Test Report No. 11251.1

No. of Pages 17

Medium Weight Shock and Vibration Test Report on 8x8x13C20 Horizontal Pump w/ 20 HP Motor for Sims Pump Valve Co., Inc. Hoboken, NJ

> NU LABORATORIES, INC. 312 Old Allerton Road, Annandale, NJ (908) 713-9300 <u>WWW.NULABS.COM</u>

71

E-Mail: sales@nulabs.com

21 October 2009

Prepared By	Checked By	Approved By
Paloma J. Geiger	W.J. Hillsinger	R.D. McAdoo
Paloma J. Geiger	Willing Them	Amal
21 October 2009	21 October 2009	21 October 2009

TABLE OF CONTENTS

1.	Purpose of Test	3
2.	Manufacturer	3
3.	Manufacturer's Type or Model No	3
4.	Specifications	3
5.	Number of Items Tested	3
6.	Security Classification of Items	3
7.	Date Testing Completed	
8.	Test Conducted By	3
9.	Test Witnesses	
10.	Disposition of Test Item	3
11.	Abstract	4
12.	Laboratory Conditions	4
13.	Medium Weight Shock Test Description	4
14.	Vibration Test Description	6
	Figures 1-8	9-16
	List of Apparatus	17

1. PURPOSE OF TEST

The purpose of this test is to demonstrate that the 8x8x13C20 Horizontal Pump with 20 HP Motor hereinafter referred to as the "Pump", complies with the requirements of MIL-S-901D when subjected to a nine (9) blow, Grade A, Class I, Type A medium weight shock test and with the requirements of MIL-STD-167-1 when subjected to vibration through the frequency range of 4 Hz through 50 Hz in each of the three (3) major axes.

2. MANUFACTURER

Sims Pump Valve Co., Inc. 1314 Park Ave. Hoboken, NJ 07030

3. MANUFACTURER'S TYPE OR MODEL NO.

8x8x13C20 Horizontal Pump with 20 HP Motor Drawing No.: NS18009-C20

4. SPECIFICATIONS

4.1 MILITARY

MIL-S-901D (NAVY) Military Specification, Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for, dated 17 March 1989

MIL-STD-167-1 (SHIPS) Military Standards Mechanical Vibrations of Shipboard Equipment, dated 1 May 1974

4.2 SIMS PUMP VALVE CO., INC.

Purchase Order No.: 9574

Drawing Number: NS18009-C20

5. NUMBER OF ITEMS TESTED

One (1)

6. SECURITY CLASSIFICATION OF ITEMS None

7. DATE TESTING COMPLETED

9 October 2009 - Shock Testing 18 October 2009 - Vibration Testing

8. TEST CONDUCTED BY

NU Laboratories, Inc. 312 Old Allerton Road Annandale, NJ 08801 (NAVY Certified Shock Test Facility by NAVSEA INST 9491.1C)

9. TEST WITNESSES

Vladimir Spektor, Sims Pump Valve Co., Inc. representative.

10. DISPOSITION OF TEST ITEM

The equipment was returned to Sims Pump Valve Co., Inc.

11. ABSTRACT

The Pump was subjected to a total of nine (9) medium weight shock blows in accordance with the referenced test specifications. Visual inspections performed after each shock blow revealed no discrepancies. Refer to Section 13 for additional information.

The Pump was subjected to vibration through the frequency range of 4 Hz to 50 Hz in each of the three (3) major axes in accordance with the referenced test specifications. Visual inspections, performed after each axis of vibration, revealed no obvious physical damage. Refer to Section 14 for additional information.

12. LABORATORY CONDITIONS

Ambient Temperature: 66° F Relative Humidity: 55% Atmospheric Pressure: 28.89 in. Hg

NOTE: cited conditions are averages of all laboratory conditions recorded throughout testing.

13. MEDIUM WEIGHT SHOCK TEST DESCRIPTION

13.1 TEST SETUP

8x8: Test Inle Two One Eigl Six Nin

Upon receipt, a visual inspection performed on the Pump revealed no obvious physical damage or discrepancies. The Pump was weighed using a digital scale and the weight was recorded in the test log. The dry weight of the Pump was 1843 lbs.

The Pump was attached to a 40" x 55" x 1.5" test plate and the plate was secured to fixture Figure 16 of MIL-S-901D. Fixture Figure 16 of MIL-S-901D was secured to the medium weight shock machine oriented in the first major axis of test. The total weight on the anvil table was 4791.5 lbs. Refer to Table 1 for medium weight shock weights and Figure 1 for photographs of the test setup.

3x13C20 Horizontal Pump with 20 HP Motor	1843 lbs.
st Plate 40"x55"x1.5"	938 lbs.
et and Outlet Flanges	108 lbs.
ro (2) Sets of Combination Channels	234 lbs.
e (1) Set of Standard Channels	83 lbs.
ht (8) Standard Channel Clamps	32 lbs.
(6) Shipbuilding Channel Clamps	34 lbs.
ne (9) T-Blocks w/ Hardware	36 lbs.

Table 1: Group I Medium Weight Shock Test Weights

13.2 TEST CONDITIONS

Nine (9) Spacers

Fixture Figure 13 of MIL-S-901D

Fixture Figure 16 of MIL-S-901D

Condition A: Energized and operating, with a discharge of 11 PSIG.

Condition B: Non-operating and flooded.

Total Weight Fixture Figure 13

Total Weight Fixture Figure 16

13.3 BLOW #1 - CONDITION A

- 13.3.1 Conditions: 30° End Down Axis, 2.25' hammer height, Group #I, 3.0" anvil table travel, fixture Figure 16 of the referenced specifications.
- 13.3.2 Observations: A post-blow visual inspection revealed no obvious physical damage or leakage.
- 13.3.3 Action: Testing was continued.

13.5 lbs.

380 lbs.

1470 lbs.

