Automatic Switch Co.

FLORHAM PARK, NEW JERSEY 07932

TEST REPORT NO.
AQS21678/TR

QUALIFICATION TESTS OF SOLENOID VALVES BY ENVIRONMENTAL EXPOSURE TO ELEVATED TEMPERATURE, RADIATION, WEAR AGING, SEISMIC SIMULATION, VIBRATION ENDURANCE, ACCIDENT RADIATION AND LOSS-OF-COOLANT ACCIDEN

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ISOMEDIX

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Performed for

AUTOMATIC SWITCH CO.

Florham Park, New Jersey

By the

COMPONENT TESTING DIVISION

of

ISOMEDIX, INC.

Parsippany, New Jersey

March, 1978

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ABSTRACT

Qualification Type Tests on Automatic Switch Company Solenoid Valves were performed in accordance with the requirements of "ASCO Qualification Specification AQS-21678/Revision B" in order to provide a family of generically similar valves for safety related use in Nuclear Power Generating Stations.

The valves were subjected to successive environments of elevated temperature, radiation, accelerated operational cycling, seismic and vibration exposures, accident radiation and a simulated loss-of-coolant accident (LOCA) environmental exposure.

The performance of the valves was periodically monitored during the program and compared with baseline data representative of ASCO specification requirements.

Three and four-way, direct and internal pilot-operated solenoid valves were included in the type test program.

CONCLUSIONS: The valves tested for qualification completed the type tests and baseline/functional tests successfully. Minor anomalies observed are detailed and explained fully in the text.

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SECTION 1 -- INTRODUCTION

Qualification tests on solenoid valves were performed for Automatic Switch Company according to test outline contained in "ASCO Qualification Specification AQS-21678 Revision B". This test outline is based on the suggestions contained in IEEE 323-1974 "IEEE Standard for Qualifiying Class 1E Equipment for Nuclear Power Generating Stations", IEEE 382-1972 "IEEE Trial-Use Guide for Type Test of Class 1 Electric Valve Operators for Nuclear Power Generating Stations", IEEE 344-1975 "IEEE Recommended Practices for Seismic Qualifications of Class 1E Equipment for Nuclear Power Generating Stations" and IEEE 382/ANSI N278.2.1 (Draft 3, Rev. 1 June 1977) "Draft American National Standard for the Qualification of Safety Related Valve Actuators".

Seven valve samples were selected to represent six generic families of valves. Two more valve samples were added to the test program to obtain resultant test information only. The samples were subjected to sequential exposures of elevated temperature, radiation, wear aging, seismic simulation, vibration endurance, accident radiation and a 30-day loss-of-coolant accident (LOCA) simulation. Baseline operational test data was obtained and recorded for all the valves before the start and after each sequence of the test exposures with the exception of coil dielectric and insulation resistance measurements which were taken before thermal aging and after accident radiation and after LOCA exposures. The valves were energized and de-energized at high and low pressures during the test phases (except radiation) and leakage from the valves was monitored.

At the conclusion of the LOCA period, the valves were returned to Automatic Switch Co. for further inspection and evaluation.

The tests were conducted during the period from August, 1977 through January, 1978 at the test facilities of Isomedix, Inc., Parsippany, New Jersey with the exception of seismic simulation and vibration endurance tests which were conducted at the facilities of Dayton T. Brown, Inc., Bohemia, New York and Automatic Switch Company, Florham Park, New Jersey.

SECTION 2 DESCRIPTION OF TEST SAMPLES

The following description of the valve samples was provided by Automatic Switch Co. Isomedix numbers were marked on valve housing with a marker pen.

TABLE 1

VALVE DESCRIPTION LIST

Isomedix No.	ASCO Cat. No.	Description
1	HVA-206-381-6F	DC, Class H leaded coil, Nema 4, 7 and 9 solenoid enclosure, metal seats, normally closed construction.
2	NP8344A71E	DC, Class H leaded coil, Nema 4, 7 and 9 solenoid enclosure.
3	XFT831654V	AC, Class F (molded) leaded coil, Nema 1 solenoid enclosure, normally closed construction.
4	HVA-206-380-3RF	AC, Class H screw terminal coil, Nema 6 solenoid enclosure, resilient seats, normally closed construction.
5	NP8320A184E	AC, Class H leaded coil, Nema 6 solenoid enclosure, normally closed construction.
6	NP831665E	DC, Class H leaded coil, Nema 4, 7 and 9 solenoid enclosure, normally closed construction.
7	HV-202-300-2RF	DC, Class H leaded coil, Nema 1 solenoid enclosure, normally closed construction.
8	NP8321A5E	DC, Class H leaded coil, Nema 4, 7 and 9 solenoid enclosure, normally closed construction.
9	NP8323A39E	(Solenoid A) AC, Class H leaded coil, (Solenoid B) DC, Class H screw terminal coil, Nema 6 solenoid enclosures, normally closed construction.

Samples 3 and 7 are for information only.

SECTION 3 TEST PROGRAM

3.1 PURPOSE:

The purpose of the program is to provide qualification tests on seven selected valves to represent six generic families of valves for safety related applications in Nuclear Power Generating Stations.

3.2 DISCUSSIONS:

3.2.1 Baseline/Functional Testing:

Baseline Tests consist of measurement of coil excitation, seat leakages at high and low pressure, noise test, operational test, external leakage test before and after all phases of type tests. Measurement of insulation resistance and coil dielectric test are to be performed in as received condition and after completion of accident radiation and LOCA Simulation phases. The valve samples are to be energized and de-energized and their operation monitored during type test phases (except radiation).

3.2.2 Thermal Aging:

The valve samples are to be thermally aged for a period and at temperature simulating a design life of 4 years for elastomers and coil materials at an ambient temperature of 140^{o}F. The valves are to be cycled (de-energize and energize) during the thermal aging phase to simulate one operation a month at 140^{o}F ambient temperature.

3.2.3 Radiation:

The valve samples are to be exposed to gamma radiation at dose rate of less than 1 megarad per hour for an accumulated dose of 50 megarads.

3.2.4 Wear Aging:

The valves are to be cycled 40,000 times at maximum operating pressure differential. The valves are to be monitored continuously during wear aging phase.

3.2.5 Seismic Simulation/Vibration Endurance:

The valves are to be mounted on a vibratory table thru test fixture. They are to be vibrated 10^6 times divided evenly in 3 axes by vibrating at a non-resonant frequency between 50 and 100 Hz at an input of .75 g or higher. The valves are to be monitored and cycled during this test phase.

The valves are to be mounted on a seismic shaker and subjected to Seismic Simulation tests per 9.4.2.4.2 of "ASCO Qualification Specification AQS-21678 Revision B" (Appendix A). The valves are to be monitored and cycled during this test phase also.

3.2.6 Accident Radiation:

The valve samples are to be exposed to gamma radiation once again to receive an additional accumulated dose of 150 megarads at a dose rate of less than 1 megarad per hour.

3.2.7 LOCA Environmental Simulation:

The valve samples are to be exposed to a Simulated Loss-of-Coolant Accident (LOCA) environment by application of steam and chemical-spray for a period of 30 days, based upon the suggested temperature/pressure profile shown in Figure 1A of Appendix A IEEE 323-1974, Figure 1 of IEEE 382-1972, and as shown in Figure 1.

During the LOCA environment exposure, the valves are to be monitored and cycled.

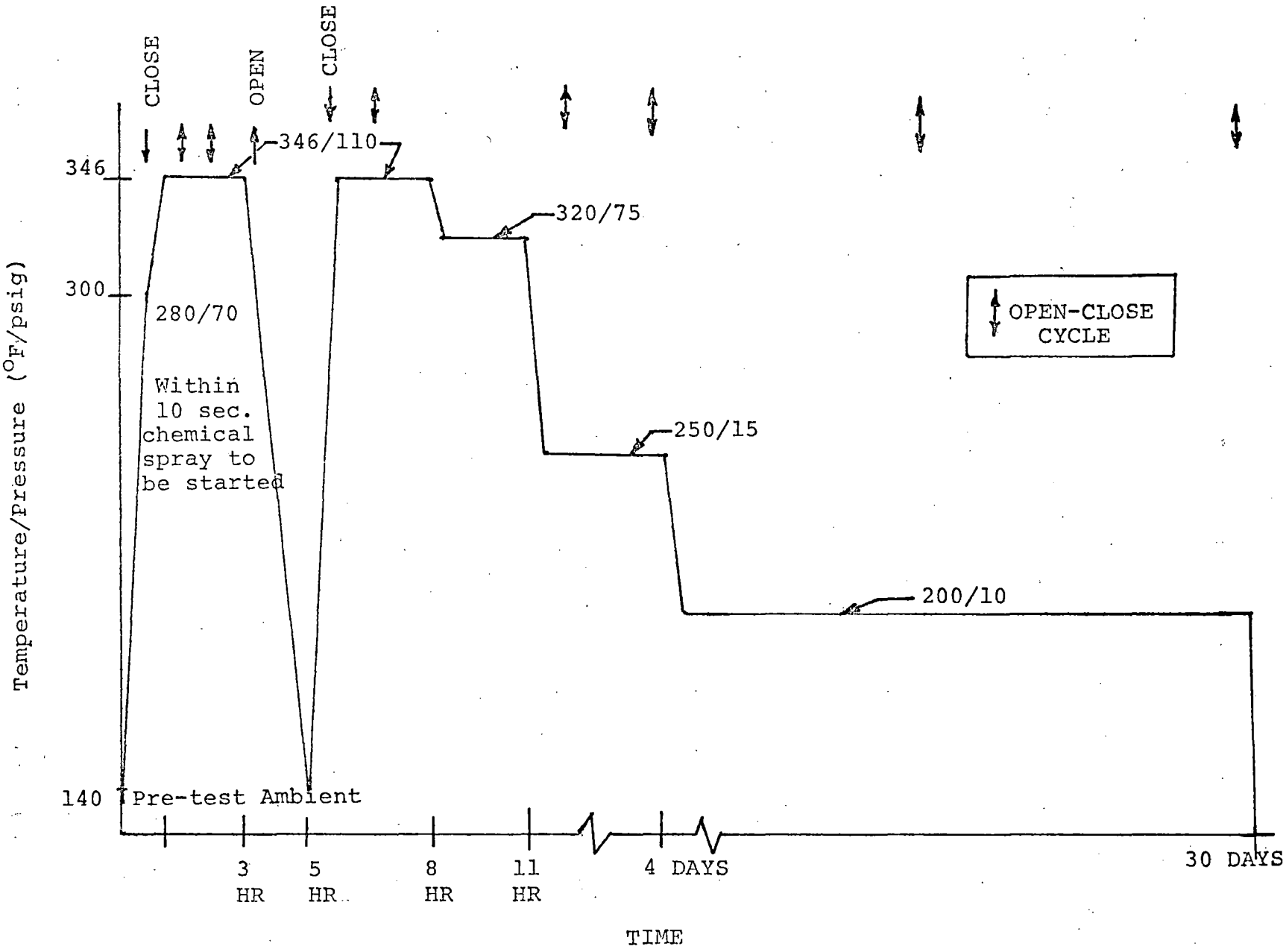

FIGURE 1
LOCA SIMULATION BY ENVIRONMENTAL EXPOSURE (STEAM/CHEMICAL)

Temperature/Pressure Profile for simulation of loss-of coolant accident (LOCA) design basis event (DBE) by steam/chemical-spray environmental exposure.

SECTION 4 TEST PROCEDURE AND RESULTS

4.1 BASELINE/FUNCTIONAL TESTING:

Baseline data was obtained before and after every phase of the Type-Test sequence. This consists of recording coil excitation, seat leakages at high and low pressures both in energized and de-energized state, noise test, operational test 10 times, external leakage both in energized and de-energized state before and after the phases of thermal aging, radiation, wear aging, vibration endurance and seismic simulation, accident radiation and LOCA simulation. Measurement of insulation resistance and coil dielectric tests were performed before thermal aging and after completion of accident radiation and LOCA simulation phases. The valve samples were energized and de-energized and their performance monitored during all the test phases with the exception of the two radiation phases.

The test data was obtained by following ASCO test procedure bulletins attached as Appendix B. The data obtained from these tests is presented in Tables 2A thru 2I of this section. The list of instruments used to record this data is attached as Appendix C.

4.2 THERMAL AGING:

The valves were exposed to temperature environment of 268^{o}F for a period of 12 days. They were cycled (de-energize for 5 minutes and then energize) every 6 hours. All the valves (except Valve No. 8) functioned satisfactorily for the full thermal aging period of 12 days.

Valve No. 8 malfunctioned after 7 days. The valve developed excessive seat leakage (50 SCFH) both in energized and de-energized states. At the end of the test, it was determined that

the excessive leakage was caused by dirt in the valve. The source of the dirt was the iron pipe used in the cylinder port as piping and an additional length used to simulate an accumulator.

A new unit of valve No. 8 was substituted. This new unit was instead thermally aged at 295°F for 100 hours and was cycled every 2 hours. This higher temperature and lower thermal aging period was chosen to accelerate the test program. After approximately 60 hours of this test, the valve started leaking in energized state. The leakage was 40 SCFH at 200 psig, 17 SCFH at 125 psig and 3 SCFH at 10 psig. The valve shifted properly and had no leakage in de-energized state.

It was postulated that the rubber exhaust orifice disc pulled off the piston assembly due to the pressure load on the disc and softening of the disc caused by the high temperature of 295°F. Normal 140°F ambient temperature would not cause noticeable softening of this disc. When the valve was disassembled at the completion of the qualification testing program, this postulation proved to be true. As the valve performed its safety function, the thermal aging continued and other phases of type tests and baseline/functional tests were conducted on this valve in the same manner as on the balance 8 valves. This No. 8 valve is normally used on air systems of 125 psig maximum. Therefore the maximum operating pressure differential has been changed from 200 psig to 150 psig. This results in a 25% load reduction on the disc.

4.3 RADIATION:

All the 9 valve samples were subjected to a Cobalt

source of gamma radiation at an exposure rate of less than 1 megarad per hour. The samples were removed after having received an accumulated minimum dose of 50 megarads. Appendix D contains the certification of radiation exposure.

4.4 WEAR AGING:

The valve samples were elctrically cycled 40,000 times at maximum operating pressure differential using a control circuit.

4.5 SEISMIC SIMULATION/VIBRATION ENDURANCE:

The valve samples were mounted on fixtures and subjected to Seismic Simulation/Vibration Endurance tests as outlined in paragraphs 9.4.2.3.4 and 9.4.2.4.2 of "ASCO Qualification Specification AQS-21678 Revision B" (Appendix A).

All the valves successfully completed vibration portion and the seismic simulation tests conducted at the facilities of Dayton T. Brown, Inc., Bohemia, New York. Their Test Report No. DTB04R77-1651 Revision A of November 7, 1977 is attached as Appendix E. Operational data obtained during these tests at Dayton T. Brown is attached as Appendix F.

Further successful seismic tests at higher g-level were conducted at the facilities of Automatic Switch Company. A summary of these tests along with operational data obtained during these tests is attached as Appendix G.

Baseline and functional tests conducted during this test phase indicate that all the valves (with the exception of Valve No.7) passed the functional requirements to the extent of paragraphs 9.4.2.3.4 and 9.4.2.4.2 and Figure 9.1 of "ASCO Qualification Specification AQS-21678 Revision B" (Appendix A).

4.6 ACCIDENT RADIATION:

The samples were placed in a radiation facility to receive gamma radiation exposure at a dose rate of less than 1 megarad per hour. The samples were removed when they had received an additional dose of 150 Megarads. Thus all the samples received a total of 200 Megarads in two stages.

4.7 LOCA SIMULATION:

The valve samples mounted on a plate were placed in a horizontal pressure vessel. All the samples were energized electrically and with pressure from nitrogen gas cylinder. Prior to initiation of steam exposure, the ambient conditions in the vessel were brought to 140°F at atmospheric pressure.

To initiate the exposure, steam was rapidly admitted, raising the temperature and pressure to 346°F/110 psig within 12 minutes. These conditions were maintained for a 3-hour period. At the end of this time, a controlled temperature drop was initiated that reduced the conditions to the pre-start ambient over the next two hours.

Approximately the time when the temperature was 288°F during the first transient, a chemical solution consisting of 3000 ppm boron as boric acid in solution with 0.064 molar sodium thiosulfate buffered with sodium hydroxide to a pH value of 10 at room temperature was sprayed on the samples at a rate corresponding to 0.306 gpm per square foot of area covered by the spray.

The chemical-spray solution pH was maintained between 9.5 and 10.5. The spray remained on throughout the entire phase of the LOCA simulation.

After returning to the pre-test ambient condition, a second transient of the LOCA simulation was initiated by again introducing steam that raised the temperature and pressure to 346°F/110 psig within 8 minutes and was held at the point for the next three hours.

At this time, the conditions were then reduced to 320°F/75 psig and maintained at this point for 3 hours before being reduced to 250°F/15 psig and held at these conditions for 4 days.

At this time, a controlled drop in temperature and pressure was initiated that further reduced the conditions to 200°F/10 psig for the remaining 30 days of exposure. Fig. 2 represents the actual LOCA Profile obtained.

The samples were cycled (energize and de-energize) during the LOCA exposure. Their leakage was checked at various time periods of the LOCA exposure. The results of this test are given in Table 3 of this section.

4.8 SUMMARY OF PERFORMANCE OF VALVE SAMPLES:

A summary of pass/fail performance of the valve samples is given in Table 4 of this section.

A check of this table indicates that all the valves (except valve No. 7) met the test requirements of "ASCO Qualification AQS-21678/Revision B" (Appendix A).

TABLE NO. 2A
VALVE SAMPLE NO. 1
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP-3-046. TEST MEDIUM: NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS ____ DC AMPS X	.154	.154	.154	.154	.154	.154	.154
COIL DIELECTRIC TEST @ 1250 Volts	OK	TNC	TNC	TNC	TNC	OK	*
SEAT LEAKAGE High Pressure @ 125 PSI Energized	40cc/min.	0	50cc/min.	2.5 SCFH	3SCFH	4.2SCFH	0
SEAT LEAKAGE High Pressure @ 125 PSI Deenergized	0	0	0	0	0	0	0
SEAT LEAKAGE Low Pressure @ 10 PSI Energized	0	0	0	100cc/min.	0	60cc/min.	0
SEAT LEAKAGE Low Pressure @ 10 PSI Deenergized	0	0	0	3SCFH	20SCFH	0	0
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @ 140 PSI	OK	OK	OK	OK	OK	OK	OK
FROM 140 TO 1/4 PSI	OK	OK	OK	OK	OK	OK	OK
EXTERNAL LEAKAGE @ 500 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHOMS)	20K	TNC	TNC	TNC	TNC	160K	5 *

TNC = Test not conducted.
* = See attached

TABLE NO. 2A
VALVE SAMPLE NO. 1

* At the end of LOCA Simulation, the coil had insulation resistance of less than one megohm, so the coil dielectric test was not performed.

