		Y axis sine beat @ 5.0 hz	
	1901	Ran Y sine beat @ 6.3 hz, 10 g's pk *, 6 beats.	JH
	1911	Ran Y sine beat @ 7.9 hz, 10 g's pk *, 6 beats.	JH
	1915	Ran Y sine beat @ 10 hz, 10 g's pk *, 20 beats.	JH
↓	1919	Ran Y sine beat @ 12.6 hz, 10 g's pk *, 20 beats	JH

TEST BY Jay R. Hall DATE 12-15-81

PAGE 6 OF 8 ENGR. Richard E. Forbes GOV'T QAR

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NTS
A NATIONAL TECHNICAL SERVICES CO.

GENERAL LOG SHEET

TEST SEISMIC MJO 548-9291
CUSTOMER STONE + WEBSTER
TEST ITEM LIMITORQUE OPERATOR P/N SMB-0-25 S/N
SPECIFICATION PAR

DATE	TIME	LOG ENTRIES	INITIAL
12-15-81	1921	Ran Y sine beat @ 15.9 hz, 10g's pk*, 20 beats.	JH
	1930	Per customer's request, we ran X axis	JH
		sine beat @ 15.9 hz, 11-12 g's pk* 6 beats	
	1935	Per customer's request we ran X axis	JH
		sine beat @ 12.6 hz, 11-12 g's pk* 3 beats.	
↓	1940	Removed operator # SMB-0-25	JH
12-16-81	0800	Mounted operator # SMB-000-5, with the	JH
		modified limit switches # 3B + 3C.	
		Re-calibrated the control accelerometers.	
	1206	Ran Y axis sine beat @ 5 hz, 8+g's pk, 6 beats	JH
	1210	Ran Y sine beat @ 6.3 hz, 8+g's pk, 6 beats.	JH
	1212	Ran Y sine beat @ 7.9 hz, 8+g's pk, 6 beats	JH
	1215	Ran Y sine beat @ 10.0 hz, 8+ g's pk, 20 beats	JH
	1219	Ran Y sine beat @ 12.6 hz, 8+ g's pk, 20 beats	JH
	1223	Ran Y sine beat @ 15.9 hz, 8+ g's pk, 20 beats	JH
	1233	Ran Y sine beat @ 20 hz, 8+ g's pk, 20 beats	JH
	1236	Ran Y sine beat @ 25 hz, 8+ g's pk, 20 beats	JH
	1250	Ran X sine beat @ 5 hz, 8+ g's pk, 6 beats	JH
	1253	Ran X sine beat @ 5 hz (Repeated per customer's	JH
		request), 8+ g's pk, 6 beats	
	1256	Ran 6.3 hz X sine beat, 8+ g's pk, 6 beats	JH
	1258	Ran 7.9 hz X sine beat, 8+ g's pk, 6 beats	JH
	1302	Ran X sine beat @ 10 hz, 8+ g's pk, 20 beats	JH
	1305	Ran X sine beat @ 12.6 hz, 8+ g's pk, 20 beats	JH
	1310	Ran X sine beat @ 15.9 hz, 8+ g's pk, 20 beats	JH
	1312	Ran X sine beat @ 20.0 hz, 8+ g's pk, 20 beats	JH
	1315	Ran X sine beat @ 25.0 hz, 8+ g's pk, 20 beats	JH
↓	1319	Rotated fixture / specimens 90° around its	JH

PAGE 7 OF 8 TEST BY Jay R. Hall DATE 12-16-81
ENGR. Richard E. Forbes GOV'T QAR

A&B PTG — 211

Report 548-9291, Rev.1

NTS

A NATIONAL TECHNICAL SERVICES CO.

GENERAL LOG SHEET

TEST SEISMIC MJO 548-9291

CUSTOMER STONE + WEBSTER

TEST ITEM LIMITORQUE OPERATOR P/N SMB-000-5 S/N

SPECIFICATION PAR

DATE	TIME	LOG ENTRIES	INITIAL
12-16-81	CONTINUED	vertical centerline to the XZ axes.	JH
	1418	Ran Z sine beat @ 5 hz, 8+ g's pk, 6 beats	JH
	1421	Ran Z sine beat @ 6.3 hz, 8+ g's pk, 6 beats	JH
	1423	Ran Z sine beat @ 7.9 hz, 8+ g's pk, 6 beats	JH
	1428	Ran Z sine beat @ 10 hz, 8+ g's pk, 20 beats	JH
	1433	Ran Z sine beat @ 12.6 hz, 8+ g's pk, 20 beats	JH
		The customer has requested the following	JH
		additional testing to satisfy the required	
		quantity of sine beats at the specified	
		levels.	
	1642	Ran Y sine beat @ 7.9 hz, 9 g's pk, 6 beats	JH
	1645	Ran Y sine beat @ 10.0 hz, 10 g's pk, 6 beats	JH
	1647	Ran Y sine beat @ 15.9 hz, 10 g's pk, 6 beats	JH
	1653	Ran X sine beat @ 10 hz, 10 g's pk, 6 beats	JH
		NOTE – All sine beats had a	
		3000 ms interval between beats.	
		Testing is completed.	

PAGE 8 OF 8

TEST BY Jay R. Hall DATE 12-16-81

ENGR. Richard E. Forbes GOV'T QAR

A&B PTG — 211

DOCUMENTATION CHECK LIST

REV: 4

ETM

CUSTOMER: Stone & Webster
ORDER NO: NMP2-P-304R
PROJECT: Nine Mile Point - 2
S&W VALVE MARK NO: 2CCP-MOV 18A
SPECIFICATION NO: NMP2-P304R REV. 1 ADD. 4
DRAWING NO: P3-7026-N6 REV: F
VGW015-P-32Q

DATA PACKAGE NO: W800004
VELAN ORDER NO: P3-7026-N IT. 38
CODE APPLICABILITY: Section III, Class 1, 2&3

REQUIRED [X]

DOCUMENT	CLASS 1	CLASS 2	CLASS 3
Manufacturer's Data Report	X	X	X
**Certificate of Compliance	X	X	X
Seismic Certificate (MOV Only)	X		
*Certified Material Test Reports Including for S/S a) Sol. Anneal. Cert. for Body, Bonnet, Disc, b) Delta-ferrite for Weld Metal	X	X	X
***Certificate of NDE Approval	X	X	X
Hydrostatic Test Record	X	X	X
M.O. Test Report (Limitorque)			
M.O./Valve Operability Test Report (Velan)			
Wall Thickness Documentation (Over 1")	X	X	X
Heat Treatment Records (Velan-P/R Parts)(when req'd.)	X	X	X N/A
Weld Record Documentation	X	X	X
Weld Repair Record (If Required)			X
Cert. of Compliance for Grade II Water			
Deviation Request Approvals (If Required)			
Pneumatic Seat Leak. Test Reports			
Stress Certificate (Class 1 only)	X		

ITEMS NOT PART OF DATA PACKAGE (Check Off Only By ESI)

Weld Procedures	(x)	Heat Treatment Procedures	(x)
NDE Procedures	(x)	Pneumatic Seat Leak. Procedure	(x)
M/O Test Procedures	(x)	Calculations MOV	(x)
Performance Test Procedures	(x)	Forty (40) Copies of Instal. and Oper. Inst.	(x)
Cleaning/Packaging Procedure	(x)	Stress Report	( )
Operability Test Procedure	(x)		
Wall Thick. Meas. Procedure	(x)		

S.W.E.C. PQA FEB 29 1980 INSPECTED 213

IR # ~~3004~~ 3003

R. Garrow

	BODY			BONNET			WEDGE/ ~~DISC~~			BOLTING			WELD FILLER METAL			WELD END			SEAL WELD			HARD FACING		
Class.....	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
*Certified Material Test Reports....	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x									
**Cert. of Material Compliance.......										x	x	x												
***NDE............																								
RT.......																								
UT.......	x			x			x			x						x								
MT.......	x	x		x			x			x						x	x		x	x				
PT.......	x	x													x	x	x	x	x	x	x	x	x	x
Charpy Impact..	6			6			6			1														

LEGEND
X - all
0 - 1" & less
1 - over 1"
2 - over 2"
3 - 2"-4"
4 - over 4"
5 - full weld
6 - over 6"

NOTE: Unmarked boxes are not applicable to this specification.

S&W Certificate of Conformance
Number: __________

Data Package Prepared By: M. Weston

DATE: 2-28-80

FORM NPV-1 MANUFACTURERS' DATA REPORT FOR NUCLEAR PUMPS OR VALVES*
(As Required by the Provisions of the ASME Code, Section III, Div. 1) W800004

1. Manufactured by Velan Valve Corporation Avenue "C" Williston, Vermont
(Name and Address of Manufacturer)
2. Manufactured for Niagara Mohawk Power Corporation, Scriba , New York
(Name and Address of Purchaser or Owner)
3. Location of Installation Nine Mile Point Station, Rt. 104 Oswego, New York
(Name and Address)
4. Pump or Valve Gate Valve Nominal Inlet Size 12 (inch) Outlet Size 12 (inch)

	(a) Model No., Series No. or Type	(b) Manufacturers' Serial No.	(c) Canadian Registration No.	(d) Drawing No.	(e) Class	(f) Nat'L Bd. No.	(g) Year Built
(1)	B18-0054B-02WN	004	-----	P3-7026-N6	3	----	1980
(2)				Rev. F			
(3)							
(4)							
(5)							
(6)							
(7)							
(8)							
(9)							
(10)							

S. W. E. C. FEB 29 1980

5. ______
(Brief description of service for which equipment was designed)

6. Design Conditions 200 (Pressure) psi 250 (Temperature) °F or Valve Pressure Class ______ (1)
7. Cold Working Pressure 300 psi at 100°F.
8. Pressure Retaining Pieces

Mark No.	Material Spec. No.	Manufacturer	Remarks
(a) Castings			
(b) Forgings			H/C
Body	ASME-SA-105	Cameron Iron Works	L2030
Bonnet	ASME-SA-105	Galt British Forge	J2114
Wedge	ASME-SA-105	Galt British Forge	F5098
DRAIN PIPE	ASME-SA-106 GR. B	TUBULAR STEEL	D64994

(1) For manually operated valves only.

* Supplemental sheets in form of lists, sketches or drawings may be used provided (1) size is 8-1/2" x 11", (2) information in items 1, 2 and 5 on this data report is included on each sheet, and (3) each sheet is numbered and number of sheets is recorded at top of this form.

(3/77) This form (E00037) may be obtained from the Order Dept., ASME, 345 E. 47 St., New York, N.Y. 10017

VELAN ENGINEERING COMPANIES

FORM VE-48-4-73A

CERTIFICATE OF COMPLIANCE

W800004

1. CUSTOMER: Niagara Mohawk Power Corp.
2. CONTRACT NO.: NMP2-P304R
3. CUSTOMER SPEC. NO.: NMP2-P304R Rev.1 Add. 4
4. CUSTOMER I.D. NO. (TAG NO.): VGW 015-P-3ZQ
5. DWG. NO.: P3-7026-N6 REV.: F
6. DATE: January 5, 1980
7. VELAN ORDER NO.: P3-7026-N ITEM: 38
8. VALVE DESCRIPTION: 12" - 150 # Bolted Bonnet Gate Valve
9. OPERATOR SERIAL NO.: 293419
10. QUANTITY: 1
11. NUCLEAR CLASS: N 1 ☐ N 2 ☐ N 3 ☒

2CCP MOV 18A

(REQ. = REQUIRED) (ENC. = ENCLOSED) QUALITY CONTROL CHECK LIST (P&C = PHYSICAL - CHEM. CERTIFICATE)

PART	SERIAL NO.	MATERIAL SPECIFICATION	HEAT CODES	P & C REQ.	P & C ENCL.	RT REQ.	RT PERF.	UT REQ.	UT PERF.	PT REQ.	PT PERF.	MT REQ.	MT PERF.
FORGINGS 1. BODY	176	ASME-SA-105	L2030	X	X								
2. BONNET (COVER)	W439	ASME-SA-105	J2114	X	X								
DRAIN	PIPE	ASME SA-106 GR. B	D64994	X	X								
DRAIN	CAP	ASME SA-105	RS129										
CASTINGS 1. WEDGE (DISC)	7322	ASME-SA-105	F5098	X	X								
Wedge Seat	Guide Welds	SFA 5.18	A09004	X	X					X	X		
Drain Weld	Pipe	SFA 5.18	A09004	X	X					X	X		
BARS 1. STEM		ASTM-A-276-410	H 22										
2. STUD		ASME SA 193 B7	15878	X	X								
3. NUT		ASME SA 194 2H	239149	X	X								
BACKSEAT SEAL WELD		SFA 5.18	A09004	X	X					X	X		
Wedge 2. HARD-FACING Seats		STELLITE	54-35734							X	X		
Backseat HDFG		STELLITE	GRM-6-77 GRM-6-85							X	X		
WEDGE REPAIR		SFA 5.1	73702	X	X					X	X		

APPLICABLE VELAN NDT QC SPECIFICATION AS APPROVED		REV.
RADIOGRAPHY	N/A	
ULTRASONIC	N/A	
PENETRANT	VEL-NDT-564B	0
MAGNETIC PARTICLE	VEL-NDT-543B	0
PRODUCTION AND HYDROSTATIC TESTS	VEL-NDT-640A	10
CLEANING	VEL-P-672	1
WALL THICKNESS	VEL-QC-665A	12
	VEL-QCI-482	4

(WHEN APPLICABLE ONLY)

SWORN AND SUBSCRIBED BEFORE ME THIS

DAY OF ____________ 19__

J.O. # 12177

S.W.E.C. PQA FEB 29 1980 INSPECTED 213

WE HEREBY CERTIFY THAT THE ABOVE STATEMENTS AND VALUES SPECIFIED ARE TRUE AND CORRECT AS CONTAINED IN THE RECORDS OF THE CORPORATION.

VELAN ENGINEERING CO.

X [signature]
MANAGER OF INSPECTION

X

CUSTOMER REPRESENTATIVE

X

DATE

VELAN ENGINEERING COMPANIES

CERTIFICATE OF NDT APPROVAL W800004 FORM VE-48-4-73A

PART	SERIAL NO. OR HEAT CODE		QUANTITY ACCEPTED	LIQUID PENETRANT NDT INSPTR.	LIQUID PENETRANT DATE	MAGNETIC PARTICLE NDT INSPTR.	MAGNETIC PARTICLE DATE
BODY							
BODY BUTTWELD	176		2 Ends	69	FEB 15,1980		
~~BONNET (COVER)~~ & BACKSEAT Hardfacing		GRM-6-77 GRM-6-85	1	56	FEB. 9,1979		
~~DISC~~ (WEDGE)							
STEM							
BACKSEAT SEAL WELD		A09004	1	56	SEPT. 29,1979		
DRAIN PIPE WELD		A09004	1	56	SEPT. 29,1979		
WELD SEATS AND GUIDE		A09004	2	56	SEPT. 29,1979		
HARDFACE SEAT		54-35734	2	56	JAN. 4,1979		
HARDFACE ~~DISC~~ (WEDGE)		54-35734	1	69	DEC. 28,1979		
WEDGE REPAIR		73702	1	69	DEC. 28 1979		
BODY REPAIR		73702	1	52	OCT 13,1978		

S.W.E.C. FEB 29 1980 INSPECTED 213

INSP. 56 69 52 LEVEL 2

CERTIFICATE OF PRODUCTION (HYDROSTATIC) TEST

TYPE OF TEST	SHELL	WEDGE	SEAT 'A' SIDE	SEAT 'B' SIDE	BACK SEAT	PACKING
DURATION MINS.	10	1	1		1	2
PRESSURE P.S.I.	425	300	150		425	300
RESULT C.C.	0	O.K	·1 ML	·2 ML	0	0

GAUGE NO. G16-3860, G16-3636

TEST DATA FOR MOTOR – OPERATED VALVES			
OPERATOR TYPE	SMB-0-25	RATED VOLTS	575
SERIAL NO.	293419	DIFFERENTIAL PRESSURE	150
		FULL RATED VOLTS	~~RATED VOLTS~~
TIME TO OPEN (SECS)	63		
TIME TO CLOSE (SECS)	63		
PEAK STARTING CURRENT (AMPS)	OPEN 3		CLOSE 4
NORMAL OPERATING CURRENT (AMPS)	OPEN 3		CLOSE 3
		OPEN	CLOSE
TORQUE SWITCH SETTING	OPEN 2		CLOSE 2
LIMIT SWITCH SETTING	SET OPEN		SET CLOSED

DATE OF TEST FEB. 14, 1980

TESTED BY L. GARRISON

CERTIFIED BY [signature]

CUSTOMER'S REPRESENTATIVE

B13

Cameron
IRON WORKS, INC.

P. O. BOX 1212 HOUSTON, TEXAS 77001

TIFICATE OF TESTS W800004

Date 14 June 1977

SOLD TO
VELAN ENGINEERING LTD.
LARGE STEEL VALVE DIVISION
2125 Ward Avenue
Montreal, Quebec, Canada

SHIP TO

Customer Order No.	C.I.W. Sales Order No.	Specification
C1217	F-17370-1	ASTM A105-73/ASME SA105 (ASME Section II, Part A, 1974 Thru Winter '75 Addenda

Description of Material: 12" L.P. Valve Body Dwg.# F00-007-002

ASME QUALITY SYSTEM CERTIFICATE (MATERIALS) NO. N-1261 EXPIRES 10-27-78.

CHEMICAL ANALYSIS

C.I.W. Part Number	Heat No.	C	MN	P	S	SI	CR	NI	MO	W	V	CU
66142-14	L 2030	.26	.98	.017	.019	.26						

.. material or components shipped under the above part number has not come in direct contact mercury or any of its compounds, or with any mercury containing devices employing a single ory of containment during the manufacturing process, tests, inspection or storage.

S.W.E.C. PQA INSPECTED 213 FEB 29 1980

MECHANICAL PROPERTIES

C.I.W. Part No. or Size	Quantity	Heat No.	.2% Offset Yield PSI	Tensile PSI	% Elong. In.	% Red. Area	Test Lot#	Hardness
66142-14	12	L 2030.	57,400	80,900	30.0	60.3	169	

Forg.Ser.#	Test Lot#	Forg. Ser.#	Test Lot#	Forg. Ser.#	Test Lot#
#0169	169	#0174	169	#0179	169
0170	169	0175	169	0180	169
0171	169	0176	169		
0172	169	0177	169		
0173	169	0178	169		

C.I.W. Heat No. Jominy Hardenability Grain Size

1565°F., held 2.83 hrs. at temp. Air cooled.

Heat-Treat Furnace report attached.

I CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF SPECIFICATION ASME SA-105 EDITION 1974 AND ADDENDA THROUGH WINTER 1975 EXCEPT AS NOTED

VELAN ENGINEERING LTD.
PER MANAGER OF INSPECTION

Subscribed and Sworn to before me this 14th Day of June 1977

AUG - 4 1977

I certify the above to be correct as contained in the records of the company.

Notary Public
H. O. WRIGHT, Metallurgist /gt

CAMERON 453-1 REV. 3/73

C50

GALT-BRITISH FORGE COMPANY

204 BEVERLY STREET — CAMBRIDGE (GALT), ONT. N1R 3Z8

DESCRIPTION Velan Valve Corp., Vermont P.O. W0689F

OCT 30 1978

ASME SA105 & ASME B. & P.V. Code Sect. 2 Part A & Sect. 3 1974 Edition & Winter 75 Addenda material from Atlas Steels

Oct 30 '78
MW

8 Discs 19" diameter x 8" thick W800004

12" - 600 lb. Bonnets Part No. 0019-008-002

Material produced according to our Q.A. Manual approved by Velan Engineering

CERTIFICATE OF TEST

NORMALIZED

CHEMICAL ANALYSIS

HEAT NO	C	MN	P	S	SI	CR	MO	NI	CU	CB	TA		
J2114	✓ .24	✓ .98	✓ .009	✓ .002	✓ .18								

PHYSICAL PROPERTIES 2"

HEAT NO.	YIELD STRENGTH P.S.I. (2% OFFSET)	TENSILE STRENGTH P.S.I.	ELONG. %	RED. OF AREA %	IMPACT FT. LBS.	BRINELL HARDNESS
T846 J2114	✓ 50,500	✓ 79,500	✓ 39.1	✓ 68.3		

JOMINY HARDENABILITY

DISTANCE (16ths)

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	18	20	22	24	26	28	30	32

I CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF SPECIFICATION ASME SA-105
EDITION 1974 AND ADDENDA
THROUGH WINTER 1975 EXCEPT AS NOTED

VELAN ENGINEERING LTD.
PER MANAGER OF INSPECTION

MAGNETIC PARTICLE INSPECTION TO AMS2301 F/...

GRAIN SIZE

1. Furnace No. 5.
2. Charge 1200° F.
3. 100° F./hr.
4. Hold 1650° F./7½ hrs.
5. Air cool.

S.W.E.C. PQA INSPECTED-213

FEB 29 1980

These forgings have not come into direct contact with mercury or any of its components, nor with any mercury containing devices during manufacture, testing, inspection or storage.

The contents of this report are correct and accurate and comply with the material specification

GALT-BRITISH FORGE COMPANY
QUALITY ASSURANCE

DATE October 18, 1978

C53

GALT-BRITISH FORGE LIMITED

204 BEVERLY STREET — CAMBRIDGE (GALT), ONT. N1R 3Z8

W800004

DESCRIPTION

Velan C1405 material from Atlas Steels

ASME SA 105 & ASTM A105-71

18 - 12" 600 lb. B.B. Gate Valve Wedges to Dwg. E00-020 Rev. 0
Pt. # E00-020-002

CERTIFICATE OF TEST

CHEMICAL ANALYSIS

HEAT NO	C	MN	P	S	SI	CR	MO	NI	CU	CB	TA	
F5098	.30	.69	.010	.033	.17							

HEAT NO.	0.2% YIELD STRENGTH P.S.I.	PHYSICAL PROPERTIES 2" TENSILE STRENGTH P.S.I.	ELONG. %	RED. OF AREA %	IMPACT FT. LBS.	BRINNELL HARDNESS
F5098	55,000	83,000	29.0	53.9		170

Normalized 1650°F ± 25°F Air cooled still air.

JOMINY HARDENABILITY

DISTANCE (16ths)

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	18	20	22	24	26	28	30	32

S.W.E.C. PQA INSPECTED 213 FEB 29 1980

MAGNETIC PARTICLE INSPECTION TO AMS2301 F/S =

GRAIN SIZE =

I CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF SPECIFICATION ASME SA-105 EDITION 1974 AND ADDENDA THROUGH Winter 1975 EXCEPT AS NOTED

VELAN ENGINEERING LTD.

PER MANAGER OF INSPECTION

These forgings have not come into direct contact with mercury or any of its components, nor with any mercury containing devices during manufacture, testing, inspection or storage.

NOV 11 1975

November 6, 1975.

DATE

GALT-BRITISH FORGE LIMITED
QUALITY ASSURANCE

GALT BRITISH FORGE COMPANY

W800004

204 BEVERLY STREET, CAMBRIDGE, CANADA N1R 3Z8 · (519) 621-8140 · TELEX 069-59390

May 7, 1979.

Test Report Supplement

Reference purchase orders:

C1405	C7028	C8994	W0544
C2633	C7303		W1001
C3554	C7355	W0025	W1009
C4658	C7357	W0026	W1079
C4659	C7726	W0029	
C4668	C7737	W0033	
C4935	C7754	W0261	
C5071	C7757	W0530	

Please add the following: "Material produced according to our Q.A. Manual approved by Velan Engineering."

S.W.E.C. PQA INSPECTED 213 FEB 29 1980

N. W. Gray

N. W. Gray,
Q.A. Manager.

HOBART BROTHERS COMPANY FILLER MATERIALS ACTUAL TESTING REPORT
WELD TEST LABORATORY

WIC — 5 JULY 1978

W800004

[X] Job No. As Welded Q8-142, 142C
[ ] Job No. Stress Relieved

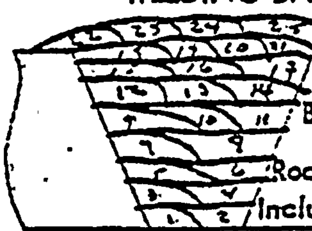
HBC Type 718 Size 5/32" Serial Number 90156Z117 Lot 73702

For Velan Valve (Purchaser) Purchase Order Number C-7787

Conduct the following test to meet the requirements of:
FM Specification Velan Spec's Re. Mil E 22200/1E Class E-7018 and ASME SFA 5.1 Chem. analysis to ASME Sect. III NB 2432.2.

INSTRUCTIONS
1) Use ink or type only.
2) Sign full name.
3) Make no erasures.
4) Retest: Designate by -1 and -2.

WELDING DATA



Thickness 3/4
Backing Bar 1/4 in by 1
Root Opening 1/2
Included Angle 60
Pass Sequence

CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF SPECIFICATION ASME SFA 5.1 EDITION 1974 THROUGH Winter 1975 ADDENDA EXCEPT AS NOTED
Chemistry Source
[X] Pad
[ ] Tensile
[ ] Wire
VELAN ENGINEERING LTD.
PER MANAGER OF INSPECTION

CHEMICAL ANALYSIS

[X] C	.043	[X] Cr	.069
[X] Mn	.67	[X] Va	.020
[X] P	.018	[X] Ni	.044
[X] S	.012	[X] Mo	.017
[X] Si	.35	[X] Al	.002
[X] Cu	.016	[X] Ti	.012

Tested by I. Shroyer Date 5-19-78
Lab Analysis No. 5642

Volts 26 Amp 190 Gas None
Preheat 225±25 Interpass Temp. 225±25
Power Source M-300
Current or Polarity DCEP
Other Comments

Route to:	Sender	Date Sent
Weld Test Lab	Platz	5-18-78
FM R & D		
FMQC	Jerry Pfister	6-2-78

S.W.C. PQA INSP. 213 FEB 29 1980

Welded by D. Warner Date 5-23-78

[X] Radiographic Test Conforms
Tested by J. Foust SNT Level II Date 5-24-78

[ ] Moisture Test (Free) [X] (Total) .23
Tested by: I. Shroyer Date 5-19-78

[X] Concentricity Test Conforms Max. 1.146% Length 14" dia .155
Tested by D. Warner Date 5-19-78

[X] Fillet Tests [ ] Horizontal [X] Vertical OK [X] Overhead OK
Tested by: D. Warner Date 5-22-78

[ ] Transverse Tensile PSI
[ ] Longitudinal Bend

(See Other Side)

W82

HOBART BROTHERS COMPANY FILLER MATERIALS ACTUAL TESTING REPORT
WELD TEST LABORATORY

FEB 28 1979

W800004

[X] Job No. As Welded Q9-1, 1C-1
[ ] Job No. Stress Relieved

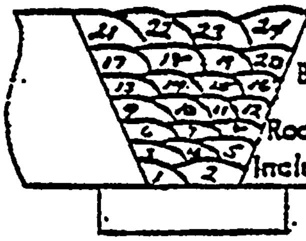
HBC Type 25 Size 3/32" Serial Number A09004
For Velan Valve (Purchaser) Purchase Order Number W0048

Conduct the following test to meet the requirements of:
FM Specification Velan Valve Spec VEL-PS-028 w/ Reference to Class E70S-3
ASME SFA 5.18 and Sect. III NB 2432.2

INSTRUCTIONS

1) Use ink or type only.
2) Sign full name.
3) Make no erasures.
4) Retest: Designate by -1 and -2.

WELDING DATA



Thickness 1/2
Backing Bar 1/4 in by 1
Root Opening 1/4
Included Angle 45
Pass Sequence

I CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF
SPECIFICATION Asme SFA 5.18
EDITION 1974 [X] [A] ADDENDA
THROUGH Winter 1975 EXCEPT AS NOTED
Chemistry Search Rod Tens Wire
VELAN ENGINEERING LTD.
PER MANAGER OF INSPECTION

CHEMICAL ANALYSIS

[X] C	.093 ✓	[X] Cr	.063
[X] Mn	1.23 ✓	[X] Va	.003
[X] P	.024 ✓	[X] Ni	<.001
[X] S	.025 ✓	[X] Mo	.020
[X] Si	.60 ✓	[X] Al	<.001
[X] Cu	.11	[X] Ti	.006

Tested by I. Shroyer Date 9/12/78
Lab Analysis No. 7078

Volts 15 Amp 160 Gas Argon
Room Temp. 65 min Interpass Temp. 300 ± 25°F
Power Source CT-300
Current or Polarity DCEN
Other Comments GTAW 1/8" dia. 2% Thoriated Tungsten

Welded by J. Foust Date 1-15-79

Route to:	Sender	Date Sent
Weld Test Lab	Platz	1/8/79
	Pfister	1/11/79
FM R & D		
FMQC	Jerry Pfister	1/22/79

[X] Radiographic Test Conforms
Tested by J. Foust SNT Level II Date 1-16-79

[ ] Moisture Test (Free) [ ] (Total)
Tested by: Date

S.W.E.C. FEB 29 1980

[ ] Concentricity Test Length
Tested by Date

[ ] Fillet Tests [ ] Horizontal [ ] Vertical [ ] Overhead
Tested by: Date

[ ] Transverse Tensile PSI [X] Cast 17-3/8"
[ ] Longitudinal Bend [X] Helix 1/8"

(See Other Side)

Tubular Steel Incorporated
502 Earth City Plaza, Earth City (St. Louis County), Missouri 63045
Mailing address: P.O. Box 65 Hazelwood, Mo. 63042
Telephone 314/524-1500 Telex 44-2338

P9
PAGE 1 #3

Performance you can count on.

W800004

HOLDER OF ASME QUALITY SYSTEMS CERTIFICATE (MATERIALS) NO. N-1590
Expiration Date: December 29, 1979

I CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF SPECIFICATION ASME SA-106 Gr.B EDITION 1974 AND ADDENDA THROUGH Winter 1975 EXCEPT AS NOTED

VELAN ENGINEERING LTD.

PER MANAGER OF INSPECTION

MATERIAL SHIPPED ON YOUR
P.O. # W2485 UNDER SECTION
III NCA3800 IS IN COMPLIANCE WITH
TUBULAR STEELS QUALITY SYSTEM
ASME CERTIFICATE #N1590

CERTIFICATION TRANSMITTAL

The material supplied on P.O. # W2485

on our Shipping # 20931 is certified by our supplier to be in

accordance with the requirements of ASTM A-106 GrB ASME SA-106 GrB

Copies of the mill certificate(s) for this material are attached.
Ø.840" OD x Ø.187" Wall Heat No. D64994 Velen Valve Part No. H-516-Ø46

Quality Assurance Mgr.

This is to certify that the contents of this report are correct and that all the operations performed are in compliance with the requirements of the material specification and the purchase order. This is to certify that the piping material described herein is in accordance with the specification, Section III Class 3, of the ASME Boiler and Pressure Vessel Code, 1974 Edition Summer 1975 addenda.

State of Missouri
County of St. Louis

Certified and subscribed before me, a Notary Public, in and for the above state and city, this day and date.

My commission expires 10/3/81

Dated 7/5/79

S.W.E.C. PQA INSPECTED-213 FEB 29 1980

JUN 14 1979

SHARON TUBE COMPANY, SHARON, PENNA.

Cold Draw Department

Report of CHEMICAL and PHYSICAL Tests for W800004 January 11, 1979

Shop Order No. 5265-78 Customer Order No. 25112

DESCRIPTION	LOT NO.	HEAT NUMBER	C	Mn	P	S	Si		HARDNESS		YIELD PSI	ULTIMATE PSI	ELONGATION IN __ IN.	PERCENT	BEND TEST
1/2" Schedule 80	1	M62617	.20	.66	.009	.020	.15		69	RB	47200	65800	2	45.0	OK
	2	D63809	.19	.75	.015	.022	.16		68	RB	50670	67560	2	43.5	OK
	3	E70393	.19	.70	.006	.013	.17		72	RB	48430	67030	2	44.5	OK
1/2" Schedule 160	1	D66270	.22	.71	.010	.017	.19		75	RB	50880	68900	2	43.0	OK
	2	D64994	.21	.70	.007	.018	.16		68	RB	49750	67450	2	46.0	OK
3/4" Schedule 160	1	E71810	.22	.75	.010	.015	.17		71	RB	50820	69920	2	44.5	OK

MATERIAL SHIPPED ON YOUR P.O. # W2452 UNDER SECTION III NCA3800 IS IN COMPLIANCE WITH TUBULAR STEELS QUALITY SYSTEM ASME CERTIFICATE #N1590

S.W.E. P.G.A. INSPECTED 213 FEB 29 1980

Cold Drawn Stress Relieved Carbon Steel Seamless Pressure Pipe Meeting the Requirements of ASTM A-106 Grades A&B and ASME SA-106 Grades A&B; Each Length of Pipe Hydrostatically Tested to 2500 P.S.I.

STATE OF PENNSYLVANIA, COUNTY OF MERCER } ss

Subscribed and sworn to before me this 11th day of January, A. D., 19 79

JUN 14 1979

Richard K. Loos Notary Public

Commission expires June 14, 1982

500098

E. G. PALKO, being duly sworn according to law, deposes and says that the figures set forth above are correct, as contained in the records of the Company.

E G Palko

SHARON TUBE COMPANY, SHARON, PENNA.
Cold Draw Department

P9 PAGE 3 of 3
RECERTIFICATION

№ 800004

Report of CHEMICAL and PHYSICAL Tests for Midland Pipe and Supply Company July 17 19 78

Shop Order No. 5265-78 Cicero, Illinois Customer Order No. 25112 REFERENCE NO. (W2485S020931)

ITEM NO.	DESCRIPTION	LOT NO.	HEAT NUMBER	CHEMICAL ANALYSIS C	Mn	P	S	Si		HARDNESS		YIELD PSI	ULTIMATE PSI	ELONGATION IN __ IN.	PERCENT	BEND TEST
5	1/2" SCHEDULE 160	1	D64994	.21	.70	.007	.018	.16		68	RB	49750	67450	2	46.0	OK

COLD DRAWN CARBON STEEL, SEAMLESS PRESSURE PIPE STRESS RELIEVED AT 1750°F FOR 10 MINUTES.

S. W. E. C. INSPECTED 213 FEB 29 1980 Q-4

Cold Drawn Stress Relieved Carbon Steel Seamless Pressure Pipe Meeting the Requirements of ASTM A-106 Grades A&B and ASME SA-106 Grades A&B; Each Length of Pipe Hydrostatically Tested to 2500 P.S.I.

STATE OF PENNSYLVANIA,
COUNTY OF MERCER } ss

Subscribed and sworn to before me this 16th day of July, A. D., 19 79

Kenneth F. Koletch Notary Public

My Commission expires April 7, 1980

E. G. PALKO, being duly sworn according to law, deposes and says that the figures set forth above are correct, as contained in the records of the Company.