3701.5 lbs

4791.5 lbs

13.4 BLOW #2 - CONDITION B

- 13.4.1 Conditions: 30° End Down Axis, 3.75' hammer height, Group #II, 3" anvil table travel, fixture Figure 16 of the referenced specifications.
- 13.4.2 Observations: A post-blow visual inspection revealed no obvious physical damage or leakage.
- 13.4.3 Action: Testing was continued.

13.5 BLOW #3 - CONDITION A

- 13.5.1 Conditions: 30° End Down Axis, 3.75' hammer height, Group #III, 1.5" anvil table travel, fixture Figure 16 of the referenced specifications.
- 13.5.2 Observations: A post-blow visual inspection revealed no obvious physical damage or leakage.
- 13.5.3 Action: Testing was continued.

The entire assembly was removed from fixture Figure 16 of MIL-S-901D, rotated and reattached to MIL-S-901D Figure 16 with the side of the Pump facing down. Refer to Figure 1. The total weight on the anvil table remained at 4791.5 pounds.

13.6 BLOW #4 - CONDITION A

- 13.6.1 Conditions: 30° Side Down Axis, 2.25' hammer height, Group #I, 3.0" anvil table travel, fixture Figure 16 of the referenced specifications.
- 13.6.2 Observations: A post-blow visual inspection revealed no obvious physical damage or leakage.
- 13.6.3 Action: Testing was continued.

13.7 BLOW #5 - CONDITION B

- 13.7.1 Conditions: 30° Side Down Axis, 3.75' hammer height, Group #II, 3.0" anvil table travel, fixture Figure 16 of the referenced specifications.
- 13.7.2 Observations: A post-blow visual inspection revealed no obvious physical damage or leakage.
- 13.7.3 Action: Testing was continued.

13.8 BLOW #6 - CONDITION A

- 13.8.1 Conditions: 30° Side Down Axis, 3.75' hammer height, Group #III, 1.5" anvil table travel, fixture Figure 16 of the referenced specifications.
- 13.8.2 Observations: A post-blow visual inspection revealed no obvious physical damage. Leakage around the packing seal was noted. The Sims Pump representative reported that the packing ring was not installed.
- 13.8.3 Action: The packing seal ring was installed per the representative's direction. Refer to Figure 2. Testing was continued.

The entire assembly was removed from fixture Figure 16 of MIL-S-901D, and attached to fixture Figure 13 of MIL-S-901D of the referenced specifications. The total weight on the anvil table was 3701.5 pounds. Refer to Figure 1 for a photograph of the test setup and Table 1 for a breakdown of the test weights.

13.9 BLOW #7 - CONDITION A

- 13.9.1 Conditions: Vertical Axis, 1.75' hammer height, Group #I, 3.0" anvil table travel, fixture Figure 13 of the referenced specifications.
- 13.9.2 Observations: A post-blow visual inspection revealed no obvious physical damage. It was noted that the packing was leaking with a drip rate of twenty-one (21) drops/minute.
- 13.9.3 Action: Testing was continued.

13.10 BLOW #8 - CONDITION B

- 13.10.1 Conditions: Vertical Axis, 2.75' hammer height, Group #II, 3.0" anvil table travel, fixture Figure 13 of the referenced specifications.
- 13.10.2 Observations: A post-blow visual inspection revealed no obvious physical damage. It was noted that the packing was leaking with a drip rate of three (3) drops/minute.
- 13.10.3 Action: Testing was continued.

13.11 BLOW #9 - CONDITION A

- 13.11.1 Conditions: Vertical Axis, 2.75' hammer height, Group #III, 3.5" anvil table travel, fixture Figure 13 of the referenced specifications.
- 13.11.2 Observations: A post-blow visual inspection revealed no obvious physical damage. It was noted that the packing was leaking with a drip rate of two (2) drops/minute.
- 13.11.3 Action: Shock testing was complete.

Refer to the Factory Test Record, Figure 3, and the Shock Acceptance Form, Figure 4, for additional information.

14. VIBRATION TEST DESCRIPTION

14.1 TEST SETUP

The Pump was attached to the Vibration machine oriented in the first major axis of test. Refer to Figure 5 for photographs of the test setups.

One (1) Accelerometer was attached to the plate and one (1) accelerometer was attached to the top of the Pump, oriented in the direction of vibration, to record the vibration input and to aid in the detection of response prominences.

It was noted that prior to the start of vibration testing the Pump continued to leak one (1) drop/minute when at a standstill.

14.2 TEST CONDITIONS

The pump was energized and operating, with a discharge of 11 PSIG throughout vibration testing.

14.3 FIRST MAJOR AXIS OF VIBRATION (VERTICAL)

14.3.1 Exploratory Vibration

The Pump was vibrated from 4 Hz through 33 Hz with a vibration input of 0.020 ± 0.004 inches (double amplitude) and from 34 Hz to 50 Hz with a vibration input of 0.006 + 0.000/-0.002 to determine response prominences. The change in frequency was made in discrete intervals of 1 Hz and the vibration was maintained at each frequency for approximately fifteen (15) seconds. No response prominences were noted.

The table input vibration levels and the accelerometer output vibration levels at each frequency were recorded on the Vibration Test Data Sheet, Figure 6.

14.3.2 Variable Frequency Vibration

The Pump was vibrated from 4 Hz to 50 Hz with input amplitudes as shown in Table 2. The change in frequency was made in discrete intervals of 1 Hz and the vibration was maintained at each frequency for a period of five (5) minutes. No response prominences were noted.

The table input vibration levels and the accelerometer output vibration levels at each frequency were recorded on the Vibration Test Data Sheet, Figure 6.

14.3.3 Endurance Vibration

Since no response prominences were noted, the endurance vibration was performed at the specified upper frequency of 50 Hz for a period of two (2) hours. Upon the completion of the two (2) hour dwell, an external visual inspection revealed no obvious physical damage.