During the LOCA phase, the solenoid enclosure was wired through Liquatite, type L.T. flexible electrical conduit manufactured by Electri-Flex Co., Roselle, Illinois. This conduit is rated for 120°F and during the 30-day LOCA test, plastic liquid-tight covering broke down allowing the spray solution to enter the solenoid and degrade the coil insulation, resulting in current leakage to ground. The valve solenoid enclosure was full of spray solution when it was disassembled.

The coil was dried out for 7 days at room temperature. At this stage the insulation resistance was measured to be 5 megohms and coil dielectric test indicated some leakage current at 200 Volts 60 Hz and no breakdown at 1250 Volts 60 Hz. The coil was operable.

Since the coil had satisfactory insulation resistance and passed the dielectric test prior to LOCA phase, it may be hypothesized that the coil would have been satisfactory but for the adverse effect of the spray solution. This condition was abnormal and is not expected during actual use.

TABLE NO. 2B
VALVE SAMPLE NO. 2
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP 8344. TEST MEDIUM: NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS ___ DC AMPS X	.074	.074	.074	.074	.074	.074	.074
COIL DIELECTRIC TEST @1250 Volts	OK	TNC	TNC	TNC	TNC	OK	OK
SEAT LEAKAGE High Pressure @140 PSI Energized	40cc/min.	0	0	50cc/min.	1.1SCFH	0	2SCFH
SEAT LEAKAGE High Pressure @140 PSI Deenergized	50cc/min.	0	0	0	0	0	*
SEAT LEAKAGE Low Pressure @20 PSI Energized	0	0	0	0	0	25cc/min.	50cc/min.
SEAT LEAKAGE Low Pressure @20 PSI Deenergized	0	0	0	0	0	0	*
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @140 PSI	OK	OK	OK	OK	OK	OK	OK
FROM 140 TO 10 PSI	OK	OK	OK	OK	OK	OK	OK
EXTERNAL LEAKAGE @500 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHMS)	80K	TNC	TNC	TNC	TNC	500K	20K

TNC = Test not conducted.
* = See attached

TABLE NO. 2B
VALVE SAMPLE NO. 2

* Leak in Accumulator Tank @ port B, due to the steel tank rusting through. It was impossible to check leakage deenergized, as the internal vessel pressure was leaking into port B and out the exhaust.

TABLE NO. 2C
VALVE SAMPLE NO. 3
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP8316. TEST MEDIUM: NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS X DC AMPS _____	102/60	102/60	102/60	102/60	102/60	102/60	102/60
COIL DIELECTRIC TEST @ 1240 Volts	OK	TNC	TNC	TNC	TNC	OK	*
SEAT LEAKAGE High Pressure @ 125 PSI Energized	0	0	0	0	0	0	0
SEAT LEAKAGE High Pressure @ 125 PSI Deenergized	0	0	0	0	0	80cc/min.	0
SEAT LEAKAGE Low Pressure @ 10 PSI Energized	0	0	0	0	0	0	0
SEAT LEAKAGE Low Pressure @ 10 PSI Deenergized	0	0	0	0	0	0	0
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @140PSI	OK	OK	OK	OK	OK	OK	OK
FROM 140 TO 10 PSI	OK	OK	OK	OK	OK	OK	OK
EXTERNAL LEAKAGE @ 200 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHOMS)	20K	TNC	TNC	TNC	TNC	800K	10*

TNC = Test not conducted.
* = See attached

TABLE NO. 2C
VALVE SAMPLE NO. 3

* At the end of LOCA Simulation, the coil had insulation resistance of less than one megohm, so the coil dielectric test was not performed.

During the LOCA phase, the solenoid enclosure was wired through Liquatite, type L.T. flexible electrical conduit manufactured by Electri-Flex Co., Roselle, Illinois. This conduit is rated for 120°F and during the 30-day LOCA test, plastic liquid-tight covering broke down allowing the spray solution to enter the solenoid and degrade the coil insulation, resulting in current leakage to ground. The valve solenoid enclosure was full of spray solution when it was disassembled.

The coil was dried out for 7 days at room temperature. At this stage the insulation resistance was measured to be 10 megohms and coil dielectric test indicated some leakage current at 1100 Volts 60 Hz and no breakdown at 1240 Volts 60 Hz.

This valve is for information only. Its test results do not affect the generic families of valves tested for qualification.

Since the coil had satisfactory insulation resistance and passed the dielectric test prior to LOCA phase, it may be hypothesized that the coil would have been satisfactory but for the adverse effect of the spray solution. This condition was abnormal and is not expected during actual use.

TABLE NO. 2 D
VALVE SAMPLE NO. 4
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP-3-046. TEST MEDIUM: NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS X / DC AMPS ____	102/60	102/60	102/60	102/60	102/60	102/60	102/60
COIL DIELECTRIC TEST @ 1240 Volts	OK	TNC	TNC	TNC	TNC	OK	OK
SEAT LEAKAGE High Pressure @ 150 PSI Energized	0	0	0	0	0	0	0
SEAT LEAKAGE High Pressure @ 150 PSI Deenergized	0	0	0	0	0	0	0
SEAT LEAKAGE Low Pressure @ 10 PSI Energized	0	0	0	0	0	0	0
SEAT LEAKAGE Low Pressure @ 10 PSI Deenergized	0	0	0	0	0	0	0
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @ 165 PSI	OK	OK	OK	OK	OK	OK	OK
FROM 165 TO 1/4 PSI	OK	OK	OK	OK	OK	OK	OK
EXTERNAL LEAKAGE @ 500 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHOMS)	200K	TNC	TNC	TNC	TNC	180K	20K

TNC = Test not conducted.

TABLE NO. 2E
VALVE SAMPLE NO. 5
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP NP-8320. TEST MEDIUM: NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS X DC AMPS ____	102/60	102/60	102/60	102/60	102/60	102/60	102/60
COIL DIELECTRIC TEST @ 1240 Volts	OK	TNC	TNC	TNC	TNC	OK	OK
SEAT LEAKAGE @ 150 PSI High Pressure Energized	0	0	0	0	0	0	0
SEAT LEAKAGE @ 150 PSI High Pressure Deenergized	0	0	0	0	0	0	0
SEAT LEAKAGE @ 1/4 PSI Low Pressure Energized	0	0	0	0	0	0	0
SEAT LEAKAGE @ 1/4 PSI Low Pressure Deenergized	0	0	0	0	0	0	0
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @ 165 PSI	OK	OK	OK	OK	OK	OK	OK
FROM 165 TO 1/4 PSI	OK	OK	OK	OK	OK	OK	OK
EXTERNAL LEAKAGE @ 500 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHMS)	20K	TNC	TNC	TNC	TNC	600K	100K

TNC = Test not conducted.

TABLE NO. 2F
VALVE SAMPLE NO. 6
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP NP 8316. TEST MEDIUM: NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS ____ DC AMPS X	.074	.074	.074	.074	.074	.074	.074
COIL DIELECTRIC TEST @ 1250 Volts	OK	TNC	TNC	TNC	TNC	OK	OK
SEAT LEAKAGE High Pressure @ 175 PSI Energized	0	0	0	0	.4SCFH	0	0
SEAT LEAKAGE High Pressure @ 175 PSI Deenergized	0	0	0	0	0	0	0
SEAT LEAKAGE Low Pressure @ 10 PSI Energized	0	0	0	0	.9SCFH	0	0
SEAT LEAKAGE Low Pressure @ 10 PSI Deenergized	0	0	0	0	0	0	0
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @ 195 PSI	OK	OK	OK	OK	OK	OK	OK
FROM 195 TO 10 PSI	OK	OK	OK	OK	OK	OK	OK
EXTERNAL LEAKAGE @ 275 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHOMS)	20K	TNC	TNC	TNC	TNC	800K	12

TNC = Test not conducted.

TABLE NO. 2G
VALVE SAMPLE NO. 7
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP NP 3-046. TEST MEDIUM: NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS ___ DC AMPS X	.177	.177	.177	.177	.177	.177	.177
COIL DIELECTRIC TEST @ 1250 Volts	OK	TNC	TNC	TNC	TNC	OK	*
SEAT LEAKAGE High Pressure @ 200 PSI Energized	0	2SCFH	60SCFH	120SCFH	100SCFH	60SCFH	TNC
SEAT LEAKAGE High Pressure @ 200 PSI Deenergized	0	0	0	0	0	0	0
SEAT LEAKAGE Low Pressure @ 10 PSI Energized	0	0	6SCFH	16SCFH	9SCFH	12SCFH	TNC
SEAT LEAKAGE Low Pressure @ 10 PSI Deenergized	0	0	0	0	0	0	0
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @ 220 PSI	OK	OK	OK	OK	OK	OK	≠
FROM 220 TO 1/4 PSI	OK	OK	OK	OK	OK	OK	≠
EXTERNAL LEAKAGE @ 500 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHOMS)	20K MEGS	TNC	TNC	TNC	TNC	400K MEGS	*

TNC = Test not conducted.
* = See attached.
≠ = See attached.

TABLE NO. 2G
VALVE SAMPLE NO. 7

* At the end of LOCA Simulation, the coil had insulation resistance of less than one megohm, so the coil dielectric test was not performed.

During the LOCA phase, the solenoid enclosure was wired through Liquatite, type L.T. flexible electrical conduit manufactured by Electri-Flex Co., Roselle, Illinois. This conduit is rated for 120°F and during the 30-day LOCA test, plastic liquid-tight covering broke down allowing the spray solution to enter the solenoid and degrade the coil insulation, resulting in current leakage to ground. The valve solenoid enclosure was full of spray solution when it was disassembled.

The coil was dried out for 7 days at room temperature. At this stage the coil was found to be open.

This valve is for information only. Its test results do not affect the generic families of valves tested for qualification.

≠ Valve was energized twice satisfactorily. Subsequently it could not be re-energized. The coil was found to be open.

Since the coil had satisfactory insulation resistance and passed the dielectric test prior to LOCA phase, it may be hypothesized that the coil would have been satisfactory but for the adverse effect of the spray solution. This condition was abnormal and is not expected during actual use.

TABLE NO. 2H
VALVE SAMPLE NO. 8
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP NP 8321. TEST MEDIUM:NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS ___ DC AMPS X	.074	.074	.074	.074	.074	.074	.074
COIL DIELECTRIC TEST @ 1250 Volts	OK	TNC	TNC	TNC	TNC	OK	OK
SEAT LEAKAGE High Pressure @ 200 PSI Energized	0	*	20SCFH	20SCFH	5.5SCFH	4.7SCFH	2SCFH
SEAT LEAKAGE High Pressure @ 200 PSI Deenergized	0	0	8SCFH	5SCFH	.6SCFH	3.6SCFH	2.5SCFH
SEAT LEAKAGE Low Pressure @ 10 PSI Energized	0	*	3.5SCFH	2.5SCFH	1.2SCFH	200cc/min.	1SCFH
SEAT LEAKAGE Low Pressure @ 10 PSI Deenergized	0	0	0	0	0	1cc/min.	0
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @ 220 PSI	OK	OK	OK	OK	OK	OK	OK
FROM 220 TO 10 PSI	OK	OK	OK	OK	OK	OK	OK
EXTERNAL LEAKAGE @ 300 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHMS)	200K	TNC	TNC	TNC	TNC	400K	14

TNC = Test not conducted.
* = See attached.

TABLE NO. 2H
VALVE SAMPLE NO. 8

* While exposing this valve to temperature environment of 268°F for a period of 12 days (for thermal aging) and cycling it once every 6 hours, it developed excessive leakage in energized and deenergized states. At the end of the test, it was determined that the excessive leakage was caused by dirt in the valve. The source of the dirt was the iron pipe used in the cylinder port as piping and an additional length to simulate an accumulator.

A new unit was substituted, which was thermally aged at 295°F for 100 hours and cycled once every 2 hours. This higher temperature and lower thermal aging period was chosen to accelerate the test program. After approximately 60 hours of this test, the valve started leaking in the energized state. The leakage was 40 SCFH at 200 psig, 17 SCFH at 125 psig and 3 SCFH at 10 psig. The valve shifted properly and had no leakage in de-energized state.

It was postulated that the rubber exhaust orifice disc pulled off the piston assembly due to the pressure load on the disc and softening of the disc caused by high temperature of 295°F. Normal 140°F ambient temperature would not cause noticeable softening of this disc. When the valve was disassembled at the completion of the qualification testing program, this postulation proved to be true. As the valve performed its safety function, the thermal aging continued. Further Type-Tests and Baseline/Functional tests were performed on this valve.

This valve is normally used on air systems of 125 psig maximum. Therefore the maximum operating pressure differential has been changed from 200 psig to 150 psig which would result in a 25% load reduction on the disc.

TABLE NO. 2 I
VALVE SAMPLE NO. 9
BASELINE/FUNCTIONAL TESTS

TESTS CONDUCTED PER ASCO TEST PROCEDURE BULLETIN TP NP 8323. TEST MEDIUM: NITROGEN GAS	THERMAL AGING		RADIATION	WEAR AGING	VIBRATION END. & SEISMIC SIM.	ACCIDENT RADIATION	LOCA
	PRE	POST	POST	POST	POST	POST	POST
COIL EXCITATION AC VOLTS X DC AMPS X	102/60 .074	102/60 .074	102/60 .074	102/60 .074	102/60 .074	102/60 .074	102/60 .074
COIL DIELECTRIC TEST 1240 AC Volts @ 1250 DC Volts	OK	TNC	TNC	TNC	TNC	OK	* OK
SEAT LEAKAGE High Pressure @ 40 PSI Energized	0	0	0	0	0	0	0
SEAT LEAKAGE High Pressure @ 40 PSI Deenergized	0	0	0	0	0	0	0
SEAT LEAKAGE Low Pressure @ 1/4 PSI Energized	0	0	0	0	0	0	0
SEAT LEAKAGE Low Pressure @ 1/4 PSI Deenergized	0	0	0	0	0	0	0
NOISE TEST	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL TEST 10 TIMES @ 44 PSI	OK	OK	OK	OK	OK	OK	OK
FROM 44 TO 1/4 PSI	OK	OK	OK	OK	OK	OK	OK
EXTERNAL LEAKAGE @ 500 PSI (Energized & Deenergized)	OK	OK	OK	OK	OK	OK	TNC
INSULATION RESISTANCE (MEGOHOMS)	100K	TNC	TNC	TNC	TNC	400K	Less than 1 meg AC 6 megs DC

TNC = Test not conducted.
* = See attached.

TABLE NO. 2I
VALVE SAMPLE NO. 9

*At the end of LOCA Simulation, the coils had insulation resistance of less than one megohm, so the coil dielectric test was not performed.

During the LOCA phase, the solenoid enclosures were wired through Liquatite, type L.T. flexible electrical conduit manufactured by Electri-Flex Co., Roselle, Illinois. This conduit is rated for 120°F and during the 30-day LOCA test, plastic liquid-tight covering broke down allowing the spray solution to enter the solenoids and degrade the coils insulation, resulting in current leakage to the ground. The valve solenoid enclosure was full of spray solution when it was disassembled.

The coils were dried for 7 days at room temperature. At this state the insulation resistance was measured to be 6 megohms (DC) and less than 1 megohm (AC). Coil dielectric test was satisfactory for DC, while it indicated some current leakage at 600 Volts/60Hz and no breakdown at 1240 Volts/60 Hz for AC. The coils were operable.

Since the coils had satisfactory insulation resistance and passed the dielectric test prior to LOCA phase, it may be hypothesized that the coils would have been satisfactory but for the adverse effect of the spray solution. This condition was abnormal and is not expected during the actual use.

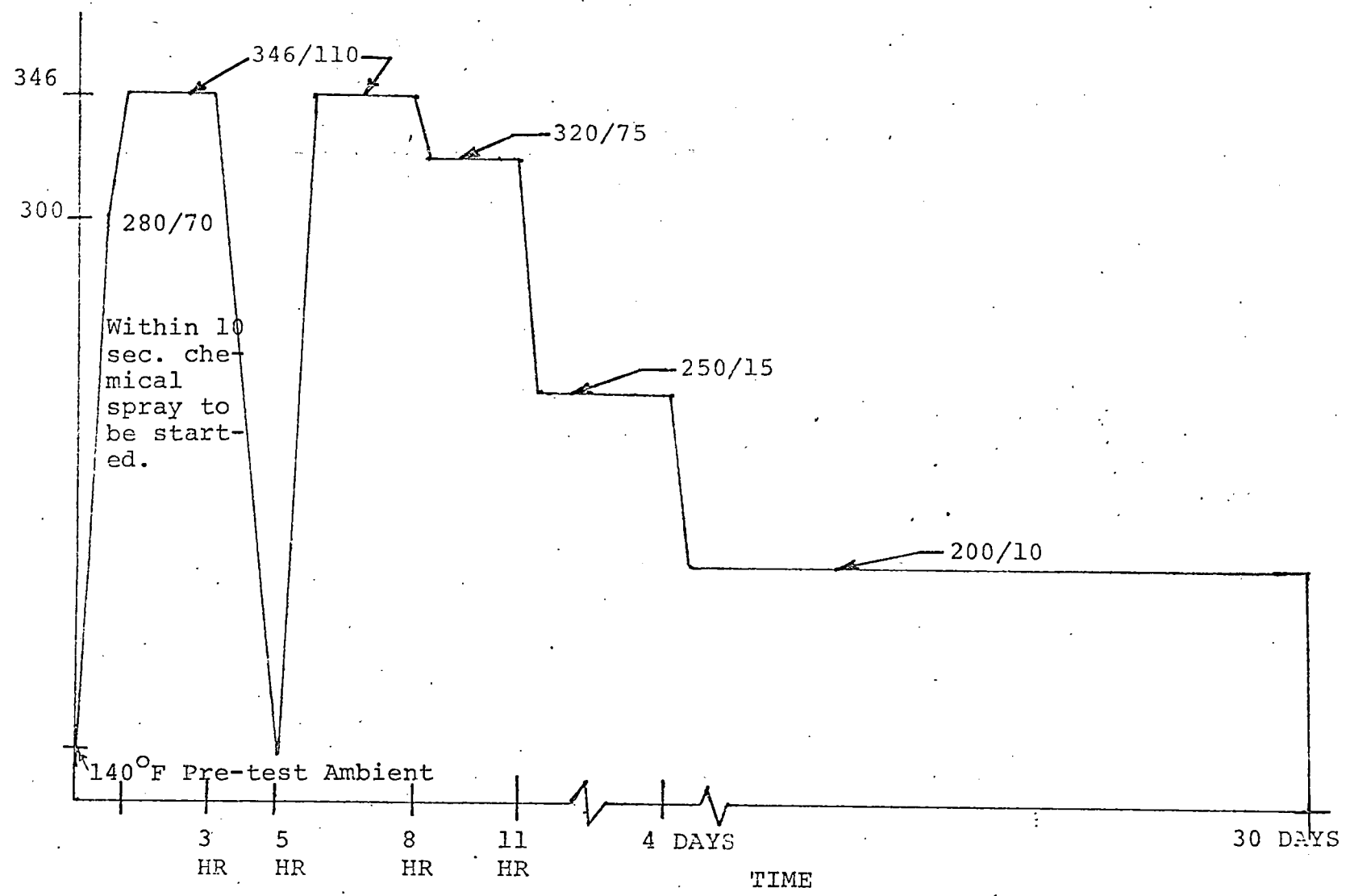

FIGURE 2
ACTUAL LOCA SIMULATION BY ENVIRONMENTAL EXPOSURE (STEAM/CHEMICAL)

Temperature/Pressure Profile for simulation of loss-of-coolant accident (LOCA) design basis event (DBE) by steam/chemical-spray environmental exposure.