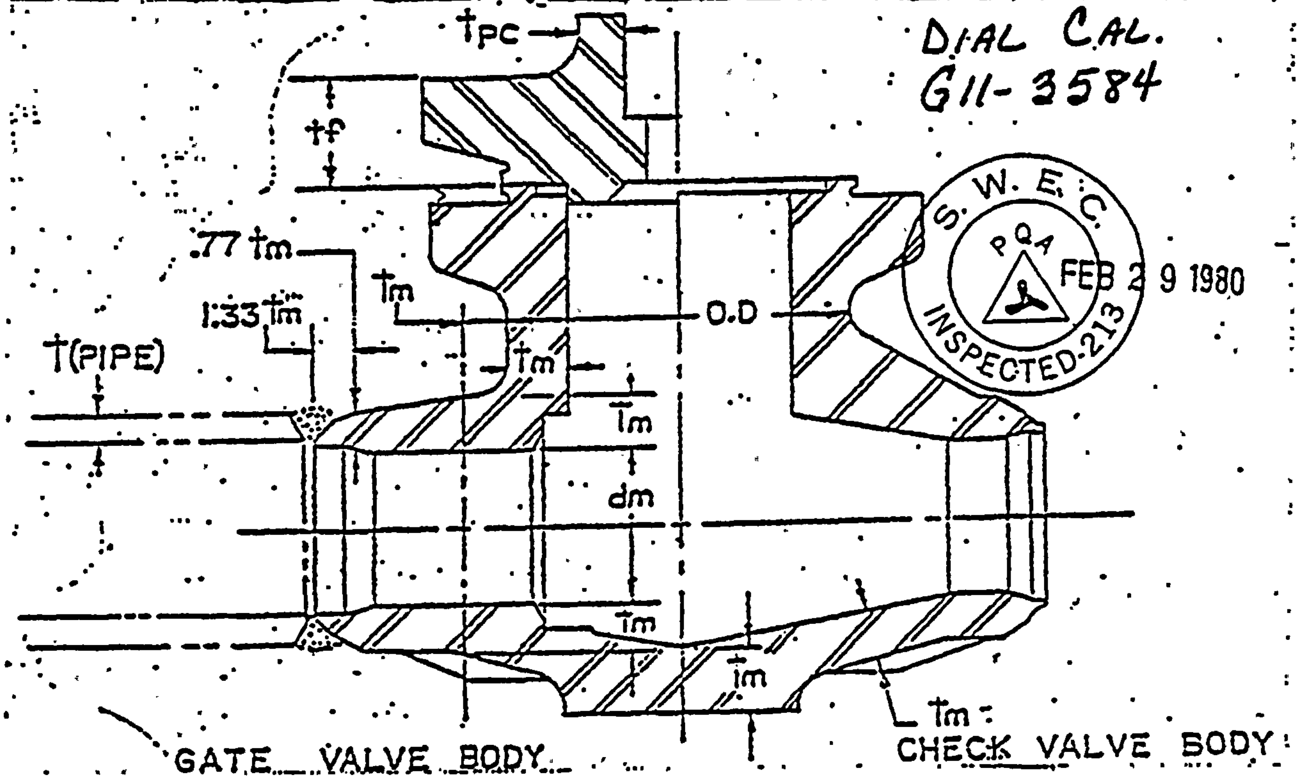
VEL INSP. 53

E. G. Palko

	VELAN ENGINEERING COMPANIES	Q.C. INSTRUCTION
	WALL THICKNESS INSPECTION	VEL-QC-665A SECTION I

VALVE TYPE	B.B. Gate	BODY SERIAL NO. 800004	0176
VALVE SIZE	12"	BONNET SERIAL NO.	
PRESSURE RATING	150#	BODY MIN. WALL THICKNESS REQ'D (t_m)	.375
NUCLEAR CLASS	3	BONNET MIN. WALL THICKNESS REQ'D (t_f)	
MATERIAL	C/S	PACKING CHAMBER MIN. WALL THICKNESS REQ'D (t_{pc})	

DIAL CAL.
G11-3584



ACTUAL MEASUREMENTS (FINISHED/MACHINED CONDITION) .289 at .489

	t INLET (t_m)	t OUTLET (t_m)	t NECK (t_m)	t BOWL (t_m)	t BONNET FLANGE (t_f)	t PACKING CHAMBER (t_{pc})	t SOCKET (.77 t_m) Inlet	Oulet
A	1.640	1.560	1.780	1.812			.476	.473
B	1.605	1.545	1.687	—			.476	.473
C	1.500	1.545	1.740	—			.476	.473
D	1.640	1.560	1.875	—			.476	.473

INSPECTOR	I. Bear	DATE	2/20/80
ACCEPTABLE	✓	REJECTED	

Values above are lowest measured in each four quadrants. For end connections, quadrants start at top and progress clockwise, facing the end. For neck and bonnet, quadrants start at side over manufacturers symbol and progress clockwise facing down.

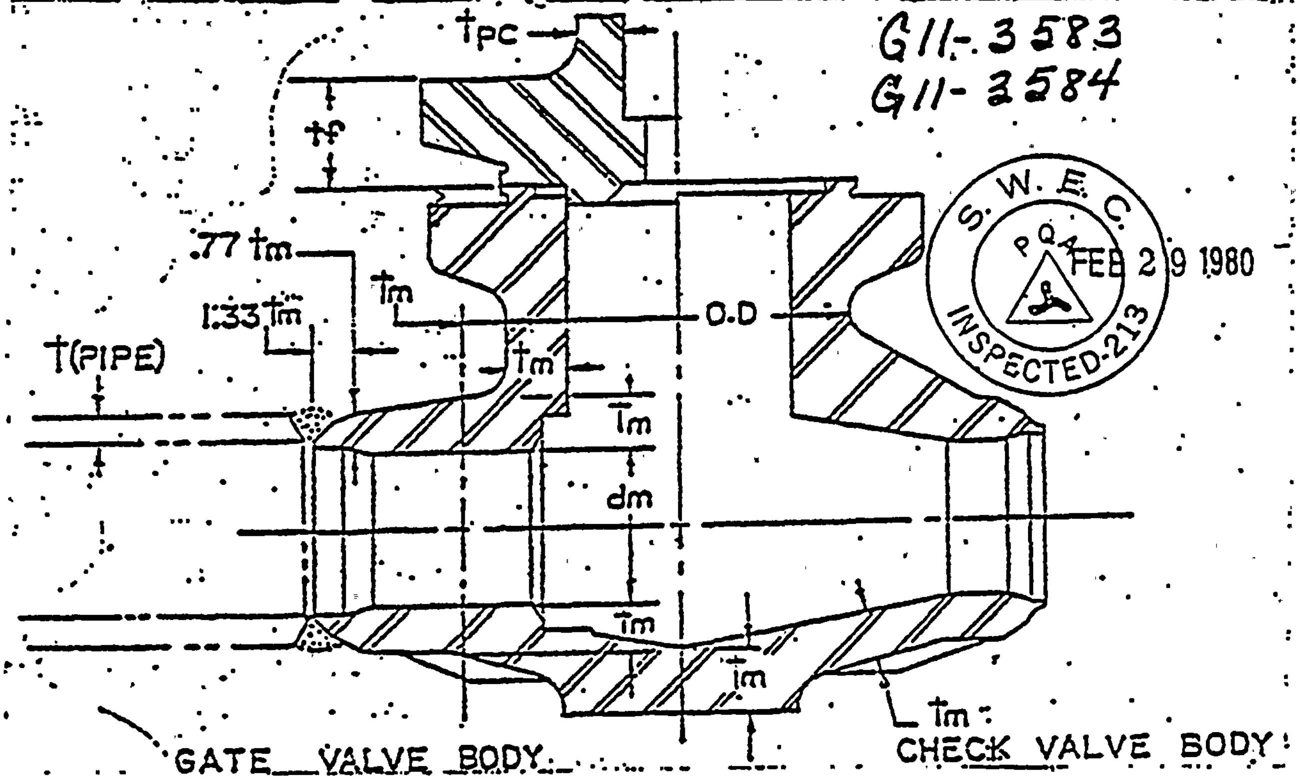
NOTE: 0.77 t_m minimum measured at a distance of 1.33t_m from weld end.

FORM NO. 67-9-76

VELAN ENGINEERING COMPANIES	Q.C. INSTRUCTION
WALL THICKNESS INSPECTION	VEL-QC-665A SECTION I

VALVE TYPE	B.B.GATE	BODY SERIAL NO. E800004	
VALVE SIZE	12"	BONNET SERIAL NO.	439
PRESSURE RATING	150	BODY MIN. WALL THICKNESS REQ'D (t_m)	
NUCLEAR CLASS	3	BONNET MIN. WALL THICKNESS REQ'D (t_f)	3.076
MATERIAL	C/S	PACKING CHAMBER MIN. WALL THICKNESS REQ'D (t_{pc})	.195

G11-3583
G11-3584



ACTUAL MEASUREMENTS (FINISHED/MACHINED CONDITION)

	t INLET (t_m)	t OUTLET (t_m)	t NECK (t_m)	t BOWL (t_m)	t BONNET FLANGE (t_f)	t PACKING CHAMBER (t_{pc})	t SOCKET (.77 t_m) Inlet	t SOCKET (.77 t_m) Oulet
A					3.687	1.001		
B					3.687	1.001		
C					3.687	1.001		
D					3.687	1.001		

INSPECTOR	Maynard	DATE	Feb-23-79
ACCEPTABLE	VEL INSP. 54	REJECTED	

Values above are lowest measured in each four quadrants. For end connections, quadrants start at top and progress clockwise, facing the end. For neck and bonnet, quadrants start at side over manufacturers symbol and progress clockwise facing down.

NOTE: 0.77 t_m minimum measured at a distance of 1.33t_m from weld end.

FORM NO. 67-9-76

TAKARA INDUSTRIES CO., LTD.
NO 23-6 SAN-CHOME OHMORI-MINAMI,
OHTA-KU, TOKYO, JAPAN
PHONE: TOKYO 743-5201
TELEX J24917

Velan Code
RS 129

Form B63

FORGED BY DAIDO STEEL
SYMBOL MARK " D O "

CERTIFICATE OF TESTS

№ 800004

DATE 31TH.AUG.1978

SOLD TO
VELAN ENGINEERING LTD.
2125 WARD AVENUE
MONTREAL 378 QUEBEC CANADA
VIA : TAKARA INDUSTRIES CO.,LTD.

SHIP TO
VELAN ENGINEERING LTD.
2125 WARD AVENUE
MONTREAL 378 QUEBEC CANADA
VIA : VANCOUVER

CUSTOMER ORDER NO	CRAFT NO.			SPECIFICATIONS
C-8553	EX-860		48 PCS.	ASME A-105

DESCRIPTION OF MATERIAL: 4" BODY FORGING TO DWG. NO. 89054
RAW MATERIAL CONFORMS TO THE REQUIRENTS OF ASME BOILER AND PRESSUER VESSEL CODE, SECTION 11 AND111, FOR CLASS 1 COMPONENTS.

HEAT IDENTIFICATION CODE AS ON PART	HEAT NO.	CHEMICAL ANALYSIS C	Si	Mn	P	S	Ni	Cr	Mo	Cu	As	Ti	
A-3	6C239	.25	0.27	1.04	.018	.016	-	-	-	-	-	-	

The material or components shipped under the above order number did not come in direct contact with mercury or any of its components, or with any mercury containing devices employing a single boundary of containment, during the manufacturing process, tests, inspection or storage.

DWG. OR PART AS APPROVED	THIS CERTIFICATE COVERED BY	HEAT NO.	MECHANICAL PROPERTIES YIELD PSI	TENSILE PSI	% ELONG.	% REDUC. AREA	CHARPY. IMPACT Kgm/cm²	HARDNESS H.B
DWG. NO. 89054	48 PCS	2924E	47653 ( )	79516 ( )	[illegible]	[illegible]		156

I CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF
SPECIFICATION ASME-SA-105
EDITION 1974 AND ADDENDA
THROUGH Winter 1975 and found acceptable, EXCEPT AS NOTED
VELAN ENGINEERING LTD.
PER MANAGER OF INSPECTION

Inspected and tested according to UT + ASTM A-370 + ASMEA-105 AS PER DWG. NO. 89054

S.W.E.C. INSPECTED 213
FEB 29 1980

HEAT TREATMENT Temp(F) Deg.
Back Heat Temp(F) Deg.

TREPANNED BODY STOCK FOR 1/2 NPT DRAIN CAPS + PLUGS

ALL MATERIAL SUPPLIED ON THIS ORDER IS CERTIFIED TO BE FREE FROM MERCURY CONTAMINATION. THE RAW MATERIAL AND FINISHED ITEMS DID NOT COME IN DIRECT CONTACT WITH MERCURY OR MERCURY BEARING COMPOUNDS DURING MANUFACTURE, ASSEMBLY OR TEST.

DATE 31TH.AUG.1978

I CERTIFY THESE TESTS TO BE CORRECT AS CONTAINED IN THE RECORDS OF THE COMPANY

T. Higuchi
Q. C. MANAGER

Oct. 27-78

W800004

SHEET 2/3

OME S.p.A. ERBA

PROVE MECCANICHE
mechanical test

ANALISI MATERIALE
material analysis

COLLAUDO inspection	DATA date	CERTIFICATO certificate
Internal	1.2.79	No. 169/79

CLIENTE purchaser: VELAN VALVE

ORDINE No order: W 1269 Pos. from12to26

VALORI RICHIESTI E OTTENUTI NELLE PROVE ESEGUITE SECONDO NORME required and obtained values in tests executed according with standards: ASME BPV. CODE SECTION II PART A AND SECT.III 1977 EDITION & SUMMER 1978 ADDENDA

PEZZO No piece No	LOTTO No lot No	PEDANA No	MATERIALE material	DESCRIZIONE description	PROVETTA Ø mm	PROVETTA AREA mm²	PROVETTA LUNG. length mm	RICHIESTI Rp 0.2 kgf/mm² min	RICHIESTI R kgf/mm² min	RICHIESTI A % min	RICHIESTI C % min	RICHIESTI HARDNESS	RICHIESTI IMPACT TEST	YIELD STRENGTH Rp (0.2) N	YIELD STRENGTH MPa kgf/mm²	TENSILE STRENGTH R N	TENSILE STRENGTH MPa kgf/mm²	ELONGATION A mm	ELONGATION A %	C %	HARDNESS	IMPACT TEST
	5		SA 193 B7	1"x 6 1/4"	12.7	126.7	50.8	724	862	16	50				790.[illegible]		[illegible]12.7		21.3	59.[illegible]		
	6		" "	1 1/8"xseveral	"	"	"	"	"	"	"				781.[illegible]		[illegible]01.8		20.4	60.[illegible]		
	7		" "	1 3/8"x9 1/2"	"	"	"	"	"	"	"				773		[illegible]94.9		21.6	60.[illegible]		

This is to certify that the contents of this report are correct and accurate and that all operations performed are in compliance with the requirements of the material specification and the purchase order.

LOTTO lot No	COLATA heat No	C	Mn	Si	P	S	Cr	Ni	Mo	V
5	56902	.42	.83	.18	.015	006	.90		.18	
6	15878	.39	.88	.27	.015	011	.97		.16	
7	967379	.42	.85	.31	.015	016	.96		.16	

MATERIAL HAS BEEN QUENCHED AND TEMPERED

NOTE remarks: DIMENSIONAL AND VISUAL CONTROL ON 5% OF THE PIECES:SATISFACTORY.

ALL STUDBOLTS HAVE BEEN STAMPED:B7-G-PLUS LOT NUMBER.

ENTE COLLAUDATORE surveyor

IL COLLAUDATORE: O.M.E. S.p.A. METALLURGICA ERBESE ERBA (Como)

I CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF SPECIFICATION SA-193-B7 EDITION 1977 AND ADDENDA THROUGH

VELAN ENGINEERING LTD.

PER MANAGER OF INSPECTION

Mod. CH

W800004

SHEET 3/3

PROVE MECCANICHE mechanical test / ANALISI MATERIALE material analysis	COLLAUDO inspection	DATA date	CERTIFICATO certificate
	Internal	1.2.79	No. 169/79

CLIENTE purchaser: VELAN VALVE

ORDINE No order: W 1269 pos. from 12 to 26

VALORI RICHIESTI E OTTENUTI NELLE PROVE ESEGUITE SECONDO NORME / required and obtained values in tests executed according with standards: ASME BPV CODE SECTION II part A, AND SECT. III 1974 EDITION SUMMER 1975 ADD.

LOTTO lot	MATERIALE material	DESCRIZIONE description	Values
			HARDNESS
8	SA 194 2H	1 1/8" nuts	Obtained values: from 28 to 32 HRC Hardness after 24 h a T.540°C Hrb=from94to98
9	" "	1 3/8" "	" " from 27 to 31 HRC " " " Hrb=from95to98

This is to certify that the contents of this report are correct and accurate and that all operations performed are in compliance with the requirements of the material specification and the purchase order.

LOTTO lot	COLATA heat No	C	Mn	Si	P	S	Cr	Ni	Mo	V
8	239149	.43			.015	.017				
9	2341	.45			.015	.028				

MATERIAL HAS BEEN QUENCHED AND TEMPERED.

ALL NUTS HAVE BEEN STAMPED 2 H — D PLUS LOT NUMBER.

APR 18 1979

NOTE: PROOF LOAD TEST ON NUTS (lot 8-9): SATISFACTORY

DIMENSIONAL AND VISUAL CONTROL ON 5% OF THE PIECES: SATISFACTORY

ENTI COLLAUDATORI surveyors

IL COLLAUDATORE surveyor: O.M.E. S.p.A. METALLURGICA ERBA

W.E.C. FEB 2 6 1979 INSPECTOR

I CERTIFY THAT THE CONTENTS OF THIS REPORT ARE IN COMPLIANCE WITH THE REQUIREMENTS OF SPECIFICATION SA-194-2H EDITION 1974 AND ADDENDA THROUGH Winter 1975 EXCEPT AS NOTED

VELAN ENGINEERING LTD.

PER MANAGER OF INSPECTION

VELAN ENGINEERING COMPANIES

Form #VE37-11-71 Rev. 2

Page 1 of 1
No. of Supp. N/A
Report No.: NR-1158

DEVIATION REPORT

E800004

Material Review Report [ ] Vendor Waiver Request [X]

NUCLEAR CLASS	SUPPLIER & P.O. NO.
3	Velan Valve Corp. P3-7026-N

QUANTITY	PART NO.	DESCRIPTION	MATERIAL
6	B18-00548-02WN	12"-150# Bolted Bonnet Gate Valve M/O	C/S SA-105

ACC	REJ.	INSPECTOR	SHOP ORDER	SERIAL NO.	DETAIL DWG. NO.	DATE RECEIVED IN INSPECTION
0	6	K. Osborn	18 BGAN 1268 18 BGAN 1342 18 BGAN 1343	169,170,171 173,176,180	8929-101/106 8949-134/135	2-21-80

CUSTOMER NAME	P.O. NO.	ITEM NO.	CUSTOMER APP. DWG. NO.	HEAT NO.
Niagara Mohawk	NMP2-304R	37,38,39	P3-7026-N6 (F)	N/A

SPECIFICATION REQUIREMENTS QCI 482 Rev. 4
Project Drawing P3-7026-N6 Rev. F

1) Item 14 calls for 12 Bonnet Stud to be 1"-8un x 61/2" Long

2) Item 22 Calls for 4 1"-8unc x 3" Long Hex Hd Cap Screws

ACTUAL DIMENSIONS OF CONDITIONS

1) Bonnet Studs and Nuts used are 11/8" Dia. 12 only.

2) Yoke Cap Screws 6-7/8"x2 3/4 Long
NOTE: 2- valves not assembled yet
Body S/N 169, 170, 171, 173, 176, 180

NOTE: Body-Dwg. 8949-134/135 Rev. 0
Assembly Dwg. 8890-047 150-600#

PERCENTAGE COMPLETE	INSPECTOR, DATE	CHIEF INSPECTOR, DATE
6 valves 100%.	[signature] 2-26-80	[signature] 2-26-80

JUSTIFICATION FOR ACCEPTANCE

Design calls for Ø 1 1/8" Qty. of 12 Bonnet studs & Ø 7/8 Qty. of 6 Yoke Cap screws, project drawing will reflect this in next revision.

CORRECTIVE ACTION

Error in Project Engineering Drawing. Engineering advised to reconcile project drawing with design drawings.

TELECOPIED
TO L. [illegible]
FROM [illegible]
NO. [illegible] DATE 2-26-80

S.W.E.C. PQA FEB 29 1980 INSPECTED-218

DISPOSITION

Accept as is.

Will not affect form, fit, function or interchangeability, due to using standard design.

ENGINEERING	DATE	QUALITY ASSURANCE	DATE	CUSTOMER	DATE
[signature]	26Feb80	[signature]	2-26-80	[signature]	2/28/80

DISTRIBUTION: President, Plant Manager, Engineering Managers, Inspection Managers, Q.A

velan
engineering
companies

Velan Valve Corporation

Plants:
Williston, Vermont
Montreal, Quebec
Granby, Quebec
Leicester, England
Paris, France

Ave. "C", Griswold Industrial Park
Williston, Vermont 05495
Telephone: (802) 863-2561
Telex: 954613

W800004

WELD RECORD

VELAN ENGINEERING COMPANIES hereby certify the following excerpts from its Weld Record Book:

Stone & Webster Job No: 12177

Customer: Niagara Mohawk

Velan Order No: P3-7026-N

Item No: 38

Valve Serial No: 004

Stone & Webster P.O. No: NMP2-P304R

Stone & Webster Spec. No: NMP2-P304R Rev.1 Add.4

S.W.E.C. PQA INSPECTED 213 FEB 29 1980

WORK DONE	WELD PROCEDURE	WFM HEAT CODE	WELDER'S NAME	SYMBOL
1. Seat Welds to Body	Vel.P.631 (5)	A09004	S. BUSIER	WA41
2. Leak off pipe to body	N/A	—	—	—
3. Tack-Weld Disc & Union	N/A	—	—	—
4. Drain pipe to body	Vel.P.631 (5)	A09004	P. BErgeron	WA 2
5. Leak off pipe to bonnet	N/A	—	—	—
6. Wedge guide to body	Vel.P.631 (5)	A09004	P. BERGERON	WA 2

[signature]
Q. C. MANAGER

velan
engineering
companies

Plants:
Williston, Vermont
Montreal, Quebec
Granby, Quebec
Leicester, England
Paris, France

W800004

Velan Valve Corporation

Ave. "C", Griswold Industrial Park
Williston, Vermont 05495
Telephone: (802) 863-2561
Telex: 954613

WELD REPAIR RECORD

VELAN ENGINEERING COMPANIES hereby certify the following excerpts from its Weld Record Book:

Stone & Webster Job No: 12177

Customer: Niagara Mohawk

Velan Order No: P3-7026-N

Item No: 38

Valve Serial No: 004

Stone & Webster P.O. No: NMP2-P304 R

Stone & Webster Spec. No: NMP2-P304 R Rev.1 Add.4

S.W.E.C. PQA FEB 29 1980 INSPECTED-213

REJECT. REPORT NO:	PART	WELD PROCEDURE	WFM HEAT CODE	WELDER'S NAME	SYMBOL	NDE INSP/DATE
NR-821	WEDGE	VEL-P-591(6)	73702	P. BERGERON	WA2	69 Dec. 28 1979
NR-053	BODY	VEL-P-591(6)	73702	J. McKinny	WA42	52 OCT 13, 1978

Q.C. Manager

VELAN ENGINEERING COMPANIES

FORM #0029 Rev. 4

W800004

REJECTION REPORT EXHIBIT 35

PAGE 1 OF 2

REPORT NO. NR-053

DATE 10/10/78

LOT QUANTITY	PART NO.	DESCRIPTION	MATERIAL
1	8929-106-002	Body 12"-150#	C/S SA-105

ACC.	REJ.	INSPECTOR	SHOP ORDER	SERIAL NO.	DETAIL DWG.#	DATE REC'D IN INSPECTION
0	1	W. Dowding	18BGAN 112F	176	8929-101-10 0	10/10/78

CUSTOMER NAME	P.O. NO.	ITEM NO.	CUSTOMER APP. DWG.#	HEAT NO.
Niagara Mohawk	P3-7026-N	37-38-39	N/A	L2030

SPECIFICATION REQUIREMENTS (LIST BY ITEM)	CAUSE OF REJECTION (LIST BY ITEM)
I/P Insp. Opr 060 1) The 14 5/8 ±1/64 ∅	1) is 14 1/4 ∅ .120 UNDERSIZE ON RADIUS.

INSPECTOR	DATE	CHIEF INSPECTOR	DATE
W.R. Dowding	10/10/78	D.A. Watson	10-10-78

CORRECTIVE ACTION	DISPOSITION (LIST BY ITEM)
HUMAN ERROR: OPERATOR HAS BEEN ADVISED TO RESPECT DRAWING.	MINOR REPAIR. 1) Weld repair using VEL-P-591. REV. 6. 2) Remachine to dwg. 3) P.T. examine to VEL-NDT-564A REV. 6

S.W.E.C. PQA INSPECTED-213 FEB 29 1980

DEPT. RESPONSIBLE	DATE	CAUSE CODE	ACCEPT AS IS	REPAIR	REWORK	SCRAP	REQUEST WAIVER
	OCT 10 78	1		1			

DISTRIBUTION: A.N.I. (CODE RELATED)
PLANT MANAGER
INSPECTION MANAGER
QA & AUDITOR
PRODUCT SUPERVISOR
PRODUCT PLANNER
FILE

QUALITY ASSURANCE D.A. Watson DATE 10-10-78

DESIGN ENGR. D.E. Patnaude DATE 10/10/78

CUSTOMER REPRESENTATIVE/ANI IF APPLICABLE DATE 10/11/78

W800004

NUCLEAR SECTION III	CLASS 3	SHOP ORDER	PART NO.	DRAWING NO.	REV.
		18BGAN 1163	8959-090-002	8959-090	0

VALVE DESCRIPTION (Wedge): 12" 150# Gate Valve BB

PART: Wedge

CUSTOMER: Niagara Mohawk

P.O. NO.: P3-7026N.

ITEM NO.: 37-38-39

MATERIAL SPEC.: C/S

HEAT CODE: F5098

ASTM.: SA-105

SHAPE: Forging.

SERIAL NO.: 7322

SIZE:

SUPPLIER & P.O. N: Montreal Stock

QUANTITY	ACC	REJ.	INSPECTOR
1	0	1	Al Maynard

Page 1 of 1 Report No. 821

SPECIFICATION REQUIREMENTS (LIST BY ITEMS)	CAUSE OF REJECTION (LIST BY ITEMS)
1) 1.218 slot Width Pre-machining TYP (WEDGE GUIDES)	1) 1.450/1.470
2) $1\frac{1}{16}{}^{+1/32}_{-0}$ STEM SLOT (T-HEAD)	2) 1.240
3) .29/32 @ 1 3/32 DEPTH OF SLOT (T-HEAD)	3) 2.045

INSPECTOR	DATE	CHIEF INSPECTOR	DATE
Al Maynard	11-6-79	[signature]	11-6-79

CORRECTIVE ACTION

Subcontractor error. Wrong drawing revision used. Subcontractor to be advised.

DISPOSITION (LIST BY ITEMS)

1 & 2 WELD REPAIR & REMK TO DRAWING.
3) ACCEPTED AS IS WILL NOT AFFECT FORM FIT FUNCTION OR INTERCHANGE ABILITY.

S.W.E.C. PQA INSPECTOR 213 FEB 29 1980

DEPT RESPONSIBLE	DATE	CAUSE CODE	ACCEPT AS IS	REPAIR	REWORK	SCRAP	REQUEST WAIVER
[signature]	13 Nov 79			1			

DISTRIBUTION: 11/21/79
- ~~ANI~~ (Code related)
- ~~Plant~~ Manager
- ~~Inspection~~ Manager
- Q.A. Auditor
- ~~Product~~ Supervisor
- ~~Planner~~
- File

QUALITY ASSURANCE: R. Roe DATE 11/14/79

DESIGN ENGINEER: [signature] DATE 13 Nov 79

CUSTOMER REPRESENTATIVE / ANI IF APPLICABLE: G. Odom DATE 11.21.79

VELAN ENGINEERING CO.

Form #89-9-78
Rev. 0

Rejection Report

W800004

Velan No.: P3-7026-N
Items: 37,38,39,45
Tags: 2SWP-MOV17A,B
2CCP-MOV14A,B
2CCP-MOV18A,B
2SWP-MOV18A,B
2RHS-MOV116
Customer P.O. NMP2-P304R

RELIANCE ELECTRIC COMPANY

NY. 107

Madison Indiana

REPORT OF ROUTINE TESTS

Induction Motor

Purchaser

Limitorque Corporation
5114 Woodall Road
Lynchburg, Va. 24502

Date of Test 1-19-79

Manufacturer's Order No. 2043047-1A

Purchaser's Order No. 3C8974 D,E,F,1

Style No. 713116

Special Markings ABOVE

NAMEPLATE DATA

Hp	Service Factor	Rpm	Phase	Hertz	Volts	Amperes
1.6	1.00	1700	3	60	575	3.2

Type	Frame	Temp Rise By Method Indicated	Ambient Temp and Insulation Class	Time Rating	Design Letter	Code Letter for Locked Kva./HP
P	RZ	60°C	CLASS RH	15min	—	—

TEST CHARACTERISTICS

SERIAL NUMBER	NO LOAD VOLTS	HERTZ	RPM	AMPERES			LOCKED ROTOR (SINGLE PHASE) (~~THREE PHASE~~) VOLTS	HERTZ	AMPERES			WOUND ROTOR OPEN CIRCUIT VOLTAGE	HIGH POTENTIAL TEST VOLTAGE
1.	575	60	1791	2.2			575	60	17.0				2500
2.	575	60	1790	2.6			575	60	16.0				2500
3.	575	60	1798	2.3			575	60	17.0				2500
4.	575	60	1799	2.7			575	60	17.0				2500
5	575	60	1796	2.4			575	60	17.0				2500
6.	575	60	1785	2.6			575	20	16.0				2500
7.	575	60	1785	2.6			575	60	17.0				2500
8.	575	60	1797	2.7			575	60	17.0				2500
9.	575	60	1794	2.3			575	60	17.0				2500
10.	575	60	1796	2.3			575	60	17.0				2500

S.W.E.C. PQC INSPECTED 109

NOTES: Data on test from THIS motor.
(this or duplicate)

Approved by Warren R. Watson

1-29-79

W800004

Date 12-79

LIMITORQUE TEST DATA

Order No. 3089[illegible]

Unit Size SMB-0-25

Ref. P3-7026-TT38C

Cust. P.O. No. 540591

Parameters	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Notes
T.S. SETTING	1	1½	2	2½	3	3½	4	
THRUST OUTPUT	6400	10900						POUNDS
VOLTAGE	461	460						VOLTS
CURRENT	3.3	4.5						AMPS
CYCLES	60	60						HERTZ
NORMAL SETTING	1 1/2	LOAD 10900	VOLTS 460		AMPS 4.5	HERTZ 60		
MAXIMUM SETTING	1 7/8	LOAD 17400	VOLTS 460		AMPS 7.7	HERTZ 60		
STALL VOLTAGE	100 %	LOAD 28700	VOLTS 572		AMPS 18.6	HERTZ 60		

S.W.E.C. PQC INSPECTED 109

W.A. Moore

W.A. Moore
Test Lab. Manager

TF

Serial No. SM-293419

P3-7026-N
ITEM: 38

VALVE No. 2 CCP-MOV-18 A

Tested by [illegible]

Title Test Lab. Tech.

5.0 CERTIFICATION OF SEISMIC REPORT SR-6393 W800004

We hereby certify that the design of the valve(s) meets the seismic requirements of the Stone & Webster Specification No. NMP2-P304R and the ASME Boiler and Pressure Vessel Code, Section III, Class 2 & 3, 1974 Edition with addenda through Winter 1975.

Report Prepared By: Thanh Nguyen-Dinh

Nov. 27/1978

Report Certified By:

Approved by:
S. ISBITSKY, Chief Stress
Analyst:
Signature:
Date: Nov. 30, 1978

INGÉNIEUR • ENGINEER
A. S. ISBITSKY
PROVINCE DE QUÉBEC

Report Certified By:

Independent Review by:
A.K. VELAN, P.E.
Signature:
Date: 30.11.78

INGÉNIEUR • ENGINEER
A. K. VELAN
PROVINCE DE QUÉBEC

2177

Valen Valve Corporation
2125 Ward Avenue
Montreal, Quebec H4M 1T6

Attention Mr. M. DiStefano

DEAR SIRS:

YOUR ATTENTION IS DIRECTED TO THE FOLLOWING:

IMPORTANT

PURCHASE ORDER NUMBER NMP2-
P304E: Carbon Steel Valves, 2½ Inch and Larger
P304H: Forged Carbon Steel Valves, 2 Inch and Smaller
P304J: Forged Stainless Steel Valves, 2 Inch and Smaller
P304L: Stainless Steel Valves, 2½ Inch and Larger
P304R: Motor Operated Carbon Steel Valves
P304S: Motor Operated Stainless Steel Valves
NINE MILE POINT NUCLEAR STATION - UNIT 2
NIAGARA MOHAWK POWER CORPORATION

~~VEL-NDT-[illegible] (Qty) [illegible] Valves~~ ~~[illegible]/77~~
VEL-NDT-543A Magnetic Particle Examination for ASME B&PV Code, Section III, Nuclear Power Plant Components. Rev. 9 3/2/77

Very truly yours,

C.C.Z.

C. C. Zappile
Lead Power Engineer

NOTED SEP

NOTED SEP 27

JJD:RPM

Copies to: JLMilka (enc) RAPlant-3 Records Mgmt.
WJStoop-3 JJDore (enc)
ARaynolds CCZohrer (enc)
Document Control Systems/Site

NOTED SEP 27 1977

JUL 14 1977

STONE & WEBSTER ENGINEERING CORPORATION

REVIEW OF SUPPLIER'S TECHNICAL DOCUMENT

A0040.519

Page 1 of 1

SUPPLIER	P.O. NO.	DOCUMENT TITLE	DOC. I.D. NO.	REV.	DATE
VELAN ENG.	SEE BELOW	TESTING OF NUCLEAR VALVES	VEL-NDT-G40(NT)	8	1977

DATE RECEIVED	SPEC. NO./DATE	REV.	ADDEN.	SPEC. TITLE
☐ NEW SUBMITTAL ☒ RESUBMITTAL	SEE BELOW	SEE BELOW		SEE BELOW

GOVERNING CODE(S) & DATE(S)	SPECIAL REQUIREMENTS	DWG REFERENCE(S)
ASME III, CL 1,2&3 P304G,H,J – 1971, W73AH P304L,R,S – 1974, W74A	N/A	S&W / SUPPLIER N/A

SPECIALIST	PROJECT	J.O. NO.	RESPONSIBLE ENG	LOCATION	EXT.	DATE
A. Joyce	NMP2	12177	J.J. Deee		3722	7/1/77

COMMENTS: Due date July 19, 1977

PO/SPEC #	SPEC DATE	REV.	ADD.	SPEC TITLE
NMP2-P304G	9-21-73	0	5	CARBON STEEL VALVES, 2½ INCH & LARGER
NMP2-P304H	10-15-73	0	5	FORGED CARBON STEEL VALVES, 2 INCH AND SMALLER
NMP2-P304J	10-25-73	0	5	FORGED STAINLESS STEEL VALVES, 2 INCH AND SMALLER
NMP2-P304L	4-26-76	0	1	STAINLESS STEEL VALVES, 2½ INCH AND LARGER
NMP2-P304R	9-17-76	1	1	MOTOR OPERATED CARBON STEEL VALVES
NMP2-P304S	9-17-76	1	1	MOTOR OPERATED STAINLESS STEEL VALVES

Subject procedure meets the requirement of specifications and governing Code.

Stone & Webster Engineering Corporation
☐ APPROVED AS DEFINED IN THE SPECIFICATIONS
☐ UNACCEPTABLE
☐ APPROVED AS NOTED
☐ REMAILED
J.O. NO.
SPEC. NO.
DATE
BY

P304H, P304J, P304L
P304R, P304S

— APPROVED —
AS DEFINED IN
SPEC. NO. NMP2-P304G
STONE & WEBSTER
ENGINEERING CORPORATION
SIGNED [signature] DATE SEP 19 1977

RESUBMITTAL REQUIRED
☐ YES ☒ NO

REVIEWER	DEPT./DIV.	DATE	LOCATION	EXTENSION
A. Reynolds	QA/NDT	9-19-77	245/5	0813

VELAN ENGINEERING COMPANIES	PROCESS PROCEDURE

BA7706220004

TESTING

OF

NUCLEAR VALVES

VEL-MDT-640A (HT)

— APPROVED — P304G P304J
AS DEFINED IN P304K
SPEC. NO. NMP2-P304E P304B -P304S
STONE & WEBSTER
ENGINEERING CORPORATION
SIGNED DATE
SEP 19 1977

VELAN ENGINEERING COMPANIES	Q.C. PROCEDURE
TESTING OF NUCLEAR VALVES	VEL-NDT-640A(ES)

DATE/ ISSUE	CHANGES PARA/PAGE	DESCRIPTION	PREPARED/ APPROVED
March 28/72	Original Issue	Rev. 0	C. MacLean/ A.K. Velan
Feb. 28/73	See Marginal Note	Rev. 1	C. MacLean/ A.K. Velan
Apr. 17/74	See Marginal Notarion	Rev. 2	E.I.Francois/ A.K. Velan
May 21/74	See marginal notes	Rev.3	E.I.Francois/ J.A. Simpson/ A.K.Velan
July 29/74	See Marginal Notes	Rev. 4	E.I.Francois/ J.A. Simpson/ A.K.Velan
July 22/75	Rewritten to meet ASME Section III	Rev. 5	Checked: Approved: Ind. Rev.
Jan.21'76	See marginal Notes	Rev. 6	Checked: Approved: Ind. Rev.:
Oct. 6'76	See Marginal Notes	Rev. 7	By: By:
March 3'77	See Marginal Notes	Rev. 8	By: By:

1. SCOPE

This procedure establishes all requirements for hydrostatic testing of Velan Nuclear Valves manufactured to conform to ASME Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components with respect to Class 1, Class 2 and Class 3 Valves.