Table 2: Variable Frequency Test Amplitudes

FREQUENCY	INPUT INCHES
(Hz)	(DOUBLE AMPLITUDE)
4 – 15 Hz	0.060 ± 0.012
16 – 25 Hz	0.040 ± 0.008
26 – 33 Hz	0.020 ± 0.004
34 – 40 Hz	0.010 ± 0.002
41 – 50 Hz	0.006 + 0.000
	-0.002

14.4 SECOND MAJOR AXIS OF VIBRATION (END-TO-END)

14.4.1 Exploratory Vibration

The Pump was vibrated from 4 Hz through 33 Hz with a vibration input of 0.020 ± 0.004 inches (double amplitude) and from 34 Hz to 50 Hz with a vibration input of 0.006 + 0.000/-0.002 to determine response prominences. The change in frequency was made in discrete intervals of 1 Hz and the vibration was maintained at each frequency for approximately fifteen (15) seconds. No response prominences were noted.

The table input vibration levels and the accelerometer output vibration levels at each frequency were recorded on the Vibration Test Data Sheet, Figure 7.

14.4.2 Variable Frequency Vibration

The Pump was vibrated from 4 Hz through 50 Hz with input amplitudes as shown in Table 2. The change in frequency was made in discrete intervals of 1 Hz and the vibration was maintained at each frequency for a period of five (5) minutes. No response prominences were noted.

The table input vibration levels and the accelerometer output vibration levels at each frequency were recorded on the Vibration Test Data Sheet, Figure 7.

14.4.3 Endurance Vibration

Since no response prominences were noted, the endurance vibration was performed at the specified upper frequency of 50 Hz for a period of two (2) hours. Upon the completion of the two (2) hour dwell, an external visual inspection revealed no obvious physical damage.

14.5 THIRD MAJOR AXIS OF VIBRATION (SIDE-TO-SIDE)

14.5.1 Exploratory Vibration

The Pump was vibrated from 4 Hz through 50 Hz with a vibration input of 0.020 ± 0.004 inches (double amplitude) and from 34 Hz to 50 Hz with a vibration input of 0.006 + 0.000/-0.002 to determine response prominences. The change in frequency was made in discrete intervals of 1 Hz and the vibration was maintained at each frequency for approximately fifteen (15) seconds. No response prominences were noted.

The table input vibration levels and the accelerometer output vibration levels at each frequency were recorded on the Vibration Test Data Sheet, Figure 8.

14.5.2 Variable Frequency Vibration

The Pump was vibrated from 4 Hz through 50 Hz with input amplitudes as shown in Table 2. The change in frequency was made in discrete intervals of 1 Hz and the vibration was maintained at each frequency for a period of five (5) minutes. No response prominences were noted.

The table input vibration levels and the accelerometer output vibration levels at each frequency were recorded on the Vibration Test Data Sheet, Figure 8.

14.5.3 Endurance Vibration

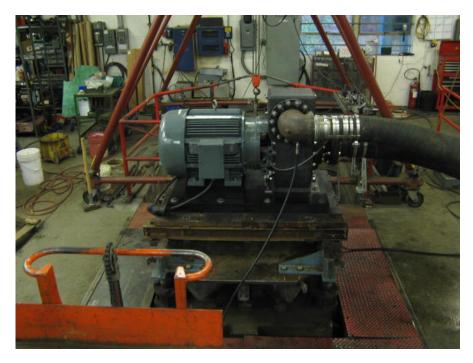
Since no response prominences were noted, the endurance vibration was performed at the specified upper frequency of 50 Hz for a period of two (2) hours. Upon the completion of the two (2) hour dwell, an external visual inspection revealed no obvious physical damage.

Shock testing was complete.



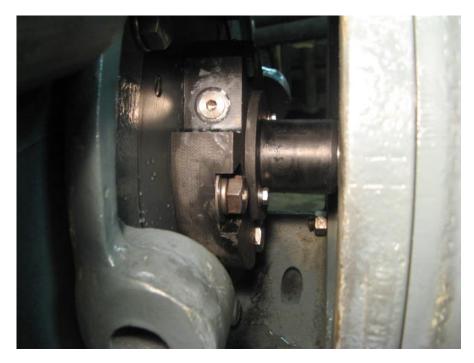
30° Side Down Axis

30° End Down Axis



Vertical Axis

Shock Test Setups Figure 1



Post-Blow #6 Pump to Motor Packing Seal Ring Figure 2

FACTORY .	TEST REC(FACTORY TEST RECORD: CLASS HI SHOCK	SHOCK				DATE: 9 October 2009	TEST# 110611
1. ITEM NAME 8X8X13	OF EQUIPMEN C20 Horizor	 ITEM NAME OF EQUIPMENT SHOCK TESTED 8X8X13C20 Horizontal Pump w/ 20 HP Motor 	1P Motor	2. RATING (KW, VOLTS, GPM, CFM, ETC.)	(VOLTS, GPM,	CFM, ETC.)		
				3. MAJOR PARTS				
PUMP, ETC.			MANUFACTURER Sims Pump Valve Co., Inc.	ADDRESS 1314 Park Ave. Hoboken, NJ 07030	030		GOV DWG NO.	IDENTIFYING #
				00000				
MOTOR, ETC.			MANUFACTURER	ADDRESS			GOV DVVG NO.	IDEN IIFYING#
STARTER, ETC.	d		MANUFACTURER	ADDRESS			GOV DWG NO.	IDENTIFYING#
4. CONTRACT NO.	.ON		CONTRACTOR	ADDRESS				
5. TYPE OF SHOCK TEST	IOCK TEST	D ASSEMBLY	D SUB-ASSEMBLY D PART					
6. TOTAL WEI 184:	6. TOTAL WEIGHT OF ASSEMBLY TESTED 1843 lbs.	ABLY TESTED	WEIGHT OF IND/VIDUAL MOTOR PARTS	MOTOR			STARTER	
7. WEIGHT CLJ	7. WEIGHT CLASSIFICATION OF ITEM D LIGHT MEDIUM	OF ITEM	8. APPLICABLE MOUNTING FIXTURE IN SPECIFICATION MIL-S-901 D Fig 7, HX 4A D Fig 8, HX 4C 20 FIX 13 D FIX 15		S FIG 16 D OTHER	ER		
				9. FOR LIGHTWEIGHT ITEMS				
			FIRST CONDITION			1 1	SECOND CONDITION	
BLOW	DROP	AXIS	DAMAGE INCURRED	BLOW	DROP	AXIS	DAMAGE INCURRED	
ITEMS SUBEC	T TO ABOVE T DIFFERENT	ITEMS SUBECT TO ABOVE TWO CONDITIONS WERE CAME CDIFFERENT	RE	REMARKS				
		Fig. 16	10. FOR MEDIUM WEIGHT ITEMS	GHT ITEMS		Fig. 13		
BLOW	GROUP	HAMMER DROP	DAMAGE INCURRED	BLOW	GROUP	HAMMER DROP	DAMAGEINCURRED	
-	_	2.25'	No damage noted	9	≡	3.75'	Refer to report	
2	=	3.75'	No damage noted	7	_	1.75'	Refer to report	
e	≡	3.75'	No damage noted	8	=	2.75'	Refer to report	
4	_	2.25'	No damage noted	6	■	2.75'	Refer to report	
5	=	3.75'	No damage noted					
TOTAL WEIGHT ON ANVIL TABLE Fig. 16: 4791.5 lbs; Fig. 13: 3701.5 lbs	TOTAL WEIGHT ON ANVIL TABLE Fig. 16: 4791.5 lbs; Fig. 13: 370	ABLE 3: 3701.5 lbs	REMARKS					
TEST LABORATORY NU Laboratories, Inc.	ATORY tories, Inc.		ADDRESS 312 Old Allerton Road, Annandale, NJ 08801			-	TEST ENGINEER - HUMUN	