TABLE NO. 3

(See Page 4-23 for explanation and notes)

CYCLING DATA DURING LOCA SIMULATION

VALVE NO.	OPERATION / ELAPSED TIME	8 MIN.	1 HR.	2 HR.	5 HR. 5 MIN.	6 HR.	8 HR.	9 HR.	11 HR.	12 HR.	22 HR.	4 DAYS	15 DAYS	30 DAYS LC DE-EN	30 DAYS LC ENER.
1	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	
	LC		0	0		0					0	0	0	0	0
2	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK(4)	OK	
	LC		210cc/min.	210cc/min.		170cc/min.					230cc/min.	0	15SCFH	(4)	2SCFH
3	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	(5)	
	LC		50cc/min.	15cc/min.		0					0	0	20cc/min.	0	(6)
4	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	
	LC		0	0		0					0	0	0	0	0
5	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	
	LC		0	0		0					0	0	0	0	0
6	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	
	LC		0	0		0					0	0	0	0	0
7	CY	(1)	OK	OK	OK	OK	OK	OK	OK	OK	OK	(2)	(3)	(5)	
	LC		0	0		0					0	0	0	0	(7)
8	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	
	LC		0	0		0					0	6SCFH	12SCFH	2.5 SCFH	2 SCFH
9AC	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	(3)	(3)	(5)
	LC		0	0		0					0	0	0	0	(6)
9DC	CY	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	(5)	
	LC		0	0		0					0	0	0	0	0

CY = Cycling ENER = Energized
LC = Leak Check DE-EN = De-energized

ALL VALVES (EXCEPT NO. 7) ENERGIZED AT .4 HOUR 35 MINUTES ELAPSED TIME. FOR VALVE NO. 7 SEE FOLLOWING NOTES 1 & 2.

LEAKAGE CHECKED DE-ENERGIZED EXCEPT AT 30 DAYS WHERE IT WAS CHECKED BOTH ENERGIZED AND DE-ENERGIZED.

NOTE (1) : Valve had failed closed by blowing 2 amp fuse in line. By failing closed, it performed its safety function. Resistance measured to be 10 ohms from the coil lead to ground. Valve would shift but continued to blow fuses.

NOTE (2) : Valve No. 7 was momentarily energized at each check until 4 day elapsed time when it was energized continuously for 5 minutes without blowing the fuse. The resistance from the coil leads to ground varied during this period from 200 to 1300 ohms.

NOTE (3) : The valves blew 2 amp fuses. Resistances measured on valve Nos. 7 and 9 (AC) were low. These valves would shift but continued to blow fuses.

NOTE (4) : Valve No. 2 showed a leakage of 15 SCFH. At the completion of the LOCA Simulation, the valve inspection revealed that the leakage was caused by the steel tank which was piped to port "B" to be rusted through. In other words, the leakage was not seat leakage but leakage of the vessel pressurized environment through port "B" to exhaust.

NOTE (5) : The valves blew 2 amp fuses. When they were replaced with 2 amp slow-blow fuses, they worked satisfactorily.

NOTE (6) : The valves blew the slow-blow fuses before a leakage check could be taken. Although no actual leakage was measured, there appeared to be no leakage.

NOTE (7) : The valve could not be energized. Subsequent inspection revealed that the coil was open.

TABLE NO. 4

SUMMARY OF VALVES PERFORMANCE

Valve No.	Baseline/ Functional Tests	Thermal Aging	Radiation	Wear Aging	Seismic Sim. & Vib. Endurance Tests	Accident Radiation	LOCA Simulation
1	Pass	Pass	Pass	Pass	Pass	Pass	Pass
2	Pass	Pass	Pass	Pass	Pass	Pass	Pass
3	Pass	Pass	Pass	Pass	Pass	Pass	Pass
4	Pass	Pass	Pass	Pass	Pass	Pass	Pass
5	Pass	Pass	Pass	Pass	Pass	Pass	Pass
6	Pass	Pass	Pass	Pass	Pass	Pass	Pass
7	Pass	Pass	Pass	Pass	Fail	Pass	Fail
8	Pass	Pass	Pass	Pass	Pass	Pass	Pass
9	Pass	Pass	Pass	Pass	Pass	Pass	Pass

The valves which experienced minor difficulties explained by acceptable reasons, in the notes of this report are indicated as having, 'Pass' performance in this table.

SECTION 5 SUMMARY

Seven solenoid valves to represent six generic families of valves and two additional valves for information only were subjected to environmental exposure for the purpose of providing qualification for safety related use in Nuclear Power Generating Stations in accordance with the outline contained in 'ASCO Qualification Specification AQS-21678 Revision B'. This test outline is based on the suggestions contained in IEEE 323-1974 "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations", IEEE 382-1972 "IEEE Trial-Use Guide for Type Test of Class 1 Electrical Valve Operators for Nuclear Power Generating Stations", IEEE 344-1975 "IEEE Recommended Practices for Seismic Qualifications of Class 1E Equipment for Nuclear Power Generating Stations" and IEEE 382/ANSI N278.2.1 (Draft 3, Rev. 1, June 1977) "Draft American National Standard for the Qualification of Safety Related Valve Actuators".

The valves were subjected to accelerated aging by exposure to elevated temperature of 268°F for a period of 12 days and cycled every 6 hours (or a temperature of 295°F for a period of 100 hours and cycled every 2 hours). Baseline/functional tests were performed before, during and after this aging phase. This was followed by exposure to gamma radiation from a Cobalt-60 Source to an accumulated dose of 50 megarads. Baseline/functional tests were again performed after this radiation exposure. Seismic Simulation and vibration endurance tests were performed to demonstrate performance during simulated earthquake and plant induced vibration.

Baseline/functional tests were performed during and after seismic simulation/vibration endurance tests. The valves were again exposed to gamma radiation from Cobalt-60 source to receive additional accumulated dose of 150 megarads. Baseline/functional tests were conducted after this radiation exposure.

The valves were finally subjected to a simulated loss-of-coolant accident (LOCA) by exposure to steam and chemical-spray for a period of 30 days. During the LOCA exposure, the valves were cycled and leakage checked. Baseline/functional tests were conducted after LOCA exposure.

RESULTS: The valves (except No. 7 which was tested for information only) successfully completed the sequential type tests and the baseline/functional tests. Minor anomalies observed are detailed and explained fully in text and/or footnotes of the tables in Section 4.

SECTION 6 CERTIFICATION

The undersigned certifies that this report presents a true account of the tests conducted and the results obtained.

Tejinder S. Sachdeva
Manager
Component Testing

George R. Dietz
President

APPENDIX A

ASCO QUALIFICATION SPECIFICATION AQS-21678/REVISION B

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QUALIFICATION SPECIFICATION FOR AUTOMATIC SWITCH CO. (ASCO) OF FLORHAM PARK, N.J. FOR SOLENOID VALVES

SPECIFICATION NO. AQS-21678/REV. B

PREPARED BY

THE COMPONENT TESTING DIVISION

OF

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REVISION SHEET

Revised areas are highlighted for your convenience by a vertical black line in the margin.

REV. A	PAGE 9-4	Added note at bottom of page
	PAGE 9-12	"until the end of 4 days" was "for a period of 14 hours"
	PAGE 9-13	Added note at bottom of page
	PAGE 9-19	Fig. 9-2 redrawn
REV. B	PAGE I-1 (Appendix I)	Changed HVA-206-382 to HVA-206-832

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* High voltage withstand potential

** SEE APPENDIX "B" FOR THESE PROCEDURES.

QUALIFICATION SPECIFICATION FOR AUTOMATIC SWITCH CO. (ASCO) SOLENOID VALVES

1. INTRODUCTION

This specification for qualification is for the purpose of conducting a program, the ultimate aim of which is to provide generic qualification for a family of solenoid valves for use in Nuclear Power Generating Stations.

This document is divided into two basic parts: Part 1 is the equipment specification, including those items required for demonstration of qualification by the acceptable methods of analysis, operating experience, and type testing; Part 2 is the type test procedure defining the specific environmental parameters during the application of which the equipment must demonstrate satisfactory operation within the constraints of the specifications presented in the first part. Part 1 includes Items 1 through 8, Part 2 includes Items 9 through 11.

2. SCOPE

This program is being conducted in accordance with the suggestions and requirements contained in the following documents. (See Note 1)

2.1 IEEE 323-1974 "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations".

2.2 IEEE 382-1972 "IEEE Trial-Use Guide for Type Test of Class 1 Electrical Valve Operators for Nuclear Power Generating Stations".

2.3 IEEE 344-1975 "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations".

2.4 The following ASCO documents for acceptance and production testing.

- 2.4.1 Valve Design Specification Sheets (Appendix I)
- 2.4.2 Individual Valve Test Procedures (Appendix II)
- 2.4.3 Measurement of Insulation Resistance Procedure (Appendix II)
- 2.4.4 Hi-pot Test Procedure (Appendix II)
- 2.4.5 Installation and Maintenance Sheets (I&M) (Appendix III)

NOTE 1 - The suggestions and requirements contained in IEEE 382/ANSI N278.2.1 (Draft 3, Rev. 1, June 1977) "Draft American National Standard for the Qualification of Safety Related Valve Actuators" have been considered and, where applicable, have been incorporated in this program.

3. EQUIPMENT DESCRIPTION

The following equipment items are included in the qualification program. These items form the generic basis for selection of the specific test units.

3.1 HVA-206-380, HVA-206-381, HVA-208-448, HVA-208-266
HVA-206-832, HVA-210-036

REF: TP-3-046

Bulletin NP-206-380, etc.

VDSS 3.1

3.2 HVA-206-384, HVA-208-279, HVA-208-293

REF: TP-NP8316

Bulletin NP8316

VDSS 3.2

3.3 HVA-206-385, HVA-208-153

REF: TP-NP8320

Bulletin NP8320

VDSS 3.3

3.4 HVA-206-386

REF: TP-NP8321

Bulletin NP8321

VDSS 3.4

3.5 HVA-206-387

REF: TP-NP8323

Bulletin NP8323

VDSS 3.5

3.6 HVA-206-389, HVA-208-264, HVA-208-265, HVA-206-390
HVA-208-267, HVA-208-269

REF: TP-NP8344
Bulletin NP8344
VDSS 3.6

4. INSTALLATION REQUIREMENTS

Unless otherwise noted on the Valve Design Specification Sheet, (Appendix I), all valves will be mounted in position such that the axis of the coil remains in a vertical and upright position. Specific installation requirements are as follows:

4.1 Mounting Orientation - As noted above and/or on Valve Design Specification Sheet. Valves shall be mounted in the most severe orientation for seismic qualification.

4.2 Connections - All connecting tubing, fittings, and other devices utilized for directing process fluid to valve shall be of a material compatible with the specified operating environments, process fluid and valve body.

Tubing, fittings, conduit, etc., shall be of a material suitable for operation in the expected environments and be of sufficient size and quality so as not to degrade the safety function or classification of the valve.

4.3 Interfaces - Connections to the test items shall not degrade its safety function and shall be identified as to type and kind relative to its use for test purposes or suitably identified as an

acceptable device currently in use in a similar plant application. Where appropriate, all such interfaces shall have been proven qualified by a process similar to this.

4.4 Fixturing - Fixtures shall be provided to accommodate test valves in accordance with their particular mounting and installation requirements as defined above or in the Valve Design Specification Sheet. Fixtures shall be used solely to facilitate holding test valves and are not to amplify or dampen motions that the valves would be expected to experience in service. Fixtures shall not interfere with the safety function of valves.

5. SPECIFICATION OF VALVE LIFE

5.1 Design life - Unless otherwise noted, valves have a design life of 40 years, during which interval satisfactory performance shall be demonstrated for the design service conditions as presented in Section 8.

5.2 Installed life - Unless otherwise noted, valves have an installed life of 40 years and 40,000 cycles. Coils and elastomeric components shall be replaced every 4 years as noted in the Valve Design Specification Sheets (Appendix I) based on the solenoid valves being constantly energized at the service conditions presented in Section 8 and provided the installation requirements recommended in the ASCO I&M Sheets (Appendix III) have been met.

5.3 Qualified life objective - In accordance with the definition for qualified life as the period of time during which satisfactory performance can be demonstrated for the service conditions, it is the intention of this program to establish the qualified life of the subject valves as coinciding with the plant design life.

6. PERFORMANCE SPECIFICATION

6.1 Acceptable limits of operation

The acceptable limits of operation of the subject valves, unless otherwise specified, are as follows:

6.1.1 Valves to operate at 15% below rated AC voltage and for short periods (line surges,etc) at 10% above; battery operated 125 VDC valves to operate from 90-140 VDC.

6.1.2 Valves to operate at the minimum and maximum operating pressure differentials as stated in tables of Valve Design Spec. Sheets in Appendix I.

6.1.3 Valve coils to operate within the following limits of acceptability below which coils must be replaced.

6.1.3.1 Insulation resistance: 1.0 megohm (minimum) at 500 VDC.

6.1.3.2 Hypot: Leakage current less than 0.5 milliamp at twice rated voltage plus 1000 VAC applied for a period of one minute (Appendix II).

6.2 Safety function to be demonstrated

The required safety function performance verification objective to be demonstrated for the valves, unless otherwise specified, is as follows:

6.2.1 Valves are to operate at test voltage or current (85% of nominal AC volts or low DC voltage condition, i.e, 90 VDC for a 125 VDC application) at minimum and maximum operating pressure differential on demand under all postulated environmental conditions.

6.2.2 Valves are not to have a pressure build-up at a vented cylinder port or pressure decrease at a pressurized cylinder port in excess of 10% of the nominal inlet supply pressure under all postulated environmental conditions.

7. LOADING

7.1 Method of load simulation

The test valves will be subjected to operational loads by means suitable to duplicate or simulate actual operation with the process fluid as specified in the ASCO Valve Design Specification Sheet and at the valve design service conditions. The test set-up utilized in conjunction with load simulation, shall provide for continuous operation and monitoring of pertinent performance characteristics that include, but are not limited to the following parameters:

A. Cycle rate and on-off time

B. Cycle count

C. Pressure at valve inlet and cylinder port(s)

D. Seat leakage

E. Electrical characteristics of coil, as applicable, .e.g. supply voltage, current, power

F. External leakage

G. Proper operation

7.2 Verification of operability

The methods and procedures utilized for load simulation operation shall be sufficient to provide proof of operability in accordance with the valve performance specification.

8. ENVIRONMENTAL SERVICE CONDITIONS

8.1 Normal and Abnormal Ambient

8.1.1 Temperature; 60°F to 140°F; Ave 120°F

8.1.2 Pressure; -.5 psig to 15 psig; Ave 0 psig

8.1.3 Relative Humidity; 0% to 100%; Ave 55%

8.1.4 Chemical Composition of environment - Standard atmospheric composition.

8.1.5 Radiologic environment

Type	Dose	Dose Rate
gamma	4.5×10^7 rads/40 yr.	120 R/hr.
neutron	8×10^{16} NVT	6×10^7 n/cm^2-sec.

8.1.6 Typical Seismic and Vibration Environment

8.1.6.1 Specification of Operating Basis Earthquake (OBE). That earthquake which produces the vibratory motion for which those features of the nuclear power plant necessary for continued operation without undue risk to the health and safety of the public are designed to perform their safety function. Typical values, including normal loads, are as follows:

horizontal (both axes): 1.5g

vertical: 1.5g

8.1.6.2 Vibration endurance capability to be demonstrated for anticipated or specified plant locations.

8.2 Design Basis Event and Post DBE Service Conditions

8.2.1 Temperature - Maximum of 330°F for a total period of 6 hours followed by post DBE conditions of 200°F up to one year, as shown in Figures 8.1, 8.2 and 8.3.

8.2.2 Pressure - maximum of 70 psig; long term post DBE condition of 10 psig up to one year; also shown in Figures 8.1, 8.2 and 8.3.

8.2.3 Relative humidity - All steam environment for temperature in excess of 250°F; greater than 90% for other conditions.

8.2.4 Chemical composition of environment - Borated water spray with sodium thiosulfate and sodium hydroxide or demineralized water spray.