2. REFERENCED DOCUMENTS

2.1 ASME Boiler and Pressure Vessel Code, Sec. III, and current Addenda

2.2 ANSI Standard B16.5

2.3 MSS Standard Practice MSS-SP-61. Hydrostatic Testing of Steel Valves (1).

2.4 Calibration of Measuring and Test Equipment, VEL-QC-503.

3. TESTING REQUIREMENTS

3.1 Test fluid for hydrostatic testing shall be demineralized "Grade A" water. Water temperature shall not exceed 100°F.

3.2 When hydrostatic tests are being conducted with water, the valve shall be relieved of all air.

3.3 The valve shall not be painted before shell pressure tests are completed.

3.4 If hydrostatic tests in the presence of the purchaser's representative are required by their specification, the test shall be conducted prior to painting the valves.

3.5 If hydrostatic tests in the presence of the purchaser's representative are requested after the valves have been tested and painted the valves may be retested without the removal of paint.

3.6. Pressure gauges shall have a range of not less than 1 1/2 times or more than 4 times the intented maximum test pressure.

3.7. Test pressures shall be observed on Pressure gauges calibrated and controlled in accordance with VEL-QC-503.

3.8 Hydrostatic test gauges shall be checked against a master test gauge, installed and protected by a shut-off valve at the test stand, prior to each series of tests.
Note: Check at each change of valve type, size or pressure class or daily, whichever occurs first.

4. <u>TEST METHODS</u>

4.1 <u>Shell, Backseat and Packing Chamber Test</u>

The hydrostatic test pressures shall be appliedowith both ends of the valves closed.

4.1.1. <u>Gate & Globe Valves (Classes 1, 2 & 3)</u>

The valve shall be given a hydrostatic shell test in the fully open position (back seat in contact) with the packing removed for valves shipped without packing rings and loosened gland bolts for packed valves.

The back seat shall then be removed from contact and the packing compressed (install packing in valves tested without) by tightening the gland so that the stuffing box will be subjected to the hydrostatic shell test pressure.

4.1.2. <u>Check Valves (Class 1, 2 & 3)</u>

The valve shall be given a hydrostatic shell test with the pressure applied under the disc. (to open the seat)

4.1.3. <u>Test Pressures and Duration</u>(Gate, Globe & Check Valves Classes 1,2 & 3)

The test pressure for Class 1 valves shall be as shown in table 1.
The test pressure for Class 2 &3 valves shall be as shown in table ii.
The duration of the test shall be 15 minutes for each inch of design minimum wall thickness but not less than 10 minutes for Class 1, 2 & 3. (See Table III). The duration of the packing chamber test shall be 5 minutes maximum.

4.1.4. Examination for Leakage

Following the application of the hydrostatic test pressure, the valve shall be examined with the hydrostatic pressure still being applied. Any leakage or permanent deformation shall be cause for rejection.

4.2 SEAT LEAKAGE TESTS

4.2.1. Gate Valves (Classes 1, 2 & 3)

The valves shall be given a hydrostatic seat test applied successively on each side of the closed seat with the opposite side connected to a leakage collection system.

The collection system is filled with water to a zero level to permit leakage to be measured.

4.2.2. Globe Valves (Classes 1, 2 & 3)

The valves shall be given a hydrostatic seat test in accordance with parag. 4.2.1 except that the pressure shall be applied below the seat with the opposite side connected to the collection system.

4.2.3. Check Valves (Classes 1, 2 & 3)

The valves shall be given a hydrostatic seat test in accordance with parag. 4.2.1 except that the pressure shall be applied on the down stream side (to close seat) of the disc with the opposite side connected to the collection system.

4.2.4. Test Pressures and Duration (Gate, Globe & Check, Class 1, 2 & 3)

Test pressures for all valves shall be in accordance with Table IV.

The duration of the test shall be 1 minute for each inch of design minimum wall thickness but not less than 1 minute for Class 1, 2 and 3 (see Table V).

4.2.5. Examination for Leakage

In the absence of custom's specifications, the leakage rate should not exceed 2cc per hour per inch of diameter of nominal valve size.

4.3 Disc Hydrostatic Test

4.3.1. Test Pressure and Duration

The valves shall be given a disc hydrostatic test with the valve disc in the fully closed position. The test pressure shall be applied across the valve disc and be in accordance with Table IV. The duration of the test shall be one minute per inch of minimum wall thickness, with a minimum duration of one minute (Table V).

4.3.2. Leakage

During this test, seat leakage is permitted unless the Contract Instruction states otherwise.

4.3.3. This test may be done concurrently with the seat leakage test.

5.0 AUTHORIZED INSPECTION

The witnessing of hydrostatic tests on all valves over 4" NPS by the Authorized Inspector is required. Valves 4" NPS and under may be witnessed by the Authorized Inspector at his option but it is not mandatory.

6.0 ACCEPTANCE MARKING

Valves passing hydrostatic tests shall be marked "HT" meaning testing has been successfully completed.

7.0 TEST REPORTS

Results of Hydrostatic testing shall be recorded in logbooks by the testing personnel to permit the preparation of the appropriate certification.

VALVE MATERIAL SPECIFICATIONS

Material Property Classification	Applicable Specification Forging	Applicable Specification Casting
Carbon Steel	SA-105	SA-216 Grade WCB
	SA-181 Grade II	SA-216 Grade WCC
Carbon Steel (low temp.)	SA-350 Grade LF1	SA-352 Grade LCB
Carbon Moly	SA-182 Grade F1	SA-217 Grade WC1
Carbon Moly (low temp.)		SA-352 Grade LC1
½ Cr – ½ Mo		
1 Cr – ½ Mo	SA-182 Grade F12	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NOTE: * — Welding end valves over 4" NPS (6" and larger)

** — Flange end valves and welding end valves 4" NPS and under (NB-3513)

TABLE II

SHELL TEST PRESSURE

CLASS 2 & 3 VALVES (ALL SIZES)

ALL PRESSURES ARE IN PSIG. (7)

CLASS. TEMP/PRESS. RATING	MATERIAL						
	FERRITIC STEEL				AUSTENITIC STEEL		
	1Cr-1/2Mo 1-1/4 Cr-1/2Mo 2-1/4 Cr-1 Mo	C/S	C/S LOW TEMP	CARBON MOLY.	321, 347 316, 310	304	304L 316L
150	425	425	425	425	425	425	425
300	1100	1100	1100	1100	1100	925	775
400	1450	1450	1450	1450	1450	1250	1050
600	2175	2175	2175	2175	2175	1875	1550
900	3250	3250	3250	3250	3250	2775	2325
1500	5400	5400	5400	5400	5400	4650	3875
2500	9000	9000	9000	9000	9000	7725	6450

1. The figures are derived from B16.5 , Hydrostatic Test Pressures (7)
(Ref. ASME Section III NC6111.1(b) & ND6111.1(b) (6)

DATE:

BY:

REV:

PAGE NO:

TABLE III

TIME FOR SHELL TEST IN MINUTES

FOR ASME CLASS 1, 2 & 3 VALVES

NOMINAL SIZE	PRESSURE CLASS 150	300	600	900	1500	2500
2 1/2	10	10	10	10	10	15
3	10	10	10	10	10	20
4	10	10	10	10	15	25
6	10	10	10	15	20	35
8	10	10	10	15	25	45
10	10	10	15	20	30	55
12	10	10	15	20	35	65
14	10	10	15	25	35	75
16	10	10	20	30	50	85
18	10	15	20	30	55	95
20	10	15	25	35	60	105
24	10	15	30	40	70	130

NOTE: Pressure shall be applied for such additional time as necessary to permit a thorough examination for leakage.

TESTING OF NUCLEAR VALVES

TABLE IV
SEAT LEAKAGE AND DISC HYDROSTATIC LEAK TESTS (6)
FOR ASME CLASS 1, 2 & 3 VALVES

ALL PRESSURES ARE IN P.S.I.G.

CLASS TEMP/PRESS RATING	MATERIAL				
	FERRITIC STEEL			AUSTENITIC STEEL	
	C/S, 1Cr-1/2Mo 1 1/4 Cr-1/2Mo 2 1/4 Cr- 1Mo	C/S LOW TEMP.	CARBON MO.	321, 304 347, 316 310, 316L	304L
150	300	300	300	300	300
300	750	750	750	750	670
400	1000	1000	1000	1000	890
600	1500	1500	1500	1500	1335
900	2250	2200	2200	2250	2005
1500	3750	3600	3600	3750	3345
2500	6250	6000	6000	6250	5570

NOTE: The figures are derived from ASME Section III (Tables NB3531-1 to 7 (6)
Reference: NB3531.2, NC 3514) and MSS-SP-61 (Table II and IV).
The higher corresponding valve of the two Tables (ASME & MSS) has been reproduced above.

DATE: March 3'77 | BY: C.L. Francois | PAGE No: 11 of 12

TESTING OF NUCLEAR VALVES

TABLE V

TIME FOR SEAT AND DISC TESTS IN MINUTES

FOR ASME CLASS 1, 2 & 3 VALVES

NOMINAL SIZE	PRESSURE CLASS					
	150	300	600	900	1500	2500
2 1/2	1	1	1	1	1	1
3	1	1	1	1	1	1 1/2
4	1	1	1	1	1	1 1/2
6	1	1	1	1	1 1/2	2 1/2
8	1	1	1	1	2 1/2	3
10	1	1	1	1 1/2	2	4
12	1	1	1	1 1/2	2 1/2	4 1/2
14	1	1	1 1/2	2 1/2	3 1/2	5
16	1	1	1 1/2	2	3 1/2	6
18	1	1	1 1/2	2	3 1/2	6 1/2
20	1	1	1 1/2	2 1/2	4	7
24	1	1	2	3	5	8 1/2

NOTE: Pressure shall be applied for such additional time as necessary to permit a thorough examination for leakage.

VELAN ENGINEERING COMPANIES

PROCESS PROCEDURE

TESTING OF NUCLEAR VALVES

VEL-NDT-640A(NT)

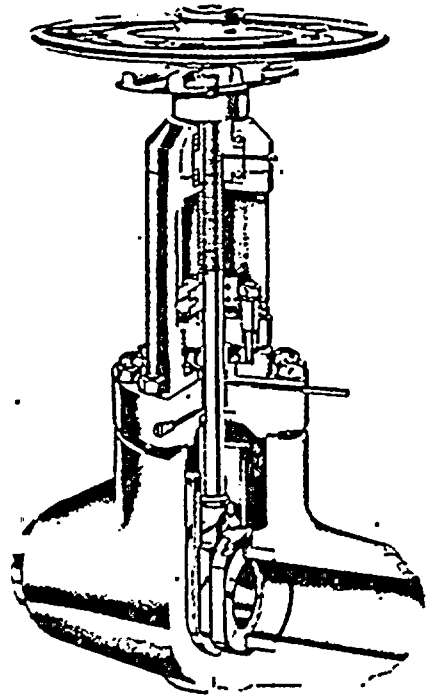
DATE:

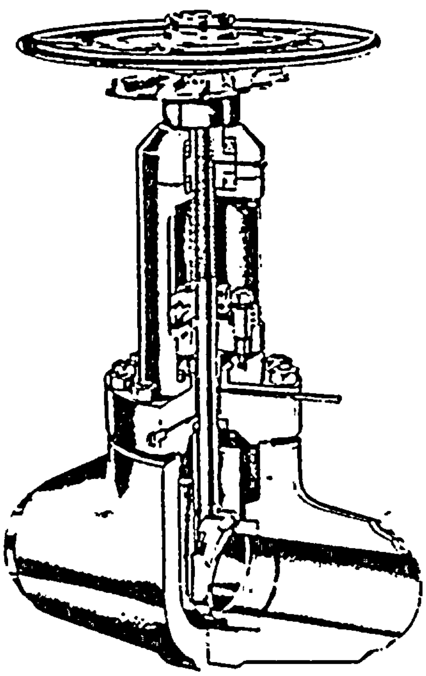
BY:

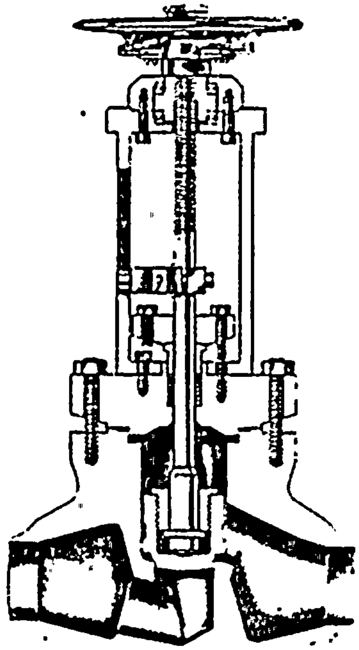
REV.:

PAGE NO.:

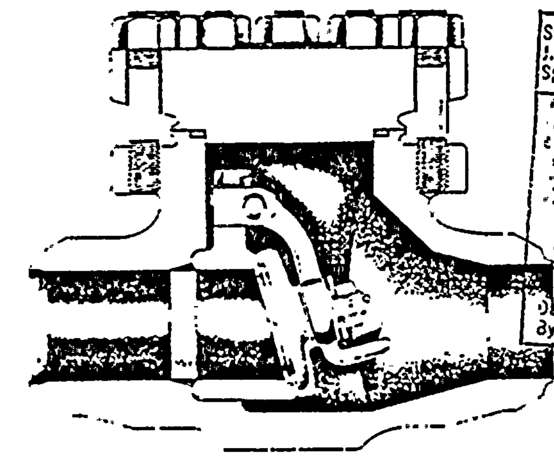
VELAN







Maintenance Manual VEL-FBBM
For 2½" – 24" FORGED
Bolted Bonnet Gate and Globe Valves
And
Bolted Cover Check Valves



Stone & Webster Engineering
J.O. No. 12177
Spec. No. 73042

RELEASED FOR:		DIRECTIONS TO SITE:	
RETURN TO SUPPLIER	X	FOR CONSTRUCTION	X
ENGN DESIGN	☐	NOT FOR CONSTRUCTION	☐
FABRICATION	☐		

- X APP Approved, Acceptable For Use
- ☐ AAR Approved As Revised
- ☐ UNA Unacceptable
- ☐ BLT As - Built
- ☐ FIO For Information Only

Date 12/11/84
By [illegible signature]

TABLE OF CONTENTS

TWX1840919

STNE WBST LYCO

VELAN P2 MTL

SEPT. 19/84
MSG 5904

ATTN.: MR. ~~CHRISTOPHER~~ GAS (SEG)

SUBJECT: NIAGARA MOHAWK
BOLTING TORQUE
VELAN MAINTENANCE MANUAL VEL-FPSM + VEL-FBBM

THIS CONFIRMS OUR TELECON OF LAST WEEK WHEN WE ADVISED YOU THE TORQUE VALUE OF 20 FT. LBS. FOR BOLTING OF THREAD SIZE 5/16 - 18UNK IN B7/A574/630

PLS BUST ::WILL RESTART

RECEIVED VIA TWX
DATE 9-19-84
TIME 7:30
NINE MILE POINT UNIT 2

For Specs.

P302E P304E
P302L P304L
P302R P304R
P304S

STNE WBST LYCO

VELAN P2 MTL

NOTED SEP 20 1984 C. GASS

SEPT. 19/84
MSG 5904

RECEIVED
J. O. NO. 12187
SEP 19 1984
STONE & WEBSTER ENG. CORP.
CONTROL LEVEL 3

Adels
x 4514

LIST OF ILLUSTRATIONS

LIST OF TABLES/DIAGRAMS

INTRODUCTION

This manual has been prepared by Velan Engineers, Designers and Maintenance Personnel to assist you in obtaining many more years of satisfactory service with your Bolted Bonnet or Bolted Cover Valves. It will also assist you in restoring your valve to the best working condition with a minimum of time and expense.

Velan Valves are designed and manufactured using many years of constant development and improvement.

Before beginning any major work, we recommend that you carefully read this booklet at least once to understand the valve's physical construction.

Please note that if the reason for the service problem is not understood, we suggest that you get in touch with your local Velan representative or call the Head Office for more technical assistance.

On beginning any major work, we recommend that you carefully check the nameplate on the valve and record the figure number to identify the type and size of valve with which you are dealing. See Figure 1 to understand how the "Key to Velan Steel Valve Figure Numbers" works.

VELAN VALVES

Velan Figure Numbers are designed to cover essential features. When ordering please show Figure Numbers to preclude misunderstanding of your requirements. A detailed description for SPECIALS must always accompany order.

Type of Connection	Size of Connection	Pressure Rating	Type	Body Style	Body Material	Trim Material
A	B	C	D	E	F	G
e.g.: F	1 0	- 0	0 6	4 C	- 0 2	T Y

A TYPE OF CONNECTION

A - SPECIAL
B - Butt Weld
C - Combination
F - Flanged
R - Flanged, Ring Joint
S - Screwed
U - Undrilled Flanges
W - Socket Weld

B SIZE OF CONNECTION

01 - 1/4	09 - 2 1/2	18 - 12	28 - 28
02 - 3/8	10 - 3	19 - 14	30 - 30
03 - 1/2	11 - 3 1/2	20 - 16	32 - 32
04 - 3/4	12 - 4	21 - 18	34 - 34
05 - 1	13 - 5	22 - 20	36 - 36
06 - 1 1/4	14 - 6	23 - 22	
07 - 1 1/2	15 - 8	24 - 24	
08 - 2	16 - 10	26 - 26	

C PRESSURE RATING

0 - 150 lb.
1 - 300 lb.
2 - 600 lb. or API 800 (as required)
3 - 1500 lb.
4 - 2500 lb.
5 - 4500 lb.
6 - 400 lb.
7 - 900 lb.

D TYPE

01 Flow Control Valve OS & Y.
02 Ball Check Valve.
03 Piston Check Valve.
04 Strainer.
05 Conventional Port Gate Valves OS & Y.
06 Full Bore Gate Valve OS & Y.
07 Stop Valve OS & Y. (Globe)
08 Stop Check Valve OS & Y.
09 Needle Valve OS & Y.
10 Continuous Blow-Down Valve with venturi OS & Y.
11 Swing Check Valve.
12 'End' Entry Ball Valve.
13 'Top' Entry Ball Valve.
14 Parallel Slide Valve.
15 Instrument Valve.
16 By-pass Valve (Inlet).
17 By-pass Valve (Outlet).
18 Drain Valve.
19 Conventional Port Gate Valve ISRS.
99 SPECIAL

E BODY STYLE

4 Vertical
5 Angle
6 Inclined

A SPECIAL
B Bolted Bonnet (Forged)
C Bolted Bonnet (Cast)
D Diaphragm
P Pressure Seal
S Bellows Seal
W Welded Bonnet
X Bonnetless (Welded Seat/Bottom Plug)
Z Bonnetless (New Style)

F BODY MATERIAL

01	SPECIAL	15	Stainless Steel, F347, CF8C
02	A105, WCB	16	Stainless Steel, F304H
03	Carbon Moly, F1, WC1	17	Stainless Steel, F430
04	Chr. Moly, F5, C5	18	Stainless Steel, F321
05	Chr. Moly, F11, WC6	19	Monel
06	Chr. Moly, F22, WC9	20	Inconel
07	-	21	Hastelloy
08	-	22	Titanium
11	Stainless Steel, F304, CF8	23	Alloy 20
12	Stainless Steel, F304L, CF3	24	LF-1
13	Stainless Steel, F316, CF8M	25	LCB
14	Stainless Steel, F316L, CF3M	26	LF-2

G TRIM MATERIAL

PLANT/PRODUCTS	CODE	WEDGE/DISC	SEAT	STEM
ALL PLANTS	AA	SPECIAL	SPECIAL	SPECIAL
1/4"-2" Forged Steel Valves	TX	13% Cr.	13% Cr.	13% Cr.
	TY	13% Cr.	13% Cr. (H1)	13% Cr.
	TS	13% Cr. (H1)	13% Cr. (H1)	13% Cr.
	TN	13% Cr. (H1)	13% Cr. (H1)	630 or 316B
	MY	SS316	SS316 (H1)	630 or 316B
	MS	SS316 (H1)	SS316 (H1)	630 or 316B
	XY	Monel S	Monel (H1)	Monel or Monel K
2-1/2" - 24" Forged Steel Valves	TS	A105 (H1)	A105 (H1)	13% Cr.
	MS	SS316 (H1)	SS316 (H1)	630
	LS	LF2 (H1)	LF2 (H1)	13% Cr.
	FM	F11 (H1) or SS316 (H1)	F11 or SS316 (H1)	13% Cr.
	FR	F22 (H1) or SS316 (H1)	F22 or SS316 (H1)	13% Cr.
	XY	Monel S	A105 (H1)	Monel or Monel K
1/2"-24" Cast Steel Valves	TY	CA 15 or WCB (H2)	A105 or A106 (H1)	13% Cr.
	TS	WCB (H1)	A105 or A106 (H1)	13% Cr.
	LS	LCB (H1)	A105 or A106 (H1)	13% Cr.
	MX	WCB (H3)	A105 or A106 (H3)	SS316
	MY	WCB (H3)	A105 or A106 (H1)	SS316
	MS	WCB (H1)	A105 or A106 (H1)	SS316
	XY	WCB (H4) or Monel S	A105 or A106 (H1)	Monel or Monel K
	SX	CF8M	CF8M (Integral)	SS316

NOTES:

1. Hardfacing Code: H1 = Stellited, H2 = 13% Cr., H3 = 316, H4 = Monel.
2. Non-standard trims are available on request and should be coded AA (detailed description required).
3. TS, TN, MS trims may have solid stellite Wedge/Disc.
4. All 1/2" - 2" Forged globes and piston checks have integral stellite seats.
5. NACE Service: Special trim available on request. (Code NC)

Fig. 1

TYPES OF VALVES

PARTS DESCRIPTION

1 • BODY
2 • BONNET
3 • STEM
4 • SPIRAL GASKET
5 • BODY • BONNET STUD
6 • BODY • BONNET NUT
7 • LEAK • OFF PIPE
8 • BLOW • OUT PLUG
9 • BLOW • OUT GASKET
10 • JUNK RING
11 • PACKING RING
12 • LANTERN RING
13 • GLAND BUSHING.
14 • PACKING FLANGE
15 • GUIDE SLEEVE
16 • BELLEVILLE WASHER
17 • PACKING FLANGE STUD
18 • PACKING FLANGE NUT
19 • TORQUE ARM
20 • TORQUE ARM. CAP SCREW
21 • TORQUE ARM KEY
22 • TORQUE ARM BEARING
23 • YOKE
24 • YOKE • BONNET CAP SCREW
25 • BEARING
26 • YOKE NUT
27 • HOUSING COVER
28 • GREASE FITTING
29 • HANDWHEEL
30 • HANDWHEEL KEY
31 • HANDWHEEL NUT
32 • HANDWHEEL NUT SET SCREW
33 • YOKE • HOUSING CAP SCREW
34 • SEAT
35 • WEDGE GUIDE
36 • WEDGE

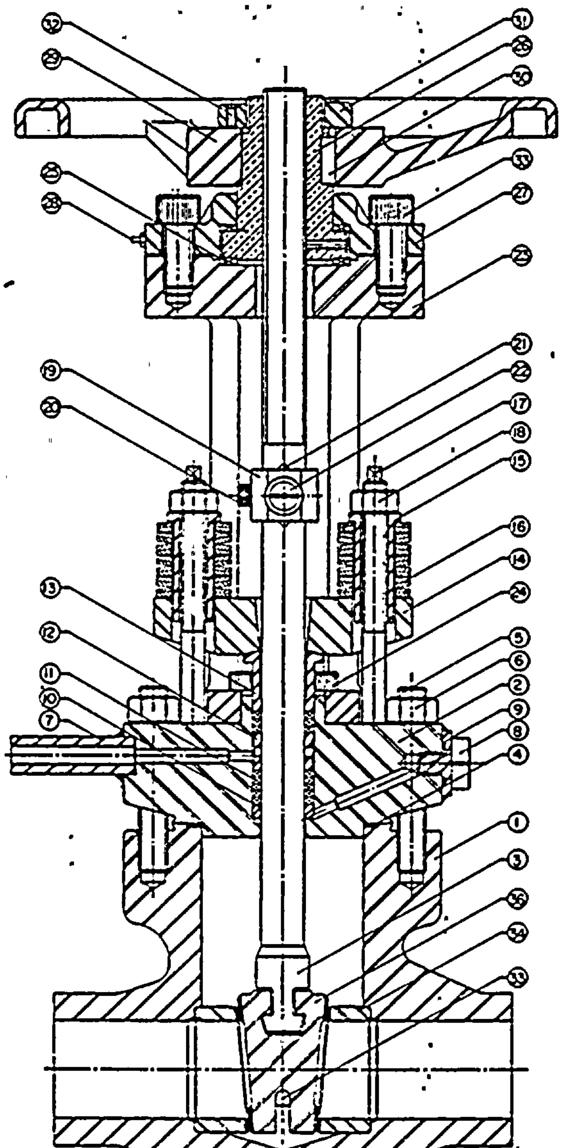


Fig. 2

Gate Valve

Forged Bolted Bonnet Gate Valves 2½" - 24". The hardfaced seats are seal welded.

PARTS DESCRIPTION

1 • BODY
2 • BONNET
3 • STEM
4 • SPIRAL GASKET
5 • BODY • BONNET STUD
6 • BODY • BONNET NUT
11 • PACKING RING
13 • GLAND BUSHING
14 • PACKING FLANGE
17 • PACKING FLANGE STUD
18 • PACKING FLANGE NUT
19 • TORQUE ARM
20 • TORQUE ARM CAP SCREW
21 • TORQUE ARM KEY
22 • TORQUE ARM BEARING
23 • YOKE
24 • YOKE • BONNET CAP SCREW
25 • BEARING
26 • YOKE NUT
27 • HOUSING COVER
28 • GREASE FITTING
29 • HANDWHEEL
30 • HANDWHEEL KEY
31 • HANDWHEEL NUT
32 • HANDWHEEL NUT SET SC
33 • YOKE • HOUSING CAP SCRE
34 • SEAT
39 • DISC
40 • LOCK BRACKET
41 • HEX HD BOLT
42 • HEX HD NUT
43 • SPRING
44 • CENTER PIECE
45 • STROKE LIMITER
46 • STROKE LIMITER CAP SC
47 • STROKE LIMITER STUD

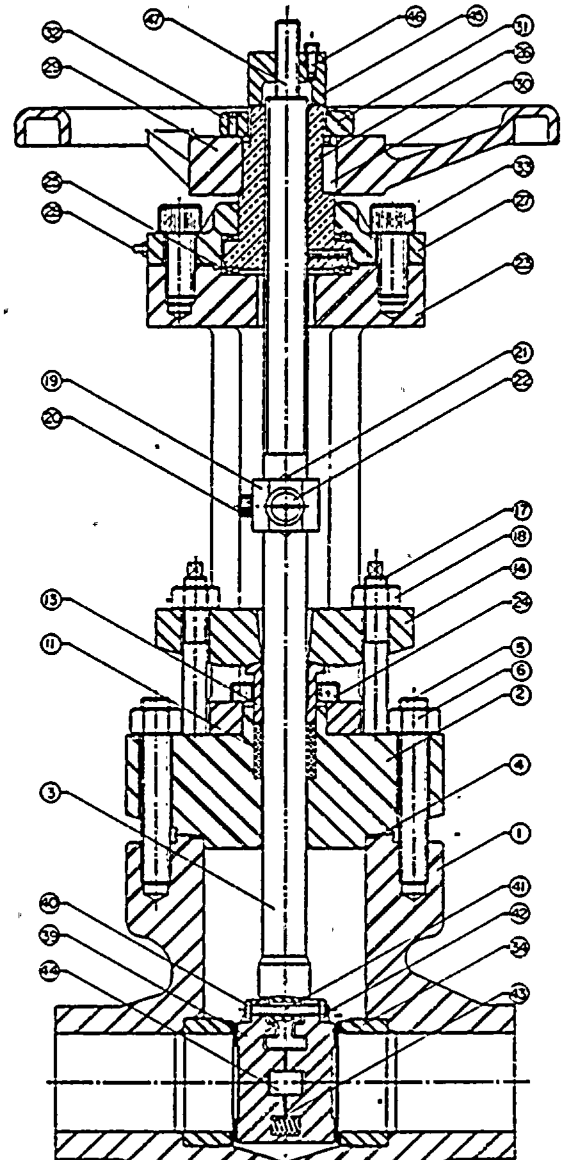


Fig. 3

Parallel Slide Valve

Forged Bolted Bonnet Parallel Slide 2½" - 24". The hardfaced seats are seal welded.

PARTS DESCRIPTION

1 • BODY	15 • GUIDE SLEEVE	27 • HOUSING COVER
2 • BONNET	16 • BELLEVILLE WASHER	28 • GREASE FITTING
3 • STEM	17 • PACKING FLANGE STUD	29 • HAMMER WHEEL
4 • SPIRAL GASKET	18 • PACKING FLANGE NUT	30 • HAMMER WHEEL KEY
5 • BODY • BONNET STUD	19 • TORQUE ARM	31 • HAMMER WHEEL NUT
6 • BODY • BONNET NUT	20 • TORQUE ARM CAP SCREW	32 • HAMMER WHEEL SET SCREW
8 • BLOW • OUT PLUG	21 • TORQUE ARM KEY	33 • YOKE • HOUSING CAP SCREW
9 • BLOW • OUT GASKET	22 • TORQUE ARM BEARING	37 • DISC
10 • JUNK RING	23 • YOKE	48 • STEM COLLAR
11 • PACKING RING	24 • YOKE • BONNET CAP SCREW	49 • DISC UNION
13 • GLAND BUSHING	25 • BEARING	50 • THRUST PAD
14 • PACKING FLANGE	26 • YOKE NUT	

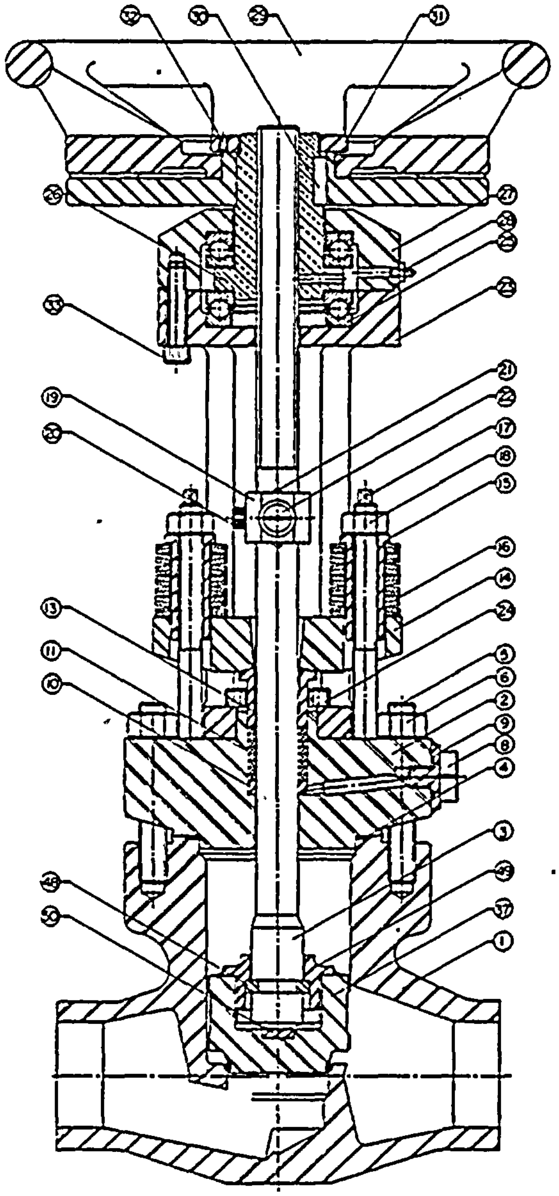


Fig. 4

Globe Valve

Forged Bolted Bonnet Globe Valves 2½" - 12" have an integral hardfaced seat. The forged disc has a hardfaced seat and guide surface. It is guided at the top and bottom.

PARTS DESCRIPTION

1 • BODY	15 • GUIDE SLEEVE	26 • YOKE NUT
2 • BONNET	16 • BELLEVILLE WASHER	27 • HOUSING COVER
3 • STEM	17 • PACKING FLANGE STUD	28 • GREASE FITTING
4 • SPIRAL GASKET	18 • PACKING FLANGE NUT	29 • HANDWHEEL
5 • BODY • BONNET STUD	19 • TORQUE ARM	30 • HANDWHEEL KEY
6 • BODY • BONNET NUT	20 • TORQUE ARM CAP. SCREW	31 • HANDWHEEL NUT
7 • LEAK • OFF PIPE	21 • TORQUE ARM KEY	32 • HANDWHEEL NUT SET SCREW
11 • PACKING RING	22 • TORQUE ARM BEARING	33 • YOKE • HOUSING CAP SCREW
12 • LANTERN RING	23 • YOKE	37 • DISC
13 • GLAND BUSHING	24 • YOKE • BONNET CAP SCREW	38 • SPRING
14 • PACKING FLANGE	25 • BEARING	

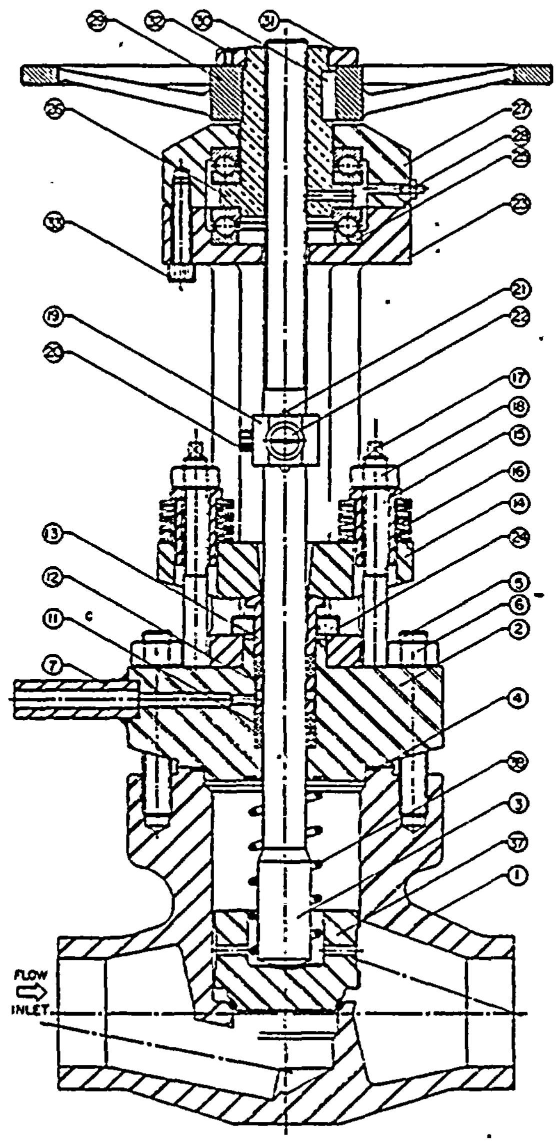


Fig. 5

Stop Check Valve

Forged Bolted Bonnet Stop Check Vavles 2½" - 12" have an integral hardface seat. The forged disc has a hardfaced seat and guide surface. It is guided at the top and bottom.