Factory Test Record Figure 3

		MIL-S-901D: SHO	OCK ACCEPTA	NCE FORM					
1.	The item identified below	w has met the requi	rements of Militar	y Specification	MIL-S-901, based upon:				
	Shock testing	of the item identifi	ed below						
	Previous shock (shock test ex	testing of an item s tension)	similar to the item	identified below	w				
	Previous shock (shock test ex	testing of an item i tension)	dentical to the iter	n identified bel	ow				
2.	Item (Nomenclature)	Pump							
3.	Item (Description)	8x8x13C20 Hor	izontal Pump w/ 2	0 HP Motor					
4.	Tested For Sims	Pump Valve Co., I	nc.						
5.	P/N:		6. S/N:						
7.	Dwg. Number: NS18009				nd Date:				
9.	Military Specification	MIL-S-901D							
10.	Ship								
12.									
13.	Shock Test Facility								
14.									
15.				shock test					
	Extension approval)								
16.	Test Category	□ Lightweight	⊠Medium weig	nt 🗆 Heavy	vweight				
17.	Shock Grade	⊠A	\Box B						
18.	Equipment Class	ΣI	□ II	□ III					
19.	Shock Test Type	XA	□ B	\Box C					
20.	Mounting Location	🗵 Deck	🗆 Hull	□ Shell	□ Wetted-Surface				
21.	Shipboard mounting pla	ane represented dur	ring shock test:						
		⊠Base □ Top	□ Front or Face □ Combination	□Back □ Other					
22.	Mounting orientation of items only): Unrest		p's fore-and-aft ax	is (for medium	weight and heavyweight test				
23.	Approval Limitations:								
24.	Approved.				-				
	-Hetratter			9	October 2009				
	Authorized Signature	Approv	val Activity		Date				
	Shock Acceptance Form Figure 4								