8.2.5 Radiologic Environment - as applicable

Type	Dose	Dose Rate
gamma	1.2×10^8 rads	4×10^6 R/hr to 1×10^2 R/hr after 1 year
neutron	NA	NA

8.2.6 Resistance to Seismic Disturbance - Safe Shutdown Earthquake (SSE)

That earthquake which produces the maximum vibratory motion for which all Category I structures, systems and components, are designed to perform their safety function. The specification requires demonstration of the ability to withstand the SSE and maintain functionability during and after. Typical values, including normal loads, are as follows:

horizontal (both axes): 3.0g

vertical: 3.0g

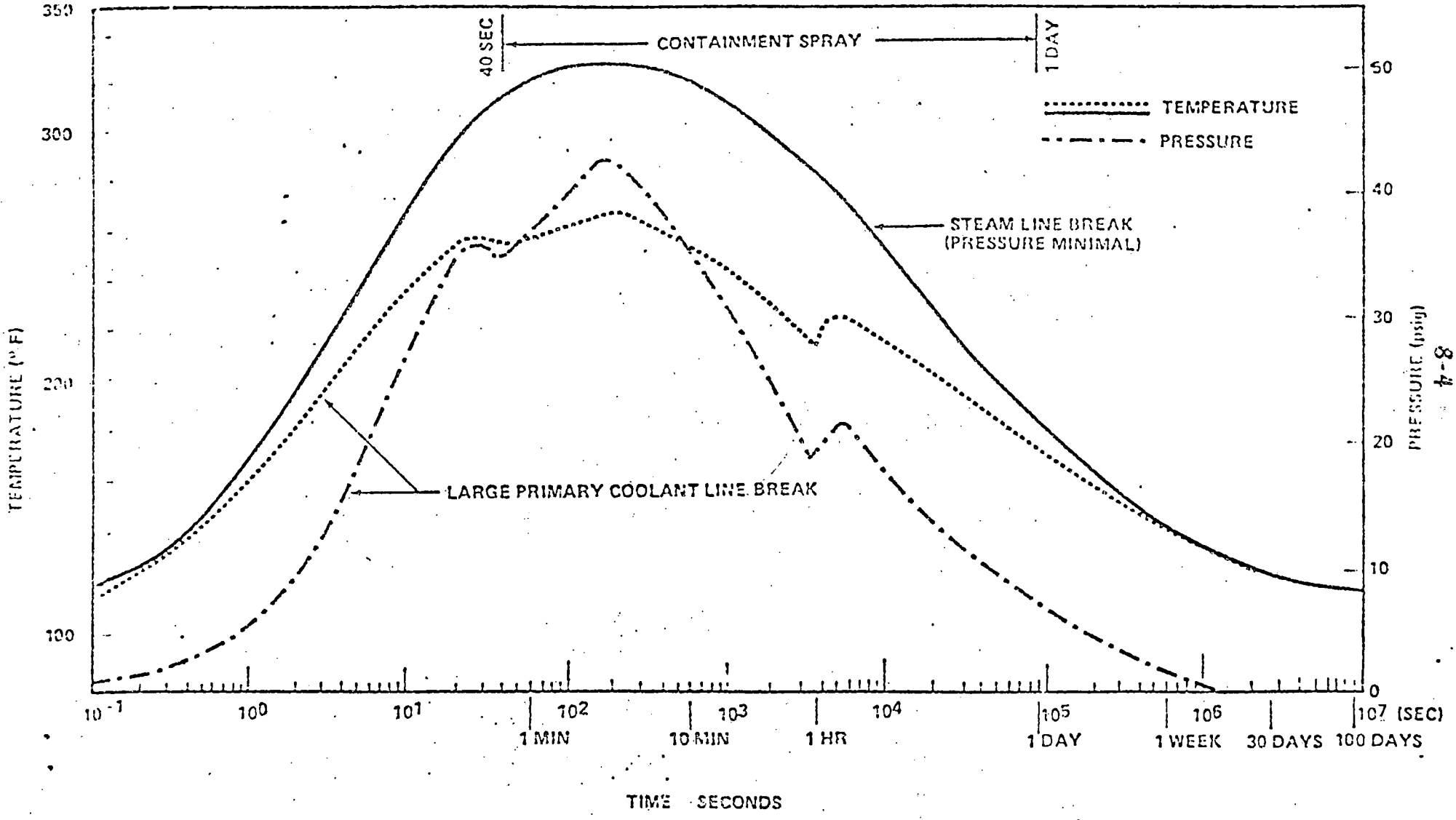


FIGURE 8.1 TEMPERATURE AND PRESSURE IN CONTAINMENT FOLLOWING DBE IN PWR PLANT

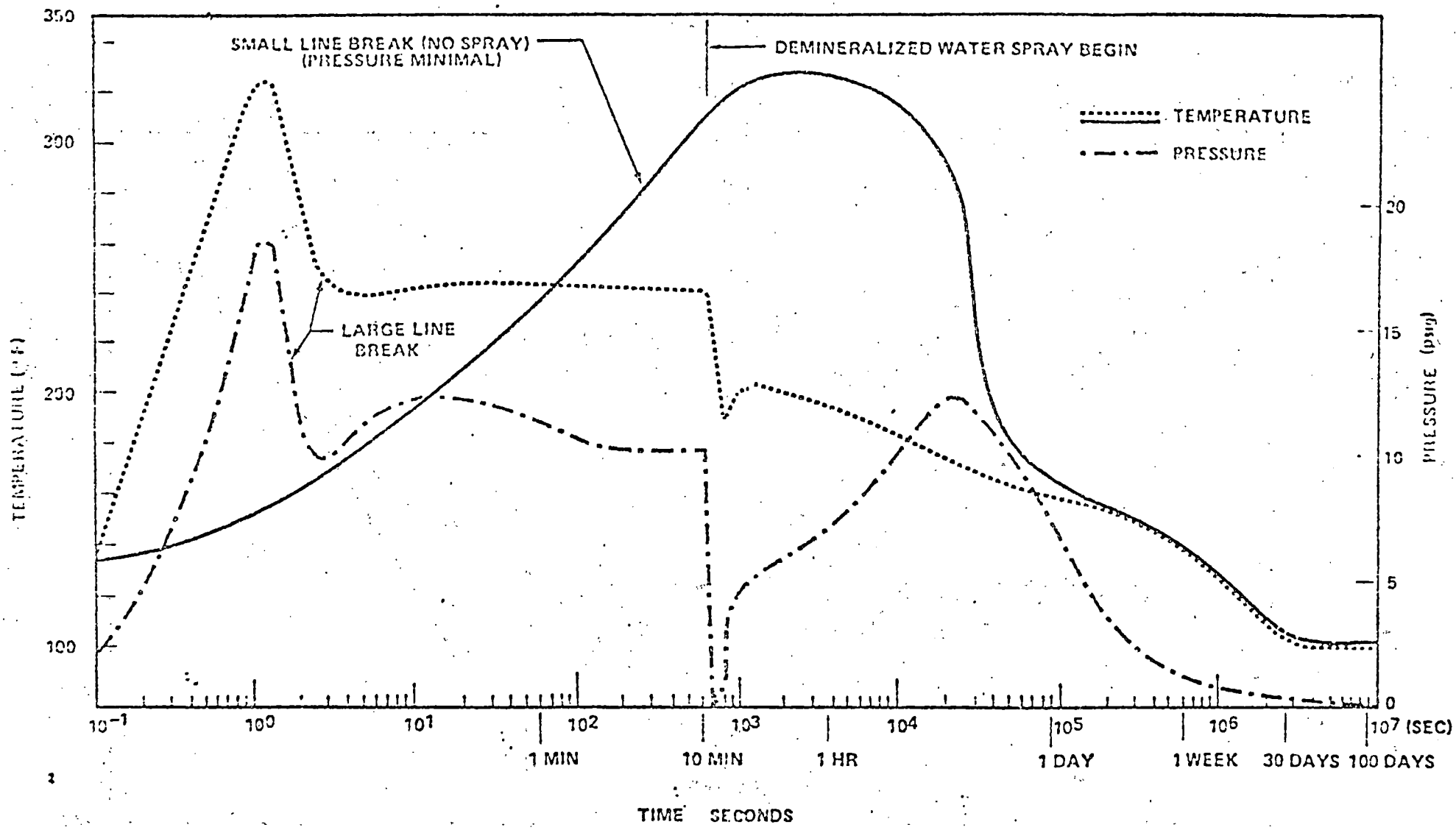


FIGURE 8.2 TEMPERATURE AND PRESSURE IN DRYWELL FOLLOWING DBE IN BWR PLANT

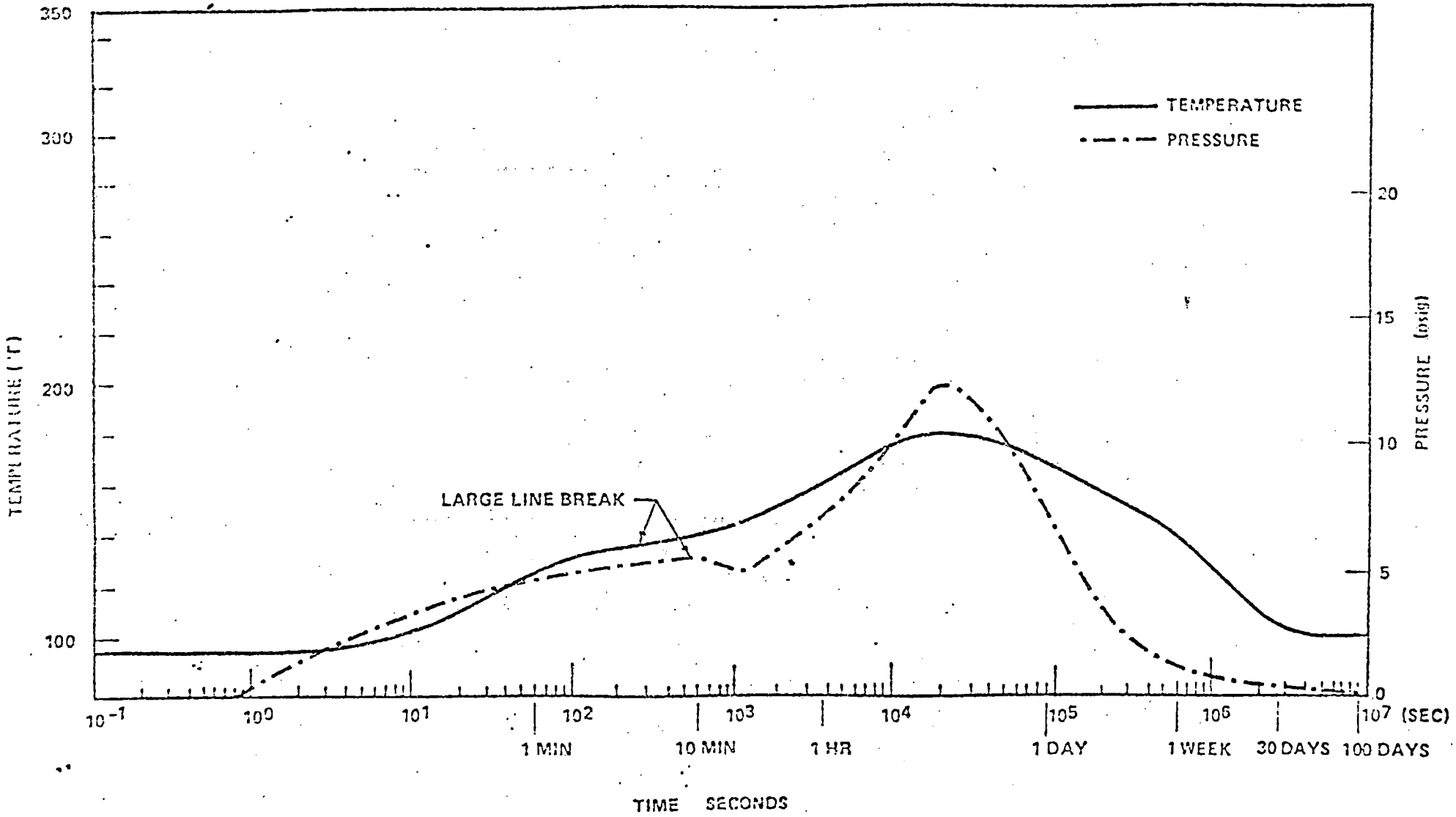


FIGURE 8.3 TEMPERATURE AND PRESSURE IN CONTAINMENT OUTSIDE DRYWELL FOLLOWING DBE IN BWR PLANT

9. ENVIRONMENTAL QUALIFICATION AND TYPE-TEST PROCEDURE

9.1 Qualification by analysis - as applicable with suitable justification and documentation.

9.2 Qualification by prior operating experience as applicable with suitable justification and documentation.

9.3 Other methods

Where methods, techniques or procedures are utilized in the qualification process other than those expressly considered in the referenced documents, they shall be completely justified and substantiated in accordance with the philosophy and intent of the referenced documents.

9.4 Qualification Type-Test Procedure

9.4.1 Description of test items

The specific items to be tested are listed in Table 9.1, showing the particular phase associated with each. Reference is made to the Valve Design Specification Sheets for the valve classification and specifications. Any deviation in the actual test item is noted in the footnotes on the table.

9.4.2 Type-test sequence

Four general aging phases have been considered in this qualification program. They are: thermal aging, wear cycling, vibration and irradiation. This takes into account the particular maintenance schedule associated with the equipment wherein organic materials shall be replaced during the installed life period.

9.4.2.1 Inspection of test items

The test items shall be inspected prior to testing to assure that the unit has not been damaged by handling subsequent to manufacture.

Any damage to the unit or disparity between the inspection report and the production sign-off, shall be duly noted and recorded with appropriate follow-up action suggested.

9.4.2.2 Baseline data operation

The test items shall be operated to verify performance specifications and provide baseline data for comparison with performance at other

stages of the test. Specifically, baseline operation shall be performed before and after each phase of the type test, and consist of the following:

A. insulation resistance of coil at 500 VDC in accordance with Procedure ELP-45 (ref. section 2.4.3 and 6.1.3).

B. external leakage at 1-1/2 maximum operating pressure differential (MOPD).

C. seat leakage at MOPD and minimum OPD or 1/4 PSIG for zero minimum valves.

D. operate valve 10 times at MOPD and test voltage or current.

E. operate from MOPD to minimum OPD at test voltage or current.

9.4.2.3 Aging Simulation

9.4.2.3.1 Thermal Aging - The basis for thermal aging was determined to be for a period of 4 years at an ambient temperature of 140°F.

This period is simulated by performing an accelerated aging program by exposing the valves to a temperature of 268°F for a period of 12 days. The test temperature and period have been calculated by the 10°C rule (Arrhenius Equation) using 4.4 years as the design life of the elastomer and coil materials.*

9.4.2.3.2 Radiation Aging - Background Thermal aging will be followed by radiation exposure to a cobalt-60 source of gamma radiation at a rate not to exceed 1 megarad per hour until a dose of 50 megarads has been received. Performance shall be monitored to insure that any transitory effects of radiation have been accounted for.

*All valves are to be pressurized at maximum operating pressure differential and energized continuously at nominal voltage. The valves are to be cycled (de-energize and energize) every 6 hours to simulate operation once a month at 140°F ambiemt temperature.

9.4.2.3.3 Wear Aging - At the conclusion of the radiation aging period, the valves will be cycled 40,000 times at maximum operating pressure differential in accordance with the requirements of 7.1. Baseline tests to be performed at the completion of the wear aging. Perform coil hi-pot test at this point.

9.4.2.3.4 Vibration Endurance

A. Mount the valves to the shaker table in accordance with installation and orientation requirements.

B. Attach all electrical and pneumatic supply and control lines in accordance with connection requirements and in conjunction with the interface definitions.

C. Control the table input motion using accelerometers located at the valve mounting surface.

D. Operate the valve under load before, during and after the test with sufficient monitoring equipment to verify functional operability.

E. Perform vibration endurance testing by subjecting the valves to a total of 10^6 cycles, separated evenly between all three orthogonal axes, by vibrating at a non-resonant frequency between 50 and 100 Hz at an input acceleration level of at least 0.75g. Operate the valve through one complete cycle, at maximum operating pressure differential, every 15 minutes during the exposure period. Perform baseline tests.

9.4.2.4 DBE and Post DBE Environmental Simulation

9.4.2.4.1 Radiation Simulation - Expose the test valves to the DBE radiation dose of 150 megarads in a gamma radiation environment of cobalt-60 at a dose

rate not to exceed 1 megarad per hour. Perform operational tests, as required, to account for transitory effects. Perform baseline tests.

9.4.2.4.2 Seismic Event Simulation - Mount the test valves as in 9.4.2.3.4 above and provide for performance verification by suitable instrumentation. Perform the seismic simulation by applying:

9.4.2.4.2.1 A low level (approximately .2g) frequency sweep search for resonance from 1-35 Hz.

9.4.2.4.2.2 OBE vibratory motion as follows:

Expose the valve to two sinusoidal sweeps at 2/3 of the RIM levels shown in Figure 9-1, in each orthogonal axis. Each sweep shall be from 1-33-1 Hz at a rate of 1 octave per

minute. One sweep shall be performed with the valve open and one with the valve closed. The OBE sweeps in each axis may be followed by the SSE test in that axis. If desired, the actuator may be instrumented, and the data from this test used for the resonance search information. (A general requirement is to perform five OBE tests prior to the SSE. The two sine sweeps are designed to provide the mechanical aging of five OBE's).

9.4.2.4.2.3 SSE vibratory motion as follows:

Expose the valve to a series of single frequency sinusoidal tests at the 1/3 octave interval dwell point frequencies indicated on Figure 9-1. At each dwell test frequency the minimum peak acceleration shall be the RIM value shown in Figure 9-1.

* Record the g-levels at which the cylinder port pressure changes by 0,5 & 10% of the nominal value, which is zero when de-energized and full inlet pressure when energized. The maximum peak acceleraion shall be a change of 10% from nominal pressure at the cylinder port, up to 10g maximum. The duration of each dwell will be the period of time required to operate the valve through one complete open/close cycle or 15 seconds, whichever is longer. The open/close cycle will start after the prescribed acceleration level is reached. Apply motion at the same frequencies and acceleration limits in each of the three orthogonal axes separately. Perform baseline tests.

*This testing goes beyond type testing and defines a fragility level at which the valve may be considered to still function properly. This level is dependent on customer requirements as to the pilot valve cylinder port pressure, which causes the main device to shift position.

9.4.2.4.3 Loss-of-Coolant Accident Environmental Simulation - The test units previously subjected to the above exposures will be installed inside a pressure vessel and subjected to a 30-day exposure to steam and chemical-spray simulating a LOCA event and post-LOCA cool-down.

The electrical lead wires and pneumatic connections for energizing, pressurizing and output monitoring are to be brought out of the chamber and connected to the monitoring equipment for recording the out-put of the unit during exposure cycle.

Prior to actually starting the exposure, but with the unit in place, the chamber shall be pres-surized to check for sealing and the spray system operated to insure proper functioning.

Cycling of the valves shall be performed and measurements of performance made, as in the baseline tests, to insure proper functioning before proceeding.