PARTS DESCRIPTION

1 - BODY
2 - COVER
3 - BODY-COVER STUD
4 - BODY-COVER NUT
5 - SPIRAL GASKET
6 - DISC
7 - HANGER
8 - BUSHING
9 - HANGER PIN
10 - HEX BOLT.
11 - LOCK BRACKET
12 - DISC NUT
13 - COTTER PIN
14 - HANGER BRACKET
15 - ROLL PIN
16 - SEAT

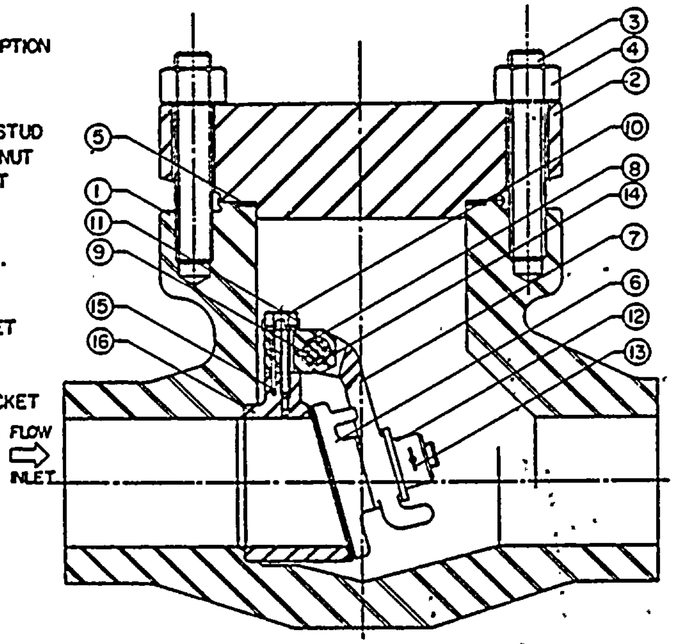


Fig. 6 – Swing Check

Forged Bolted Cover Swing Check Vavle 2½" - 24". The hardfaced seat is seal welded.

PARTS DESCRIPTION

1 - BODY
2 - COVER
3 - BODY-COVER STUD
4 - BODY-COVER NUT
5 - SPIRAL GASKET
6 - DISC
17 - SPRING

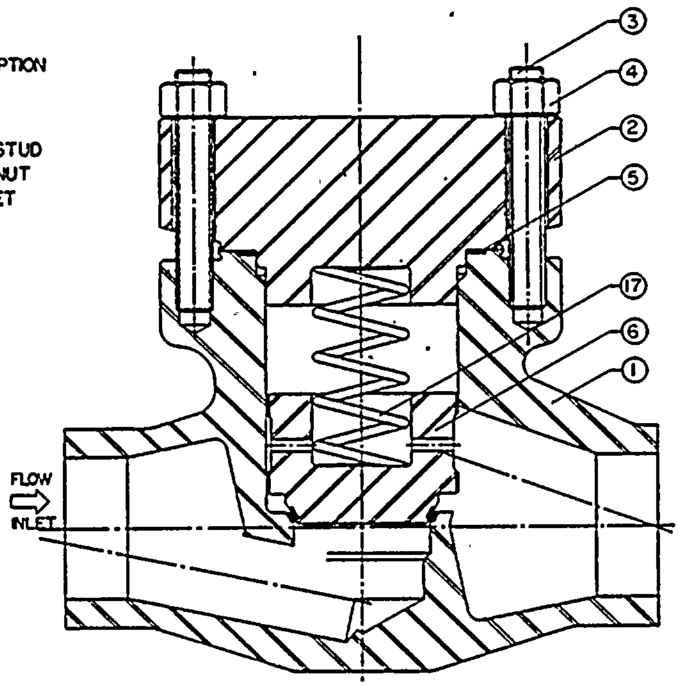


Fig. 7 – Piston Check

Forged Bolted Cover Piston Check Valves 2½" - 12" have a hardfaced integrally deposited seat. The light disc piston ensures maximum lift and low pressure drop.

II RECEIVING AND PREPARATION FOR INSTALLATION

1.0 Receiving Inspection

All valves must be examined for signs of damage that may have occurred during transportation. Any damage which may have been caused to the valve during transportation should be analysed and a damage report should be issued. Any serious damage should be reported to your local Velan representative or a call should be made to the Head Office so that a suitable arrangement for repairs can be made without delay.

1.1 Quality Control Documentation

For valves purchased with Quality Control (Q.C.) certification, check the package of documents to see that Quality Control certificates are complete as per the purchase order.

1.2 Storage

Valves should be stored in a suitably sheltered place to prevent contamination by weather, dirt or dampness. The valve is shipped with end protectors on the inlet and outlet which should stay on the valve until it is ready for installation.

Note: If actuators are involved, please refer to the applicable actuator manufacturer's instruction for storage.

1.3 Handling and Preparation

On large valves, a hoist is needed to assist installation. A sling should be placed under the valve body so that the unit can be lifted vertically to meet its final destination. From all types of valves, end protectors must be removed and connections checked for cleanliness. Any visible foreign matter must be removed from end connections on weld end valves. The weld end preparation must be cleaned properly with a suitable solvent such as acetone of alcohol. Do not use chloride or fluoride bearing solvents.

1.4 Special Instruction for Gate Type Valves

The flow through gate valves can be from either end. There may be exceptions to this when bypass piping is welded to the valve body. Check your piping layout drawing to ensure correct position and direction of flow. Gate valves should be installed and welded into the pipeline with the wedge or disc in the fully closed position. If the valve is left open or partially open, the valves could distort and may leak during operation. Also, leaving the valve in a fully closed position helps prevent weld spatter from falling directly onto the mating faces of the seats.

1.5 Special Instruction for Globe Type Valves

Globe type valves are usually installed with the inlet below the valve seat (Fig. 4). This has to be checked carefully to prevent incorrect installation. If throttling service is particularly severe, it is recommended that consideration be given to installing the valve so that the flow enters over the top of the seat and goes down through it. In this case, the valve is maintained in a more stable condition.

Consequently, the amount of wear is minimized and the external noise which is sometimes heard is reduced. The valve operation becomes easier due to reduced torque required when closing the valve.

Globe type valves should be installed and welded with the disc in a fully closed position to prevent damage to the valve during installation. Also, leaving the disc in a fully closed position helps prevent weld spatter from falling directly onto the mating faces of the seat and disc.

Precaution: Allow time for welding to cool before trying the valve for the first time in the pipeline.

1.6 Special Instruction for Check Type Valves

Check type valves must be installed with the inlet in direction of arrow (Figs. 5, 6 and 7). This has to be checked carefully before installing the valve. The placing of a check valve in the opposite direction to the flow will prevent the disc from swinging free and therefore prevent normal operation of the valve.

III OPERATION

1.0 General

All valves require checking before being put into operation. In addition, regular inspection is recommended during operation. Prompt attention should be paid when trouble arises. As a general rule, valves should be subjected to scheduled maintenance.

1.1 Smoothness of Operation

Lubrication of stem threads, gearing and other working components outside the fluid area should be performed frequently and at least once every six months. Specific lubricants and frequency of application are shown in Table A. Valves that are not operated frequently and which may remain open or closed for long periods of time should be worked even if only partially about once a month.

Important: Excessive handwheel effort can indicate the following.

a) Improperly lubricated or damaged valve stem.
b) Valve packing compression too tight (check torques to Table C).
c) Faulty or damaged valve parts.

TABLE A
RECOMMENDED LUBRICATION

PART	LUBRICATION	APPLICATION	FREQUENCY
Stem threads	Shell: Abrasia No. 3 Molykote Corp: Molykote "G" or equal	Directly to threads.	When threads appear dry.
Yoke nut	Shell: Abrasia No. 3 Molykote Corp: Molykote "G" or equal	Inject through grease fitting at hub of yoke.	Concurrently with stem thread lubrication
Spiral Wound Asbestos Gasket	Neolube (graphite and mineral spirits)	Thin coating on all surfaces.	On valve assembly only.
All threaded parts except stem and yoke nut.	Anti-seize compound No. 425-A made by Crane Co. or equal.	Thin coat on threads.	On valve assembly only.

1.2 Seat Tightness – Closing Torques

Even a new valve with seating faces lapped to perfection and a full seatwedge or disc contact will be pressure tight only when sufficient stem load is applied. The minimum stem load for each size of valve and operating pressure varies, of course, but should be known by the operating personnel in order to seat the valve properly. Slight over-torquing should not damage a properly designed valve.

Caution: Do not use cheaters on handwheel.

Diagram A indicates the approximate minimum torques required to close a valve tightly for any given operating pressures. Take your operating pressure multiplied by the K factor for a given size of valve and add K_2 factor. This will give you an approximate torque to seat a standard Velan Valve.

Torque = (Pressure x K_1) + K_2

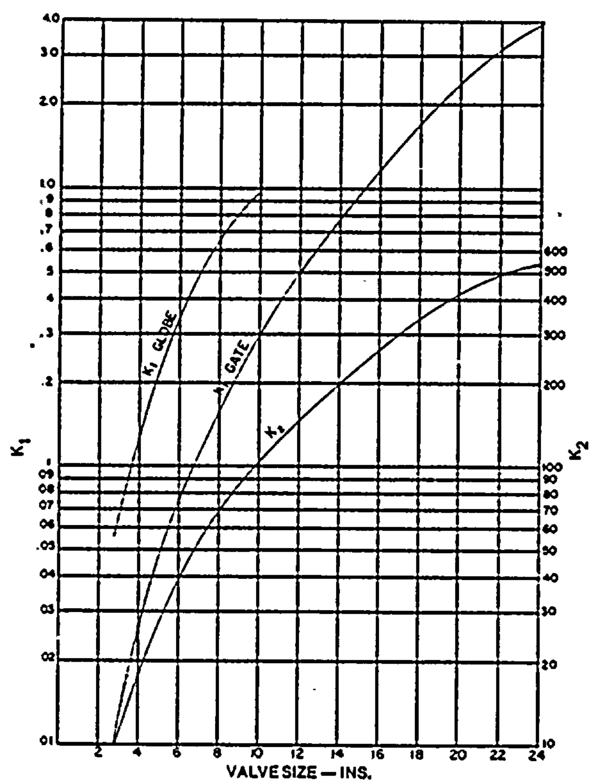


DIAGRAM A

(e.g.) Torque = (1125 x .29) + 100 = 426

Type	=	Gate
Valve Size	=	10"
Pressure	=	1125 lb.
K_1	=	.29
K_2	=	100
Torque	=	426 ft./lb.

IV MAINTENANCE

TROUBLE SHOOTING CHART

TABLE B

AREA	GENERAL PROBLEMS	PROCEDURE FOR REPAIR
Packing Chamber Leakage	•Packing compression •Gland bushing binding	•Packing chamber leakage Section IVa Para. 1.0
	•Packing worn •Stem, packing chamber damaged	•Repacking procedure Section IVa Para. 1.1
Body-Bonnet Joint Leakage	•Spiral gasket damaged •Body or bonnet damaged	•Replacement of gasket Section IVb Para. 1.4
	•Tightness of bolting	•Body-bonnet stud torquing Section IVb Para. 1.1
Seat Leakage	•Lack of seating torque	•Closing torque Section III Para. 1.2
	•Damaged seat faces	•Seat Repair Section IVc Para. 1.0
	•Disc movement restricted	•Disassembly & reassembly swing check valves Section V Para. 1.5 Section VI Para. 1.5
Operation Smoothness	•Lubrication	•Lubrication Section III Para. 1.1
	•Packing compression	•Packing torque Section IVa Para. 1.5
	•Stem thread yoke nut thread	•Disassembly & reassembly Section V Para. 1.4 Section VI Para. 1.1

IV MAINTENANCE

IV(a) Packing Chamber Leakage

1.0 General

If moisture or dripping occurs around the stem or the I.D. packing chamber, the following points must be investigated before removing the packing.

1. Check if the packing flange is torqued down to the correct torque as shown in Table C.

2. Check if the live load arrangement is in correct order. Compare your live loading arrangement with Fig. 8 (a) and (b). If the live loading arrangement is not correct, open the valve to the backseat position and tighten up on the seat firmly.

CAUTION: One must determine the effectiveness of the backseat seal as you dismantle the live loading arrangement. If leakage occurs during disassembly, line pressure must be shut off. Reassemble live loading arrangement in correct order then torque down to the correct torque as shown in Table C.

LIVE LOADING

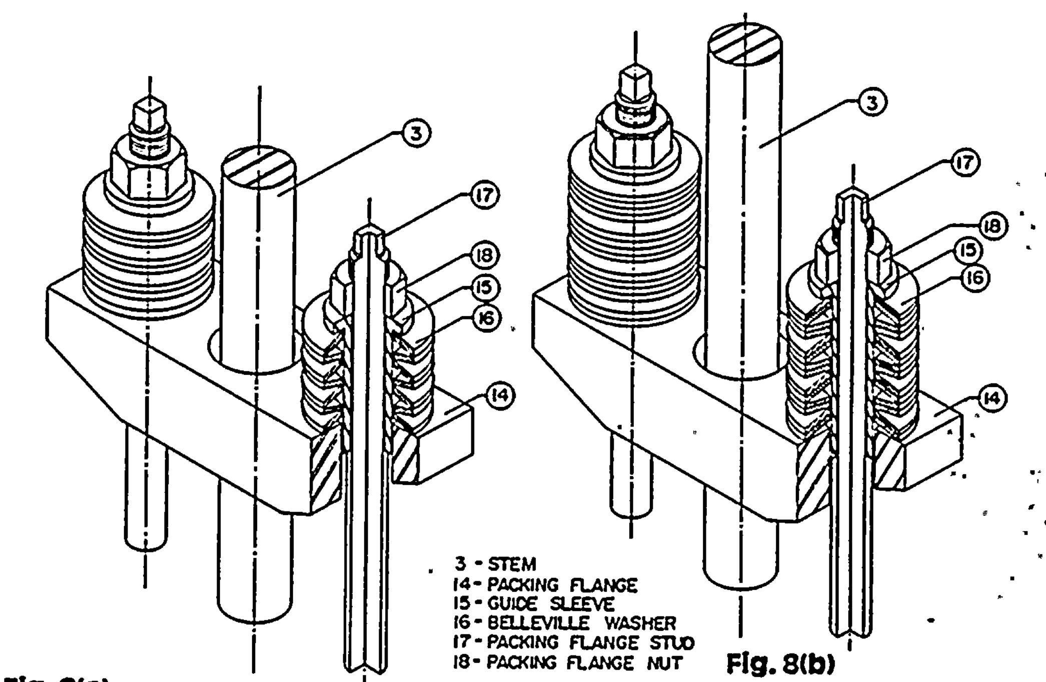


Fig. 8(a)
Single Stacking Arrangement

Fig. 8(b)
Double Stacking Arrangement

3. Check if the gland bushing is binding against the packing chamber wall or stem. If so, open valve to backseat position and firmly tighten up on seat. Loosen the packing flange and realign the gland bushing. Tighten up the packing flange a little at a time on each side, then torque down to the correct torque as shown in Table C.

4. After retightening, cycle the valve 3 to 5 times and retighten nuts to original torque value (Table C), slacken the nuts slightly if torque is too high. If Steps 1 to 4 do not stop leakages, proceed with the removal and replacement of packing rings.

1.1 Removal of Packing Rings

Use of Backseat

Normally, it is practical to repack Velan Valves under line pressure as all backseats are lapped and factory-leak tested. However, valve manufacturers in general do not recommend this practice due to the inability of determining the effectiveness of the backseat seal. The decision of the effectiveness basically lies with the user. To backseat a valve it is necessary to open the valve fully and tighten the stem against the backseat firmly.

1.2 Removal with Special Tools

1. Remove the packing flange nut and live loading assemblies.
2. Lift packing flange and gland bushing up as high as possible and secure.
3. Remove old packing using special flexible removal tools. The removal tools have special hooks which screw into the packing ring. Removal of the packing rings is a difficult and time consuming operation. Care has to be taken not to scratch the stem or the walls of the packing chamber during the removal of the packing rings.
4. If the valve is equipped with a leak-off pipe there is a lantern ring after the third packing ring. To remove the lantern ring, insert two hooks into the holes at the top of the lantern ring or insert screwed in extracting wires where the tapped holes are provided.
5. After the lantern ring is lifted, the last five packing rings can be removed using the same procedure as described in Step 3.

Note: All of our designs can be equipped with a blow-out plug option. If this connection is provided, the packing rings can be removed by apply gas or hydraulic pressure from below as shown schematically in Fig. 9. Proceed as follows.

1.3 Removal with Blow-Out – Alternative

1. Fully open the valve and tighten the stem against the backseat firmly.
2. Loosen packing flange nut and live loading assembles.
3. If valve is equipped with a leak-off pipe, block off connection.
4. Remove blow-out plug and gasket. Attach the pressure source to the connection. The packing rings will be pushed out of the packing chamber.

Note: When applying gas pressure, this operation will happen quite quickly and it is possible that trapped liquids will spray out.

5. All packing rings can be removed simultaneously. This is a fast and efficient operation.

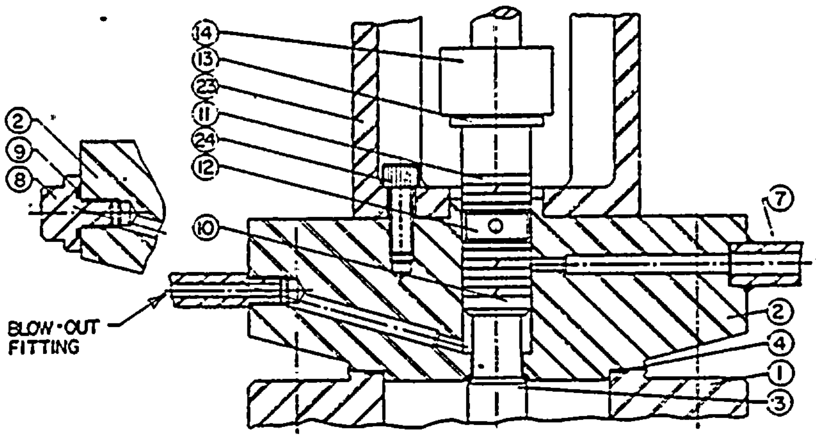


Fig. 9

1 - BODY
2 - BONNET
3 - STEM
4 - SPIRAL GASKET
7 - LEAK-OFF PIPE
8 - BLOW-OUT PLUG
9 - BLOW-OUT GASKET
10 - JUNK RING
11 - PACKING RING
12 - LANTERN RING
13 - GLAND BUSHING
14 - PACKING FLANGE
23 - YOKE
24 - YOKE - BONNET CAP SCREW

1.4 Repacking with Uncompressed Packings

1. Velan generally uses three types of packings: braided asbestos reinforced wire with Inconel (e.g. John Crane 187-I) or pre-formed graphite ribbon (e.g. Grafoil) or Teflon (e.g. Chesterton). The repacking procedure is basically the same for all types of packing.

2. Before repacking, check the stem and the packing chamber wall for damage. Scratches no greater than .010" can be removed by polishing the surfaces with a fine emery cloth or special lapping.

3. To insert the first packing ring, squeeze the ring manually and place as deep into the chamber as possible. Fig. 10(a).

4. Insert the split ring and adaptors. Push the packing ring to the bottom of the chamber ensuring that the lap joint does not become reversed during the operation.

5. Place the gland bushing and packing flange into position and compress the bottom packing by tightening the nuts using the torque shown in Table C Fig. 10(b).

6. Remove the nuts and split packing adaptors, insert the next packing and repeat the procedure as above. **Note:** The split lap joints of each consecutive ring must be staggered at 120° so that the 4th ring installed has its lap back at the starting point (Fig. 10c). Subsequent packing rings are repacked in the same manner until the point is reached whereby the special packing adaptors are not required anymore and the standard gland bushings can be used.

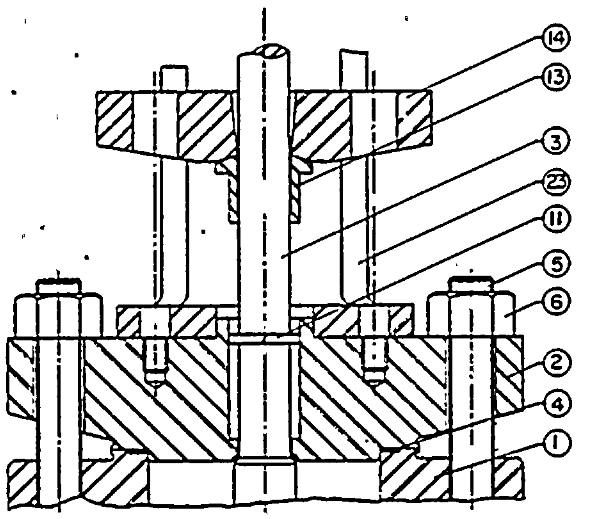


Fig. 10(a)

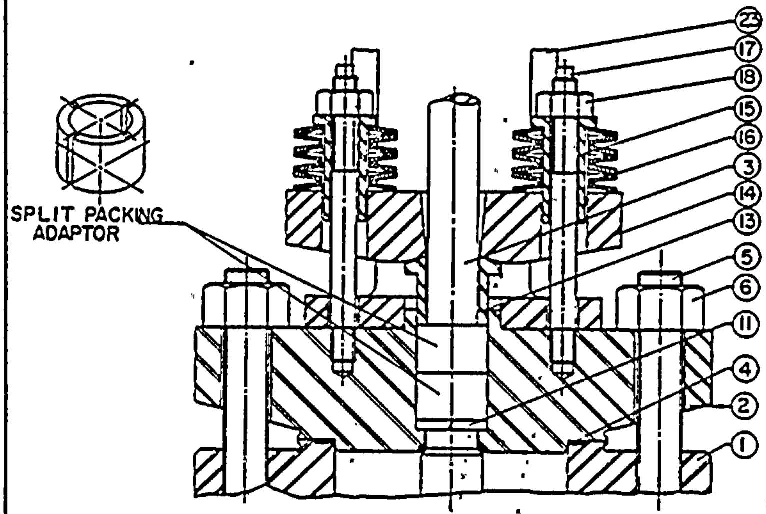


Fig. 10(b)

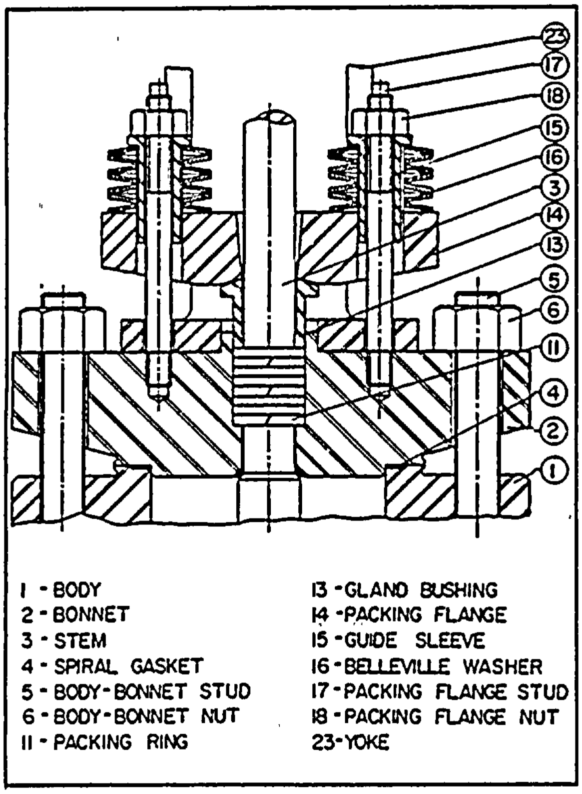


Fig. 10(c)

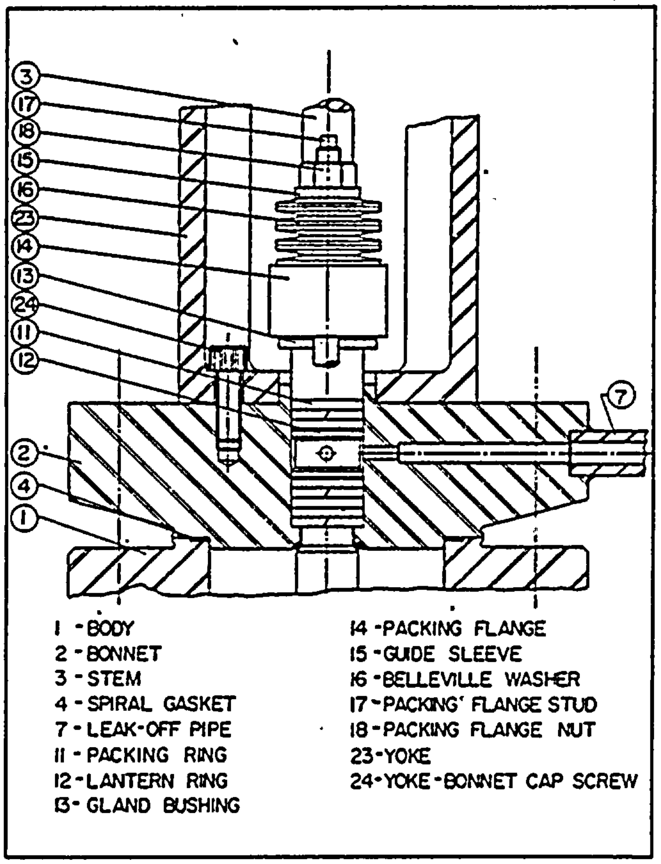


Fig. 10(d)

7. Valves with a leak-off pipe connection will require the lantern ring to be inserted after the 5th packing is compressed. Ensure that the lantern ring lines up with the leak-off connection – Fig. 10(d).

8. Insert the next three packings in the same manner as before.

9. Carefully align the gland bushing into the packing chamber and return the packing flange to its correct position. Mount the live loading assembles in the correct order and tighten packing flange nuts on each side to the recommended torque found in Table C. See Fig. 8(a) and (b) for correct assembly order of live loading parts.

10. Cycle valve at least 5 times from full closed to full opened position, whenever possible under line pressure. After cycling is completed, retighten packing flange nuts to required torque – Table C.

1.5 Repacking with Pre-Compressed Packings

Braided Asbestos Packings (Fig. 11)

1. Braided Asbestos packings can be pre-compressed because of the construction of the packing.

2. When using advanced pre-compressed braided asbestos packing, two packing rings can be installed simultaneously by stagger lapping joints 120° apart. This is considerable time saving and results are very satisfactory.

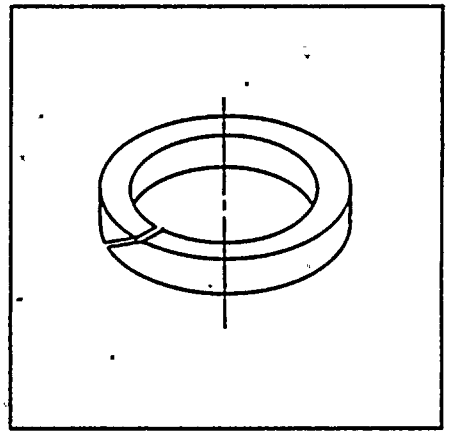


Fig. 11

Pre-Formed Graphite Ribbon (Fig. 12)

1. The pre-compressing of graphite ribbon is not required because this packing is already preformed and compressed.

2. Just stagger the two lap joints so that the laps are 120° apart. Two packing rings can be installed simultaneously.

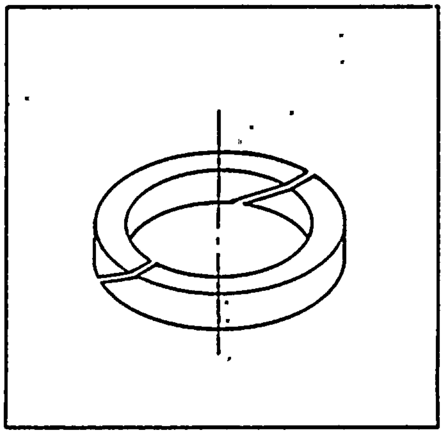


Fig. 12

Packing Placement Sequence

The installation of graphite ribbon packing in any part of the packing chamber where larger clearances are found; (e.g.) first and last packing, is not recommended. This is due to the possibility that the graphite ribbon will extrude through the clearance provided for the stem. Therefore, Velan recommends braided packings be placed first and last in the packing chamber (Fig. 12a), and if required, the placement of two braided packings at the top and bottom of the lantern ring (Fig. 12b).

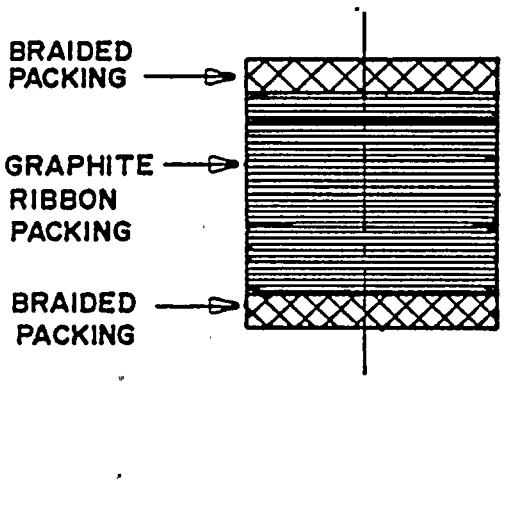


Fig. 12a

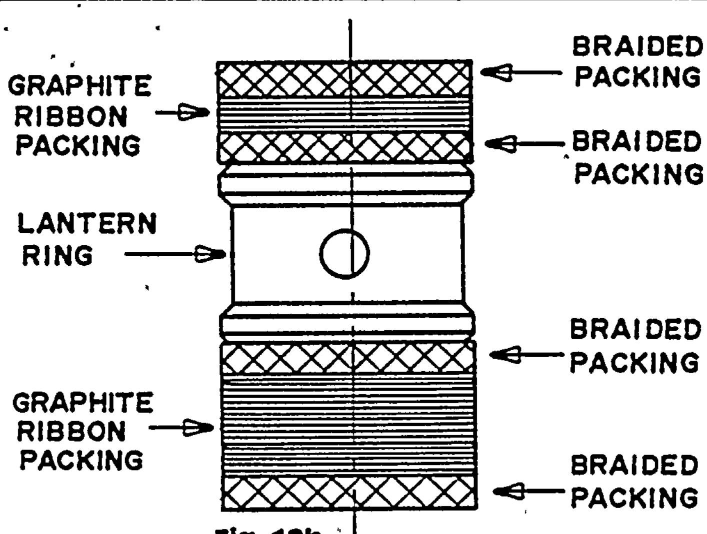


Fig. 12b

1.6 Packing Torques

Step 1: Clean all studs and nuts. Visually inspect all threads to ensure removal of all foreign matter, rust, corrosion, burrs, and previous lubricants.

Step 2: Liberally cover the stud threads and the female threads of the nuts with an antiseize compound of Felpro, type CSA Hi-Temp Antiseize compound or approved equal.

Step 3: With nuts hand tight, tighten up the packing flange nuts a little at a time on each side, then torque down to the correct torque in accordance with valve type, size, pressure class and type of packing in valve, as shown in Table C.

Note: Values given in Table C are approximate for standard Velan Valves. Whenever possible, one should refer to project engineering drawings for particular valve items and their required torques.

TABLE C

PACKING FLANGE NUT TORQUES

VALVE SIZE	BRAIDED ASBESTOS				GRAPHITE RIBBON OR TEFLON	
	150	600	900	1500	150	1500
	GATE	GLOBE	GATE	GLOBE	GATE	GLOBE
2½	25	25	40	40	25	25
3	30	30	50	50	30	30
4	40	40	65	65	40	40
6	80	75	150	175	80	75
8	90	110	205	200	90	110
10	100	115	250	245	100	115
12	105		300		105	
14	115		325		115	
16	125		350		125	
18	125		350		125	
20	155		375		155	
24	200		420		200	
26	200				200	
28	200				200	
30	200				200	

NOTE: FOR SIZES WHERE NO VALUE IS GIVEN, CONSULT MANUFACTURER.

IV(b) Body/Bonnet & Body/Cover Leakage

1.0 General

To maintain the tightness of a factory tested bolted bonnet or cover valve, it is essential that sufficient bolt tension exists at all times by having the proper torque on the nuts. The original torque might be lost due to vibration, relaxation of material caused by frequent temperature and pressure fluctuation of material caused by frequent temperature and pressure fluctuations, or by creep in high temperature application. It is recommended that the gasket joint be inspected for leakage periodically. The tightness of the joint bolt tension should be checked at approximately one year intervals.

1.1 Body/Bonnet & Body/Cover Torquing

The following recommendations in this section are for ideal conditions. However, because of the many interacting tolerances, some latitude must be given in the acceptance standards as follows.

1. The gasket may be fully compressed (e.g.) zero gap between interfaces of the joint at a torque either less than or greater than the torque given in Table D. The following criteria should be used. See Fig. 13.

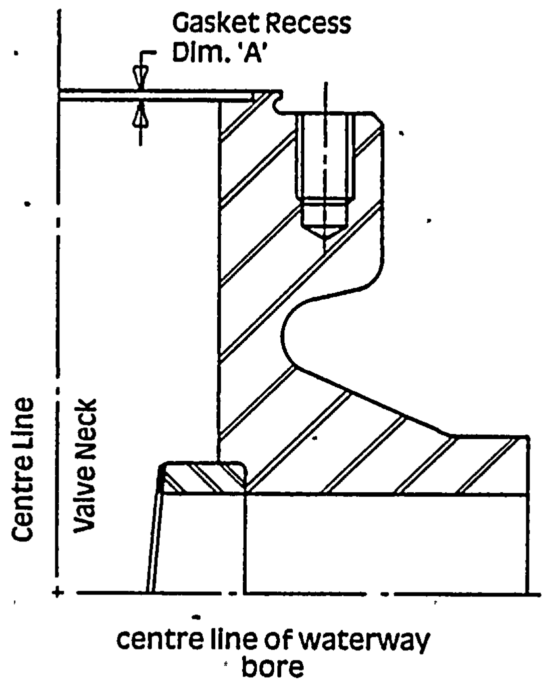
The bolt torque is satisfactory if:

a) the gasket is fully compressed at 90% of the recommended bolt torque, provided that 100% torque value is finally applied.

b) The gasket is fully compressed at 100% torque.

c) The gap between the interfaces of the joint is no more than 0.003" after 125% torque has been applied and the bolts have been slackened individually and re-torqued to 100% torque.

Fig. 13



Dimension 'A' (inches)	Valve Size	Gasket Size
.085-.090	up to 16" inclusive	1/8" (nominal thickness)
.125-.135	18" and above	3/16" (nominal thickness)

Note: Bonnet machining does not control gasket compression. Any repair to the body recess should maintain the above dimensions.

1.2 Torque Procedure

Step 1: Clean all studs and nuts. Visually inspect all threads to ensure removal of all foreign matter, rust, corrosion, burrs and previous lubricants.

Step 2: Liberally cover the stud threads and surface under the nut head with an antiseize compound of Felpro, type C5A Hi-Temp Antiseize compound or approved equal. Also, lubricate the female threads of the nuts and wipe off any excess lubricant that may adhere to any of the stainless steel parts with approved solvents. Approved solvents for this work are:

a) unused or re-distilled acetone

b) alcohol

c) Freon PCA

Note: The use of other solvents is prohibited.

Step 3: With bolts hand tight, follow the bolt tightening sequence shown in Fig. 14. This sequence is dependent upon the number of bolts employed and the sketch is only an illustration as to possible tightening sequence. The bolts shall be torqued to recommended values in Table D.

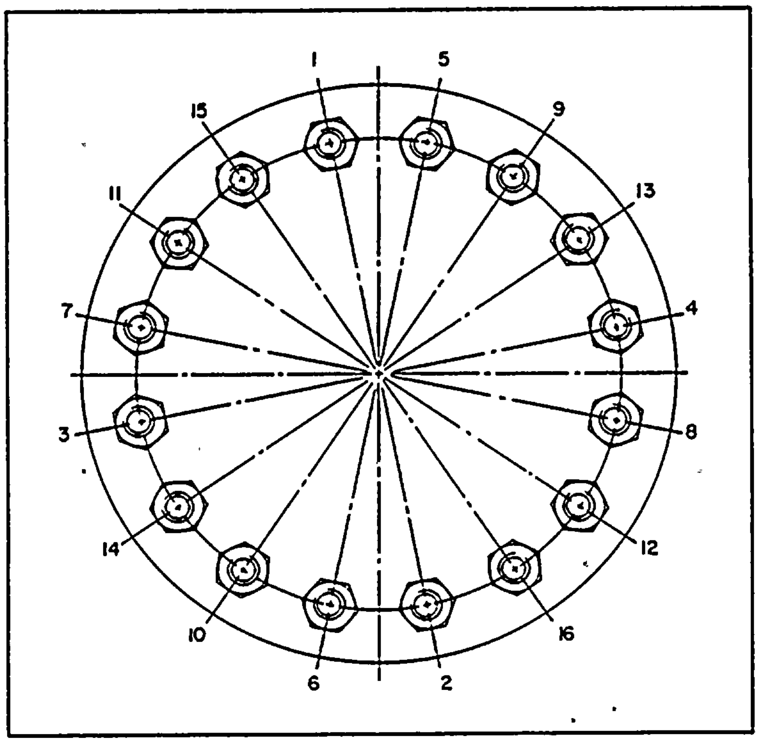


Fig. 14

1.3 Application of Torque

When applying the torque to the bolts, each bolt should be torqued in steps of approximately 20% of the final torque. It will be found that as the final torque is approached, the required step will become much less than 20%.