Vertical Axis

End-to-End Axis



Side-to-Side Axis

Vibration Test Setups Figure 5

Int. INPUT CH.1 CH.2 INPUT CH.1 CH.2 4 $O 20$ $O 21$ $O 62$ $O 67$ $O 67$ $O 7$ 5 $O 20$ $O 21$ $O 61$ $O 64$ $O 64$ $O 7$ 7 $O 19$ $O 20$ $O 57$ $O 62$ Mis $V = A T I = A$ 8 $O 19$ $O 20$ $O 57$ $O 60$ Mis $V = A T I = A$ 10 $O 17$ $O 17$ $O 67$ $O 60$ Mis Mis $NIL \text{LABORATORIES}$ 11 $O 17$ $O 17$ $O 60$ Mis Mis $NIC A BORATORIES$ 12 $O 17$ $O 17$ $O 60$ Mis Mis Mis Mis 13 $O 17$ $O 17$ $O 60$ Mis <th></th> <th>EXPLOR</th> <th>RATORY FR</th> <th>EQUENCY</th> <th>VARIA</th> <th>BLE FREQU</th> <th>ENCY</th> <th colspan="4">VIBRATION TEST DATA SHEET</th>		EXPLOR	RATORY FR	EQUENCY	VARIA	BLE FREQU	ENCY	VIBRATION TEST DATA SHEET				
8 OII_{1}^{2} OII_{2}^{2} OII_{1}^{2} OII_{1}^{2} OII_{2}^{2} OII_{2}^{2} OII_{1}^{2} $OIII_{1}^{2}$	Hz	INPUT	СН. 1	СН. 2	INPUT	СН. 1	СН. 2					
6 014° 020° 064° 7 019 020° 057° 062° 8 017° 017° 057° 062° 9 017° 017° 057° 060° 10 015° 017° 057° 060° 11 017° 017° 057° 060° 12 017° 017° 057° 060° 13 017° 017° 057° 060° 14 017° 017° 057° 060° 15 017° 017° 057° 060° 16 017° 040° 041° 091° 017° 017° 017° 040° 041° 018° 1018° 1018° 1018° 017° 044° 041° 018° 1018° 1018° 018° 019° 041° 017° 018° 019° 019° 011	4	.020	.021		.062	.067		JOB NO. / 1 2 5-1 DATE / 10-15-09				
8 017 020 057 062 8 019 020 057 062 9 019 020 057 062 9 019 019 057 060 10 017 017 057 060 11 017 017 057 060 12 019 017 057 060 13 019 019 057 060 14 019 017 057 060 15 017 017 057 060 16 017 017 040 0411 Imput purp 16 017 017 040 041 S0 006 17 017 019 040 041 S0 006 $2HBS$ 18 017 017 040 041 S0 006 $2HBS$ 2 017 019 040 042 017 025	5	.020	.021		.061	-		$\begin{array}{c} \text{DATE} \\ \text{AXIS} \\ \end{array} \begin{array}{c} \hline & & \\ \hline \\ \hline$				
1 0.19 0.20 0.57 0.62 8 0.19 0.20 0.57 0.62 10 0.17 0.057 0.62 11 0.17 0.57 0.60 12 0.19 0.57 0.60 13 0.19 0.57 0.60 13 0.19 0.57 0.60 14 0.19 0.57 0.60 15 0.17 0.60 NOTE: RECORDED DATA IS DOUBLE AMPLITUDE 16 0.17 0.19 0.57 0.60 17 0.15 0.19 0.40 0.41 INPUT DURATION 18 0.19 0.19 0.40 0.41 INPUT DURATION 18 0.17 0.19 0.40 0.41 INPUT DURATION 19 0.17 0.19 0.40 0.41 INPUT DURATION 19 0.17 0.19 0.41 0.41 INPUT DURATION 19 0.17	6	.019	.020		.061	.064		AXIS				
0.17 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.012 0.17 0.02 0.02 0.012	7	.019	.020		.059	.062		\cap				
NULABORATORIES NULABORATORIES 10 $0.1f$ 0.17 0.57 0.60 312 OLD ALLETTOR RD, ANNANDALE, NJ 11 0.19 0.19 0.57 0.60 312 OLD ALLETTOR RD, ANNANDALE, NJ 11 0.19 0.19 0.57 0.60 312 OLD ALLETTOR RD, ANNANDALE, NJ 12 0.19 0.19 0.57 0.60 NOTE: RECORDED DATA IS DOUBLE AMPLITUDE 13 0.19 0.19 0.57 0.60 NOTE: RECORDED DATA IS DOUBLE AMPLITUDE 16 0.18 0.19 0.40 0.41 ENDURANCE NULABORATORES 17 0.15 0.19 0.40 0.41 SO 0.06 Z Higs 18 0.19 0.19 0.40 0.42 Import DURATION 18 0.19 0.19 0.44 0.42 Import DURATION 19 0.15 0.19 0.44 0.42 Import DURATION 21 0.19 0.44 0.42 Import S N S N S N S N S N S N S N S S N S N S	8				.058	.062		NU LABORATORIES				
10 OIF OIG O	9	.019	,019					312 OLD ALLERTON RD., ANNANDALE, NJ				
1 0.019 0.0575 0.000 13 0.019 0.0575 0.060 13 0.019 0.0575 0.060 15 0.019 0.0575 0.060 16 0.15 0.019 0.0575 0.060 17 0.015 0.019 0.077 0.060 18 0.019 0.019 0.040 0.941 ENDURANCE 17 0.15 0.019 0.940 0.941 SO 0.006 2.008 18 0.019 0.040 0.941 SO 0.006 2.008 2.006 2.0	10	.018	.019		.057	.060		312 OLD ALLERTON RD., ANNANDALE, NJ				
1 $OI7_{1}$ $OI7_{1}$ $OI7_{1}$ $OI7_{1}$ $OI7_{2}$ OGO 11 $OI7_{1}$ $OI7_{1}$ OGO NOTE: RECORDED DATA IS DOUBLE AMPLITUDE 15 $OI7_{1}$ $OI7_{1}$ OGO NOTE: RECORDED DATA IS DOUBLE AMPLITUDE 15 $OI7_{1}$ $OI7_{1}$ OGO NOTE: RECORDED DATA IS DOUBLE AMPLITUDE 16 $OI7_{1}$ $OI7_{1}$ OGO NOTE: RECORDED DATA IS DOUBLE AMPLITUDE 16 $OI7_{1}$ $OI7_{1}$ OGO NOTE: RECORDED DATA IS DOUBLE AMPLITUDE 17 $OI7_{1}$ $OI7_{1}$ OHO_{1} OHI_{1} SUP 18 $OI7_{1}$ OHO_{1} OHI_{1} SOO_{1} OOG_{1} 18 $OI7_{1}$ OHO_{1} OHI_{2} OHI_{2} OHI_{2} 21 $OI7_{1}$ OHO_{2} OHI_{2} $SX S \times I3C_{2}$ $SX S \times I3C_{2}$ 22 OIF_{1} OI_{2} OI_{1} OII_{1} $SX S \times I3C_{2}$ $Pump$ 23 OIF_{1} OI_{2} OII_{1} OII_{1} OII_{1} $SX S \times I3C_{2}$ <t< td=""><td>11</td><td>.018</td><td>.019</td><td></td><td>.058</td><td>.060</td><td></td><td colspan="4"></td></t<>	11	.018	.019		.058	.060						
Image: Image	12	.019	.019		.058	.060		-				
Image: Solution of the second constraints of the second constrese constresex of the second constraints of the second		.019	.019		.058	.060						
10 OIF OIG OGO 16 OIF OIG OHO OHI ENDURANCE 17 OIF OIG OHO OHI SO OOG $2HRS$ 19 OIF OIG OHO OHI SO OOG $2HRS$ 19 OIF OIG OHO OHI SO OOG $2HRS$ 10 OIF OIG OHO OHI SO OOG $2HRS$ 10 OIG OHO OHI SO OOG $2HRS$ 12 OIG OIG OHO OHI SO OOG $2HRS$ 12 OIG OIG OHO OHI SVR $SVRS$ $ISC 20$ 13 OIG OIG OHG OHI OII $SIMS$ $PumP$ $PumP$ 17 OIS OIC OIG OII OIC $SIMS$ $PumP$ $PumP$ 17 OIS OIC OIC		1			.057	.060		NOTE: RECORDED DATA IS DOUBLE AMPLITUDE				
013 017 040 041 047 040 041 018 017 <t< td=""><td></td><td>.018</td><td>.019</td><td></td><td>057</td><td>.060</td><td></td><td colspan="4"></td></t<>		.018	.019		057	.060						
OIP		018	.019		.040	.041						
OIT_{1} OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} 10 OIF OIT_{2} OIT_{2} OIT_{2} OIT_{2} 11 OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} 11 OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} 12 OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} 12 OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} 13 OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} 14 OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} $Pump$ 12 OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} OIT_{2} $Pump$ OIT_{2} OI					.040	.041		Securition				
19 $0.15 \ 0.017$ $0.017 \ 0.017$ 0.042 20 $0.17 \ 0.017$ 0.040 0.042 21 $0.017 \ 0.017$ 0.040 0.042 23 $0.17 \ 0.017$ 0.040 0.042 23 $0.17 \ 0.017$ 0.040 0.042 24 $0.15 \ 0.017$ 0.040 0.042 25 $0.017 \ 0.017$ 0.040 0.047 26 $0.17 \ 0.020$ 0.020 0.021 28 $0.15 \ 0.020$ $0.017 \ 0.021$ $5.057 \ 0.017 \ 0.020$ 29 $0.17 \ 0.020$ $0.017 \ 0.021$ TESTED FOR: 30 $0.17 \ 0.020$ $0.020 \ 0.022$ $5.052 \ 0.020 \ 0.022$ 31 $0.17 \ 0.020$ $0.020 \ 0.022$ $0.020 \ 0.022$ 32 $0.17 \ 0.021$ $0.020 \ 0.022$ $0.017 \ 0.026 \ 0.026$ 34 $0.06 \ 0.006 \ 0.016 \ 0.017 \ 0.026 \ 0.017 \ 0.016 \ 0.017 \ 0.026 \ 0.017 \ 0.026 \ 0.017 \ 0.016 \ 0.017 \ 0.026 \ 0.017 \ 0.016 \ 0.016 \ 0.017 \ 0.016 \ 0.016 \ 0.017 \ 0.016 \ 0$					-	.041		50 .006 2 HRS.				