The LOCA simulation event is to follow the suggestions of IEEE-323-1974 "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations", IEEE 382-1972 "IEEE Trial-Use Guide for Type Test of Class 1 Electric Valve Operators for Nuclear Power Generating Stations", and Draft 3, Revision 1, American National Standard for the Qualification of Safety Related Valve Actuators, IEEE 382/ANSI 278.2.1, and in particular, the pressure/temperature profile shown in Figure 9.2. Specifically, steam is to be rapidly admitted,increasing

the temperature from room ambient to 300°F within 60 seconds and to 346°F within 5 minutes. This condition will be maintained for a period of one hour. The first transient is followed by a one-hour drop period to 135°F and a dwell period of one hour maintained at that temperature. The second transient is to commence with a temperature rise to 300°F in 60 seconds and to 346°F within 5 minutes, followed by a dwell period of three hours at 346°F. This dwell period will be followed by a drop in temperature from 346° to 320°F within 30 minutes. This drop is followed by a dwell period of three hours at 320°F. The temperature will then be dropped from 320°F to 250°F within a 30 minute period. This will be followed by a dwell period of 250°F until the end of 4 days,

followed by a drop in temperature from 250°F to 200°F within 30 minutes, followed by a dwell time at that temperature to the conclusion of the test of 30 days. The valves are to be cycled at the times indicated on Figure 9.2.*

A chemical solution, consisting of 3000 ppm of boron as boric acid in solution with 0.064 molar sodium thiosulfate buffered with sodium hydroxide to a pH between 9 and 11 at room temperature, is to be sprayed into the chamber after reaching 280°F during the first transient and maintained throughout the entire 30 day period. The spray rate will correspond to 0.306 gpm per square foot of area covered by the spray. The pH of the solution is to be periodically checked and new solution added as

*The valves are assumed to be constantly energized during the normal plant operation. They will, for this test, be energized for 4 hours (to produce coil saturation) prior to the first transient. When the vessel temperature reaches 280°F the valves will perform their safety function by closing (de-energize). They then will be cycled "open - close" at times indicated on p. 9-19.

required to maintain the pH. The pressure followed during this exposure cycle may correspond to the saturation pressure for the particular temperature.

At the conclusion of the 30 day LOCA simulation event, the test valves are to be examined,cycled and inspected prior to removal from the test chamber. Baseline tests and coil hi-pot tests are also to be performed. (Reference Section 6.1.3 and Appendix II.

9.4.3 Post Test Inspection and disassembly - After completion of the entire test program, the valves shall be disassembled and visually inspected for degradation resulting from the exposure environments. Photographs will be taken at suitable periods during and after the tests as a permanent record of the physical condition of the test valves.

TABLE 9.1

IDENTIFICATION OF TEST VALVES

VALVE (REF. VDSS)	TEST VALVE NO.	DESCRIPTION	PHASE
HVA-206-380-3RF	4	AC, Class H screw terminal coil, Nema 6 solenoid enclosure, resilient seats, normally closed construction. (Ref. VDSS 3.1, Appendix I)	Para. 9.4 Type Test Procedure
HVA-206-381-6F (Note 1)	1	DC, Class H leaded coil, Nema 4, 7, and 9 solenoid enclosure, metal seats, normally closed construction. (Ref. VDSS 3.1, Appendix I)	Para. 9.4 Type Test Procedure
NP831665E	6	DC, Class H leaded coil, Nema 4, 7, and 9 solenoid enclosure, normally closed construction. (Ref. VDSS 3.2, Appendix I)	Para. 9.4 Type Test Procedure
NP8320A184E	5	AC, Class H leaded coil, Nema 6 solenoid enclosure, normally closed construction. (Ref. VDSS 3.3, Appendix I)	Para. 9.4 Type Test Procedure
NP8321A5E	8	DC, Class H leaded coil, Nema 4, 7, and 9 solenoid enclosure, normally closed construction. (Ref. VDSS 3.4)	Para. 9.4 Type Test Procedure
NP8323A39E	9	(Solenoid A) AC, Class H leaded coil, (Solenoid B) DC, Class H screw terminal coil, Nema 6 solenoid enclosures, normally closed construction, (Ref. VDSS 3.5, Appendix I)	Para. 9.4 Type Test Procedure

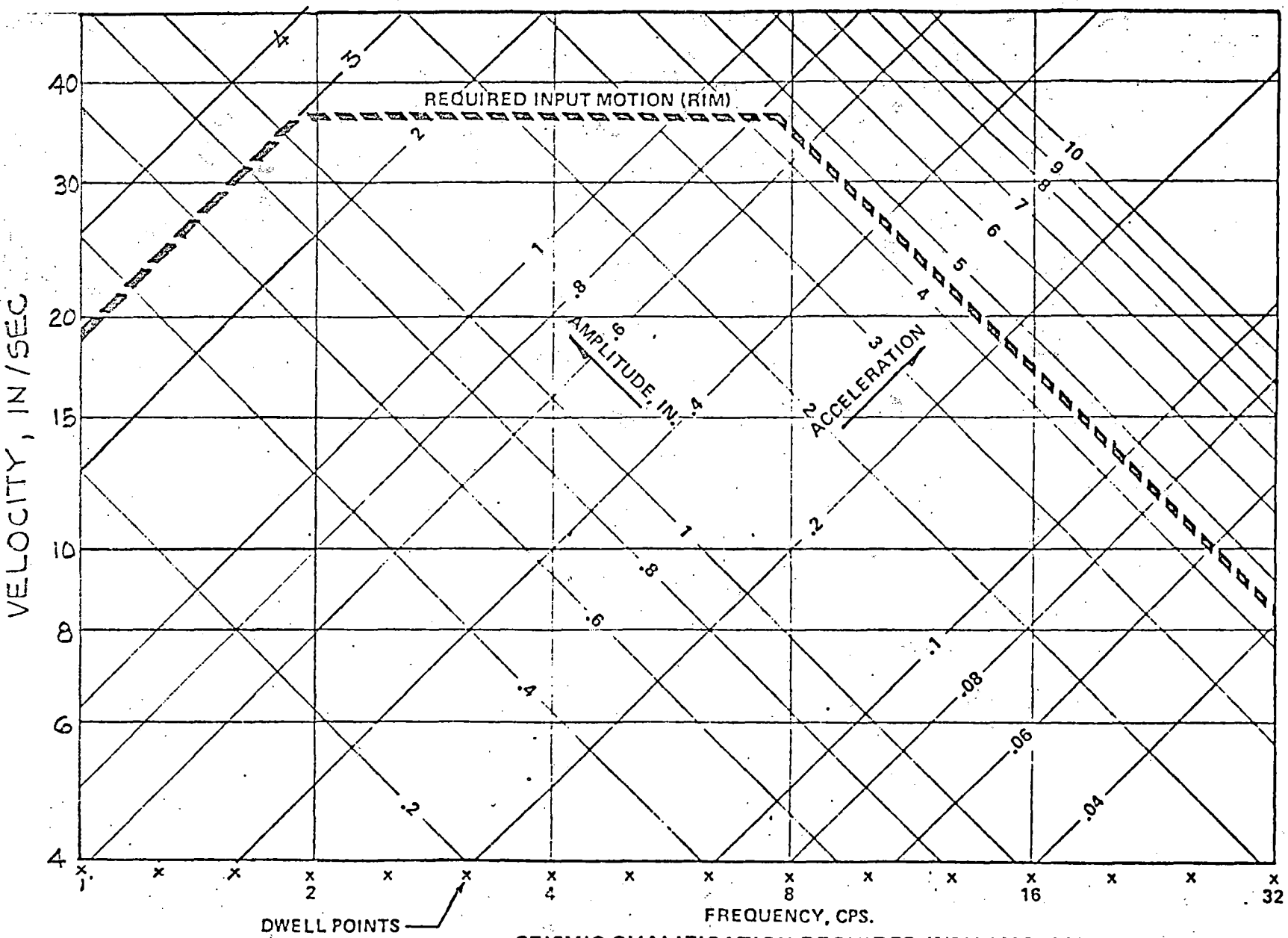
VALVE (REF. VDSS)	TEST VALVE NO.	DESCRIPTION	PHASE
NP8344A71E (Note 2)	2	DC, Class H leaded coil, Nema 4, 7, and 9 solenoid enclosure. (Ref. VDSS 3.6, Appendix I)	Para. 9.4 Type Test Procedure
XFT831654V	3	Note 3	Para. 9.4 Type Test Procedure
HV-202-300-2RF	7	Note 4	Para. 9.4 Type Test Procedure

NOTE 1 - Melamine epoxy painted solenoid enclosure

NOTE 2 - Viton main discs (2) and 'U' Cups (2)

NOTE 3 - AC, Class F (molded) leaded coil, Nema 1 solenoid enclosure (melamine epoxy paint) normally closed construction, viton elastomers. This valve was included to obtain information on Class F molded coils and viton elastomers.

NOTE 4 - DC, Class H leaded coil, Nema 1 solenoid enclosure (melamine epoxy paint) normally closed construction, Buna 'N' elastomers. This valve was included to obtain information on the type of solenoid utilized on this valve and Buna 'N' elastomers.



SEISMIC QUALIFICATION REQUIRED INPUT MOTION
FIGURE 9.1

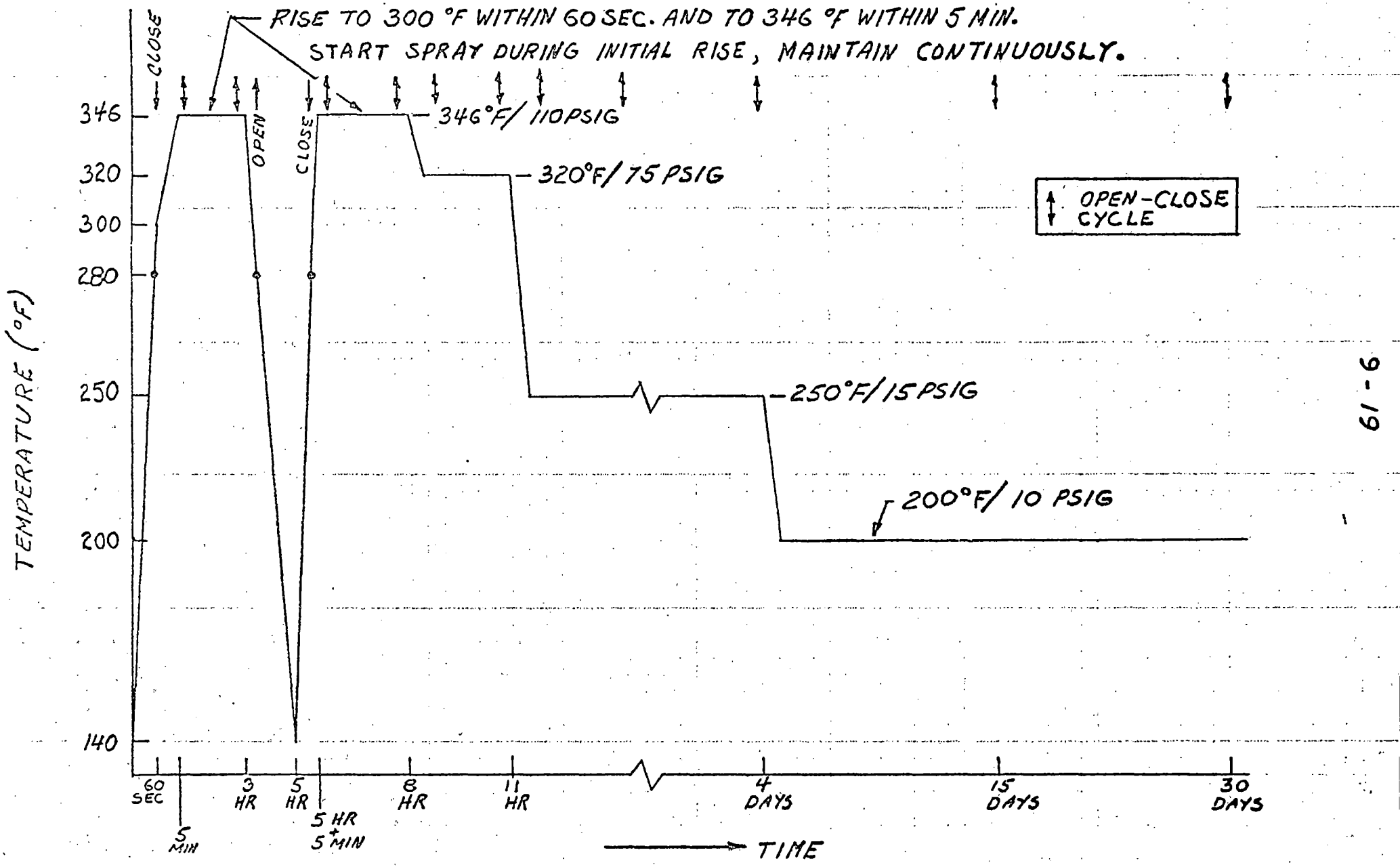


FIG. 9.2 ENVIRONMENTAL QUALIFICATION PARAMETERS FOR LOSS-OF-COOLANT ACCIDENT (LOCA) SIMULATION

10. SUBMITTALS PRIOR TO TEST

10.1 Diagrams of mounting, loading and seismic fixtures

10.2 Detailed test procedures, as applicable, including monitoring technique and acceptance criteria.

10.3 Installation, instrumentation, interconnection and interface diagrams, as applicable.

10.4 Summary of qualification programs previously performed, as applicable.

10.5 Justification for analysis

11. REPORTS AND CERTIFICATION

At the completion of the entire test program, a report shall be written documenting the program, procedures, methods and results obtained. The report shall be certified as to radiation, seismic and environmental parameter values and also contain a listing of test equipment, recording equipment with calibration date, pertinent diagrams and test data sheets.

All strip chart records are to be maintained and portions may be reproduced in the report, as required.

Comparisons between baseline data and test data are to be made as required and presented as appendices to the main body of the report.

A summary of the results shall be presented, including the conclusion whether the solenoid valves were qualified or not.

APPENDIX I

I-1

VALVE DESIGN SPECIFICATION SHEET

VDSS 3.1 HVA-206-380, HVA-206-381, HVA-208-448, HVA-208-266, HVA-206-832, HVA-210-036,(Bulletin NP206-380, etc.)

3.1.1 Description: Three-way, direct acting solenoid valve with packless construction.

3.1.2 Application: Pilot valve controlling oil free instrument quality air.

3.1.3 Specifications:

3.1.3.1 Available in normally open, normally closed and universal construction

3.1.3.2 1/8 to 1/2 NPT

3.1.3.3 Brass, steel, and austenitic stainless steel bodies

3.1.3.4 Metal or resilient seated

3.1.3.5 NEMA 6 and NEMA 4, 7 & 9 solenoid enclosures with 3/4 NPT conduit connection

3.1.3.6 Internal parts in contact with fluid are Type 300 and 400 stainless steel

3.1.3.7 Ethylene propylene elastomers

3.1.3.8 20 watts, A.C., 35.1 watts DC

3.1.3.9 Class H coil

3.1.3.10 Process fluid: instrument quality, oil free air

3.1.3.11 Ambient: 60-140°F

3.1.3.12 Installation: solenoid vertical and upright

3.1.3.13 Normal maintenance schedule: 4 years. (Replacement of coils and elastomeric components). (Installation and maintenance sheet packed and shipped with each valve).

3.1.3.14 Safe body working pressure: 600 psig for brass construction, 1500 psig for steel and stainless steel constructions.

SPECIFIC VALVE DESIGNATIONS INCLUDED IN VDSS 3.1 GENERIC FAMILY

NEMA TYPE 4,7,9 SOLENOID ENCLOSURE	NEMA TYPE 6 SOLENOID ENCLOSURE	PIPE	PORT	WATTS AC	WATTS DC	C v	MOPD	BODY MATERIAL
HVA206-832-1	HVA-206-380-1	1/8	3/16	20		.35	200	Brass
-2	-2	1/4	3/16	20		.35	200	Brass
-3	-3	1/4	1/4	20		.45	150	Brass
-4	-4	3/8	3/16	20		.35	200	Brass
-5	-5	3/8	1/4	20		.45	150	Brass
-6	-6	3/8	5/16	20		.75	100	Brass
-7	-7	1/2	5/16	20		.75	100	Brass
HVA210-036-1	HVA208-266 -1	3/8	3/16	20		.35	200	Steel
-2	-2	3/8	1/4	20		.45	150	Steel
-3	-3	3/8	5/16	20		.75	100	Steel
-4	-4	1/2	5/16	20		.75	100	Steel
-5	-5	1/2	5/16	20		.75	100	St.Steel
HVA206-381-1		1/8	3/16		35.1	.35	200	Brass
-2		1/4	3/16		35.1	.35	200	Brass
-3		1/4	1/4		35.1	.45	150	Brass
-4		3/8	3/16		35.1	.35	200	Brass
-5		3/8	1/4		35.1	.45	150	Brass
-6		3/8	5/16		35.1	.75	125	Brass
-7		1/2	5/16		35.1	.75	125	Brass
HVA208-448-1		3/8	3/16		35.1	.35	200	Steel
-2		3/8	1/4		35.1	.45	150	Steel
-3		3/8	5/16		35.1	.75	125	Steel
-4		1/2	5/16		35.1	.75	125	Steel
-5		1/2	5/16		35.1	.75	125	St.Steel

VALVE DESIGN SPECIFICATION SHEET

VDSS 3.2 HVA-206-384, HVA-208-279, HVA-208-293

(Bulletin NP8316)

3.2.1 Description: Three-way, internal pilot, diaphragm, solenoid valve.

3.2.2 Application: Pilot valve controlling oil free instrument quality air.

3.2.3 Specifications

3.2.3.1. Available in normally closed and normally open construction

3.2.3.2 3/8 to 1 NPT

3.2.3.3 Brass body

3.2.3.4 Resilient seated

3.2.3.5 NEMA 6 and NEMA 4, 7 & 9 solenoid enclosure with 3/4 NPT conduit connection

3.2.3.6 Internal parts in contact with fluid are Type 300 and 400 stainless steel

3.2.3.7 Ethylene propylene elastomers

3.2.3.8 10.5 Watts AC, 17.4 Watts DC

3.2.3.9 Class H coil

3.2.3.10 Process fluid: instrument quality oil free air

3.2.3.11 Ambient: 60-140°F

3.2.3.12 Installation: can be installed in any position without affecting operation

3.2.3.13 Normal maintenance schedule: 4 years. (Replacement of coils and elastomeric components). (Installation and maintenance sheet packed and shipped with each valve).