TABLE D

STUD SIZE	TORQUE VALUES	
	Bolting Material	
	B7, 630	660
	100%	100%
3/8-16UNC	20	20
7/16-14UNC	30	30
1/2-13UNC	50	45
9/16-12UNC	70	62
5/8-11UNC	95	85
3/4-10UNC	170	150
7/8-9UNC	270	240
1-8UNC	410	360
1-1/8-8UN	600	535
1-1/4-8UN	845	750
1-3/8-8UN	1150	1020
1-1/2-8UN	1520	1350
1-5/8-8UN	1955	1740
1-3/4-8UN	2475	2200
1-7/8-8UN	3075	2735
2-8UN	3765	3345
2-1/8-8UN	4500	4045
2-1/4-8UN	5440	4835
2-1/2-8UN	7545	6710

Note: All values are in ft./lb.

Precaution:

1. If tightening sequence is not followed, it is possible that the gasket will not be compressed evenly therefore causing the joint to leak.
2. Over torquing can cause deformation of the bonnet or cover flange and cause the joint to leak.
3. Do not use impacting device to draw up the bolting on body to bonnet or body to cover closures. There are many satisfactory torquing machines on the market which are useful for large valves.

4. Use standard wrenches – If torque wrenches are not available you can use standard wrenches and the following guideline will apply.

1/2"	–	Bolts	–	6" Wrench
9/16"	–	Bolts	–	9" Wrench
5/8"	–	Bolts	–	12" Wrench
3/4"	–	Bolts	–	18" Wrench
7/8"	–	Bolts	–	24" Wrench
1-1/8"	–	Bolts	–	36" Wrench

On sizes of bolts larger than 1-1/8", special torque multiplier with ratio(s) 1:7 or 1:6 should be used for torquing.

1.4 Replacement of Spiral Wound Asbestos – Stainless Steel

1. The gasket recess seating faces on the body and bonnet must first be checked for scratches, which can normally be removed with an emery cloth. The faces should then be solvent degreased and dried before assembly. Approved solvents are Acetone, Alcohol or Freon PCA.

2. Install the gasket. On valves 4" and larger, it is recommended to lubricate the gasket (Fig. 15) with an approved lubricant such as Neolube or equal to prevent damage to the gasket and seating faces when aligning the heavy bonnet assembly or cover on the body (Fig. 16). The valve is now ready for installation of the bonnet assembly and tightening up of bolting in accordance with the torquing procedure Section IV(b), Para. 1.1. **Precaution:** Valve must not be closed or seated when torquing bolts.

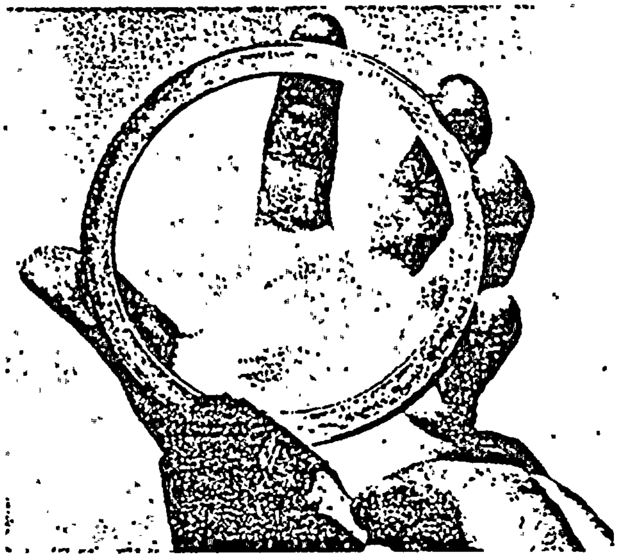


Fig. 15

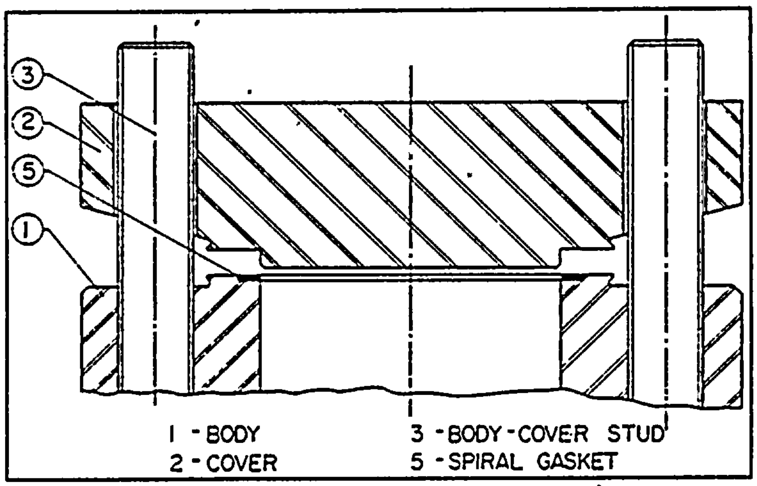


Fig. 16

1.5 Seal Weld Removal

1. General

Seal welding of the body-bonnet or body-cover flange joints shall be performed when necessary to prevent leakage. This joint is not intended to carry the mechanical load on the flange due to internal pressure, gasket compression, thermal stresses or stem thrust. All these forces are taken up by the bolting. Bolting must be maintained under torques shown in Table D Section IV(b), Para. 1.3.

2. Cutting of the Weld (Fig. 17a)

In order to disassemble a bolted bonnet or cover valve with a seal welded body-bonnet joint, all the nuts and studs must be removed first. Grind off the seal weld using the body flange surface as a guide for the grinding to control the height of engagement.

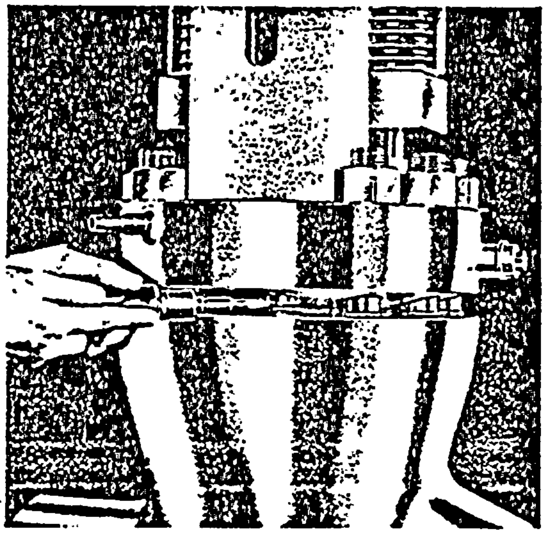


Fig. 17a

3. Preparation for Welding

Before welding, the valve must be drained and the flange lips cleaned with suitable solvent such as Acetone, Alcohol or equal.

4. Qualifications

The welding procedure and welder should be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

5. Actual Welding Process (Fig. 17b)

Remove two nuts and studs in sequence as shown in Fig. 17c. This sequence is dependent upon the number of bolts employed. The sketch is only an illustration as to possible welding sequence. After removing two studs, the seal weld should be applied in the area exposed by the removal of the two studs. Complete the seal welding. Before proceeding to weld the next section, reinstall the two stud nuts and torque down in accordance with torque values given in Table D. Continue the same process for the remaining circumference of valve body-bonnet joint.

Note:

When the weld is complete, it should be examined by a liquid penetrant method according to the requirements of the recommended codes. Refer to Figs. 17d and 17e.

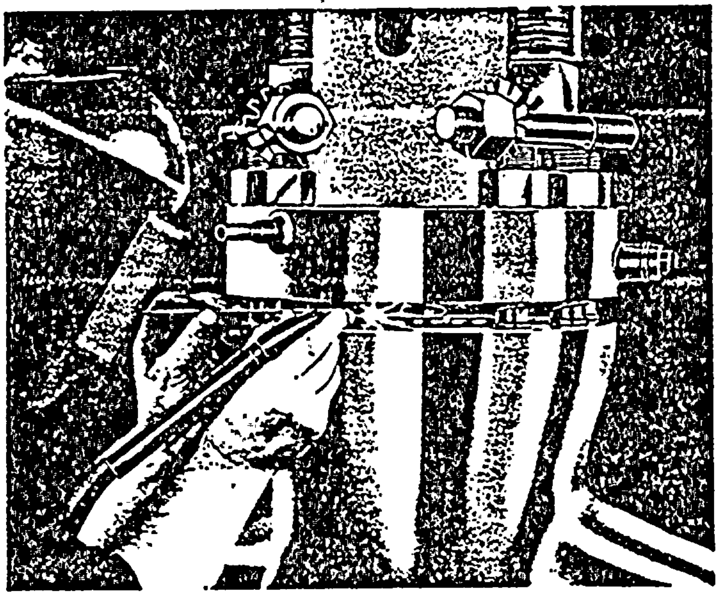


Fig. 17b

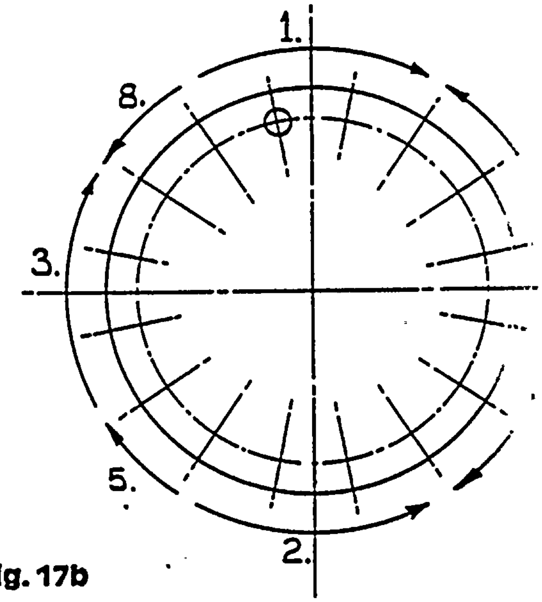


Fig. 17c

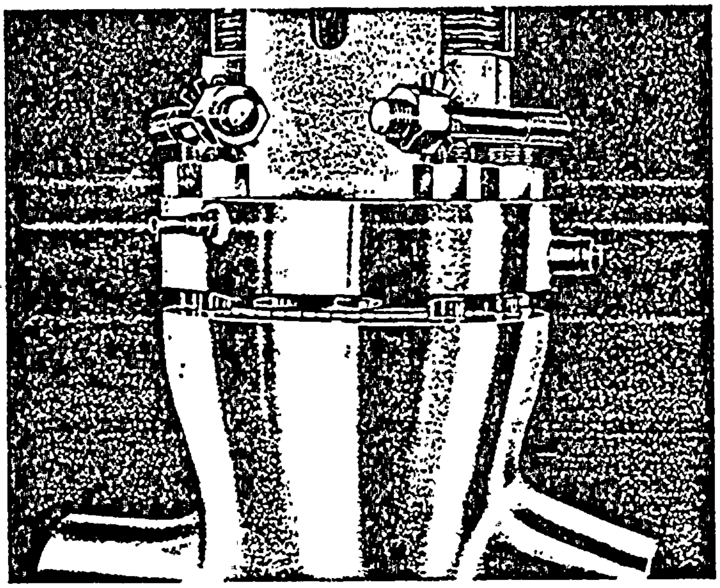


Fig. 17d

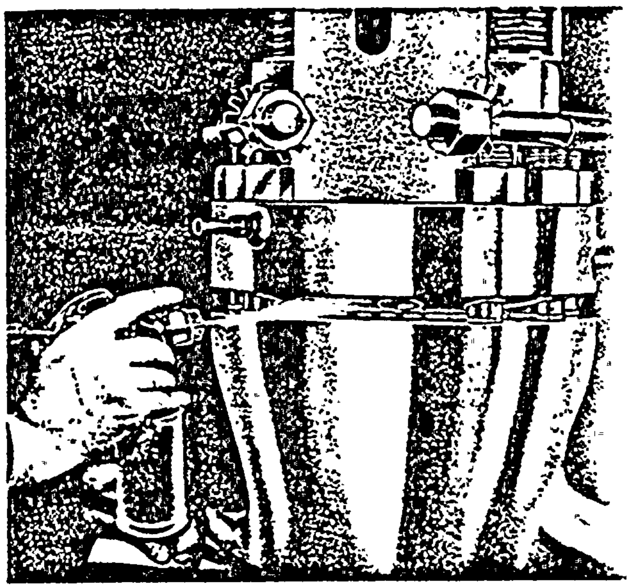


Fig. 17e

IV(c) Seat Leakage

1.0 General

An indication that a valve leak exists after a valve has been properly closed may be found by observing the pressure loss in the high pressure line side of the valve. In the case of hot water or steamlines, by noting if the downstream pipe remains hot beyond the usual length of time. This type of leak may be the result of a distorted seat caused by improper welding of the valve into the pipeline, or by stress relieving temperatures that may have been used during installation.

Also, leaks can develop by failure to close the valve tightly resulting in a flow through a small opening at high velocity. In spite of the fact that the hardfacing material (e.g. Stellite 6) is corrosion and erosion resistant, it is still possible to form grooves, pit marks or other surface irregularities on the mating faces. Valves which leak should be repaired as soon as possible to prevent greater damage caused by high velocity.

1.1 Wedge and Disc Repairs – Gate, Parallel Slide Valves

1. Disassemble valve as described in Section V, Para. 1.1, and inspect the wedge or disc for scratches or damages.

2. If seating faces are scratched they sometimes can be polished with very fine emery cloth on perfectly flat surface.

3. If polishing is not quite sufficient, the wedge must be lapped. Only slight pitting, grooving or indentations not deeper than .005" can be removed by lapping. If defects cannot be corrected by lapping the wedge or disc, they can be ground. Velan recommends that a maximum of only .005" be removed per side. After grinding is done, lap the wedge or disc again.

4. For the lapping, a flat plate, preferably cast iron, should be used and an abrasive lapping compound mixed with olive oil evenly distributed over the plate as shown in Fig. 18. Only light even pressure should be applied on the plate, lifting the wedge or disc as often as possible to prevent accumulation of particles in one area and to allow for proper distribution of lapping compound. The lapping plate position should be turned slightly every few strokes to keep a flat surface. The part should be lapped until seating faces are smooth. Velan recommends the use of Clover Compound (silicon carbide) Grade D or C or an approved equivalent.

Fig. 18

5. Thoroughly clean off the lapping compound with a suitable cleaning fluid such as acetone or alcohol. Do not use chloride or fluoride bearing solvents.

Precaution: Lapping may be slow due to the erosion resistant surface, but too much lapping must be avoided.

1.2 Seat Repairs – Gate, Parallel Slide Valves

1. Automatic grinding and lapping can be done by one man using one of the following machines.
   a) Dexter Gate Valve Reseater – Fig. 19
   b) Unislip Gate and Parallel Slide Valve Grinders – Fig. 20

   Both machines can regrind and lap seats within one hour by one man. These machines can be mounted directly onto a valve which is already welded in the pipeline. Both machines automatically set themselves to the correct seat surface angle. These two types of machines are available for different sizes of valves and are suitable for almost all of Velan's gate and parallel slide valves.

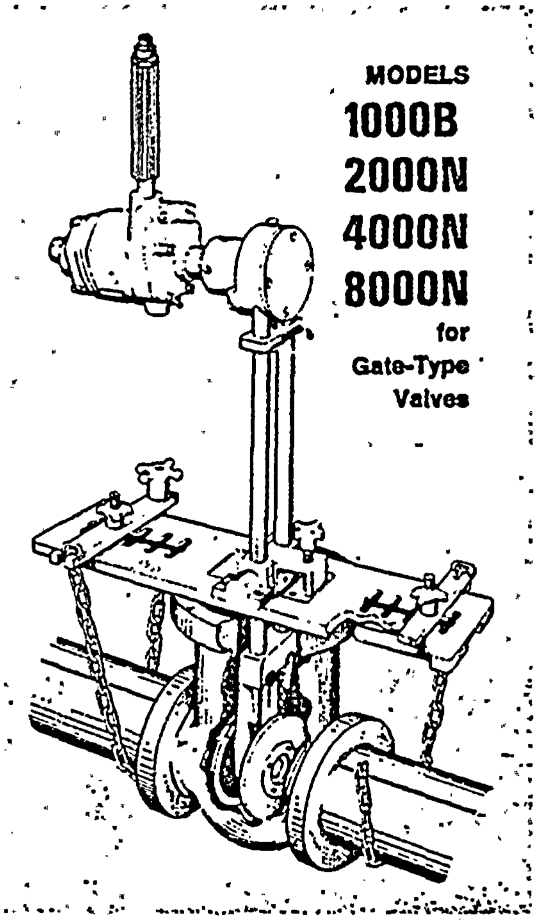


Fig. 19

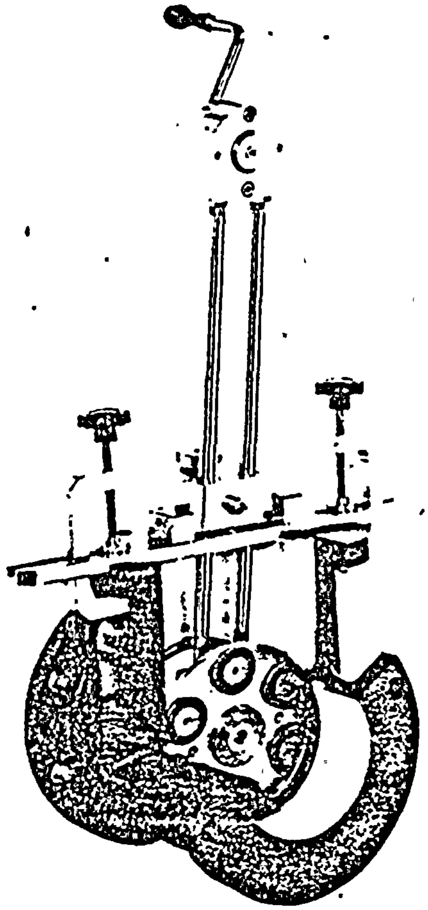


Fig. 20

Model 2000N will regrind gate valves 2½"–4".
Model 4000N will regrind gate valves 4½"–8".
Model 8000N will regrind gate valves 8½"–12".
Air motor operates at 90 PSI pressure (recommended).
Special Valve Reseating Machines can be furnished for Valve Sizes over 12" upon request.

2. If the automatic grinding and lapping machine is not available, seat faces must be repaired by using a lapping plate, cast iron if possible, and large enough to cover the face of the seat (Fig. 21). Apply lapping compound mixed with olive oil and evenly distribute on plate. Lap seat by moving lapping plate in a circular motion on seat face. Lift the plate as often as possible to prevent accumulation of particles in one area and to allow for proper distribution of the lapping compound. Lap until both seats have smooth faces and then clean off the lapping compound very thoroughly with a suitable cleaning fluid such as acetone or alcohol.

Precaution: Do not remove too much hard-facing deposit material because the seat cannot be replaced when valve is in pipe system.

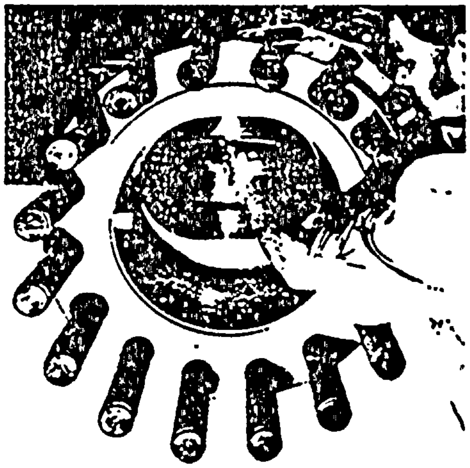


Fig. 21

1.3 Fitting of Repaired Parts – Gate, Parallel Slide Valves

1. After the seating faces of the wedge, discs or seats have been relapped and cleaned, a blueing test is recommended before reassembly. A blueing ink should be placed smoothly and equally over the full circumferential surface of both sides of the wedge or discs (Fig. 22). Place the marked up side of the wedge or disc together with the marked up side of the seat. Slowly lower the part into the body and find the correct mating point of the faces.

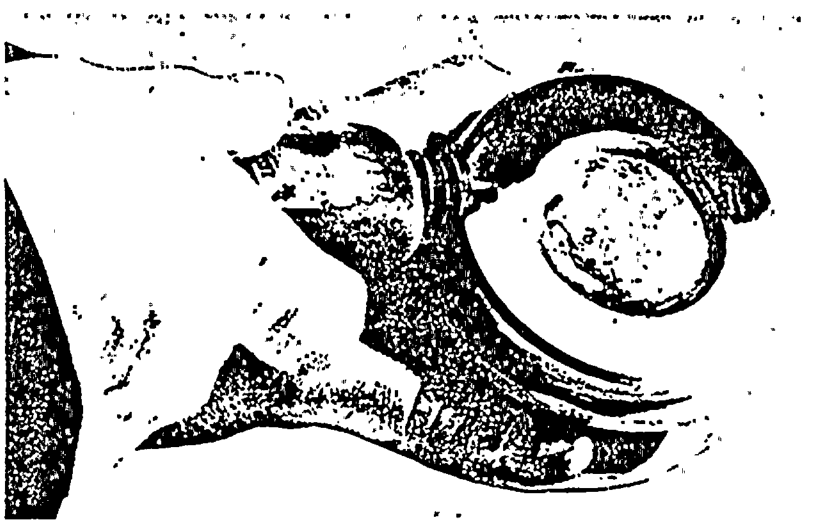


Fig. 22

2. If a part cannot be repaired, new parts must be fitted and installed. All spare part wedges are supplied slightly oversized. They must be ground and lapped as much as needed in order to fit over the full circumference of the seat. Refer to Fig. 23.

Note: If the outside diameter of hardface and top and bottom face-to-face dimensions of the old wedge are given, it is possible that there will be very little lapping or fitting required at the site when replacing the part.

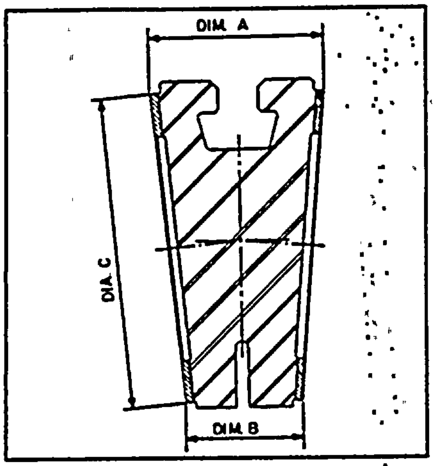


Fig. 23

3. In some cases it is possible that the seat angle is lost when grinding the seat in the body. Therefore, one must shim the wedge while grinding it. Shim only as much as required to have a full fit over the full circumference of the seating faces. Fig. 24a illustrates a wedge with a full seating circumference. This must be achieved whenever fitting a wedge.

4. When fitting a wedge, it is also important that the wedge guide slot has sufficient clearance to allow the wedge to move freely along the wedge guide, as shown in Fig. 24b.

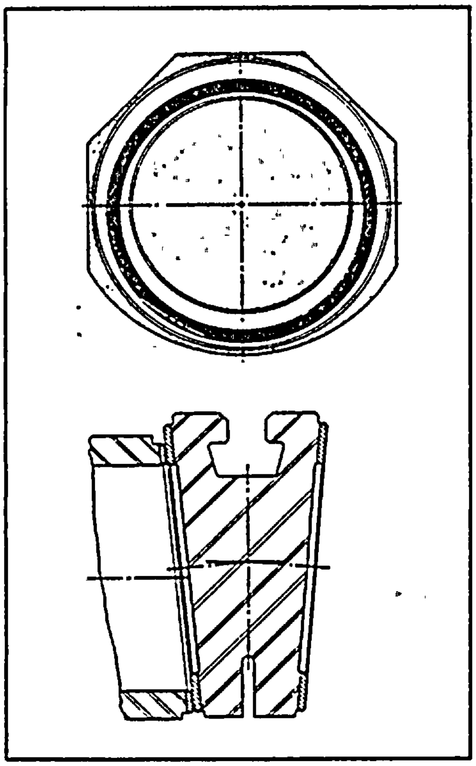


Fig. 24a

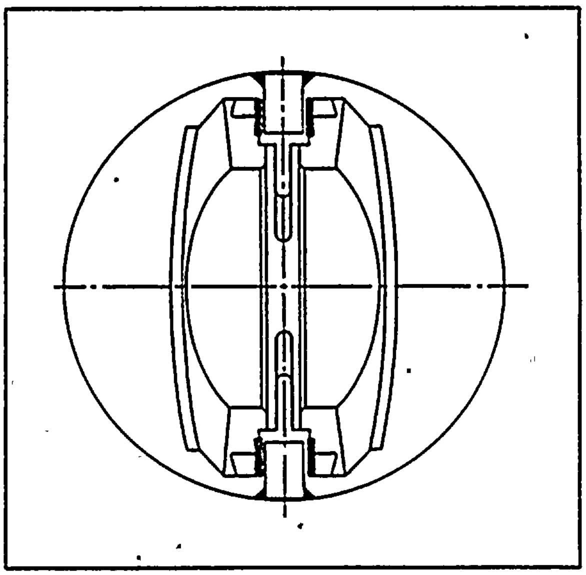


Fig. 24b

1.4 Seat Repairs – Globe, Needle, Stop, Piston Check Valves

1. Disassemble the valve as described in Disassembly Section V, Para. 1.1, and inspect the disc and seat for scratches, pitting marks or other damages.

2. Where indentations of pitting marks are deeper than .010", a cast iron lapping disc – Fig. 25 (a), with the proper seat angle must be used with a suitable lapping compound to roughen the surface first. With the use of a new or already pre-finished original disc – Fig. 25 (b), you can use a finer lapping compound to finish lapping the disc and seat together.

   Important: A guiding plate for the stem is required to maintain alignment during the lapping operation – refer to Fig. 25 (b). It can be made from wood or any suitable material to the same gasket dimensions as the bonnet. The section of the plate where the stem extends through is to be made 1/64" larger than the outside diameter of the stem.

3. Place a small quantity of lapping compound mixed with olive oil and evenly distribute on the two mating surfaces.

4. It is important to apply slight pressure when lapping seats and to rotate in reciprocally. For best results, use an air or electric hand tool with adjustable speed and reciprocal movement. The lap should be lifted frequently and turned to a new starting position so that the lapping will be rotated over a new area.

5. In order to assure that the pressure is applied evenly, it is necessary, on some valves, to suspend the disc and stem assembly from a coil spring in such a manner as is shown in Fig. 25 (a).

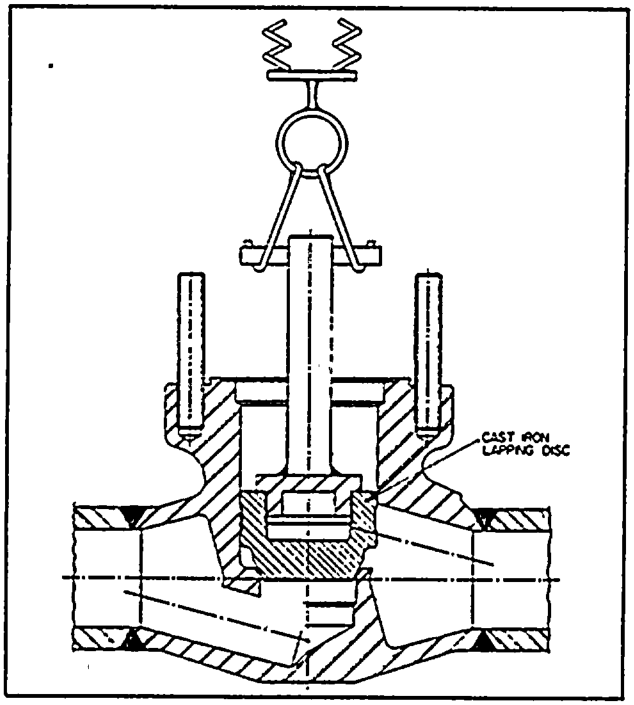


Fig. 25 (a)

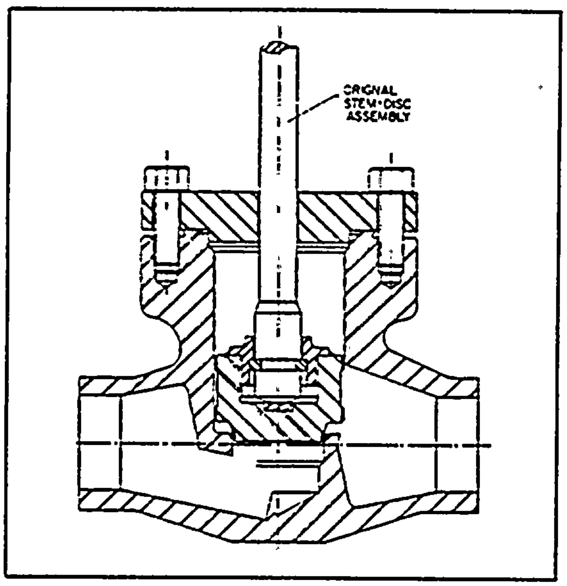


Fig. 25 (b)

6. Automatic grinding and lapping can be done by one man using the same machines, possibly a different model, as mentioned in Para. 1.4.

a) Dexter Globe Valve Reseater, Fig. 26.

b) Unislip Globe and Safety Valve Grinders, Fig. 27.

Both machines can regrind and lap a seat within one hour by one man. These machines can be directly mounted onto a valve which is already welded in the pipeline. Both machines can be supplied with different grinding heads or discs to refinish any one of Velan's globe seat angles. These two types of machines are available for different sizes of valves and are suitable for almost all of Velan's globe, needle, stop check or piston check valves.

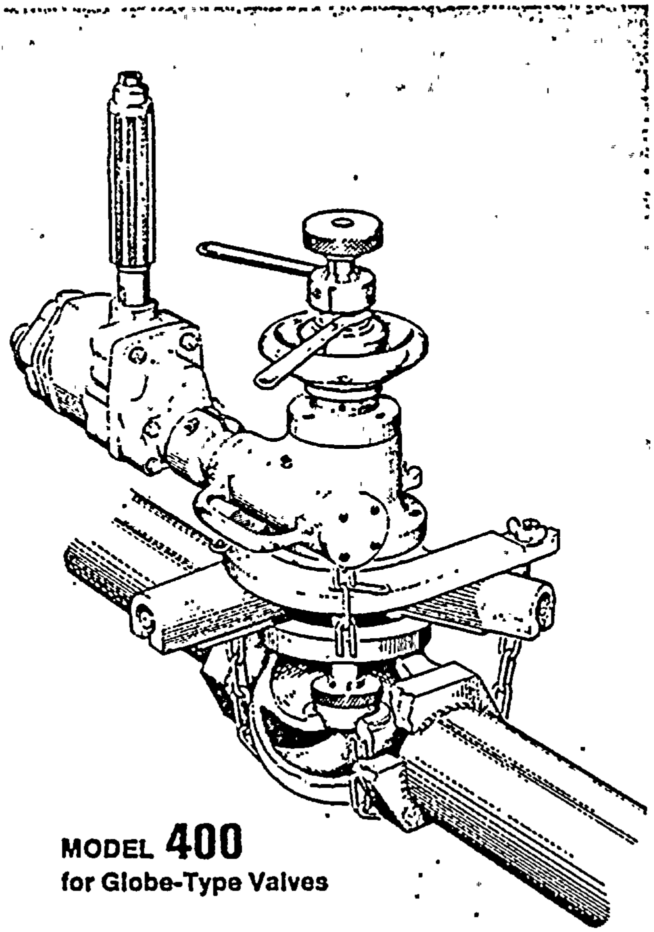


Fig. 26

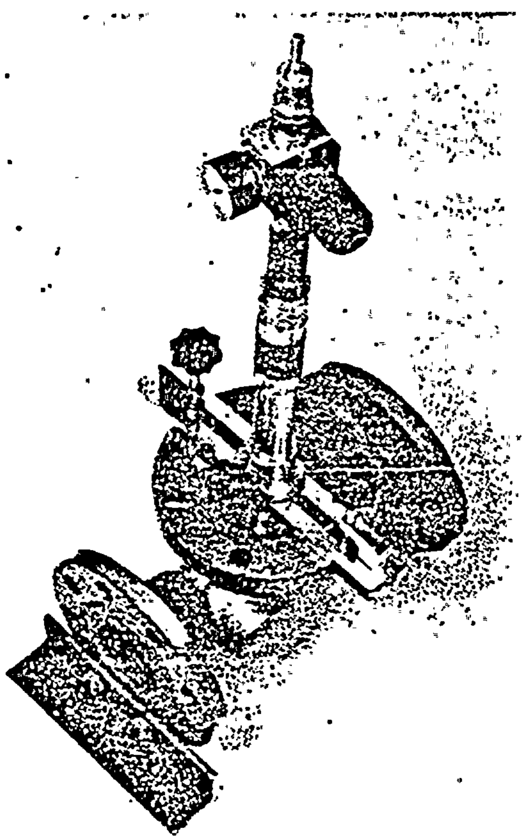


Fig. 27

Model 400 will regrind globe valves 4" to 12".
(Model 100R will regrind globe valves 2½" to 4".

1.5 Fitting of Repaired Parts – Globe, Stop Check, Piston Check Valves

1. After the seating faces of the disc and seat have been relapped and cleaned with a suitable cleaning fluid such as acetone or alcohol, it is essential that the results of the lapping be verified by a blueing test to check for full circumferential contact. A blueing ink should be placed smoothly and equally over the seating diameter of the disc. Slowly lower the part into the body and find the correct mating point of the faces. Fig. 28a illustrates a disc with a full seating circumference. This must be achieved whenever fitting a disc.

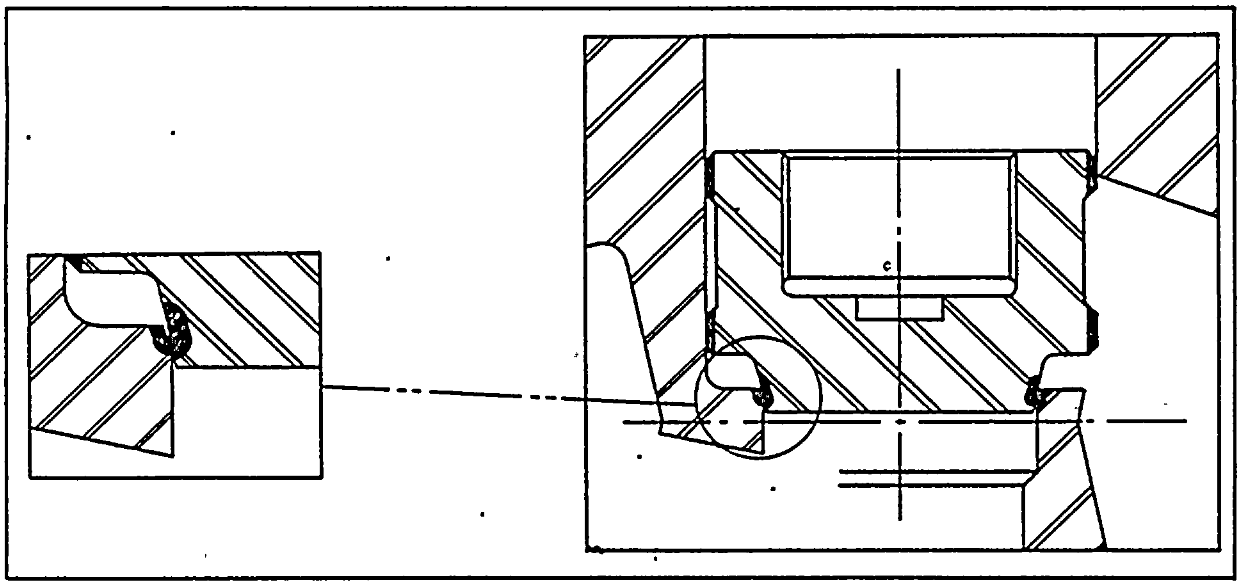


Fig. 28a

2. When fitting the disc, it is also important that the body inside diameter be checked for sufficient clearance to allow the disc to move freely up and down. It is recommended to make a visual examination of the body wall. Any groove or scratches should be polished with a fine emery cloth.