21 0.19 0.40 0.42 22 0.15 0.19 0.40 0.42 23 0.15 0.19 0.40 0.42 24 0.15 0.19 0.40 0.42 25 0.15 0.02 0.20 0.21 28 0.15 0.20 0.20 0.21 28 0.15 0.20 0.21 TESTED FOR: 29 0.15 0.20 0.21 TESTED FOR: 30 0.15 0.20 0.21 TESTED FOR: 31 0.15 0.20 0.22 0.22 31 0.02 0.20 0.22 INPUT 0.57 0.06 33 0.19 0.21 0.20 0.22 INPUT 0.57 0.06 $P.075$ 34 0.06 0.06 0.17 0.175 0.12 INPUT 0.57 0.06 37 0.05 0.06 0.17 0.175 0.12 Inthe proteindeteeeeeeeeeeeeeeeeeeeeeeee						.042						
0.77 0.74 0.74 0.74 22 0.18 0.19 0.94 TEST ARTICLE IDENTIFICATION: 24 0.18 0.19 0.40 0.942 TEST ARTICLE IDENTIFICATION: 24 0.18 0.019 0.940 0.942 TEST ARTICLE IDENTIFICATION: 25 0.18 0.019 0.20 0.942 $8 \times 8 \times 13 \in 20$ 26 0.018 0.020 0.021 $9 \times 9 \times 13 \in 20$ $p \times 9 \times 9 \times 13 \in 20$ 26 0.18 0.20 0.020 0.21 TESTED FOR: 29 0.18 0.20 0.21 TESTED FOR: $5 \times 8 \times 13 \in 20$ 31 0.14 0.20 0.21 $5 \times 9 \times 13 \in 20$ 7×6 31 0.14 0.20 0.21 $5 \times 9 \times 13 \in 20$ 7×6 31 0.14 0.20 0.22 0.22 0.21 $7 \times 6 \times 6 \times 6$ 31 0.04 0.21 0.20 0.22 0.22 0.21 $7 \times 6 \times 6 \times 6 \times 7$ 31 0.05 0						-						
1018 0.17 0.70 0.74 TEST ARTICLE IDENTIFICATION: 24 0.18 0.19 0.40 0.43 TEST ARTICLE IDENTIFICATION: 25 0.18 0.19 0.40 0.43 $8 \times 8 \times 13 \in 20$ 9 ump 26 0.18 0.20 0.20 0.21 $8 \times 8 \times 13 \in 20$ 9 ump 27 0.18 0.20 0.21 TESTED FOR: 9 ump 28 0.18 0.20 0.21 TESTED FOR: $5 \text{ ims} 8 \text{ ump VALVE Co.}, Twee 30 0.18 0.20 0.22 0.22 Sims 8 \text{ ump VALVE Co.}, Twee 31 0.19 0.20 0.22 0.22 Sims 8 \text{ ump VALVE Co.}, Twee 32 0.18 0.20 0.22 0.22 NPUT 0.66 Fix Tune Pure 33 0.19 0.21 0.20 0.22 NPUT 0.66 \text{ Fix Tune Pure 34 0.06 0.06 0.06 0.06 0.08 0.05 38 0.05 0.06 0.06 0.06 $.019	019		.040							
0.18 0.17 0.40 0.47 24 0.18 0.19 0.40 0.47 25 0.18 0.20 0.20 0.21 26 0.18 0.20 0.20 0.21 27 0.18 0.20 0.21 TESTED FOR: 29 0.18 0.20 0.21 TESTED FOR: 29 0.18 0.20 0.21 TESTED FOR: 30 0.18 0.20 0.22 0.22 31 0.18 0.20 0.22 0.22 31 0.18 0.20 0.22 0.22 31 0.18 0.20 0.22 0.22 31 0.19 0.21 0.20 0.22 33 0.19 0.21 0.20 0.22 34 0.06 0.06 0.176 0.14 35 0.05 0.06 0.176 0.14 37 0.05 0.06 0.111 0.176		.018.	019		.040	.042						
25 014 0040 047 940 947 940 947 940 947 940 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">TEST ARTICLE IDENTIFICATION:</td></t<>								TEST ARTICLE IDENTIFICATION:				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $.043		8×8×13C20				
23 017 020 019 021 27 018 020 019 021 Tested For: 28 018 020 019 021 Tested For: 29 018 020 021 Sims Pump Value co., Inc 31 018 020 022 Sims Pump Value co., Inc 32 018 020 022 022 Accelerometer locations 33 019 021 020 022 026 027 34 006 006 002 021 026 0176 $CH.1$ 35 005 006 010 018 $CH.2$ 008 908 36 005 006 010 018 018 013 005 006 016 37 005 006 016 016 016 016 016 41 005 006 006 006 006 006 43 005 <					040	.043						
28 014 021 TESTED FOR: 29 018 020 014 021 Sims Pump VALUE Co., Inc. 30 018 020 021 Sims Pump VALUE Co., Inc. 31 018 020 022 Sims Pump VALUE Co., Inc. 31 018 020 022 022 32 018 020 022 022 33 019 021 020 022 022 34 006 002 018 016 017 35 005 006 010 017 018 018 37 005 006 011 012 018 005 38 005 006 016 016 016 016 41 005 006 016 016 016 016 41 005 007 006 006 006 006 41 005 007 006 006					.020	.021		Римр				
29 $01\$$ 020 019 0211 Sins Pump Value co., Inc 30 $01\$$ 020 022 022 Sins Pump Value co., Inc 31 $01\$$ 020 022 022 Accelerometer locations 33 019 021 020 022 Input 015% 045% 34 006 006 006 010 01% 01% 0175 36 005% 006 010 01% 01% 01% 37 005% 006 $01/1$ 01% 01% 01% 38 005% 006 $01/1$ 01% 01% 01% 40 005% 006 01% 01% 01% 01% 41 005% 006 00% 00% 00% 00% 43 005% 007 00% 00% 00% 00% 00% 45 006 00% 00% 00% 00% 00% 00% <td></td> <td></td> <td></td> <td></td> <td>.019</td> <td>.021</td> <td></td> <td colspan="4">TESTED FOR:</td>					.019	.021		TESTED FOR:				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1000 (1000)					.021						
30 $O1$$, $O20$ $O22$ $O22$ 31 $O1$$, $O20$ $O22$ $O22$ 32 $O1$$, $O21$ $O20$ $O22$ $ACCELEROMETER LOCATIONS$ 33 $O19$, $O21$ $O20$ $O22$ $INPUT$ $OPrix Turke Prize 34 OO6 OO6 OO6 OI6 OI7 CH.1 Top or Prixe 35 OO5^+, OO6 OI0^ IIP OPrixe Prixe 36 OO5^-, OO6 OI0^ IIP CH.2 CH.3 37 OO5^-, OO6 OII^+ IIP OI7 OI6^+ 38 OO5^-, OO6 OII^+ IIP OI7 OI6^+ 40^-, OO5^-, OO6 OII^+ IIP OI7 OI6^+ 41^-, OO5^-, OO6 OO6^+, OO6^+ OI6^+ OI6^+ OI6^+ 41^-, OO6^-, OO7^-, OO6^+, OO6^+ OI6^+, OO6^+ OI6^+, OO6^+ OI6^+, OO6^+ OI6^+, OO6^+, OO7^+ OO6^+, OO8^+, OO6^+, OO6^+, OO8^+, OO6^+, $	12.89					.021		Sims Pump VALUE CO., INC.				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$												
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								ACCELEROMETER LOCATIONS				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			50 20					INDUT				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.50753								ON FIXTU	AS PUZZ		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	C8/123		F		.010				Topor PL	inp		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$												
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								0.110				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								REMADU				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			anita in					REMARKS	7.			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	-											
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$. 3.0					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$												
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						DAL						
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	-					200						
46 006 006 006 006 47 006 007 TEST ENGINEER: IIIIIII 48 006 007 108 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		×				DAL						
47 006 007 TEST ENGINEER: 48 006 007 1006 1008 49 006 007 006 008 50 006 008 sheet: 1												
40 .006 .007 .006 .008 49 .006 .007 .006 .008 50 .006 .008 sheet:								TEST ENG	INEER:			
49 .006 .008 50 .006 .008 .006 .008									TUM			
50 .006 .007 .006 .008 SHEET:	49											
on but i			-			1		ener	1			
Res. Hz		Res.	- /	Hz	000	008		SHEET:				