3.2.3.14 Safe body working pressure 300 psig (250 psig for 1 NPT)

SPECIFIC VALVE DESIGNATIONS INCLUDED IN VDSS 3.2 GENERIC FAMILY

NEMA TYPE 4,7,9 SOLENOID ENCLOSURE	NEMA TYPE 6 SOLENOID ENCLOSURE	PIPE	PORT	WATTS A.C.	WATTS D.C.	C v	MOPD A.C.	MOPD D.C.	MOPD MIN.	FORM
NP831655E	NP831654E	3/8	5/8	10.5	17.4	3	175	175	10	N.C.
NP831665E	NP831664E	1/2	5/8	10.5	17.4	4	175	175	10	N.C.
NP8316A75E	NP8316A74E	3/4	11/16	10.5	17.4	5.5	175	175	10	N.C.
NP8316E35E	NP8316E34E	1	1	10.5	17.4	13	175	175	10	N.C.
NP831657E	NP831656E	3/8	5/8	10.5	17.4	3	175	175	10	N.O.
NP831667E	NP831666E	1/2	5/8	10.5	17.4	4	175	175	10	N.O.
NP8316A77E	NP8316A76E	3/4	11/16	10.5	17.4	5.5	175	175	10	N.O.
NP8316E37E	NP8316E36E	1	1	10.5	17.4	13	175	175	10	N.O.

VALVE DESIGN SPECIFICATION SHEET

VDSS 3.3 HVA-206-385, HVA-208-153 (Bulletin NP8320)

3.3.1 Description: Three-way, direct acting, compact design with all three connections in valve body for in-line piping.

3.3.2 Application: Pilot valve controlling oil free instrument quality air.

3.3.3 Specifications

3.3.3.1 Available in normally open, normally closed, and universal construction.

3.3.3.2 1/4 NPT

3.3.3.4 Resilient seated

3.3.3.5 NEMA 6 and NEMA 4, 7 & 9 solenoid enclosures with 3/4 NPT conduit connection.

3.3.3.6 Internal parts in contact with fluid are Type 300 and 400 stainless steel

3.3.3.7 Ethylene propylene elastomers

3.3.3.8 10.5 Watts AC, 17.4 Watts DC

3.3.3.9 Class H coil

3.3.3.10 Process fluid: instrument quality oil free air

3.3.3.11 Ambient: 60-140°F

3.3.3.12 Installation: can be installed in any position without affecting operation

3.3.3.13 Normal maintenance schedule: 4 years. (Replacement of coils and elastomeric components). (Installation and maintenance sheet packed and shipped with each valve).

3.3.3.14 Safe body working pressure: 500 psig

SPECIFIC VALVE DESIGNATIONS INCLUDED IN VDSS 3.3 GENERIC FAMILY

NEMA TYPE 4,7,9, SOLENOID ENCLOSURE	NEMA TYPE 6 SOLENOID ENCLOSURE	PIPE	PORT	WATTS A.C.	WATTS D.C.	C v	MOPD A.C.	MOPD D.C.	MIN	FORM	BODY MATERIAL
NP8320A183E	NP8320A182E	1/4	1/16	10.5	17.4	.09	175	160	0	N.C.	Brass
NP8320A185E	NP8320A184E	1/4	3/32	10.5	17.4	.15	150	115	0	N.C.	Brass
NP8320A187E	NP8320A186E	1/4	1/8	10.5	17.4	.31	85	60	0	N.C.	Brass
NP8320A189E	NP8320A188E	1/4	11/64	10.5	17.4	.38	40	25	0	N.C.	Brass
NP8320A193E	NP8320A192E	1/4	1/16	10.5	17.4	.09	175	135	0	N.O.	Brass
NP8320A195E	NP8320A194E	1/4	3/32	10.5	17.4	.15	140	100	0	N.O.	Brass
NP8320A197E	NP8320A196E	1/4	1/8	10.5	17.4	.31	70	55	0	N.O.	Brass
NP8320A199E	NP8320A198E	1/4	11/64	10.5	17.4	.38	40	30	0	N.O.	Brass
NP8320A173E	NP8320A172E	1/4	1/16	10.5	17.4	.09	125	75	0	U	Brass
NP8320A175E	NP8320A174E	1/4	3/32	10.5	17.4	.15	75	60	0	U	Brass
NP8320A177E	NP8320A176E	1/4	1/8	10.5	17.4	.31	35	25	0	U	Brass
NP8320A179E	NP8320A178E	1/4	11/64	10.5	17.4	.38	20	12	0	U	Brass
NP832064E	NP832063E	1/4	1/16	10.5	17.4	.09	125	125	0	N.C.	St. St
NP832094E	NP832093E	1/4	3/32	10.5	17.4	.15	110	65	0	N.C.	St. St.
NP832066E	NP832065E	1/4	1/8	10.5	17.4	.31	40	40	0	N.C.	St. St.
NP832068E	NP832067E	1/4	1/16	10.5	17.4	.09	125	125	0	N.O.	St. St.
NP832096E	NP832095E	1/4	3/32	10.5	17.4	.15	110	65	0	N.O.	St. St.
NP832070E	NP832069E	1/4	1/8	10.5	17.4	.31	40	40	0	N.O.	St. St.
NP832058E	NP832057E	1/4	1/16	10.5	17.4	.09	100	65	0	U	St. St.
NP832060E	NP832059E	1/4	3/32	10.5	17.4	.15	40	40	0	U	St. St.
NP832062E	NP832061E	1/4	1/8	10.5	17.4	.31	30	20	0	U	St. St.

VALVE DESIGN SPECIFICATION SHEET

VDSS 3.4 HVA-206-386 (Bulletin NP8321)

3.4.1 Description: Three-way, internal pilot operated solenoid valve.

3.4.2 Application: Pilot valve controlling oil free instrument quality air.

3.4.3 Specifications

3.4.3.1 Available in normally open and normally closed construction

3.4.3.2 1/4 & 3/8 NPT

3.4.3.3 Brass body

3.4.3.4 Resilient seated

3.4.3.5 NEMA 6 and NEMA 4, 7, & 9 solenoid enclosures with 3/4 NPT conduit connection

3.4.3.6 Internal parts in contact with fluid are Type 300 and 400 stainless steel

3.4.3.7 Ethylene propylene elastomers

3.4.3.8 10.5 watts AC, 17.4 watts DC

3.4.3.9 Class H coil

3.4.3.10 Process fluid: instrument quality oil free air

3.4.3.11 Ambient: 60-140°F

3.4.3.12 Installation: can be installed in any position without affecting operation

3.4.3.13 Normal maintenance schedule: 4 years. (Replacement of coils and elastomeric components). (Installation and maintenance sheet packed and shipped with each valve).

3.4.3.14 Safe body working pressure: 500 psig

SPECIFIC VALVE DESIGNATIONS INCLUDED IN VDSS 3.4 GENERIC FAMILY

NEMA TYPE 4,7,9, SOLENOID ENCLOSURE	NEMA TYPE 6 SOLENOID ENCLOSURE	PIPE	PORT	WATTS A.C.	WATTS D.C.	C v	MOPD A.C.	MOPD D.C.	MIN	FORM
NP8321A5E	NP8321A1E	1/4	(1)	10.5	17.4	(2)	150	150	10	N.C.
NP8321A6E	NP8321A2E	3/8	(1)	10.5	17.4	(2)	150	150	10	N.C.
NP8321A7E	NP8321A3E	1/4	(1)	10.5	17.4	(2)	150	150	10	N.O.
NP8321A8E	NP8321A4E	3/8	(1)	10.5	17.4	(2)	150	150	10	N.O.

(1) 9/32 (pressure) & 11/32 (exhaust) (2) 0.8 (pressure) & 1.2 (exhaust)

VALVE DESIGN SPECIFICATION SHEET

VDSS 3.5 HVA-206-387 (Bulletin NP8323)

3.5.1 Description: Three-way, direct acting, solenoid valve with redundant solenoids.

3.5.2 Application: Pilot valves controlling oil free instrument quality air.

3.5.3 Specifications

3.5.3.1 Available in normally open and normally closed construction

3.5.3.2 1/4 NPT

3.5.3.3 Brass body

3.5.3.4 Resilient seated

3.5.3.5 NEMA 6 and NEMA 4, 7 & 9 solenoid enclosures with 3/4 NPT conduit connection

3.5.3.6 Internal parts in contact with fluid are Type 300 and 400 stainless steel

3.5.3.7 Ethylene propylene elastomers

3.5.3.8 10.5 watts AC, 17.4 watts DC

3.5.3.9 Class H coil

3.5.3.10 Process fluid: instrument quality oil free air

3.5.3.11 Ambient: 60-140°F

3.5.3.12 Installation: can be installed in any position without affecting operation.

3.5.3.13 Normal maintenance schedule: 4 years. (Replacement of coils and elastomeric components). (Installation and maintenance sheet packed and shipped with each valve).

3.5.3.14 Safe body working pressure: 500 psig

SPECIFIC VALVE DESIGNATION INCLUDED IN VDSS 3.5 GENERIC FAMILY

NEMA TYPE 4,7,9, SOLENOID ENCLOSURE	NEMA TYPE 6 SOLENOID ENCLOSURE	PIPE	PORT	WATTS SOL.A A.C.	WATTS SOL.B A.C.	WATTS SOL.B D.C.	C v	MOPD	MIN.	FORM
NP8323A20E	NP8323A19E	1/4	1/16	10.5	10.5		.09	125	0	N.C.
NP8323A22E	NP8323A21E	1/4	3/32	10.5	10.5		.15	110	0	N.C.
NP8323A24E	NP8323A23E	1/4	1/8	10.5	10.5		.31	40	0	N.C.
NP8323A28E	NP8323A27E	1/4	1/16	10.5	10.5		.09	125	0	N.O.
NP8323A30E	NP8323A29E	1/4	3/32	10.5	10.5		.15	110	0	N.O.
NP8323A32E	NP8323A31E	1/4	1/8	10.5	10.5		.31	40	0	N.O.
NP8323A36E	NP8323A35E	1/4	1/16	10.5		17.4	.09	125	0	N.C.
NP8323A38E	NP8323A37E	1/4	3/32	10.5		17.4	.15	110	0	N.C.
NP8323A40E	NP8323A39E	1/4	1/8	10.5		17.4	.31	40	0	N.C.
NP8323A44E	NP8323A43E	1/4	1/16	10.5		17.4	.09	125	0	N.O.
NP8323A46E	NP8323A45E	1/4	3/32	10.5		17.4	.15	110	0	N.O.
NP8323A48E	NP8323A47E	1/4	1/8	10.5		17.4	.31	40	0	N.O.

VALVE DESIGN SPECIFICATION SHEET

VDSS 3.6 HVA-206-389, HVA-208-264, HVA-208-265, HVA-206-390, HVA-208-267, HVA-208-269 (Bulletin NP8344)

3.6.1 Description: Four-way, two position, internal pilot operated, poppet type solenoid valve.

3.6.2 Application: Pilot valve controlling oil free instrument quality air.

3.6.3 Specifications

3.6.3.1 Available in single and dual solenoid construction

3.6.3.2 1/4 - 1 NPT

3.6.3.3 Brass body

3.6.3.4 Resilient seated

3.6.3.5 NEMA 6 and NEMA 4, 7 & 9 solenoid enclosures with 3/4 NPT conduit connection

3.6.3.6 Internal parts in contact with fluid are Type 300 and 400 stainless steel.

3.6.3.7 Ethylene propylene elastomers

3.6.3.8 10.5 watt AC, 17.4 watt DC

3.6.3.9 Class H coil

3.6.3.10 Process fluid: instrument quality oil free air

3.6.3.11 Ambient: 60-140°F

3.6.3.12 Installation: can be installed in any position without affecting operation

3.6.3.13 Normal maintenance schedule: 4 years. (Replacement of coils and elastomeric components). (Installation and maintenance sheet packed and shipped with each valve).

3.6.3.14 Safe body working pressure: 1/4 NPT - 500 psig; 3/8 NPT & 1/2 NPT - 480 psig; 3/4 NPT & 1 NPT - 300 psig.

SPECIFIC VALVE DESIGNATION INCLUDED IN VDSS 3.6 GENERIC FAMILY

NEMA TYPE 4,7,9, SOLENOID ENCLOSURE	NEMA TYPE 6 SOLENOID ENCLOSURE	PIPE	PORT	WATTS A.C.	WATTS D.C.	C v	MOPD AC	MOPD D.C.	MIN	TYPE
NP8344A71E	NP8344A70E	1/4	1/4	10.5	17.4	0.53	125	125	10	Single Solenoid
NP8344A73E	NP8344A72E	3/8	3/8	10.5	17.4	1.3	125	125	10	Single Solenoid
NP8344A75E	Np8344A74E	1/2	3/8	10.5	17.4	1.3	125	125	10	Single Solenoid
NP8344A77E	NP8344A76E	3/4	3/4	10.5	17.4	5.5	125	125	10	Single Solenoid
NP8344A79E	NP8344A78E	1	3/4	10.5	17.4	5.5	125	125	10	Single Solenoid
NP8344A58E	NP8344B46E	1/4	1/4	10.5	17.4	0.53	350	125	10	Dual Solenoid
NP8344B62E	NP8344B50E	3/8	3/8	10.5	17.4	1.3	300	125	10	Dual Solenoid
NP8344B64E	NP8344B52E	1/2	3/8	10.5	17.4	1.3	300	125	10	Dual Solenoid
NP8344B66E	NP8344B54E	3/4	3/4	10.5	17.4	5.5	300	125	10	Dual Solenoid
NP8344B68E	NP8344B56E	1	3/4	10.5	17.4	5.5	300	125	10	Dual Solenoid

2.4.3 Measurement of Insulation Resistance

The solenoid insulation resistance is to be measured prior to the qualification testing and at each baseline test. Insulation resistance is to be measured using a Freed Model 1620 Megohmmeter to be supplied by Automatic Switch Company. The test will be performed in accordance with Automatic Switch Company Procedure ELP-45.

2.4.4 Hypot Test

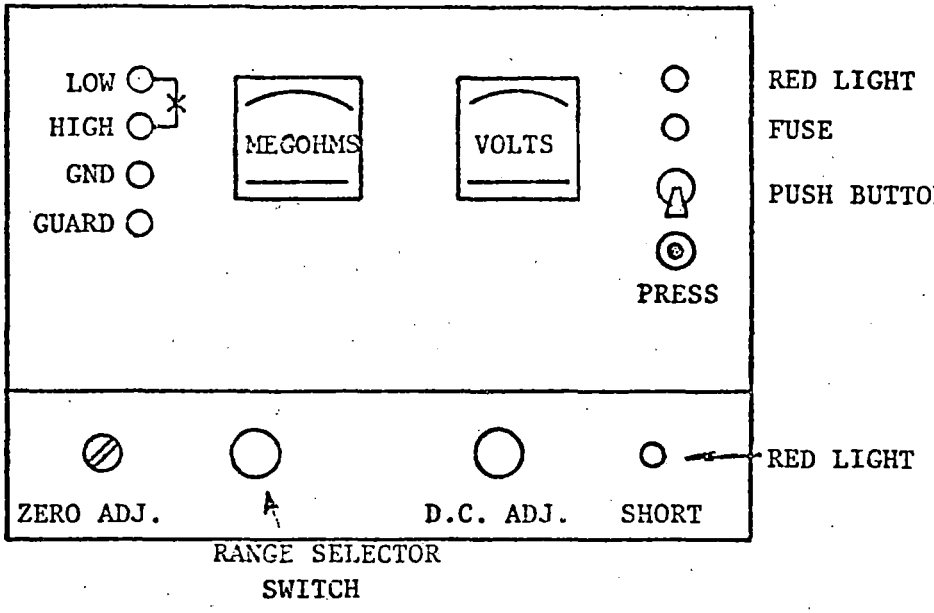
The Hypot test is to be performed prior to the qualification testing, at the end of the aging sequence, and at the end of the LOCA simulation. Measurement is to be made using an Associated Research Type 404 Hypot Tester to be supplied by Automatic Switch Company. The test voltage is to be twice rated voltage plus 1000 volts AC applied for one minute (the coil leads are to be twisted together and placed in contact with one of the Hypot output leads, the remaining hypot output lead is to be placed in contact with a clean, paint-free metallic part of the solenoid housing).

Automatic Switch Co. VALVE ENGINEERING LABORATORY		ISSUED BY L. R. Guthreau	NO. ELP-45
		APP. BY	CHANGE LETTER A
TITLE OPERATION OF FREED MODEL 1620 MEGOHMMETER		DATE ISSUED 5/17/60	PAGE 1 OF 2

PURPOSE:

To establish the method of operating the Freed Model 1620 Megohmmeter used for measuring insulation resistance.

PROCEDURE:



1. Turn Power switch to the "On" position. Allow five minutes warm up period.

2. Turn the Range Selector switch to the "Zero Adjust" position.

3. Press the Push button and turn the "Zero Adjust" control until the "Megohms" panel meter reads infinity.

4. Turn the Range Selector switch to the "Calibration" position.

5. Press the Push button and set the "D.C. Adjust" until the voltmeter reads 500 volts. The megohmmeter should also indicate 500 volts.

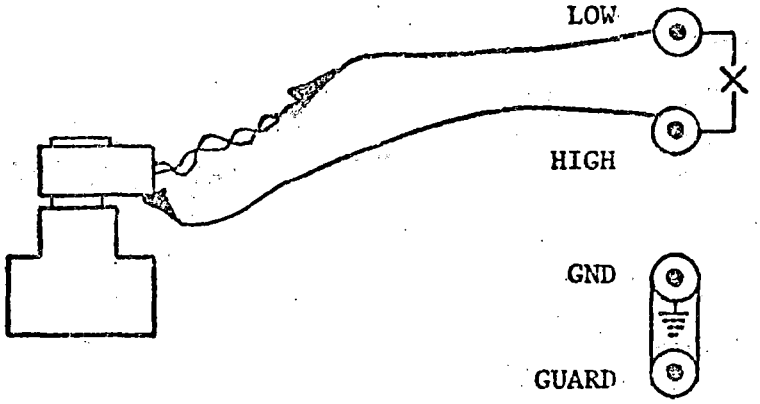
6. If the 10K or 100K Range is to be used the following procedure should be used:

   a. Check the infinity reading of the meter with no leads attached. A slight readjustment of the "Zero Adjust" may be necessary.

   b. Connect the test leads provided with the instrument to the "X" terminals. These are low leakage leads and no attempt should be made to correct this slight leakage by readjusting the "Zero Adjust" knob.