3. Verification of contact between the valve disc and the stem is made by a radius on the end of the valve stem and is designed to give center loading for the disc as close as possible. A hard thrust pad, Fig. 28b, which can be found in some designs will help prevent galling. On valves without a thrust pad, the bearing surface in the disc has a hardface deposit on it, Fig. 28c. If particles get between the end of the valve stem and the disc, the center loading of the stem can be destroyed and the disc will not seat tightly.

The contact surfaces of the stem and the disc must be checked first in leaky valves in order to ensure that the disc-stem contact is in proper condition.

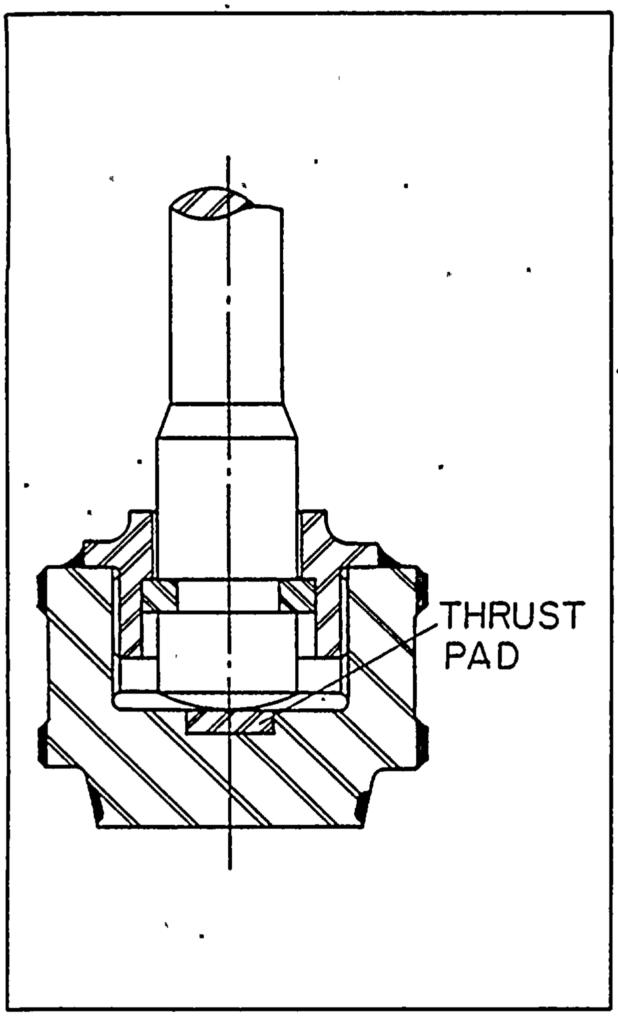


Fig. 28b

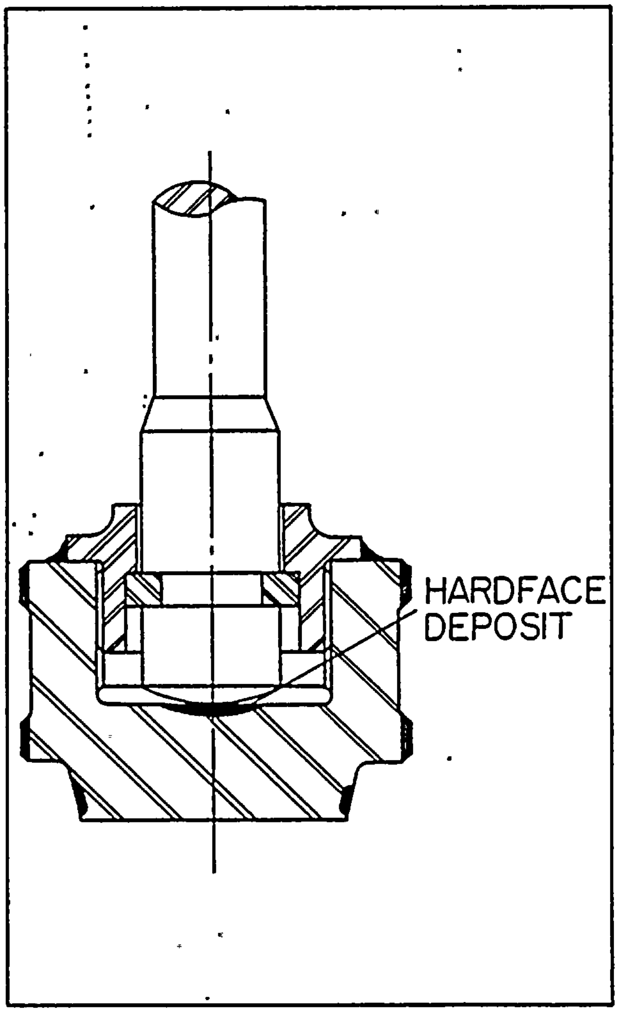


Fig. 28c

1.6 Disc Repairs – Swing Check

1. Disassemble the valve as described in the disassembly Section V, Para. 1.5, and inspect the disc and seat for scratches, pitting marks or other damages.

2. If the seating face of the disc is scratched, it can sometimes be polished with a very fine emery cloth on a perfectly flat surface.

3. If polishing is not quite sufficient, the disc must be lapped. Only slight pitting, grooving or our indentations not deeper than 0.010" can be removed by lapping. If defects cannot be corrected by lapping, the disc can be ground but Velan recommends the only a maximum of 0.020" be removed. After grinding is completed, lap the disc.

4. For the lapping, a flat plate, preferably cast iron, should be used and the abrasive lapping compound mixed together with olive oil and evenly distributed over the plate as shown in Fig. 29. Only light even pressure should be applied when the disc is moved in a circular motion on the plate, lifting the disc as often as possible to prevent accumulation of particles in one area and to allow for proper distribution of the lapping compound. The lapping plate position should be turned slightly every few strokes to keep a flat surface. The part should be lapped until seating faces are smooth.

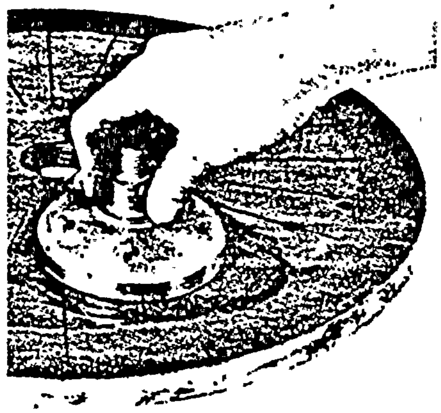


Fig. 29

5. Thoroughly clean off the lapping compound with a suitable cleaning fluid such as acetone or alcohol. Do not use chloride or fluoride bearing solvents.

1.7 Seat Repairs – Swing Check

If repairs are required on the seat of a swing check, the procedure is the same as described in Para. 1.2 on seat repairs – gate, parallel slide valves. The only difference between these seats is the angle of the seat face. One can repair with an automatic grinding or lapping machine or by the use of the manual method.

1.8 Fitting of New Disc – Swing Check

When damage on the disc seating face cannot be removed by grinding or lapping, the disc must be replaced. All new discs coming from the factory are already ground and should be lapped before installation. See installation procedures described in Reassembly of Swing Check, Section VI, Para. 1.5.

1.9 Backseat Repairs

1. All of the following valves are equipped with an integral or welded in backseat in the bonnet (Fig. 30).

   a) Gate Valve

   b) Parallel Slide Valve

   c) Globe Valve

   d) Needle Valve

   e) Stop Check Valve

   The above list of valves have a stem with a backseat shoulder. This should sit perfectly against the bonnet backseat to make a perfect seal. It is possible that this seal may leak due to many reasons (e.g. scratches or pitting). Therefore, this seal must be repaired by relapping the mating faces.

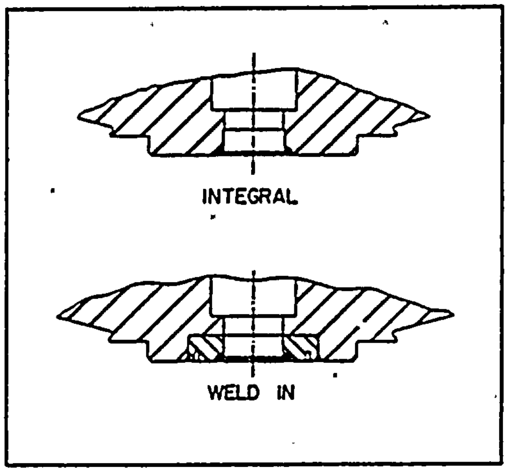


Fig. 30

2. Dismantle the valve in accordance with valve disassembly procedures found in Section V, Para. 1.2.

3. Place the bonnet and stem upside down as shown in Fig. 31 and insert two or three packing rings in the packing chamber to serve as a guide for the centralizing of the stem to the backseat. Add a fine mixture of lapping compound and olive oil between the two mating faces. Gently rotate the stem to a new position circularly around the backseat so that lapping will be rotated over a new area. This can be done by hand or with a suitable air or electric tool.

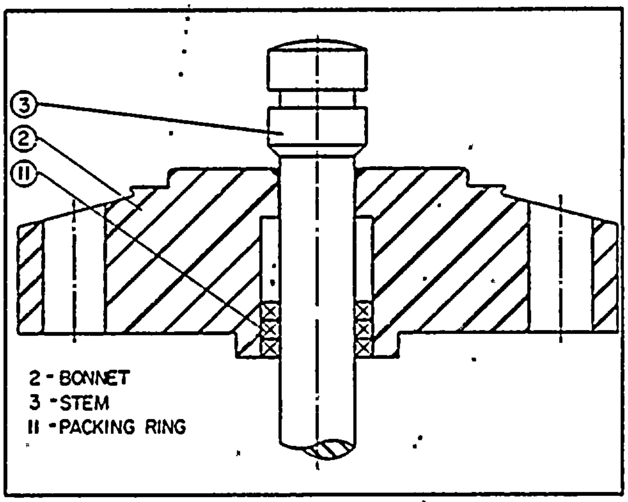


Fig. 31

Note: On larger valves, stem must be supported so that the weight of the stem does not cause a groove or galling on the backseat.

4. After the lapping procedure is finished, all lapping compound must be removed with a suitable cleaning fluid such as acetone or alcohol.

5. It is recommended that the lapping procedure be verified for full contact by blueing one of the two faces. After verification is done the surfaces must be cleaned again.

V DISASSEMBLY

1.0 General Disassembly

There are two basic methods by which Velan Valves can be disassembled.

a) A total disassembly – see Fig. 32.

b) A partial disassembly to allow access to the area which requires maintenance.

The decision on which method to use depends on the nature of the problem and the space availability.

First, determine where the problem lies. Maintenance problems for these valves can be divided into three major areas.

Area 1 – Valve internal problems, spiral gasket, wedge, disc, seat, etc.

Area 2 – Valve mid-section, stem, torque arm, gland bushing, etc.

Area 3 – Valve top works, handwheel or operator, etc.

Caution: Make sure all pressure has been relieved from both sides of the valve before any specific disassembling work is started. Exceptions to this caution are noted below.

Area 1 Service

Line pressure must be relieved with no exception.

Area 2 Service

Line pressure must be relieved with exception to torque arm removal with yoke-bonnet body intact.

Area 3 Service

Line pressure can remain in valve. Valve must be fully opened and backseated. The upward force on the stem due to pressure in the line will keep the stem on the backseat.

PARTS DESCRIPTION

1 -BODY
2 -BONNET
3 -STEM
4 -SPIRAL GASKET
5 -BODY-BONNET STUD
6 -BODY-BONNET NUT
7 -LEAK-OFF PIPE
8 -BLOW-OUT PLUG
9 -BLOW-OUT GASKET
10 -JUNK RING
11 -PACKING RING
12 -LANTERN RING
13 -GLAND BUSHING
14 -PACKING FLANGE
15 -GUIDE SLEEVE
16 -BELLEVILLE WASHER
17 -PACKING FLANGE STUD
18 -PACKING FLANGE NUT
19 -TORQUE ARM
20 -TORQUE ARM CAP SCREW
21 -TORQUE ARM KEY
22 -TORQUE ARM BEARING
23 -YOKE
24 -YOKE-BONNET CAP SCREW
25 -BEARING
26 -YOKE NUT
27 -HOUSING COVER
28 -GREASE FITTING
29 -HANDWHEEL
30 -HANDWHEEL KEY
31 -HANDWHEEL NUT
32 -HANDWHEEL NUT SET SCREW
33 -YOKE-HOUSING CAP SCREW
34 -SEAT
35 -WEDGE GUIDE
36 -WEDGE

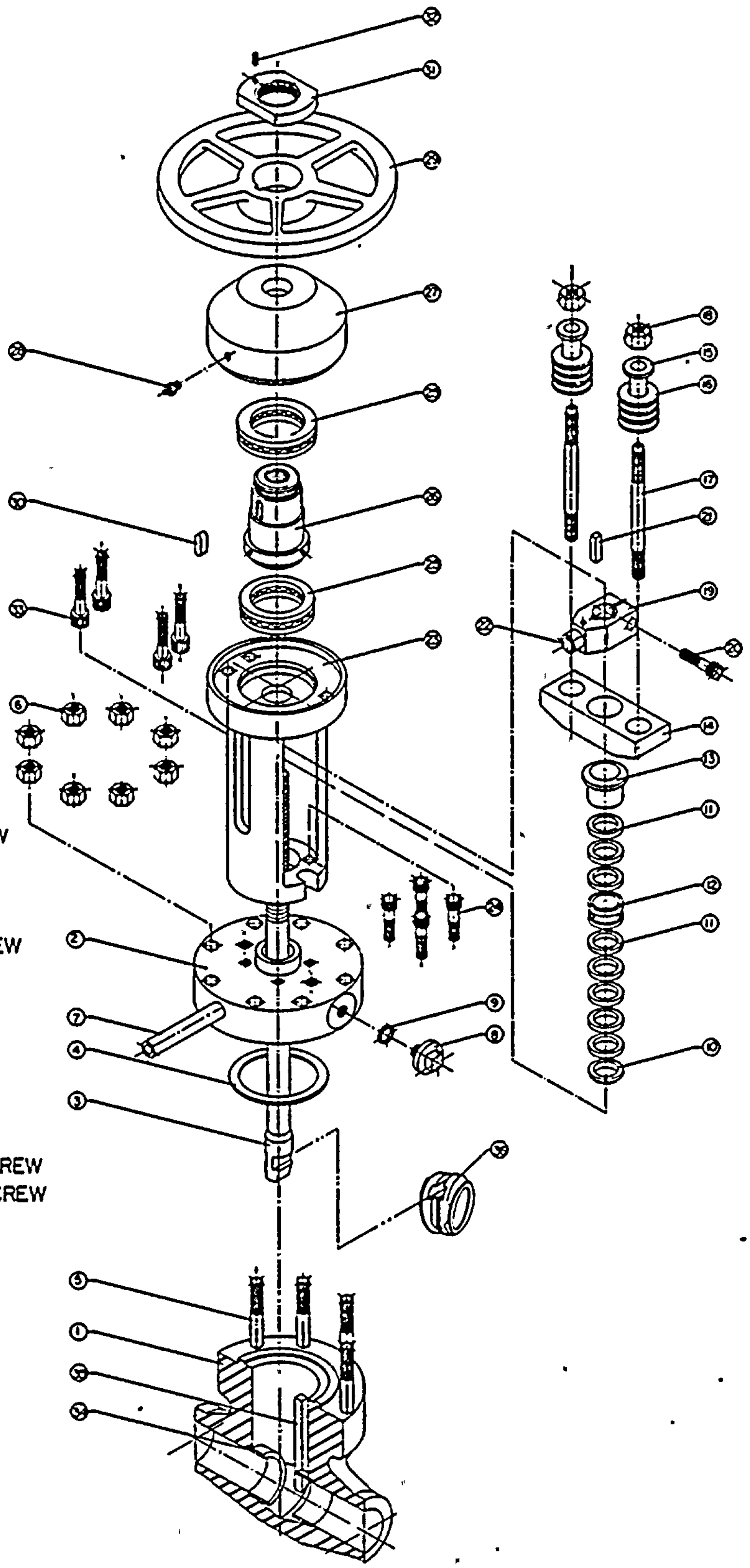


Fig. 32
Typical Exploded View Gate Valve

1.1 Disassembly Area 1 – Valve Internal Problems

The disassembly instructions that are described below will cover three of Velan's basic valve designs – Gate, Globe and Stop-Check. As a general disassembly process, place matching marks on parts so that the same orientation of parts can be maintained as reassembly.

Refer to Figures 2, 3, 4 and 5.

1. The valve should be in a partially open position.

2. Before proceeding with disassembly of valves, check if the valve is equipped with a leak-off pipe option (7). If so, then disconnect first. Leak-off pipes should be cut approximately 6" from the bonnet side and not at the welded joint on the bonnet.

3. Remove body-bonnet nuts (6).

   Note: If a valve has been in high temperature service for extensive periods of time, the nuts sometimes become seized to the stud. Tight nut threads can sometimes be loosened by applying penetrating oil or applying heat to the nut and working it free. As a last resort, a hacksaw, a cutting torch or cold chisel can be used to cut nut away from stud.

4. Once all the nuts are removed, the entire yoke-bonnet assembly can be lifted from the valve body as shown I Fig. 33a and Fig. 33b..

   Note: When lifting the yoke-bonnet assembly, care should be taken to prevent internal parts from disengaging from the stem. (e.g.) The wedge (36) is attached to the stem (3) with a T slot and as soon as it is disengaged from the guides in the body, it can slip off the stem. Make certain that wedge is match marked.

5. Remove used spiral wound asbestos stainless steel gasket (4).

6. The valve is now ready for inspections and repairs of wedge, disc, seat, etc.

7. During inspection check the body-bonnet stud (5) for damage. Studs may have been damaged when removing seized nuts or when lifting the yoke-bonnet assembly. If studs are damaged, remove and replace them.

   a) Screw on the two nuts.
   b) Lock the bottom nut to the top nut.
   c) Turn the bottom nut to remove the stud.
   d) Take the new stud and apply antiseize compound to it. See Section III, Para. 1.1 for recommended compound.
   e) Screw in the stud and tighten.

1 • BODY
2 • BONNET
3 • STEM
4 • SPIRAL GASKET
5 • BODY • BONNET STUD
6 • BODY • BONNET NUT
7 • LEAK • OFF PIPE
8 • BLOW • OUT PLUG
9 • BLOW • OUT GASKET
10 • JUNK RING
11 • PACKING RING
12 • LANTERN RING
13 • GLAND BUSHING
14 • PACKING FLANGE
15 • GUIDE SLEEVE
16 • BELLEVILLE WASHER
17 • PACKING FLANGE STUD
18 • PACKING FLANGE NUT
19 • TORQUE ARM
20 • TORQUE ARM CAP SCREW
21 • TORQUE ARM KEY
22 • TORQUE ARM BEARING
23 • YOKE
24 • YOKE • BONNET CAP SCREW
25 • BEARING
26 • YOKE NUT
27 • HOUSING COVER
28 • GREASE FITTING
29 • HANDWHEEL
30 • HANDWHEEL KEY
31 • HANDWHEEL NUT
32 • HANDWHEEL NUT SET SCREW
33 • YOKE • HOUSING CAP SCREW
34 • SEAT
35 • WEDGE GUIDE
36 • WEDGE

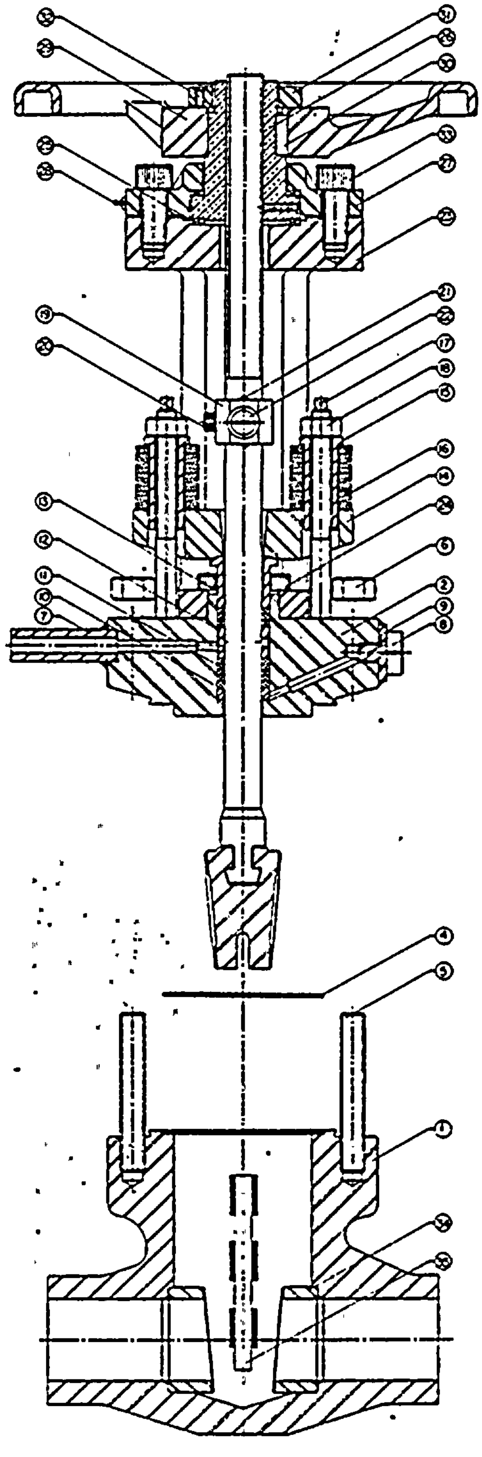


Fig. 33(a)
Gate Valve

1 • BODY
2 • BONNET
3 • STEM
4 • SPIRAL GASKET
5 • BODY • BONNET STUD
6 • BODY • BONNET NUT
8 • BLOW • OUT PLUG
9 • BLOW • OUT GASKET
10 • JUNK RING
11 • PACKING RING
13 • GLAND BUSHING
14 • PACKING FLANGE
15 • GUIDE SLEEVE
16 • BELLEVILLE WASHER
17 • PACKING FLANGE STUD
18 • PACKING FLANGE NUT
19 • TORQUE ARM
20 • TORQUE ARM CAP SCREW
21 • TORQUE ARM KEY
22 • TORQUE ARM BEARING
23 • YOKE
24 • YOKE • BONNET CAP SCREW
25 • BEARING
26 • YOKE NUT
27 • HOUSING COVER
28 • GREASE FITTING
29 • HAMMER WHEEL
30 • HAMMER WHEEL KEY
31 • HAMMER WHEEL NUT
32 • HAMMER WHEEL SET SCREW
33 • YOKE • HOUSING CAP SCREW
37 • DISC
48 • STEM COLLAR
49 • DISC UNION
50 • THRUST PAD

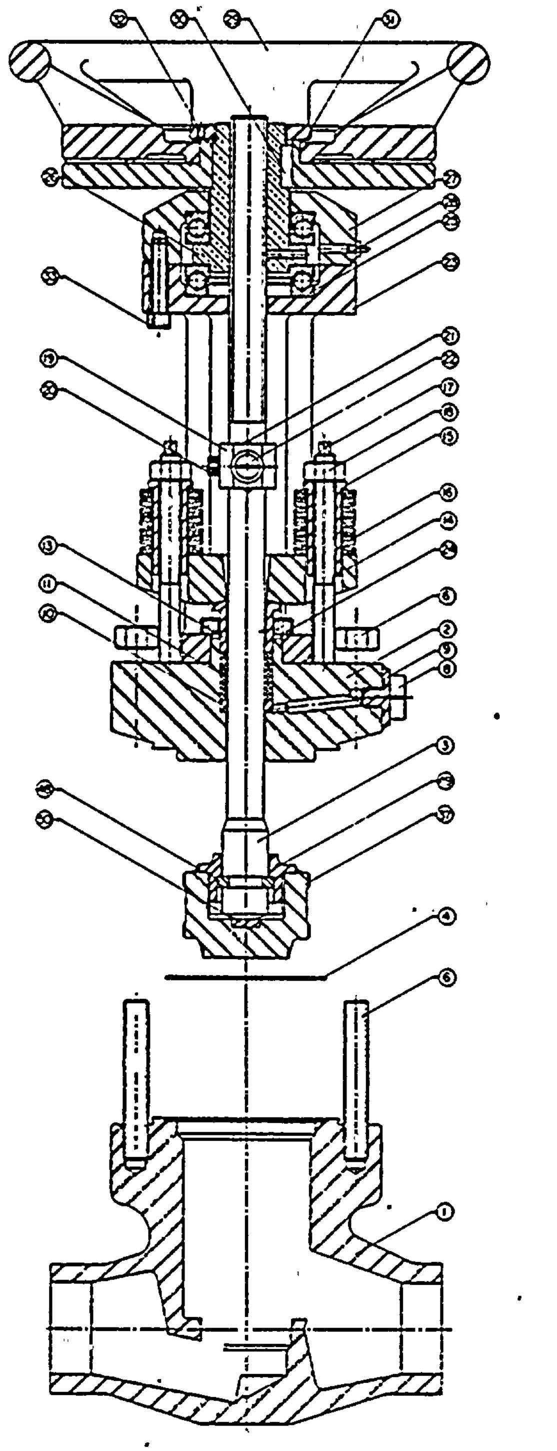


Fig. 33(b)
Globe Valve

8. If the type of valve you are disassembling is a globe or needle valve (Fig. 34), the stem (3) and disc (37) will come out in one piece with the yoke-bonnet assembly. This can be disassembled with the stem remaining in the yoke-bonnet assembly or the stem and disc assembly can be removed. For removal of stem, see Disassembly Area 2.

9. The connection between the stem (3) and the disc (37) is made by the use of a disc union (49) and the stem collar (48). To remove this connection, break the tack welds by using a saw or a small sharp chisel.

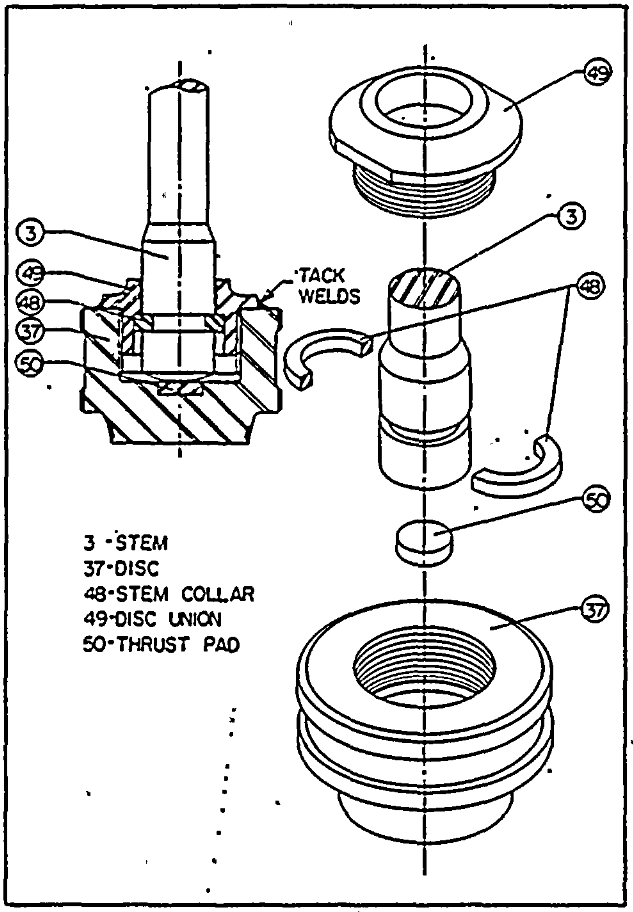


Fig. 34

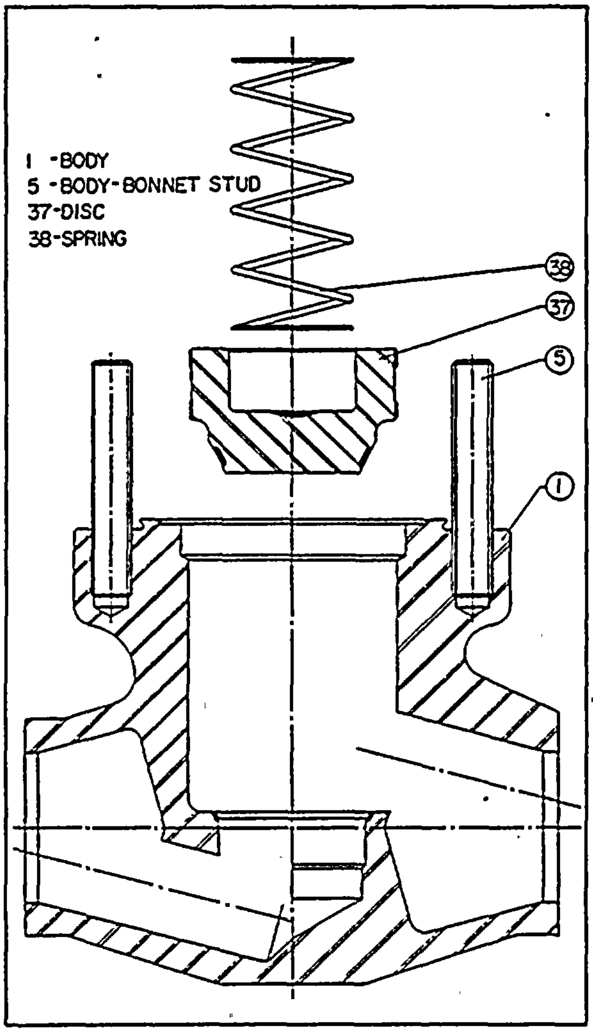


Fig. 35

10. After the tack welds are removed, unscrew the disc union from the disc, pull the disc off the stem and remove the stem collar (two pieces) from the stem. Check inside the disc. Some discs will have a hardfacing deposit at the bottom centre or they will have a small thrust pad (50).

11. Now the disc can be repaired or replaced.

12. If the type of valve you are disassembling is a stop check, refer to Fig. 5, the stem is not attached to the disc. The disc (37) and spring (38) must be lifted from the valve body after the yoke-bonnet assembly has been removed. See Fig. 35.

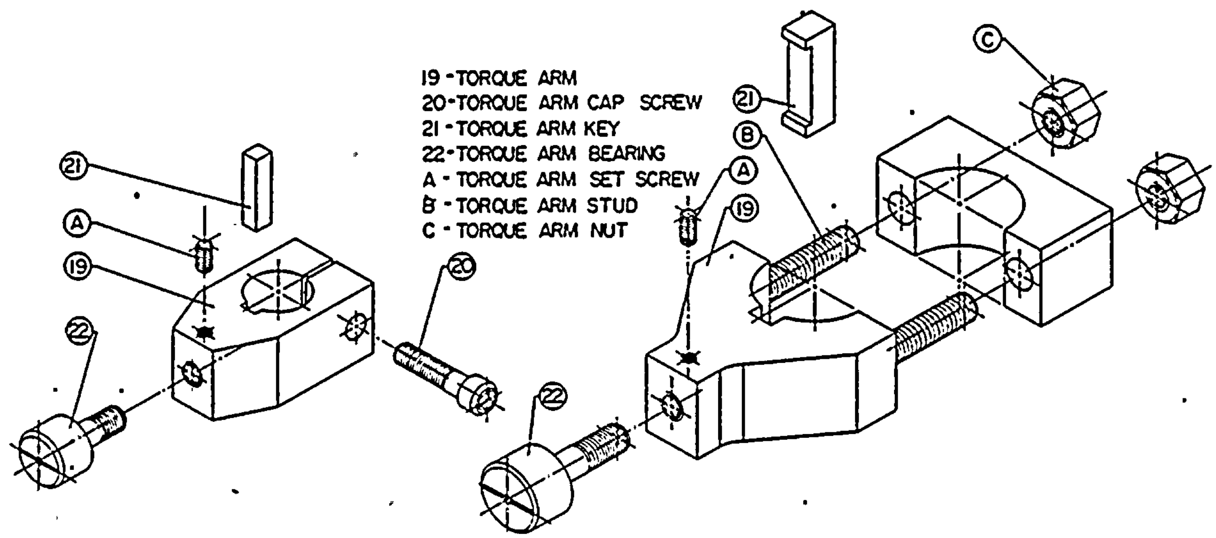
1.2 Disassembly Area 2
Valve Mid-Section – Gate, Globe, Stop-Check

The disassembly instructions that are described below will cover the removal of stem and torque arm as long as the valve has been disassembled in accordance with the disassembly procedures found in Disassembly Area 1.

1. Remove packing flange nut (18) and live loading option.

   Note: If the valve is equipped with a live loading option, such as guide sleeves (15), Belleville washers (16) as shown in Figs. 8a and 8b, one must make note of the order of these parts so that at reassembly, the parts will return in the same order.

2a. Remove torque arm. There are two types of torque arms. Type I (Fig. 36) is a one piece torque arm and Type II (Fig. 37) is a two piece torque arm which can be removed under line pressure.



Type I (Fig. 36) **Type II (Fig. 37)**

2b. Removal of Type I, loosen capscrew (20), and remove. Slide torque arm (19) up along stem and remove torque arm key (21) from stem. Torque arm will not come off at this point, but you must make sure that the torque arm slides free over the stem.

2c. Removal of Type II, loosen hex nuts (c) and pull torque arm apart and remove torque arm key (21) from stem. Torque arm will come totally off assembly at this point.

3. Remove packing rings (11) in accordance with Section IV(a), Para. 1.1 – Removal of Packing Rings.

4. Remove stem (3) by turning it out of the yoke nut (26). When the stem is disengaged from the yoke nut, pull the stem out through the bottom of the yoke-bonnet assembly.

   Note: When removing the stem, Type I, torque arm (19), packing flange (14), gland bushing (13), lantern ring (12) and junk ring (10) will be free and can be removed from the assembly.

5. The valve and parts are now ready for inspection, repairs and replacement of stem, torque arm etc.

1.3 Disassembly Areas 1 and 2 – Parallel Slide Valve – Valve Internal & Mid-Section Problems

Refer to Fig. 3.

The disassembly instructions that are described below will cover two of Velan's basic Parallel Slide Valve designs.

1. The valve should be in a partially open position.

2. Before proceeding with disassembling of valves, check if the valve is equipped with a leak-off pipe option (7). If so, disconnect this first. Leak-off pipes should be cut approximately 6" from the bonnet side and not at the welded joint on the bonnet.

3. Loosen packing flange nuts (18) and remove packing rings (11) in accordance with Section IVa, Para. 1.1, Removal of Packing Rings.

4. One of Velan's Parallel Slide Valve designs has a stroke limiter (45) mounted on the top of the valve stem as shown in Fig. 38. The important point one must note is the distance the stud (47) extends out of the stroke limiter (45) as shown in Fig. 38. This distance regulates the position of the two discs in this style of Parallel Slide Valve.

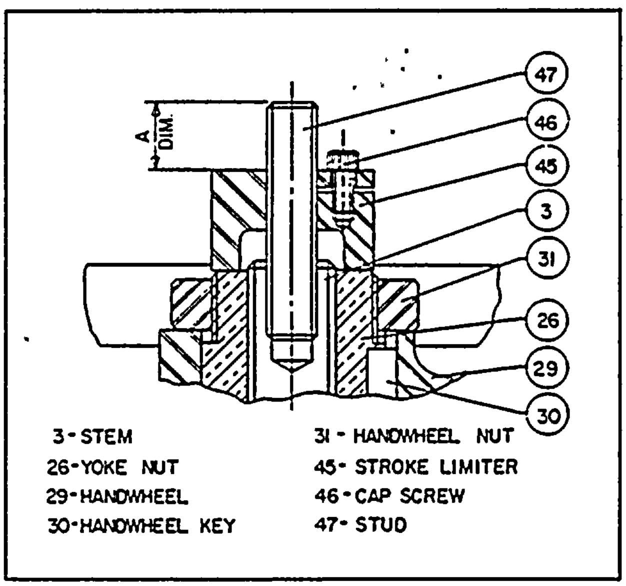


Fig. 38

5. After the distance has been noted, remove stroke limiter (45).

6. Remove the small handwheel nut set screw (32) in handwheel nut (31) before removing handwheel nut and then unscrew handwheel nut.