Vibration Test Data Sheet Figure 6

	EXPLO	DRATORY FR	REQUENCY	VARL	ABLE FREQU	ENCY	VIBRATION TEST DATA SHEET				
Hz	INPUT	СН. 1	CH. 2	INPUT	CH. 1	CH. 2	1 "				
4	,017	,019		,052	.050		JOB NO. 112 SI				
5	,016	,017		,052	.050		DATE $10^{-1}6^{-0}$				
6	.016	.017		,056	1061		\overline{N}				
7	.016	.017		,054	1058						
8	016	.016		.053	.053						
9	,017	.018		,055	.060		NU LABORATORIES 312 OLD ALLERTON RD., ANNANDALE, NJ				
10	,017	.018		.056	.059		NU LABORATORIES 312 OLD ALLERTON RD., ANNANDALE, NJ 08801 (908) 713-9300				
11	.018	020		1059	,067		08801 (908) 713-9300				
12	018	,020	10	059	.067						
13	018	,020		.05%	.067						
14	510	,019		1057	.065						
15	1017	.019		058	065		NOTE: RECORDED DATA IS DOUBLE AMPLITUDE				
16	,017	.020		039	,046		ENDURANCE				
17	017	.020		,040	048		Hz INPUT DURATION				
18	,017	,020		1040	1048		50 .005 2 HAS				
19	.017	.020		.038	.048		SC COS 2 HAS				
20	,017	.020		.039	.048						
21	510.	,020		.039	.048						
22	,017	.020		.039	. 049						
3	1017	,021		0039	049		TEST ARTICLE IDENTIFICATION:				
4	017	,021		.038	.049		EVENIE				
5	,017	.022		.038	049		8×8×13 c 20 PUMP				
6	.017	.021		,021	.027						
7	1017	.022		021	.028						
8	1017	.022		,021	.028		TESTED FOR:				
9	.017	.022		.021	.028		Sins Pump Value cu. Inc.				
	510	,022		,020	.028						
	.017	550.		.020	029						
	110	,012		,020	.029		ACCELEROMETER LOCATIONS				
	011	.022		,020	,030		INPUT	UN FixTU	NO PLATS		
-		.010		,010	.015		СН. 1	TOPOF			
1		009		,010	.015		СН. 2				
		010		010	015		СН. 3				
		010		.010	,015						
		010			016		REMARKS	5:			
		010			.016						
		010		.010	.017						
		010		.005	,010						
		010		.005	010						
		011		.005	010						
		012		005-	010						
		on		.005	010						
		012			010						
		012		.005.	010		TEST ENG	INEER:	RAT		
		012		005	011			-##	hulles		
		012			.011		SHEET:				
				005	011						