Automatic Switch Co. VALVE ENGINEERING LABORATORY	DSN ☐ CONT ☐ ENG ☐ MFG ☐ QCH ☐ QA ☐ SAV ☐ ☐ ☐ ☐ ☐ ☐	ISSUED BY L. Guthreau APP. BY DATE ISSUED 5/17/60	NO. ELP-45 CHANGE LETTER A PAGE 2 OF 2
TITLE OPERATION OF FREED MODEL 1620 MEGOHMMETER			

7. To measure the leakage resistance of coil proceed as follows:



a. Connect the "Guard" to the "Ground" terminal with the supplied connecting strip.

b. Connect the two leads supplied with the instrument to the "X" terminals.

c. Twist the two coil leads together and connect one of the "X" leads to them.

d. Clip the other "X" lead to a clean metal part of the housing.

e. Set the range selector switch to the range desired.

f. Push the button on the megohmmeter and note the reading on each meter.
NOTE: Do not touch the terminals on leads while the "Push" button is depressed.

g. The value of the unknown resistance is the product of the meter readings multiplied by the setting of the Range Selector switch.

8. Do not make any adjustments to this instrument other than those listed in this procedure.

NOTE: For information on other tests, consult the instrument manual kept in the Switch Laboratory.

APPENDIX B

TEST PROCEDURE BULLETINS

VALVE NO.	BULLETIN
1	TP-3-046
2	TP-NP8344
3	TP-NP8316
4	TP-3-046
5	TP-NP8320
6	TP-NP8316
7	TP-3-046
8	TP-NP8321
9	TP-NP8323

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AL ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ ☐ PS ☐	ISSUED BY R. Powell APP. BY R Powell DATE ISSUED 6/21/77	NO. TP-3-046 CHANGE LETTER A PAGE 1 OF 2

TITLE

TEST PROCEDURE: HVA-206-380, HVA-206-381, HVA-208-448, HVA-208-266 HVA-206-832, HVA-210-036

TEST MEDIUM:

These valves contain Ethylene Propylene elastomers...Test on oil free, filtered air only.

GENERAL:

1. Check general construction and appearance of valve.
2. Check nameplate data for conformance to shop order specifications.

TEST FIXTURES

TA-981-11448
AT-8300C-F-1
P37 Valves

TJ-537-9075
TA-905-9984
TJ-905-10168
P38 Valves

TEST VOLTAGE AND CURRENT:

1. All D.C. valves are to be tested using the test current listed under the specified voltage on Data Sheet No. 26.
2. All A.C. valves are to be tested using the test voltage listed on Test Procedure TP-1-003.

COIL TESTS:

1. A.C. - Energize solenoid and check milliampere reading. Value should agree with that shown on Data Sheet No. 24.
2. D.C. - Energize solenoid and check voltage reading. Value should agree with that indicated per Note 2 on Data Sheet No. 26.
3. Dielectric test - measure the current leakage at 1000 volts plus twice the rated voltage in accordance with TP-1-002 (test method #2) Any evidence of damage, arcing, breakdown or current leakage in excess of 0.5 milliampere is cause for rejection.

EXTERNAL LEAKAGE:

Apply seamtest solution to all joints and pressurize valve to 500 psig energized and de-energized (do not energize valve above maximum operating pressure). Any bubbling or foaming is reason for rejection. (Ref.: TP-1-009)

NOTE:

To avoid seat leakage or noise caused by the possible presence of dirt or loose chips, blow air at maximum operating pressure thru the valve before proceeding with tests below.

SEAT LEAKAGE (HIGH PRESSURE)

Check valve for seat leakage at maximum operating pressure. Allowable leakage:

Resilient Seats - 0

Metal Seats - 1.5 SCFH

NOISE TEST:

During the operational tests, check valve for noise. Any chattering or rattling in excess of normal A.C. hum is reason for rejection. Valve should be tested at test voltage first, but voltage may be increased to full line voltage if necessary to pass the Noise Test Only. (Ref. TP-1-015)

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AL ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ ☐ PS ☐	ISSUED BY R. Powell APP. BY R. Powell DATE ISSUED 6/21/77	NO. TP-3-046 CHANGE LETTER A PAGE 2 OF 2

TITLE TEST PROCEDURE: HVA-206-380, HVA-206-381
HVA-208-448, HVA-208-266
HVA-206-832, HVA-210-036

OPERATIONAL TESTS:

1. Operate valve at least 10 times at maximum operating pressure.
2. Operate valve from maximum operating pressure down to minimum operating pressure.

SEAT LEAKAGE (LOW PRESSURE)

Check seat leakage at 10 psi. Allowable leakage:

Resilient Seats - 0

Metal Seats - 1.5 SCFH

PREPARATION FOR SHIPMENT

Seal all pipe connections with plastic thread protectors and hank coil leads around bonnet. Attach tag FV-206-825-1.

CORRECTIVE ACTION RECORD:

Maintain Test Log (Form 1109) on all large production runs.

(A) ERV-83338 - Updated - 10/25/77 - R.D.P.
ERV-82135 - Issued - 6/28/77 - R.D.P.

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AL ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ ☐ PS ☐	ISSUED BY R. Powell	NO. TP-NP8316
TITLE TEST PROCEDURE: BULLETIN NP8316		APP. BY R. Powell	CHANGE LETTER
		DATE ISSUED 6/21/77	PAGE 1 OF 1

TEST MEDIUM: These valves contain Ethylene Propylene Elastomers...Test on oil free, filtered air only.

GENERAL:

1. Check valves general appearance and construction.
2. Check nameplate data for conformance to shop order specifications.

TEST FIXTURE: TH-48-4307.

TEST VOLTAGES AND CURRENTS

1. All D.C. valves are to be tested using the proper test current listed under specified voltage on Data Sheet #26.
2. All A.C. valves are to be tested using the proper test voltage listed on Test Procedure TP-1-003.

COIL TEST

1. A.C. - Energize solenoid and check milliampere reading. Reading should agree with the value given on Data Sheet #24.
2. D.C. - Energize solenoid and check voltage reading. Reading should agree with value from Note 2 on Data Sheet # 26.
3. Dielectric test - measure the current leakage at 1000 volts plus twice the rated voltage in accordance with TP-1-002 (test method #2). Any evidence of damage, arcing, breakdown or current leakage in excess of 0.5 milliampere is cause for rejection.

OPERATIONAL TESTS

1. Check all valves at least five (5) times dry at full line voltage for proper solenoid operation and noise level as follows:
   a. A metallic "click" of the core striking the plugnut should be heard when the solenoid is energized. No "click" indicates a power failure or sticker.
   b. Chattering, rattling, or A.C. hum in excess of laboratory standards is reason for rejection. (Ref: Test Procedure TP-1-015)
2. Operate valve at least ten (10) times at maximum operating pressure.
3. Operate valve from maximum operating pressure down to minimum operating pressure.

SEAT LEAKAGE: Check seat leakage with valve energized and de-energized at maximum and minimum operating differential pressure. Seats must be bubbletight. Any leakage is cause for rejection.

EXTERNAL LEAKAGE: Apply seamtest solution to all joints and fittings and pressurize valve to 1-1/2 times maximum operating pressure. Check valve both energized and de-energized (do not operate valve above maximum operating pressure) Any bubbling or foaming is cause for rejection.

PREPARATION FOR SHIPMENT: Cap valve pressure, cylinder, and exhaust ports with plastic coated paper plugs and wrap coil leads together. Attach tag FV-206-825-1.

CORRECTIVE ACTION RECORD: Maintain test log (Form 1109) on all production runs.

ERV-62135 - Issued - 6/28/77 - R.D.P.

M-1x77

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AL ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ ☐ PS ☐	ISSUED BY R. Powell APP. BY DATE ISSUED 6/21/77	NO. TP-NP8320 CHANGE LETTER PAGE 1 OF 2

TITLE

TEST PROCEDURE: BULLETIN NP8320

TEST MEDIUM: These valves contain Ethylene Propylene Elastomers...Test on oil free, filtered air only.

GENERAL:

1. Check general construction and appearance of valve.
2. Check nameplate data for conformance to shop order specifications.

TEST FIXTURES

Functional and Seat Leakage Tests:

1/8 NPT: Adapter TF-332-7301 w/attachment GT-332-6900-4
1/4 NPT: Adapter TP-332-7301 w/attachment GT-332-6900-3

External Leakage Tests:

1/8 NPT: AT-8320-A-1
1/4 NPT: AT-8320-B-1

TEST VOLTAGE AND CURRENT:

1. All D.C. valves are to be tested using the test current listed under the specified voltage on Data Sheet No. 26.
2. All A.C. valves are to be tested using the test voltage listed on Test Procedure TP-1-003.

COIL TESTS:

1. A.C.- Energize solenoid and check milliampere reading. Value should agree with that shown on Data Sheet No. 24.
2. D.C.- Energize solenoid and check voltage reading. Value should agree with that indicated per Note 2 on Data Sheet No. 26.
3. Dielectric test - measure the current leakage at 1,000 volts plus twice the rated voltage in accordance with TP-1-002 (test method #2). Any evidence of damage, arcing, breakdown or current leakage in excess of 0.5 milliampere is cause for rejection.

EXTERNAL LEAKAGE:

All valves are to have external leakage tests performed in Valve Assembly with Solenoid Base Sub-Assembly attached to body but before coil, housing, etc. are assembled.

a. Brush seamtest solution around all joints.
b. Pressurize valve to 500 psig. Any bubbling or foaming is reason for rejection. (Ref. TP-1-009)

NOTE: To avoid seat leakage or noise caused by the possible presence of dirt or loose chips, blow air at maximum operating pressure thru the valve before proceeding with tests below.

SEAT LEAKAGE (HIGH PRESSURE):

With cylinder port closed off, check valve for seat leakage at maximum operating pressure. Valves must be bubbletight.

a. Normally Closed Construction: Apply pressure at Port #2, check leakage at Port #3, energized and de-energized.
b. Normally Open Construction: Apply pressure at Port #3, check leakage at Port #2, energized and de-energized.

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AL ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ ☐ PS ☐	ISSUED BY F. Powell APP. BY F. Powell DATE ISSUED 6/21/77	NO. TP-NP8320 CHANGE LETTER PAGE 2 OF 2

TITLE

TEST PROCEDURE: BULLETIN NP8320

NOISE TEST:

During the operational tests, check valve for noise. Any chattering or rattling in excess of normal A.C. hum is reason for rejection. Valve should be tested at test voltage first, but voltage may be increased to full line voltage if necessary to pass the NOISE TEST ONLY. (Ref. TP-1-015)

OPERATIONAL TESTS:

1. Operate valve at least 10 times at maximum operating pressure.
2. Operate valve from maximum operating pressure down to minimum operating pressure.

NOTES: Universal constructions are to be tested for both normally open and normally closed operation.

SEAT LEAKAGE (LOW PRESSURE)

With cylinder port closed off, check seat leakage at 1/4 psi. Valves must be bubbletight.

a. & b. Same as High Pressure.

PREPARATION FOR SHIPMENT:

Seal all pipe connections with plastic coated paper plugs or plastic thread protectors and hank coil leads or wrap leads around bonnet. Attach tag FV-206-825-1.

CORRECTIVE ACTION RECORD:

Maintain test log (Form 1109) on all production runs.

ERV-82135 - Issued - 6/28/77 - R.D.P.

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AL ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ PS ☐	ISSUED BY R. Powell	NO. TP-NP8321
TITLE TEST PROCEDURE: BULLETIN NP8321		APP. BY R. Powell	CHANGE LETTER
		DATE ISSUED 6/21/77	PAGE 1 OF 2

TEST MEDIUM: These valves contain Ethylene Propylene elastomers...Test on oil free, filtered air only.

GENERAL:

1. Check valves general appearance and construction.
2. Check nameplate data for conformance to shop order specifications.

TEST FIXTURES:
AT 92-623-A1 (Normally Closed)
AT 8321-B1 (Normally open)

TEST VOLTAGES AND CURRENTS:

1. All D.C. valves are to be tested using the test current listed on Data Sheet #26.
2. All A.C. valves are to be tested using the test voltage listed on Test Procedure TP-1-003.

COIL TEST:

1. A.C. - Energize solenoid and check milliampere reading. Reading should agree with the value given on Data Sheet #24.
2. D.C. - Energize solenoid and check voltage reading. Reading should agree with value per Note 2 on Data Sheet #26.
3. Dielectric test - measure the current leakage at 1000 volts plus twice the rated voltage in accordance with TP-1-002 (test method #2). Any evidence of damage, arcing, breakdown or current leakage in excess of 0.5 milliampere is cause for rejection.

OPERATIONAL TESTS:

1. Check all valves at least five (5) times dry at full line voltage for proper solenoid operation and noise level as follows:
   a. A metallic "click" of the core striking the plugnut should be heard when the solenoid is energized. No "click" indicates a power failure or sticker.
   b. Chattering, rattling or A.C. hum in excess of laboratory standards is reason for rejection. (Ref: Test Procedure TP-1-015)
2. Operate valve at least ten (10) times at maximum operating pressure.
3. Operate valve from maximum operating pressure down to minimum operating pressure.

SEAT LEAKAGE: Check seat leakage with valve energized and de-energized at maximum and minimum operating pressure. Allowable leakage: 90 cc/min.

EXTERNAL LEAKAGE: Apply seamtest to all joints and fittings and pressurize valve to 500 psig. Check valve both energized and de-energized (do not operate valve above maximum operating pressure). Any bubbling or foaming is cause for rejection.(Ref.: TP-1-009)

PREPARATION FOR SHIPMENT: Cap valve pressure, cylinder, and exhaust ports with plastic coated paper plugs or plastic thread protectors, and wrap coil leads together. Attach tag FV-206-825-1.

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AL ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ ☐ PS ☐	ISSUED BY R. Powell APP. BY R Powell DATE ISSUED 6/21/77	NO. TP-NP-8321 CHANGE LETTER PAGE 2 OF 2
TITLE TEST PROCEDURE: BULLETIN NP8321			

CORRECTIVE ACTION RECORD:

Maintain test log Form (1109) on all production runs.

ERV-82135 - Issued - 6/28/77 - R.D.P.

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AI ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ ☐ PS ☐	ISSUED BY R. Powell APP. BY R Powell DATE ISSUED 6/21/77	NO. TP-NP8323 CHANGE LETTER A PAGE 1 OF 2

TITLE
TEST PROCEDURE: BULLETIN NP8323
(REDUNDANT SOLENOID)

TEST MEDIUM: These valves contain Ethylene Propylene elastomers...Test on oil free, filtered air only.

GENERAL:

1. Check the valve for general construction and appearance.
2. Check nameplate data for conformance to shop order specifications.

TEST FIXTURE: AT-8323-A1 or piped direct to air line.

TEST VOLTAGE AND CURRENT:

1. All D.C. solenoids are to be tested using the test current listed under the specified voltage on Data Sheet No. 26.
2. All A.C. solenoids are to be tested using the test voltage listed on Test Procedure TP-1-003.

COIL TEST:

1. A.C. - Energize each solenoid separately and check the milliampere reading. Reading should agree with value per Data Sheet No. 24.
2. D.C. - Energize each solenoid separately and check the voltage reading. Reading should agree with value from Note 2 on Data Sheet No. 26.
3. Dielectric test - measure the current leakage at 1000 volts plus twice the rated voltage in accordance with TP-1-002 (test method #2). Any evidence of damage, arcing, breakdown or current leakage in excess of 0.5 milliampere is cause for rejection.

OPERATIONAL TESTS:

1. Operate each solenoid at least five times dry at full line voltage and check for proper solenoid operation and noise level as follows:

   (a) A metallic "click" of the core striking the plugnut should be heard when the solenoid is energized. No "click" indicates a power failure or sticker.

   (b) Any chattering, rattling, or A.C. humming in excess of Laboratory Standards, is reason for rejection. (Ref.: TP-1-005)

2. For normally closed catalog items apply pressure at "2" and for normally open catalog items apply pressure at #3.

   (a) Operate valve at least ten times at maximum operating pressure using Solenoid #A; repeat using Solenoid #B.

   (b) Operate valve from maximum to minimum operating pressure using Solenoid #A; repeat using Solenoid #B.

SEAT LEAKAGE: With cylinder port (1) closed check for leakage at 1/4 psi and at maximum operating pressure differential as below:

(a) For normally closed construction apply pressure at "2" and check for leakage at "3" de-energized, with Solenoid "A" only energized, and with Solenoid "B" only energized. Valves must be bubbletight.

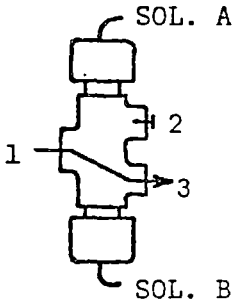
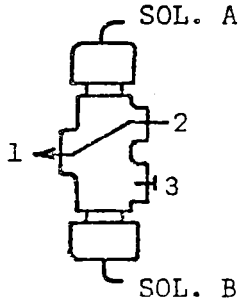
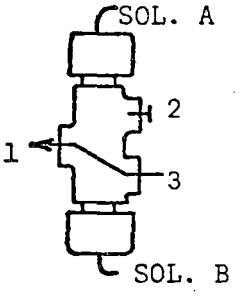
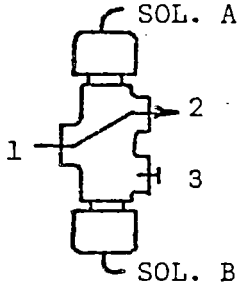
(b) For normally open construction apply pressure at "3" and check for leakage at "2" de-energized, with Solenoid "A" only energized, and with Solenoid "B" only energized. Valves must be bubbletight.

EXTERNAL LEAKAGE:

With solenoid energized or de-energized as required, pressurize interior of valve to 500 psig, apply seam test to all joints and fittings. Any bubbling or foaming is cause for rejection. (Ref. TP-1-009)

PREPARATION FOR SHIPMENT:

Cap "1", "2", and "3" ports of valve with plastic coated plugs or plastic thread connectors and hank coil leads. Attach tag FV-206-825-1.

FLOW DIAGRAMS		CATA. NOS.	
NORMALLY CLOSED			
SOL. A & B DE-ENERGIZED	EITHER OR BOTH SOLS. ENERGIZED	GP	EP
		832319 21 23 35 37 39	832320 22 24 36 38 40
NORMALLY OPEN			
SOL. A & B DE-ENERGIZED	EITHER OR BOTH SOLS. ENERGIZED	832327 29 31 43 45 47	832328 30 32 44 46 48
			

CORRECTIVE ACTION RECORD:

Maintain test log (Form 1109) on all production runs.

ERV-83712 - Revised - 12/5/77 - R.D.P.
ERV-82135 - Issued - 6/28/77 - R.D.P.