7. After the handwheel nut has been removed, pull off the handwheel (29).

8. Loosen and remove housing cover bolting (33). Lift housing cover (27) up over yoke nut (26) and stem (3).

9. Remove first set of bearings (25), (3 pieces).

10. Unscrew yoke nut (26) from stem (3).

11. After the yoke nut has been removed, remove second set of bearings (25), (3 pieces).

12. Remove body-bonnet nuts (6).

13. Once all the nuts are removed, the entire yoke-bonnet assembly can be lifted from the valve body as shown in Fig. 39.

Note: When lifting the yoke-bonnet assembly, the stem and discs must stay in the valve body. It is possible that the springs, which are between the two discs, could fall into the valve body. One must be careful of not allowing the discs to open up.

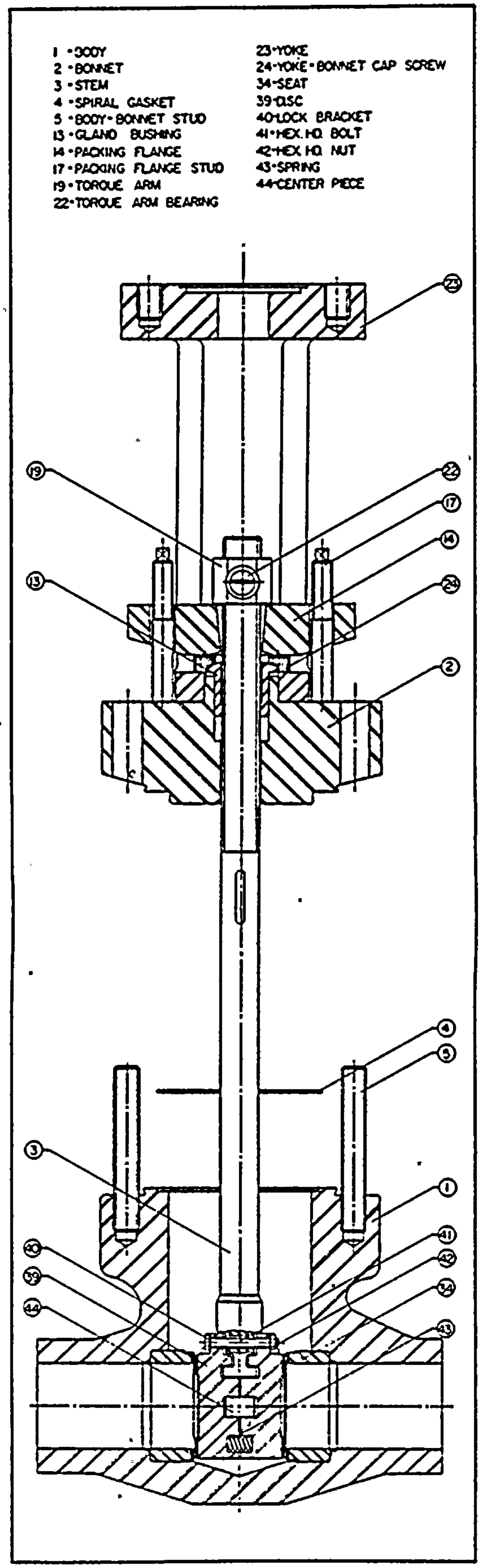


Fig. 39

14. Before removing the discs from the stem, note the orientation of the discs with respect to the torque arm keyway in the stem. Each disc has an identification mark on it which corresponds to an equivalent mark on a seat in the body. These seats and discs must be mated when reassembling.

15. For removal of the stem and discs, use a parallel slide disc clamp. Fig. 40 shows the general principle of the clamp.

Adjusted screws (1) should be slackened (counter-clockwise rotation) sufficiently to allow the tips of the arm (2) to be placed over the two discs. The tips should be placed slightly below the centreline of the discs. Tighten the adjusting screws until the discs are free from seats. Now lift total stem, discs and clamp out of the valve body.

16. (a) **Style I Fig. 41**

Disassemble discs from the stem. The lock brackets (40) must be opened by prying the tab upwards. The discs (39) can be removed for lapping, if required, by removing bolt (41) and nut (42).

NOTE: If the bolt and nut are removed, carefully store the springs (43) and centering piece (44). These should be identified for the valve size involved.

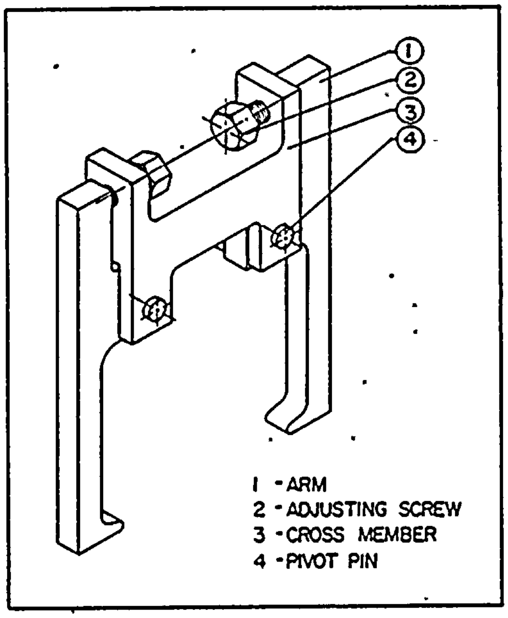


Fig. 40

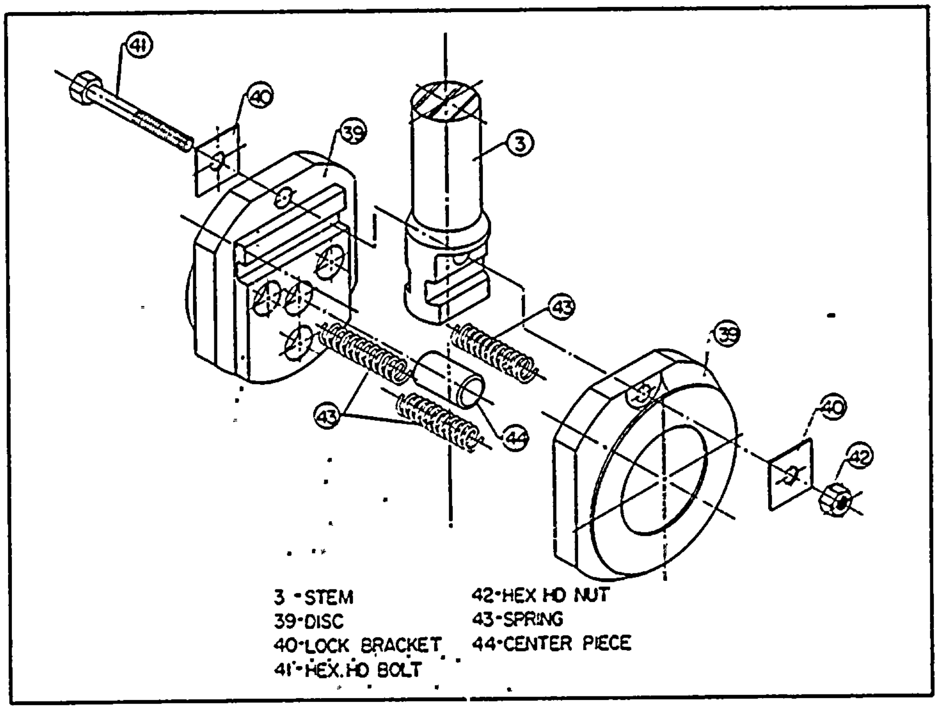


Fig. 41

16. (b) **Style II Fig. 42**

Disassemble discs from the stem and disengage the stem (3) from the disc carrier (51) by pushing stem T out of slot in the disc carrier. Remove the disc retainer (52) and disc will spring apart. Carefully store the springs (43). These should be identified for the valve size involved.

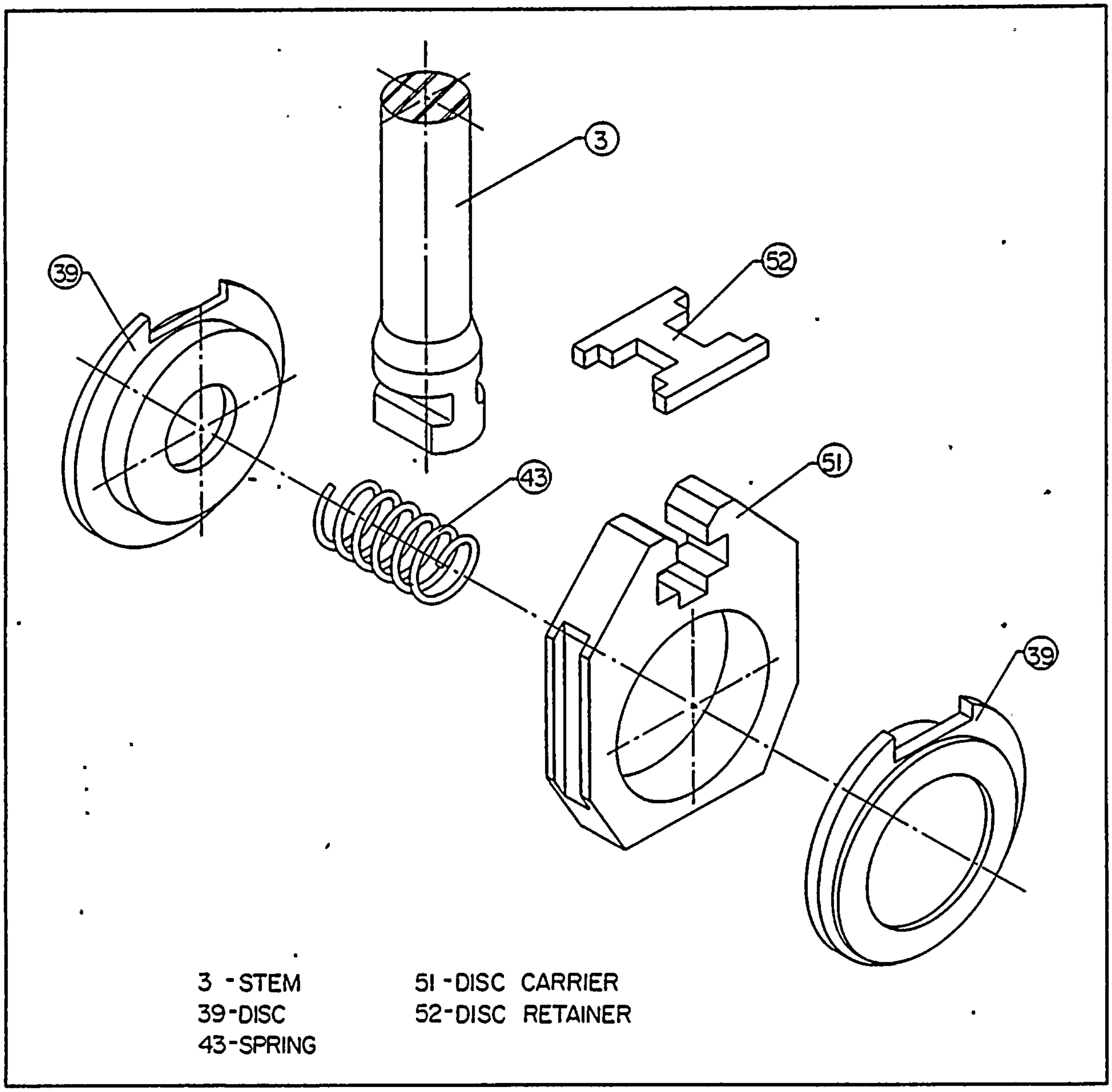


Fig. 42

17. The valve is now ready for inspection and repairs of seat, disc, stem, etc.

1.4 Disassembly Area 3 – Valve Top Works

The disassembly instructions that are described below will cover four of Velan's basic valve designs (Gate, Globe, Stop-Check, Parallel Slide).

1. If line pressure is maintained in the valve, backseat the valve in full open position before starting any disassembly in Area 3.

2. Remove small set screw (32) in handwheel nut (31), then unscrew handwheel nut.

   Note:
   Important – see Step 4 of Section V, Para. 1.3, Disassembly Area 1 and 2 Parallel Slide Valve, before removing stroke limiter. If the type of valve you are disassembling is a parallel slide, Style I, remove stroke limiter (45) at the top of the stem.

3. Remove handwheel (29).

4. Remove housing cover bolting (33) and remove housing cover (27).

5. Remove first set of bearing (25) (3 pieces).

6. Unscrew yoke nut (26) from the stem (3).

7. After the yoke nut has been removed, remove second set of bearings (25).

8. Now valve and parts are ready for inspection, repairs and replacement of yoke nut, bearing, etc.

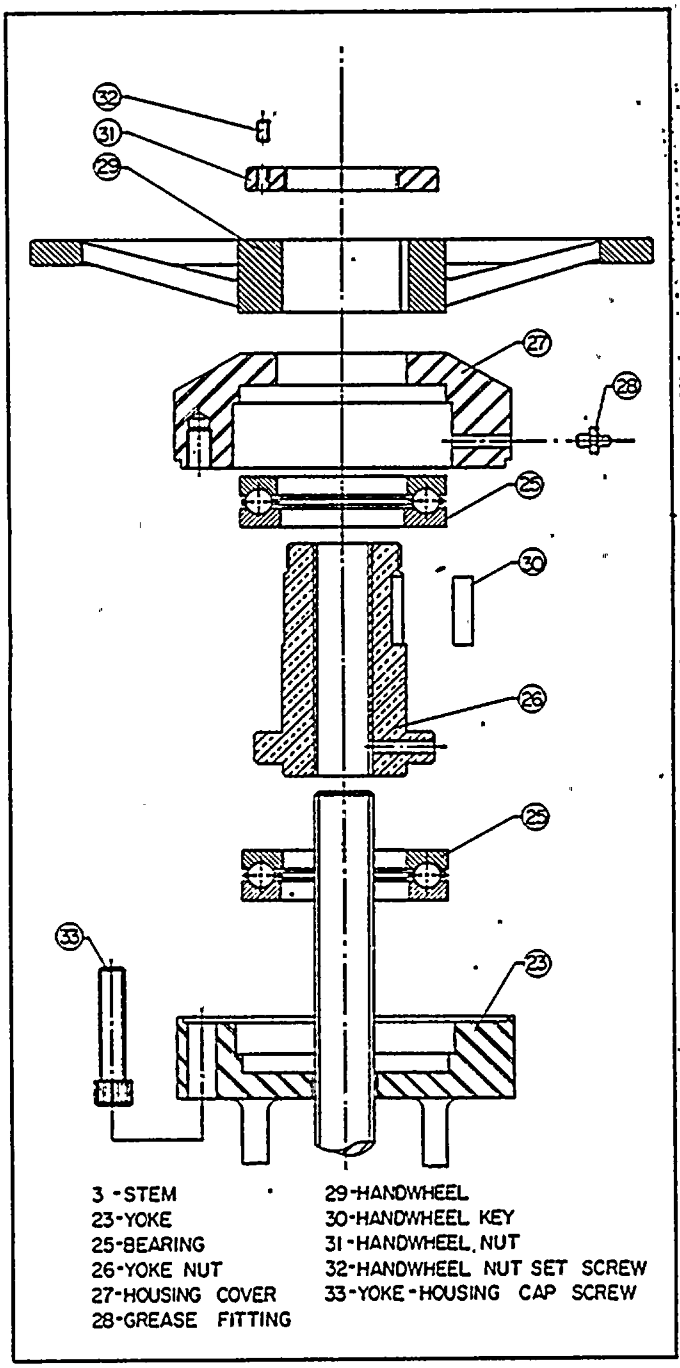


Fig. 43

1.5 **Disassembly Area 1 – Check Valves**

Valve Internal Problems

1. Remove body-cover nuts (4).

2. Once all the nuts are removed, the cover (2) and spiral gasket can be lifted from the valve body as shown in Fig. 44.

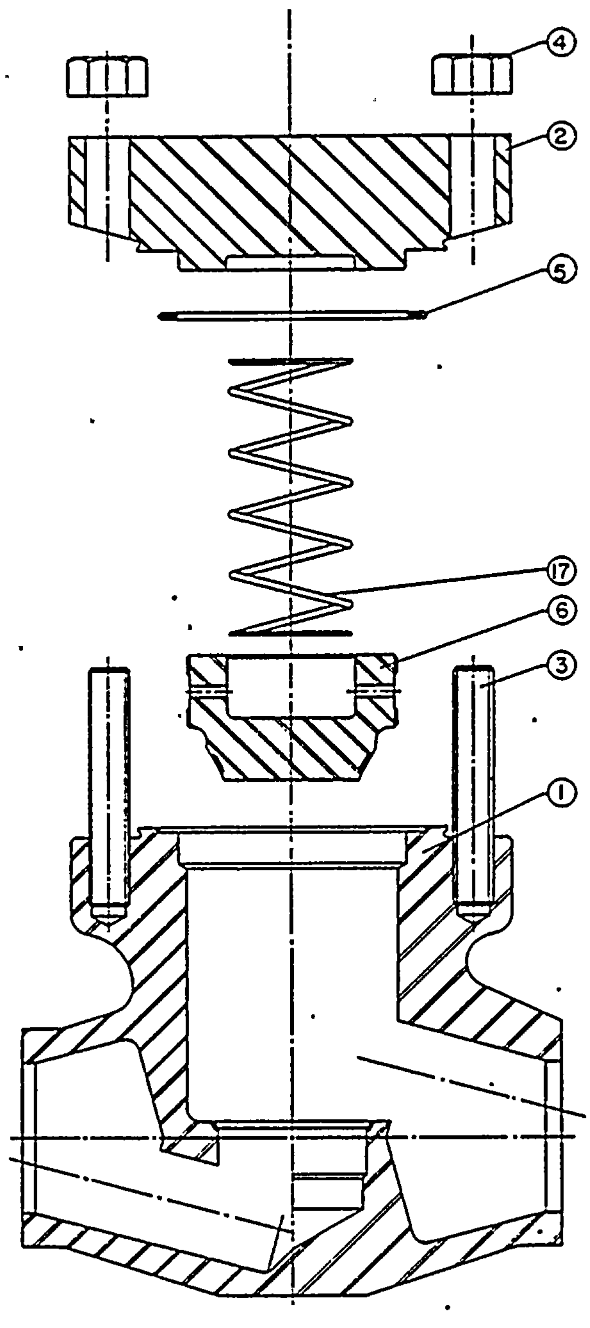
3. The valve is now ready for inspection. At this point of the disassembling procedure, inspect the rotation of the disc on the hanger alignment between the disc and seat. Ensure that the hanger has free movement and is not seized or cannot be restricted by any internal part.

4. After inspecting all points mentioned above, remove all internal parts by unfolding the lock bracket or tab washer (11) around the hex HD bolt (10) in body.

5. After hex HD bolts (10) have been removed, the internal assembly can be lifted from the body.

Note:
Velan has four major styles of swing checks.
a) Style I Fig. 45 (a) (b)
b) Style II Fig. 46 (a) (b)
c) Style III Fig. 47 (a) (b)
d) Style IV Fig. 48 (a) (b)
All four styles can be disassembled in the same manner.

6. If the type of valve you are disassembling is a piston check, refer to Fig. 44. The disc (6) and spring (17) must be lifted from the valve body after the cover has been removed.



1 - BODY
2 - COVER
3 - BODY - COVER STUD
4 - BODY - COVER NUT
5 - SPIRAL GASKET
6 - DISC
17 - SPRING

Fig. 44

6. (a) **Style I, Fig. 45 (a) (b)**

Hanger Pin (9) can be pushed out of hanger (7) and hanger bracket (14). Hanger will disengage from hanger bracket. There are four bushings (8) in this style. Two bushings in the hanger and two in the bracket.

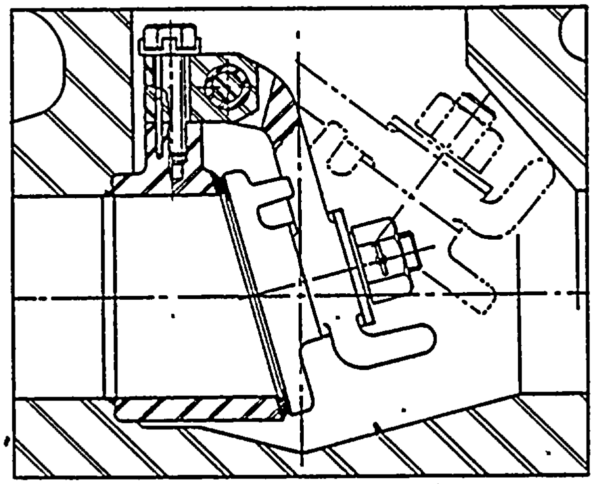


Fig. 45 (a)

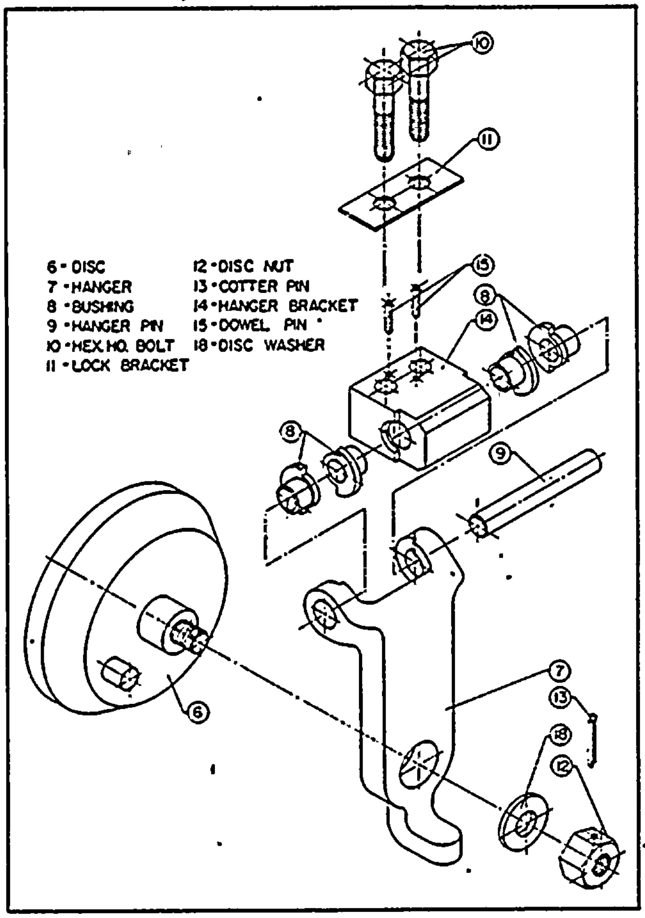


Fig. 45 (b)

6. (b) **Style II, Fig. 46 (a) (b)**

Push hanger pin (9) out of the hanger (7). Remove two washers (19) from the pin. Push bushing (8) out of hanger.

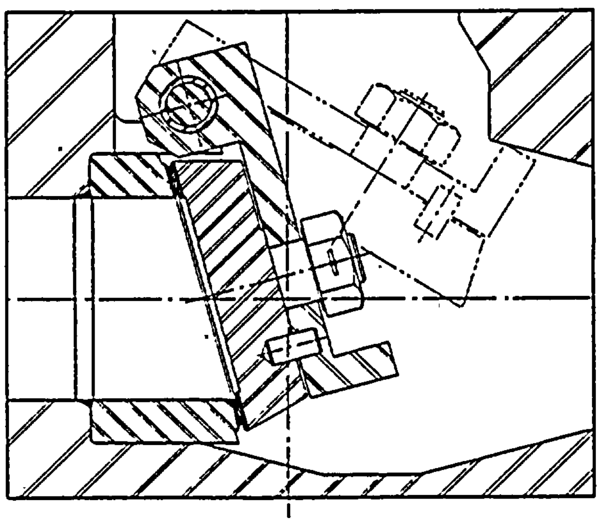


Fig. 46 (a)

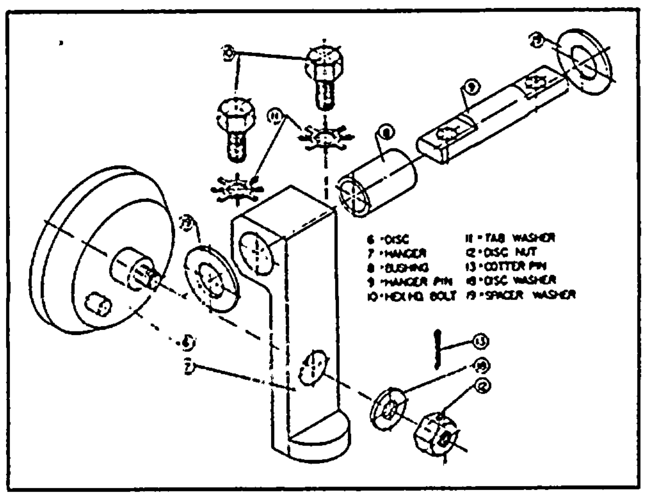


Fig. 46 (b)

6. (c) **Style III Fig. 47 (a) (b)**

Hanger Pin (9) can be pushed out of the hanger (7) and hanger ring (14). Hanger will disengage from hanger ring. There are four bushings (8) in this style – two bushings in the hanger and two in the hanger ring.

Fig. 47 (a)

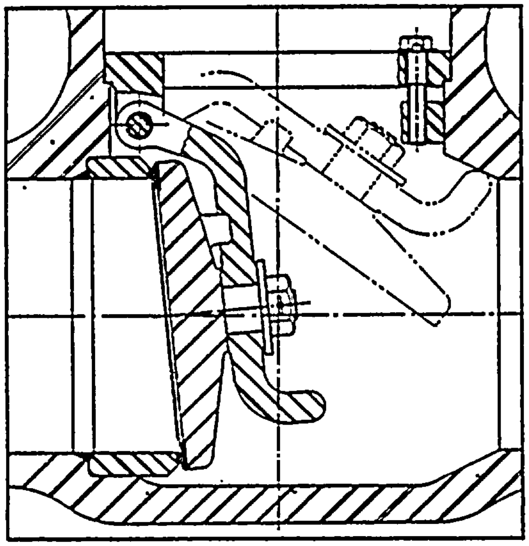
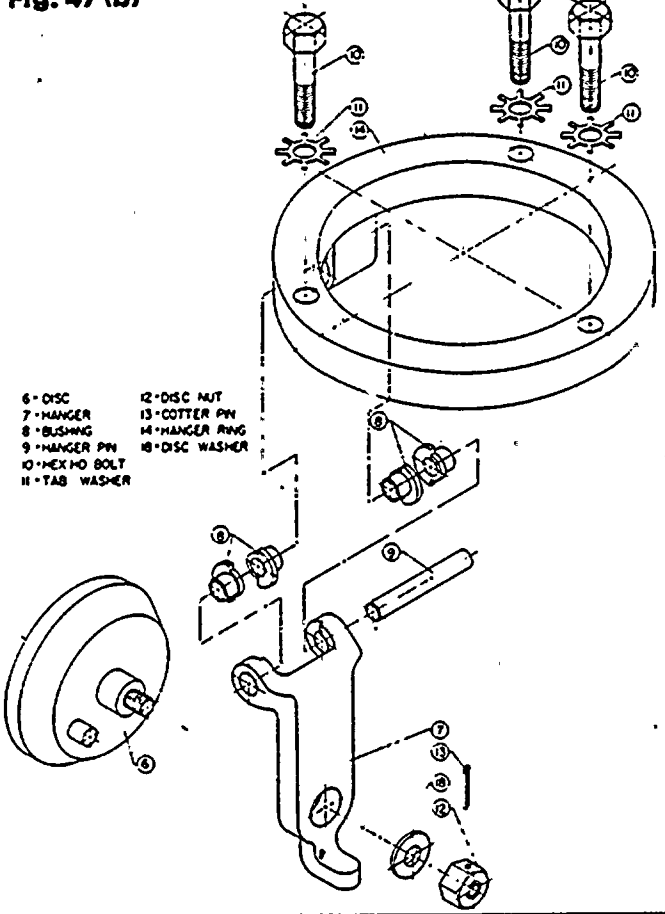


Fig. 47 (b)

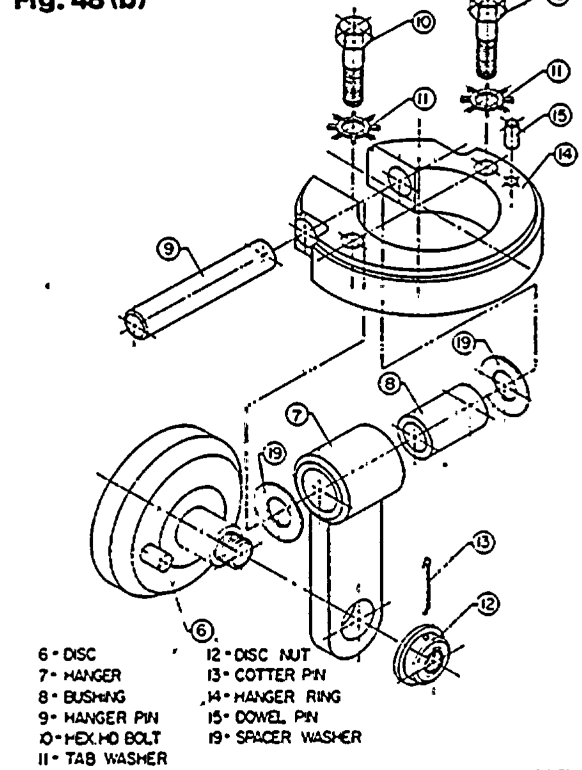


6. (d) **Style IV Fig. 48 (a) (b)**

Push hanger pin (9) out of hanger ring (14) and hanger (7). Push bushing (8) out of hanger (8).

7. To remove disc (6) from hanger (7), remove cotter pin (13) from disc nut (12). Unscrew disc and remove disc washer (18) and disc (6). Now all parts are ready for inspection and repairs of disc, seat, bushing, etc.

Fig. 48 (b)



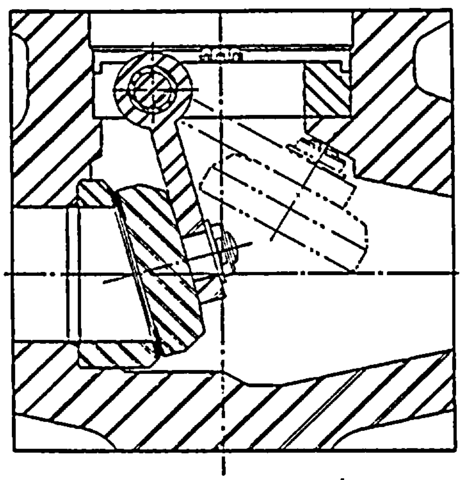


Fig. 48 (a)

VI REASSEMBLY

1.0 General

The reassembly procedures are not as detailed as the disassembly procedures since, in most cases, the reverse procedure is required.

1. The most important fact to be considered is the cleanliness of all parts. All rust and dirt should be removed from all parts with a wire brush or emery cloth. Oil and grease should have been removed with suitable solvents.

2. All threaded parts (capscrew, nuts, studs) must be well re-lubricated. The stem and yoke nut threads should be clean of old grease before a new application of grease is applied to the threads. All recommended lubricants can be found in Section III, Para. 1.1.

   Note: Use correct lubricant for each individual part.

3. Repaired or replacement parts must be checked to see if all repair procedures have been done and that all replacement parts (e.g. packing rings, spiral gasket, etc.), have been checked for size so that they will fit into the valve you are servicing.

4. All orientation marks assigned during disassembly must be observed so that correct orientation is maintained.

1.1 Reassembly Area 3 – Valve Top Works

The reassembly procedures in Area 3 are, in most cases, the reverse procedure of Disassembly Area 3.

1. Apply new grease to threaded portion of stem (3) above top flange on yoke (23).

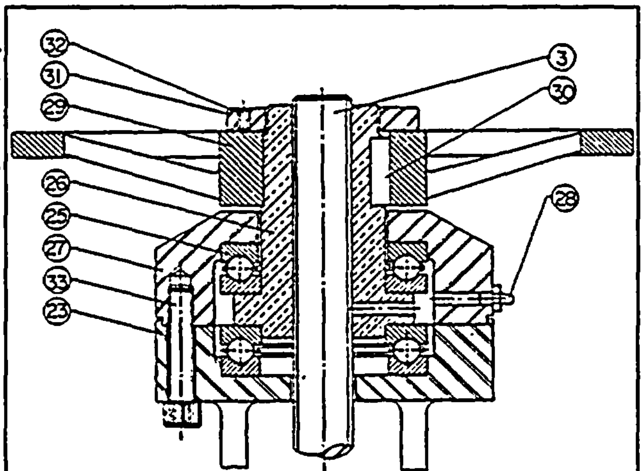
2. Mount second set of newly greased bearings (25) in recess of yoke.

   Note: Bottom race must fit loosely around yoke nut and top race must be tight around yoke nut. See Fig. 49.

3. Apply new grease to internal thread in yoke nut (26) and turn yoke nut on stem.

4. Mount first set of newly greased bearings (25) on yoke nut.

   Note: Bottom race must fit tightly around yoke nut and top race must be loose.



3 -STEM
23-YOKE
25-BEARING
26-YOKE NUT
27-HOUSING COVER
28-GREASE FITTING
29-HANDWHEEL
30-HANDWHEEL KEY
31-HANDWHEEL NUT
32-HANDWHEEL NUT SET SCREW
33-YOKE-HOUSING CAP SCREW

Fig. 49

5. After the bearing and yoke nut are in place, mount housing cover (27) on top. Tie down housing cover with the use of housing cover bolting (33). Bolting must be torqued down in accordance with torque values found in Table E.

6. Insert handwheel key (30) in keyway in yoke nut and mount handwheel (29).

7. Return handwheel nut (31) and tighten. Use handwheel nut set screw (32) to lock handwheel nut in place.

8. Inject more new grease into housing cover by the use of grease fitting found on side of housing cover.

   Note: If the type of valve being reassembled is a parallel slide, return stroke limiter (45) to the top of the stem.
   Important: The distance the stud extends out of the top of the stroke limiter must be the same as noted when disassembling valve.

9. Verify operation by cycling at least once from fully open to fully closed position.

1.2 Torque Values – Operator, Yoke/Bonnet Bolting

The torque values given in Table E are for all other bolting except body-bonnet, body-cover or packing flange stud.

TABLE E

	TORQUE VALUES	
Thread Size	Bolting Material	
	B7, A-574, 630	B8, B8M
3/8-16UNC	30	10
7/16-14UNC	45	15
1/2-13UNC	75	25
9/16-12UNC	105	35
5/8-11UNC	145	50
3/4-10UNC	255	85
7/8- 9UNC	405	135
1- 8UNC	615	205
1-1/8- 8UN	900	300
1-1/4- 8UN	1270	425
1-3/8- 8UN	1725	575
1-1/2- 8UN	2280	760
1-5/8- 8UN	2935	980
1-3/4- 8UN	3715	1240
1-7/8- 8UN	4615	1540
2- 8UN	5650	1885

1.3 Reassembly Areas 1 and 2 – Valve Internal & Mid-Section

Gate, Globe, Stop-Check Valves

The reassembly instructins that are described below will cover three of Velan's basic valve designs (gate, globe, stop-check). The reassembly procedures in Areas 1 and 2 are, in most cases, the reverse procedures of Disassembly Areas 1 and 2.

1. (a) **Gate Valve Fig. 33(a)**

   Place wedge on T-head of stem making sure that the marked up side of the wedge mates with the marked up seat in the body. This is extremely important on valves with welded in seats to ensure optimum sealing.

   (b) **Globe Valve Fig. 34**

   Install small thrust pad (50) into disc so that it fits into recess in bottom of disc (37). Place stem collar (48) around groove on stem (3). Install stem and stem collar in disc and tighten down with disc union. Check if disc can be rotated. If disc can be rocked, it is correctly installed on stem. The rocking will allow the disc to self-align itself to the seat.

   Tack weld disc union to disc in three or four places depending on the valve size. Check again to see if the disc can rock after tack welding has cooled.

   (c) **Stop-Check Valve Fig. 35**

   Insert disc (37) into valve body and then insert spring (38) into disc.