Vibration Test Data Sheet Figure 7

	EXPLO	RATORY FR	EQUENCY	VARIA	ABLE FREQU	ENCY	VIBRATION TEST DATA SHEET					
Hz	INPUT	СН. 1	CH. 2	INPUT	CH. 1	CH. 2						
4	-021	.072		,064	.066		JOB NO. //75/ DATE /////9/09					
5	.021	.022		.063	,064							
6	020	.022		262	.264		AXIS <u>Stroe fo supe</u>					
7	.220	.021		262	1265		NU LABORATORIES 312 OLD ALLERTON RD., ANNANDALE, NJ					
8	071	.021		.062	.065							
9	-021	071		,061	.066							
10	.031	.021		.261	266		312 OLD ALLERTON RD., ANNANDALE, NJ 08801 (908) 713-9300					
11	.020	.08/		261								
12	.020	.022			.066							
13	.020	.032		-261	.067							
14	.020	,023		.061	.067							
15	210			.061	208		NOTE: RECORDED DATA IS DOUBLE AMPLITUDE					
16		.023		-061	.068		ENDURANCE					
17	.0/7	. 333		.143	.044							
18	.019	.033		.043	.045							
19	.014	,023		.043	.045		50 .003 3.1125					
20	.019	503		044	.046							
20	017	.122		.044	.046							
	.019	-028		.044	.047							
22	.0/9	023		. 044	.041							
23	.018	. 202		.044	.048		TEST ARTICLE IDENTIFICATION: SXSX 13C70					
24	.018	.027		,044	-048							
25	,018	.022		.044	948		TESTED FOR: SAMS JUND VALVE, LIDE.					
26	.28	.000		.022	.023							
27	1/8	.027		.022	.023							
28	. 2/8	-273		.022	.024							
29	.018	133		.022	.024							
30	. 118	033		.03.2	025		1					
31	. 1/8	123		.022	.025				1			
32	.118	.024		-182	.025			ACCELEROMETE	R LOCATIONS			
13	.018	.024		.022	.025		INPUT TOPOF Fix AURE					
14	.006	.008		:011	-113		CH. 1	TOPUT PU.				
5	,006	.00 8		.011	.014		CH. 2	101 01 10				
6	.006	008		.0/1	.014		СН. 3					
7	,006	.009		.011	.)jer	0						
8	105	.009		011	215		REMARKS	:				
9	005	009		.011	.0/5				~			
0	1005	.009		.011	.016		in	T OPEM	471105.			
1	.005	.009		1006	. 010							
2	. 205	109		and	011							
3	205	010		.006	.011							
4	.005	,010			0/1							
5	,015	.0/0		.006	.212							
6				-006 10C								
7		.0//		1005	012		TEST ENG	NEER.				
8		.0//		,005	013		TEST ENG	A. G. S. P. S. S. S.	atto			
9		0/1		-105					miller			
1	015	-011		.005	014			3				
0	005	0//		-005	11.105			~				

Vibration Test Data Sheet Figure 8

LIST OF APPARATUS

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL DATE	DUE DATE
Temp/Humidity					
Sensor	Radio Shack	63-1013	006	6/4/09	6/4/10
Barometer	B&K	UZ001	BAR003	3/16/09	3/16/10
Pressure Gauge	Weksler	GP2-16-3	1003	12/1/08	12/1/09
Torque Wrench	Armstrong	CG3250FQARBH	5080258523	5/27/09	5/27/10
Torque Wrench	Central Tools	96355	794037102	5/27/09	5/27/10
Platform Scale	Fairbanks-Morse	1124A	G-511379	12/3/08	12/3/09
Balance Scale	Ohaus	1225	EL-330	12/3/08	12/3/09
Digital Scale	Industrial Commercial Sales	TI-500SSB-5K	5D190110000188	12/3/08	12/3/09
MW Shock Machine	New Eng. Trawler	10-T-3351-C	N/A		tional
Vibration Machine	LAB	RVH-72-5000	51401		tional
Function	Dellenting		220.404		
Generator	Ballantine	6201A6	220-104	6/4/09	6/4/10
1 hour timer	Gra-Lab	165	739	5/8/09	5/8/10
Charge Amp	Trig Tek	203M	220	3/31/09	3/31/10
Charge Amp	Trig Tek	203M	211	5/20/09	5/20/10
Accelerometer	Endevco	2221D	EM03	3/23/09	3/23/10
Accelerometer	Endevco	2221D	EY62	3/23/09	3/23/10

All calibrations are traceable to the National Institute of Standards and Technology. Procedures satisfy the requirements set forth in MIL-STD-45662 or ANSI/NCSL Z540-1. Calibration records are on file at NU Laboratories, Inc.

All weights and scales are traceable to the State of NJ Office of Weights and Measures (NJSA 51:1-61; 75; NJAC 13:47E-1.2)