2. Insert stem through the bottom of the bonnet placing junk ring (10), with the knurled side downward into the packing chamber. The lantern ring (12), gland bushing (13), packing flange (14), and Type I torque arm (19) must be in correct positions before turning stem into yoke nut (26).

   Note: Turn stem into yoke nut one turn only and then apply new grease to thread portion of stem below top flange of yoke. After new grease has been applied, turn stem into the yoke nut until approximately one inch of stem extends out of top of yoke nut.

3. Place new spiral gasket in recess on top mounting face of body, follow cleanliness and lubrication instruction as described in Section IV(b), Para. 1.4

4. Line up bonnet-yoke assembly with body and lower onto the body. It is extremely important to prevent the gasket from getting damaged when aligning a heavy bonnet assembly on the body.

5. Apply recommended lubricant to the body-bonnet (5) stud and then install body-bonnet nuts (6). Tighten body-bonnet nuts in strict accordance with Section IV(b), Para. 1.2.

   Caution: Do not tighten body-bonnet nuts when wedge, disc, etc., is in fully closed position.

6. Mount packing flange nut (18) and live loading option and torque down in accordance with Section IV(a), Para. 1.6

   Note: If the valve is equipped with a live loading option, live loading parts must return in the same order as noted in disassembly.

7. Mount torque arm on stem (3) and make sure the key (21) is fitting properly in the stem and torque arm keyway.

8. Verify operation by cycling at least three times from fully opened to fully closed position.

1.4 Reassembly Areas 1 and 2 – Parallel Slide Valves

Valve Internal and Mid-Section

The reassembly instructions that are described below will cover Velan's basic parallel slide valve designs.

Refer to Fig. 41 Style I

1. a) Install the three springs (43) and centering piece (44) into the respective holes in the discs (39). Slip T-head of stem (3) into the machined grooves.

   Note: The discs should be orientated about the torque arm keyway as noted during disassembly.

Insert the bolt and lock bracket. The two discs should be pressed together against the stem with the bolt head firmly pressed against its lock bracket, thread nut on to the bolt until there is a gap of .060-.070 between the nut and the lock bracket. Lock both brackets.

Refer to Fig. 42 Style II

1. b) Install the springs (43) into the respective holes in the discs (39).

   Install disc into the disc carrier (51), use disc retainer (52) and lock disc (39) into place. Discs shown have a gap of .060"-.070" between them.

   The discs are now assembled with the proper "float" allowance.

   Slide T-head on the stem(3) into T-slot on top of disc carrier (51).

2. In order to assemble some valves it is necessary to use a clamp to keep the discs together when guiding them into the seats. Refer to Fig. 40.

3. With the clamp in place, the discs can be lowered into the seats. As soon as the discs are engaged in the seats (about 1"), the clamp can be removed. The discs can now be inserted fully into the seats by means of the stem.

4. Place new spiral gasket in recess on top mounting face of body. Follow cleanliness and lubrication instruction as described in Section IV(b), Para. 1.4. Refer to Fig. 39.

5. Line up the bonnet-yoke assembly with the body and lower onto the body. It is extremely important that one prevents the gasket from becoming damaged when aligning the heavy bonnet assembly onto the body.

Note: When lowering the bonnet-yoke assembly, place the junk ring (10) with the knurled side downward into the packing chamber. The lantern ring (12), gland bushing (13), packing flange (14), and Type 1 torque arm (19) must be in correct positions before stem enters top flange on yoke.

6. Apply recommended lubricant to body-bonnet studs (5) and then install body-bonnet nuts (6). Tighten body-bonnet nuts in strict accordance with Section IV(b), Para. 1.2.

Caution: Do not tighten body-bonnet nuts when discs are in a fully closed position.

7. Now continue step-by-step reassembly procedures as described in Section VI, Para. 1.1 – Reassembly Area 3.

8. Repack valve in accordance with Section IV(a), Para. 1.4.

9. Mount packing flange nut (18) and live loading option and torque down in accordance with Section IV(a), Para. 1.6.

Note: If the valve is equipped with a live loading option, live loading parts must return in the same order as noted in disassembly.

10. Mount torque arm on stem and make sure the key is fitting properly in the stem and torque arm keyway.

11. Verify operation by cycling at least three times from fully open to fully closed position.

1.5 Reassembly Area 1 – Check Valves

Valve Internal

1. Mount disc (6) on hanger (7), tighten disc nut (12) and lock in place with cotter pin (13). Check if disc can rotate freely on hanger.

2. a) **Style I, Figs. 45 (a) (b)**

   Place two bushings (8) in hanger and two bushings in hanger bracket (14). Insert hanger pin (9) into hanger (7) and push pin through the hanger bracket into opposite side of hanger.

   b) **Style II, Figs. 46 (a) (b)**

   Push bushing (8) into hanger and insert hanger pin (9) into bushing. Place one washer on each side of hanger pin.

(c) **Style III, Figs. 47 (a) (b)**

Place two bushings (8) in hanger and two bushings in hanger ring (14). Insert the hanger pin (9) into the hanger (7) and push pin through the hanger ring to the opposite side of the hanger.

(d) **Style IV, Figs. 48 (a) (b)**

Push bushing (8) into the hanger (7) and insert the hanger pin (9) into the hanger ring (14). Push pin through the bushing to the opposite side of the hanger ring.

3. Place entire assembly carefully back into the body making sure that the hanger pin can move freely in an axial direction.

4. Insert lock bracket or tab washer (11) and tighten down with hex bolts (10). Lock the bolts by turning up the ears on the lock brackets.

5. After installation is finished, check the rotation of the disc on the hanger and the alignment between the disc and seat.

6. With regard to the piston check valve (Fig. 44), insert the disc (6) and the spring (17) back into the valve body.

7. Place the new spiral gasket (5) in the recess on the top mounting of the body. Follow cleanliness and lubrication instruction as described in Section IV(b), Para. 1.4.

8. Line up the cover with the body and lower onto the body. It is extremely important to prevent the gasket from becoming damaged when aligning the heavy cover to the body.

9. Apply the recommended lubricant to the body-cover studs (3) and then screw on the body-cover nuts (4). Tighten the body-cover nuts in strict accordance with Section IV(b) Para. 1.2.

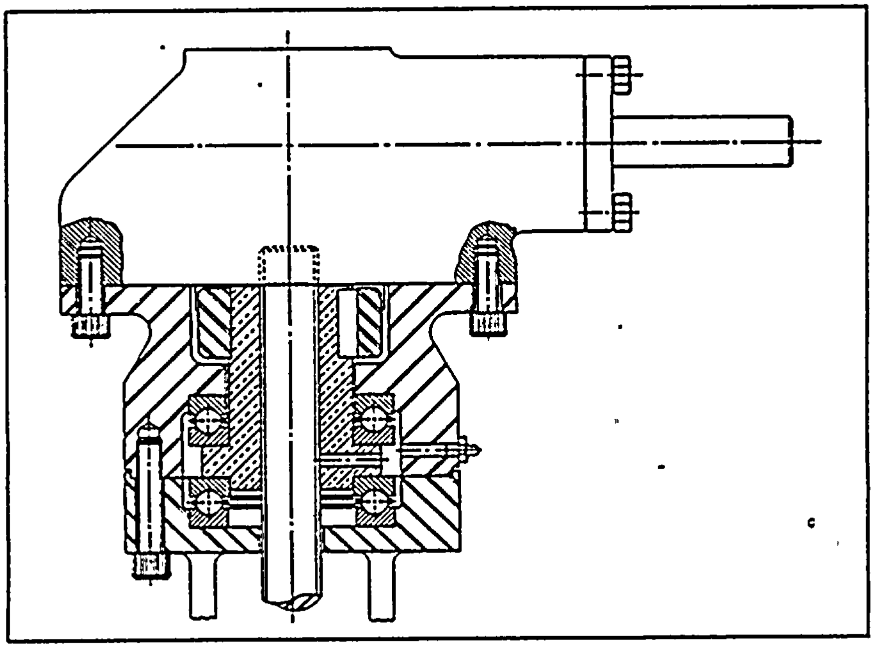
APPENDIX A

1.0 Procedure for Removing Manual Gear Actuator

Velan valves can be equipped with a variety of manual gear actuators. Actuators of this type come in two main styles.

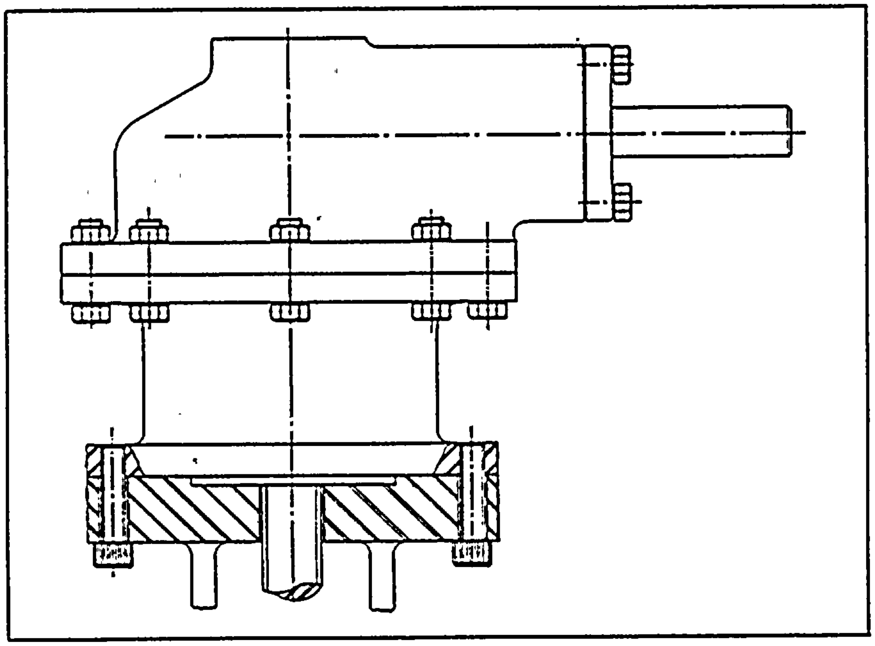
a) **Style I (Fig. 50)**

Applications where only rotary torque is required.



b) **Style II (Fig. 51)**

Applications where both rotary torque and linear thrust are required.



Generally, all pressure must be relieved from both sides of the valve before removal of the manual gear actuator is started. Exceptions to this rule can be found when valves have a self-contained thrust unit.

Important: Determine the style actuator that is mounted on the valve you are servicing. If it is not possible to determine the style of actuator, it is best to refer to the actuator manufacturer's maintenance and instruction manual or get in touch with your local Velan representative for more technical assistance.

1.1 Removing Style I – (Fig. 52)

1. With the Style I manual gear actuator, the valve will be equipped with a self-contained thrust unit. This actuator can be removed under line pressure.
2. Remove housing-actuator bolting (56).
3. Using a hoist, raise the actuator (53) above the stem (3) and yoke nut (26).
4. For repairs to the actuator, refer to the manufacturer's maintenance and instruction manual. If there is further work to do on the valve, refer to the proper valve disassembly and maintenance section in this manual.
5. The disassembly of the self-contained thrust unit will follow the same procedure as described in Area 3 Valve Top Works.

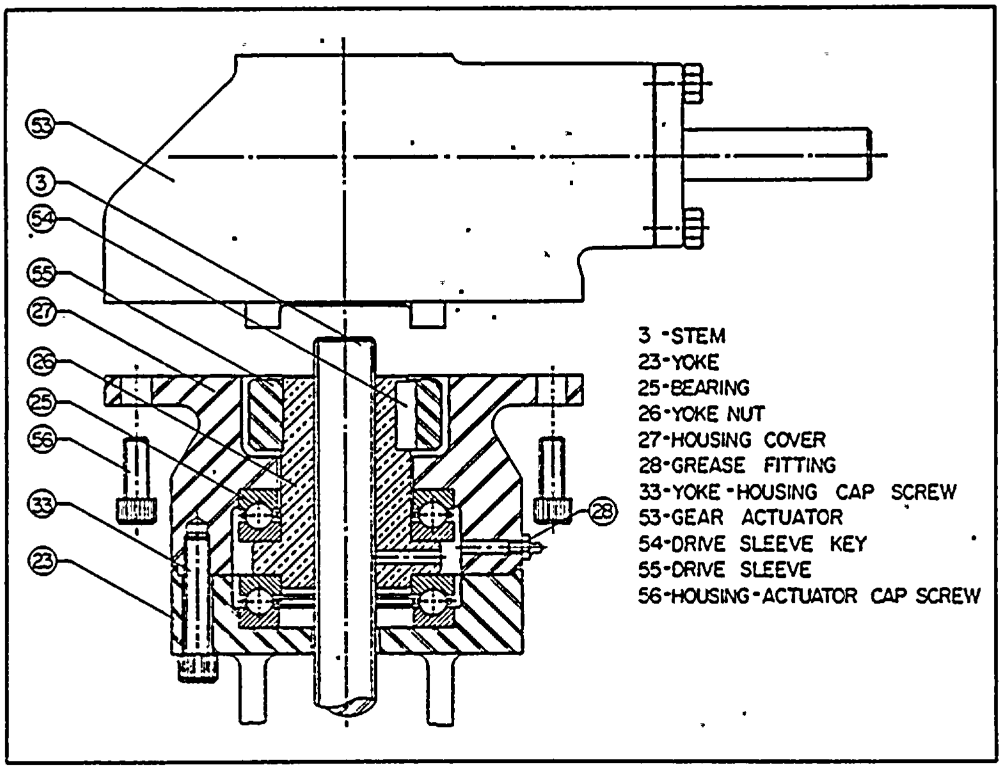


Fig. 52

1.2 **Removing Style II – (Fig. 53)**

1. With the Style II manual gear actuator, the actuator will be equipped with a self-contained thrust unit and will be removed with the actuator. Therefore, this actuator cannot be removed under line pressure. The pressure must be relieved.

2. The valve should be in a partially open position.

3. Make sure that the packing flange nuts (18) are tight.

4. Remove the yoke-actuator bolting (56).

5. Turn the actuator handwheel to close the valve. This will cause the actuator (53) to rise and unthread from the valve stem. As this takes place, the weight of the actuator should be supported by a hoist to prevent any damage to the stem thread or any internal part of the valve.

6. For repairs to the actuator, refer to the manufacturer's maintenance and instruction manual. If there is further work to be done on the valve, refer to the proper valve disassembly and maintenance section in this manual.

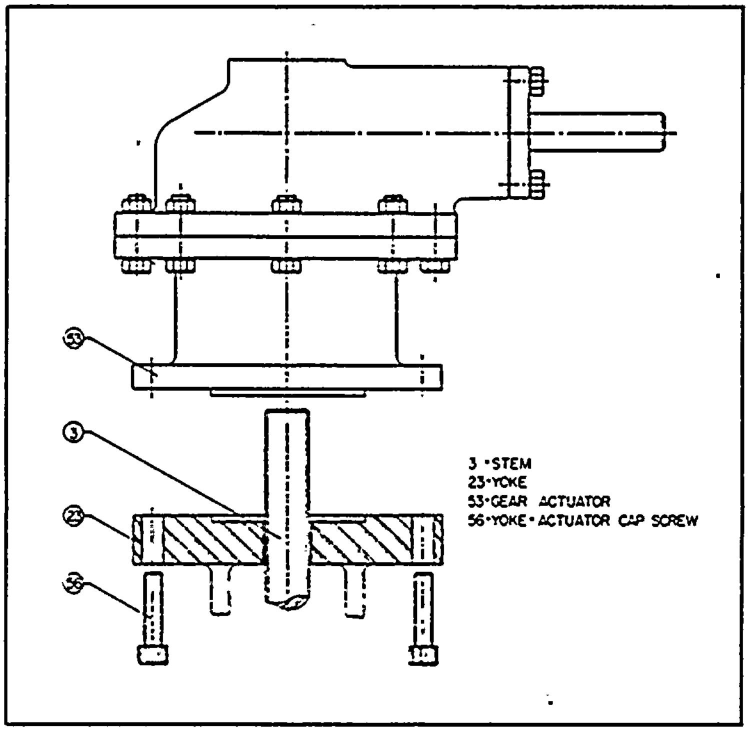


Fig. 53

APPENDIX B

1.0 Procedures for Removing Motor Actuator

Velan valves can be equipped with a variety of electrical motor actuators. Motor actuators are mounted through two different methods. Some units are directly attached to the yoke (Fig. 54), and some units are attached to an adaptor plate and then to the valve yoke (Fig. 55). Both methods have the same removal procedure.

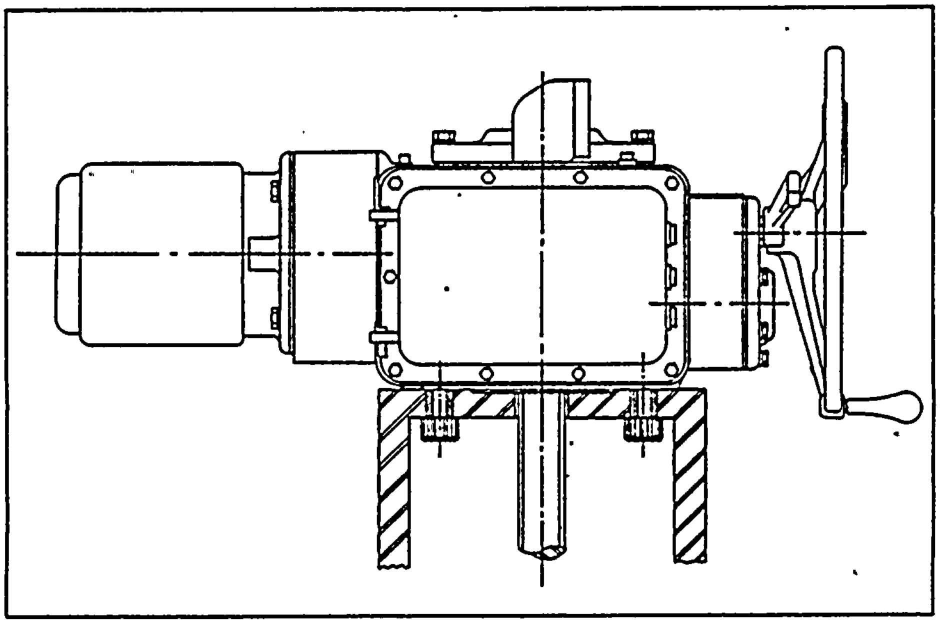


Fig. 54

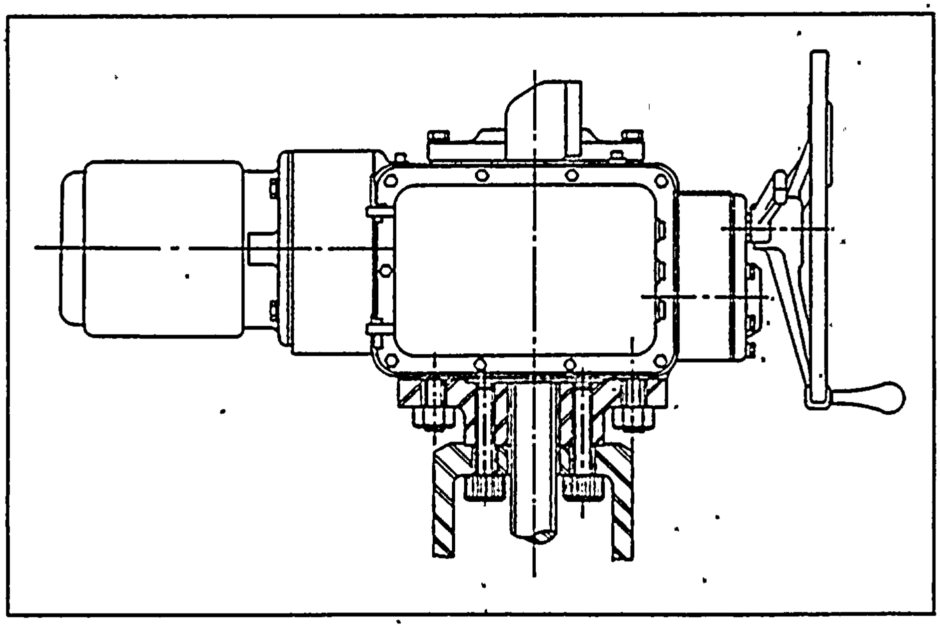


Fig. 55

IMPORTANT POINTS

The torque switch of the motor actuated valve is set during factory assembly to close the valve against the specified differential pressure and requires the same special attention for resetting.

WARNING

Should it become necessary to change the torque switch setting, for any reason, your local Velan representative should be contacted in order that a correct new setting can be obtained from the factory.

CAUTION

- If for any reason the valve packing type is changed, it may be necessary to change the torque switch setting.

- Upon reassembly of a valve equipped with an electo-mechanical actuator, the open and close limit switches must be reset. Please refer to the maintenance and instruction manual provided by the actuator manufacturer for appropriate instruction.

- 1) When checking for proper rotation of the electrical actuator, make sure that the valve is in its mid stroke position. If the three phase wiring connection is incorrect, the valve will close when the open button is pressed, and the close torque switch will not function, thus causing possible damage to the valve. If the valve does not travel in the correct direction, then simply interchange any two of the three power connections.

  2) When checking for full stroke of the valve without pressure in the line, it is strongly recommended that the closing torque switch is set to its minimum value which will close the valve, until all testing is finished. The torque switch should then be reset to its recommended value.

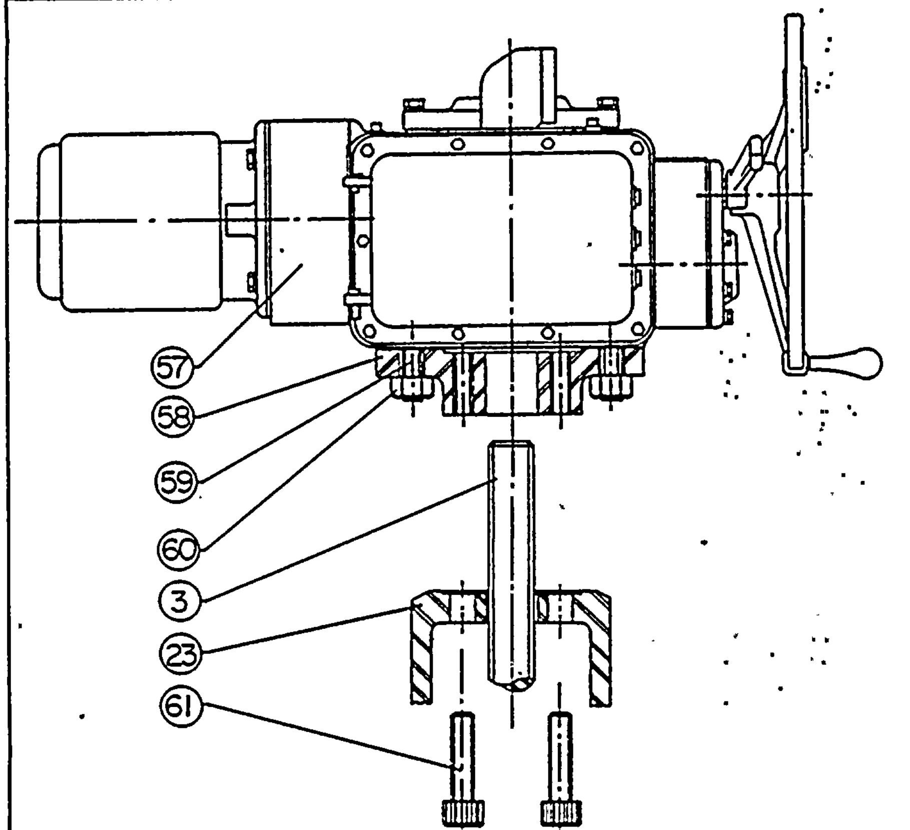
  3) It is customary to bypass the torque switch at the beginning of the opening stroke on gate type valves. This allows the full torque of the motor to be developed in case the wedge has become excessively tight in the seats. This is accomplished with a jumper between a closed limit switch and the open torque switch.

  Refer to the actuator manual for complete details. If problems are encountered, call the valve or the actuator manufacturer.

Refer to Fig. 56

1. All pressure must be relieved from both sides of the valve before the removal of the motor actuator is started.
2. The valve should be in a partially open position.
3. Disconnect the electrical wiring from the actuator.
4. Tighten the packing flange nuts (18).
5. Remove all actuator bolting (56) from the underside of the yoke flange.
6. All electrical actuators have an automatic handwheel declutching arrangement. In most cases, move the lever from the motor operation position to hand operation position.

   Note: Do not try to force declutch lever into an operating position.
7. Turn the actuator handwheel to close the valve. This will cause the actuator to rise and unthread itself from the valve stem. As this takes place, the weight of the actuator should be supported by a hoist to prevent damage to the stem or to internal parts of the valve.
8. If further disassembly of the actuator is required, refer to the maintenance manual provided by the actuator manufacturer.
9. If there is further work to be performed on the valve, refer to the proper valve disassembly.... and maintenance section in this manual.



3 - STEM
23 - YOKE
57 - MOTOR ACTUATOR
58 - ADAPTOR PLATE
59 - ADAPTOR - ACTUATOR STUD
60 - ADAPTOR - ACTUATOR NUT
61 - YOKE - ADAPTOR CAP SCREW

Fig. 56

APPENDIX C

1.0 Procedure for Removing Hydraulic or Pneumatic Actuator

Refer to Fig. 57

The following instructions will give you a general guide to the removal and re-installation of a hydraulic or pneumatic actuator.

All hydraulic or pneumatic actuators have a connection between the valve stem and the stem of the actuator. All these connections are formed by some type of coupling. Fig. 58 illustrates some examples fo coupling used on Velan valves. As a rule, examine this connection first to understand how the coupling works.

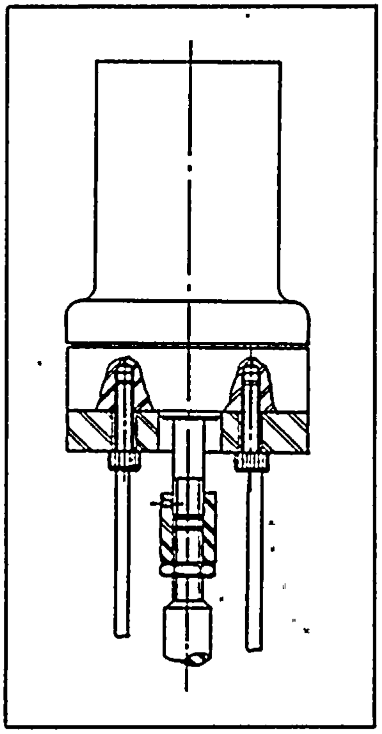


Fig. 57

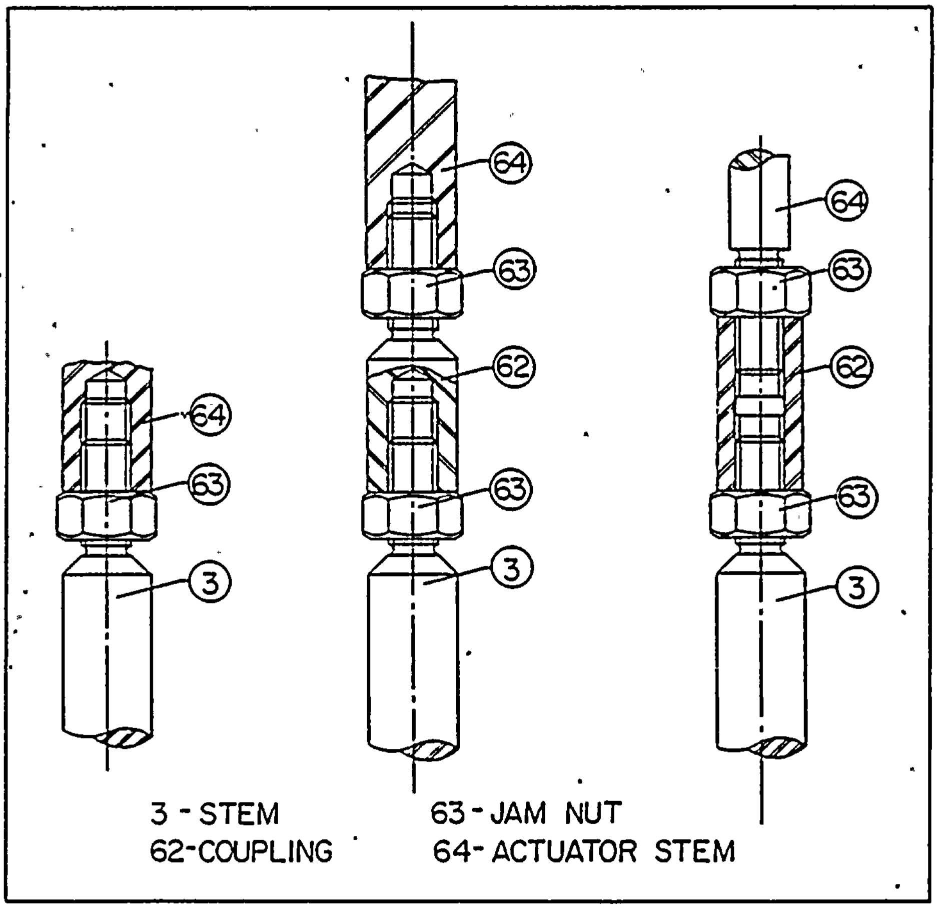


Fig. 58

Removal of Actuators:

Refer to Fig. 59

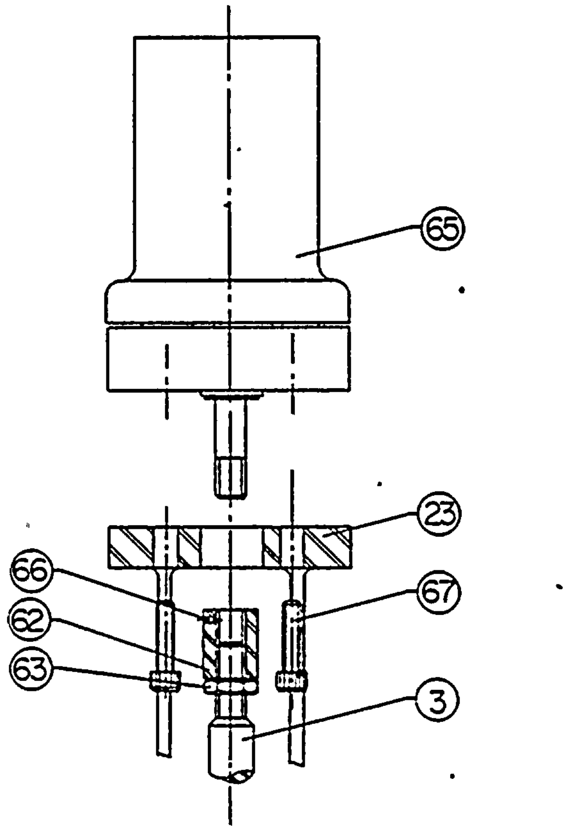
1. All pressure must be relieved from both sides of the valve before removal of actuator is started.
2. All pressure must be relieved from actuator before disassembling is started.
3. Remove yoke-actuator bolting (67).

4. Loosen coupling (62).
   Precaution: Examine coupling (62) for set screw (66) or any locking device before loosening it.

   Note: On some actuators, it is necessary to rotate the actuator stem to remove this connection.
5. When the stem threads are disengaged, lift the actuator (65) clear of the yoke and place it down on a clean area for further disassembly, if required. If further disassembly on the actuator is required, refer to the actuator manufacturer's maintenance and instruction manual.

6. If there is further work to be performed on the valve, refer to the proper valve disassembly section in this manual.

Fig. 59



3 -STEM
23-YOKE
62-COUPLING
63-JAM NUT
65-ACTUATOR
66-COUPLING SET SCREW
67-YOKE-ACTUATOR CAP SCREW

APPENDIX D

1.0 Spare Parts

All parts on any valve can be ordered, but Velan does not recommend the changing of all parts in the field (e.g. integral seat, integral backseat, wedge guides, etc.). The changing of these parts will in some cases require special machining equipment and special fitting. In these cases, it is best to get in touch with your local Velan representative. The representative will assist you in determining the way to restore your valve with a minimum of time and expense.

When ordering spare parts, correctly determine which parts are required. After this is done, present Velan with some of the following information.

1. Velan order number.
2. Velan item number (if more than one item).
3. Velan figure number.

OR

1. Customer order number.
2. Customer item number.
3. Valve size, type and pressure class.

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VELAN

TERMS AND CONDITIONS OF SALE

CONTRACT: Orders are subject to acceptance by the Velan Companies hereinafter referred to as the Seller. No terms or conditions of Purchaser's order contrary to the Seller's terms and conditions shall be binding upon the seller unless specifically agreed to by the Seller in writing.

MINIMUM: order charge $150.00.

PRICES: All quoted prices are subject to change by the Seller without prior notice and, unless otherwise stipulated by Seller, are understood to be F.O.B. Seller's plant, with delivery to carrier constituting delivery to purchaser. Right to possession of the material to secure the payment of the purchase price shall remain in Seller until all payments therefor shall have been fully made. For the protection of the buyer and the seller, verbal customer orders must be confirmed by a formal written urchase order. If a written purchase order is not received within ten days of a verbal order product descriptions, quantities, specification, etc., as set forth in Seller's acknowledgement and invoice shall be conclusive and binding on both parties. Any order that is shipped before receipt of confirmation which might have been entered incorrectly and would require remedial action would be for the buyer's account.

TAXES: All prices are exclusive of taxes. Sales, use and other taxes, by whomsoever levied, are to be paid by the Purchaser, and unless invoiced, are to be paid by the Purchaser direct to the appropriate governmental agency.

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RETURN OF MATERIALS: Materials may be returned only with prior written agreement of seller.

CANCELLATION: Cancellation of orders may be made only with the Seller's written consent and Purchaser shall be subject to cancellation charges.

PRODUCT WARRANTY: Seller warrants the equipment of its own manufacture to be free of defects in material and workmanship, under normal use and proper operation, for a period of one year from date of shipment from Seller's plant. Seller's obligation under this warranty shall be strictly limited, at Seller's option, to: (i) furnishng replacement parts for or repairing without charge to Purchaser, B.O.B. Seller's Plant, or (ii) issuing written authorization for Purchaser or others to replace or repair, without charge to Purchaser, at costs comparable to Seller's normal manufacturing costs those parts proven defective; or (iii) in discharge of Seller's maximum liability herewith, refunding all monies paid by Purchaser to Seller for the Product and, at discretion of Seller, having the product removed and returned to Seller at Purchaser's expense. All transportation charges relative to corrective work, defective parts or replacement parts shall be borne by Purchaser. Purchaser shall give Seller immediate notice upon discovery of any defect. The undertaking of repairs or replacement by Purchaser or its agents without Seller's written consent shall relieve Seller of all responsibility herewith.

Finished materials and accessories purchased from other manufacturers are warranted only to the extent of the manufacturer's warranty to Seller.

Any alteration in material or design of Seller's product or component parts thereof by purchaser or others without written authorization by Seller voids all obligations of Seller regarding the product and any associated warranty herein stated or implied.

Seller's sole liability shall be exclusively as set forth herein, and Seller shall not be liable for any incidental or consequential damages due to its breach of any warranty here in contained, or otherwise. Without limitation to the foregoing, in no event shall Seller be liable for the loss of use of the product or for the loss of use of any other product, process, plant, equipment, or facilities of the Purchaser or the end-user whether partially or wholly due to defects in material and/or workmanship and/or design of Seller's product, and in no event shall Seller be liable for removal of appurtenances or incidentals such as connections, pipe work and similar items of obstruction or for any cost brought about by the necessity of removing the product from its point of installation.

Seller makes no warranty of any kind whatsoever, expressed or implied, other than as specifically stated herein; and there are no warranties of merchantability and/or fitness for a particular purpose which exceed the obligations and warranties specifically stated herein.

Parts furnished without charge as replacements for original parts under warranty are warranted for that period of time during which the original parts warranty is effective.

ALL SHIPMENTS WILL BE F.O.B. PLANT LOCATION.
SHIPMENTS WILL BE MADE VIA MOST ECONOMICAL CARRIERS UNLESS OTHERWISE REQUESTED.
TERMS: NET 30 DAYS FROM DATE OF INVOICE. 1 1/2% PER MONTH ON ALL OVERDUE ACCOUNTS, ALL TAXES EXTRA.
PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

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