Automatic Switch Co. VALVE ENGINEERING DEPT.	DEW ☐ CONT ☐ AL ☐ AM ☐ CH ☐ KA ☐ AV ☐ AR ☐ AA ☐ ☐ ☐ PS ☐	ISSUED BY E. Powell APP'D BY E. Powell DATE ISSUED 6/21/77	NO. TP-NP8344 CHANGE LETTER PAGE 1 OF 2

TITLE

TEST PROCEDURE: BULLETIN NP8344

TEST MEDIUM: These valves contain Ethylene Propylene Elastomers...Test on oil free, filtered air only.

GENERAL:

1. Check general construction and appearance of valve.
2. Check nameplate data for conformance to shop order specifications.

TEST FIXTURES

TJ-546-8023
TJ-764-8949
TA-793-9149

TEST VOLTAGE AND CURRENT:

1. All D.C. valves are to be tested using the test current listed under the specified voltage on Data Sheet No. 26.
2. All A.C. valves are to be tested using the test voltage on Test Procedure TP-1-003.

COIL TESTS:

1. A.C. - Energize solenoid and check milliampere reading. Value should agree with that shown on Data Sheet No. 24.
2. D.C. - Energize solenoid and check voltage reading. Value should agree with that indicated per Note 2 on Data Sheet No. 26.
3. Dielectric test - measure the current leakage at 1000 volts plus twice the rated voltage in accordance with TP-1-002 (test method #2). Any evidence of damage, arcing, breakdown or current leakage in excess of 0.5 milliampere is cause for rejection.

EXTERNAL LEAKAGE: Apply seamtest solution to all joints and pressurize valve to 500 psig, energized and de-energized (do not operate valve above maximum operating pressure). Any bubbling or foaming is cause for rejection. (Ref.: TP-1-009)

NOTE: To avoid seat leakage or noise caused by the possible presence of dirt or loose chips, blow air at 10% over maximum operating pressure rating thru the valve before proceeding with tests below.

SEAT LEAKAGE: (HIGH PRESSURE) Check valve for seat leakage at 10% over maximum operating pressure. Allowable leakage:

Air: 6 SCFH

NOISE TEST: During the Operational Tests, check valve for noise. Any chattering or rattling in excess of normal A.C. hum is reason for rejection. Valve should be tested at test voltage first, but voltage may be increased to full line voltage if necessary to pass the NOISE TEST ONLY. (Ref. TP-1-015)

OPERATIONAL TESTS:

Single Solenoid Valves:

Operate valve at least ten (10) times at maximum operating pressure and from maximum operating pressure down to minimum operating pressure, alternately opening cylinder connections after operating to make sure by leak check that proper shifting has occurred.

OPERATIONAL TESTS:

Dual Solenoid Valves:

1. Test as for single solenoid valves, energizing and de-energizing solenoids alternately.

2. Alternately energize and de-energize solenoids in normal pressure range ending up with solenoid A (Sol #2) last energized. Then increase inlet pressure at least 15 psi or more. If lock-up bleed is not present, valve will leak heavily out of exhaust. This is a defective rejectable valve.

3. Solenoids must be energized at least 0.3 seconds on air service.

SEAT LEAKAGE: (LOW PRESSURE)

Check seat leakage at 20 psi.
Allowable Leakage:
Air: 6 SCFH

PREPARATION FOR SHIPMENT:

Seal all pipe connection with plastic coated paper plugs or plastic thread protectors and hank coil leads. Attach tag FV-206-825-1.

CORRECTIVE ACTION RECORD:

Maintain test log (Form 1109) on all production runs.

APPENDIX C

INSTRUMENTS USED FOR BASELINE/FUNCTIONAL TESTS

Isomedix, Inc. • 25 Eastmans Road, Parsippany, New Jersey 07054 (201) 887-4700

Chicago, Illinois • 7828 Nagle Ave., Morton Grove, Illinois 60053 (312) 966-1160
Columbus, Mississippi • Post Office Box 2044, Industrial Park South, Columbus, Mississippi 39701 (601) 327-8015

APPENDIX C

NAME	MANUFACTURER	SERIAL NO.	RANGE	FIRST CALIBRATION DATE	CALIBRATION DONE EVERY	LAST CALIBRATION DUE DATE
Pressure Gauge	Helicoid	VLPG 600-23	0-600 psi	5/21/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 600-14	0-600 psi	5/18/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 300-13	0-300 psi	5/19/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 300-36	0-300 psi	5/19/77	4 months	2/1/78
Pressure Gauge	Dwyer Mfg. Co.	VLDP 15-4	0-15" H_2O	5/25/77	4 months	5/26/78
Pressure Gauge	Helicoid	VLPG 30-28	0-30 psi	5/23/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 300-48	0-300 psi	5/19/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 60-5	0-60 psi	5/4/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 60-13	0-60 psi	5/4/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 200-15	0-200 psi	5/24/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 200-11	0-200 psi	5/23/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 60-4	0-60 psi	5/19/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 60-19	0-60 psi	5/19/77	4 months	2/1/78
Pressure Gauge	Helicoid	VLPG 100-17	0-100 psi	5/23/77	4 months	2/22/78
Differential	Pitney Bowes	VLDP 15-1	0-15" H_2O	6/7/77	4 months	5/26/78
Differential	Helicoid	VLPG 30-20	0-30 psi	5/23/77	4 months	2/1/78
Flow Meter	Fischer & Porter	VLFCC 200-7	0-200 cc/min	10/19/76	1 year	10/21/78
Flow Meter	Dwyer Mfg. Co.	VLFP 10-7	0-1- SCFH	10/28/76	1 year	10/28/78
Flow Meter	Dwyer Mfg. Co.	VLF 200-2	20-200 SCFH	10/19/76	1 year	10/20/78
Flow Meter	Dwyer Mfg. Co.	VLF 50-1	0-50 SCFH	10/27/76	1 year	10/2/78
Flow Meter	Dwyer Mfg. Co.	VLF 200-7	20-200 SCFH	10/20/76	1 year	10/20/78
Megohmmeter	Freed Transformer	VLMO 20-1	0-1000 volts 0-INF. ohms	12/16/76	6 months	6/17/78
Ammeter	Weston	VLADC 5-2	0-5 amps	2/7/77	4 months	2/15/78
Voltmeter	Weston	VLVAC 300-26	0-300 VAC	5/15/77	4 months	2/16/78
Voltmeter	Weston	VLVAC 300-32	0-300 volts	5/10/77	4 months	2/15/78
Hypot Tester	Associated Research	VLH 4000-1	0-4000 volts	3/14/77	4 months	2/16/78

APPENDIX D

RADIATION CERTIFICATE

Isomedix, Inc. • 25 Eastmans Road, Parsippany, New Jersey 07054 (201) 887-4700

Chicago, Illinois • 7828 Nagle Ave., Morton Grove, Illinois 60053 (312) 966-1160
Columbus, Mississippi • Post Office Box 2044, Industrial Park South, Columbus, Mississippi 39701 (601) 327-8015

March 27, 1978

TO: Tejinder S. Sachdeva
Manager, Component Testing

FROM: George R. Dietz,
Manager, Radiation Services

SUBJECT: Radiation Exposure of ASCO Valves

This will summarize parameters pertinent to the irradiation of nine valves for the Automatic Switch Company.

Radiation exposure was conducted in two sequences. In the first, the valves were placed in a cobalt-60 gamma field at an average dose rate of 0.51 Mrad per hour for 99 hours, yielding a total dose of 50.5 Mrad. This step was completed on September 15, 1977.

The valves were again placed into the radiation chamber on October 27, 1977, and exposed for an additional 188.5 hours at an average dose rate of 0.8 Mrad per hour, yielding an additional dose of 150.8 Mrad. Hence the total dose from both exposures was 201.3 Mrad.

During both exposures, the units were rotated at the respective mid-exposure points, in order to obtain the most even dose distribution.

Dosimetry was performed using an Atomic Energy of Canada Limited (AECL) Red Perspex system with Type BC-2 readout. Calibration of the Perspex is made by AECL using Ceric dosimetry traceable to the U. S. National Bureau of Standards. Isomedix regularly cross-calibrates its AECL system with an in-house Harwell Perspex system, and makes semiannual calibrations directly with NBS, using the NBS Radiochromic Dye system. A copy of the dosimetry correlation report is available upon request.

Irradiation was conducted in air at ambient temperature and pressure. Radiant heat from the source heated the samples somewhat, but the temperature did not exceed 85°F, as indicated by previous measurements on an oil solution in the same relative position.

George R. Dietz

GRD:of

APPENDIX E

'DAYTON T. BROWN' TEST REPORT

Isomedix, Inc. • 25 Eastmans Road, Parsippany, New Jersey 07054 (201) 887-4700

Chicago, Illinois • 7828 Nagle Ave., Morton Grove, Illinois 60053 (312) 966-1160
Columbus, Mississippi • Post Office Box 2044, Industrial Park South, Columbus, Mississippi 39701 (601) 327-8015

DAYTON T. BROWN INC.

ENGINEERING AND TEST DIVISION

CHURCH STREET, BOHEMIA, LONG ISLAND,
NEW YORK 11716 / (516) 589-6300

TEST REPORT / PROCEDURE No. DTB04R77-1651 Revision A A

DAYTON T. BROWN, INC. JOB No. 401797-00-000

CUSTOMER: ISOMEDIX, INC.
25 EASTMANS ROAD
PARSIPPANY, NEW JERSEY 07054

SUBJECT: SEISMIC TEST PROGRAM PERFORMED ON NINE SOLENOID VALVES

ATTENTION: MR. N. BURSTEIN

THIS REPORT CONTAINS: FIVE PAGES AND TWO ENCLOSURES

PREPARED BY	S. J. FRANKLIN
TEST ENGINEER	W. W. SCHAAF
STAFF ENGINEER	R. J. ROTHAUG
DATE	7 NOVEMBER 1977

THE DATA CONTAINED IN THIS REPORT WAS OBTAINED BY TESTING IN COMPLIANCE WITH THE APPLICABLE TEST SPECIFICATION AS NOTED

DAYTON T. BROWN INC

Revision Page

Page	Change
Cover Page	Revision A added to Test Report Number; Date updated
Enc. 1, Pg. 4	Notes 1, 2, and 3 added
Enc. 1, Pg 5	Test Condition changed from Lo to Hi in Sequence Number 25

DAYTON T. BROWN INC.

TABLE OF CONTENTS

DAYTON T. BROWN INC.

1.0 ABSTRACT

This test report details the results of a seismic test program conducted on nine solenoid valves under reference (a) to the requirements of reference (c).

Results of the test are detailed in the following text.

The test items were operated during portions of testing.

The test items' operation was the sole responsibility of Isomedix Inc. personnel, and all operational data was retained by same.

Test data pertinent to this test program will remain on file at Dayton T. Brown, Inc. for 90 days.

2.0 REFERENCES

(a) Customer Purchase Order Number 2019

(b) Dayton T. Brown, Inc. Job Number 401797-00-000

(c) Test Specification and ASCO Qualification Specification, dated January 1977, Revision, September 19, 1977

DAYTON T. BROWN INC.

3.0 ADMINISTRATIVE INFORMATION

Customer: Isomedix Inc.

Test Item Description: Solenoid Valves

Quantity Received: Nine

Serial Numbers:

ASCO S/N	Dayton T. Brown, Inc. Assigned S/N
HV-206-381-6F	1
NP-8344-A-71E	2
XFT-831654-V	3
HV-206-380-3RF	4
NP-8320-A-184E	5
NP-831665-E	6
HVA-202-300-2RF	7
NP-8321-A-5E	8
NP-8323-A-39E	9

Date Received: 30 September 1977

Date Shipped: 7 October 1977

Customer Representatives Present During Portions of Test:

Name	Affiliation
Mr. D. Gibbons	Isomedix Inc.
Mr. N. Burstein	Isomedix Inc.
Mr. Conca	Isomedix Inc.
Mr. Plaut	Automatic Switch Company
Mr. G. Fleishman	Automatic Switch Company
Mr. R. D. Powell	Automatic Switch Company
Mr. T. R. Hays	Automatic Switch Company

DAYTON T. BROWN INC.

4.0 TEST PROGRAM OUTLINE

Test	Test Item Description	Results
Seismic	Solenoid Valves	See Enclosure 1

DAYTON T. BROWN INC.

Enclosure 1

Seismic Test and Results

1651

DAYTON T. BROWN INC.

TEST REQUIREMENT

The seismic test shall be conducted in accordance with reference (c).

TEST PROCEDURE

The nine solenoid valves were subjected to the following procedure in each of the three orthogonal test axes.

Step 1: A pretest visual inspection of the test items was performed.

Step 2: The test items were mounted on the test fixture and set up to be energized during testing. A triaxial control accelerometer was mounted on the test fixture and response accelerometers were mounted on the test items.

Step 3: The test items, energized, were subjected to a sinusoidal vibration survey from 3 to 100 Hz at a sweep rate of 1.0 octave per minute. The applied vibration level was ± 0.2 g.

The accelerometers' output signals were plotted on graphs of acceleration versus frequency.

Step 4: Step 3 was repeated with the test items de-energized.

Step 5: The test items, energized, were subjected to a sinuscidal vibration dwell test. The frequency was determined by the representatives: 90 Hz - Z axis, 95 Hz - Y axis, 100 Hz - X axis. The applied level was ± 0.75 g. Dwell testing was performed for 333,333 cycles in each of the three axes. The test items were energized for all testing. Every 15 minutes, the items were de-energized for approximately 15 seconds.

Step 6: The test items, energized, were subjected to the OBE seismic test. One cycle from 1 to 33 to 1 Hz was performed in 10 minutes. The applied vibration levels are given below:

Table I

Frequency (Hz)	Applied Level
1.0 to 1.2	6.0 inches d.a.
1.2 to 8.0	24 inches per sec.
8.0 to 33	± 3.0 g's

Step 7: Step 6 was repeated with the test items de-energized.

TEST PROCEDURE - (Continued)

Step 8: The test items were subjected to a combined SSE and fragility test. Each of the following frequencies were maintained for 15 seconds: 1.0, 1.25, 1.6, 2.0, 2.5, 3.2, 4.0, 5.0, 6.3, 8.0, 10.0, 12.5, 16.0, 20.0, 25.0, 32.0, and 33.0 Hz. The applied vibration levels are given below:

Table II - S/N's 1 - 9, Axes Z & X and S/N 6, Axis Y

Frequency (Hz)	Applied Input Level
1.0	6.0 in. d.a.
1.25	5.5 in. d.a.
1.6	4.3 in. d.a.
2.0	5.0 in. d.a.
2.5	4.5 in. d.a.
3.2	4.4 in. d.a.
4.0	3.7 in. d.a.
5.0	2.8 in. d.a.
6.3	2.2 in. d.a.
8.0	1.8 in. d.a.
10.0 - 33.0	± 7.0 g's

Table III - S/N's 1 - 5, 7, 8, 9, Axis Y

Frequency (Hz)	Applied Input Level
1.0	6.0 in. d.a.
1.25	4.5 in. d.a.
1.6	3.6 in. d.a.
2.0	2.7 in. d.a.
2.5	2.4 in. d.a.
3.2	1.9 in. d.a.
4.0	1.6 in. d.a.
5.0	1.5 in. d.a.
6.3	1.6 in. d.a.
8.0	1.0 in. d.a.
10.0	0.75 in. d.a.
12.5 - 33.0	± 4.2 g's

The test was performed with the valves energized and de-energized and with high and low pressure. The leakage rate was monitored by Automatic Switch Company during testing.

TEST PROCEDURE - (Continued)

Step 9: A post-test visual inspection of the test items was performed.

TEST RESULTS

A pretest visual inspection of the test items revealed no anomalies.

All testing was performed in accordance with the referenced specification. Refer to the vibration test summary for tabulated results.

A post-test visual inspection of the test items revealed no anomalies due to testing.

VIBRATION TEST SUMMARY

Seq.	Units DTBS/N	Axis	Ener. De-en.	Test Condition	Duration (min.)	Dwell Test Data: Freq. (Hz)	Input (± g's)	Test Point	Response (± g's) Start	Middle	End	Page No. of Graph (Enc 1)	Rem.
1	1 - 9	Z	En.	Survey	5.0							7 - 17	Note 1
2	1 - 9	Z	De-en.	Survey	5.0							18 - 26	Note 1
3	1 - 9	Z	En.	Dwell	61.5	90	0.75	1	0.68	0.66	0.64		
								2	1.1	1.1	1.1		
								3	0.80	0.79	0.76		
								4	0.90	1.0	1.0		
								5	1.1	0.85	0.80		
								6	0.81	0.80	0.78		
								7	0.60	0.68	0.66		
								8	0.70	0.82	0.80		
								9	1.0	0.95	0.90		
4	1 - 9	Y	En.	Survey	5.0							27 - 37	
5	1 - 9	Y	De-en.	Survey	5.0							38 - 46	
6	1 - 9	Y	En.	Dwell	58.5	95	0.75	1	0.78	0.78	0.76		
								2	0.75	0.75	0.74		
								3	1.30	1.30	1.32		
								4	0.61	0.60	0.60		
								5	0.77	0.75	0.75		
								6	0.81	0.80	0.78		
								7	0.50	0.50	0.50		
								8	1.25	1.25	1.25		
								9	0.63	0.63	0.62		
7	1 - 9	X	De-en.	Survey	5.0							47 - 55	Notes 2
8	1 - 9	X	En.	Survey	5.0							56 - 65	& 3
9	1 - 9	X	En.	Dwell	55.0	100	0.75	1	3.2	3.2	3.2		
								2	1.3	1.4	1.3		
								3	0.9	0.9	0.9		
								4	1.4	1.3	1.3		
								5	3.1	3.1	3.1		
								6	1.0	1.0	1.0		
								7	4.1	4.1	4.0		
								8	4.3	4.2	4.2		
								9	2.8	2.8	2.8		

Note 1 - Data was lost at TP #5 during the survey.
Note 2 - Crosstalk was not recorded at control point for the second horizontal axis.
Note 3 - Data was lost at TP #1 during the survey.

165A Enc 1 Pg 4

VIBRATION TEST SUMMARY

Seq.	Units DTBS/N	Axis	Ener. De-en.	Test Condition	Duration (min.)	Dwell Test Data: Freq. (Hz)	Input (± g's)	Test Point	Response (± g's): Start	Middle	End	Page No. of Graph (Enc 1)	Rem.
10	1 - 9	Y	En.	OBE	10.0							66	
11	1 - 9	Y	De-en.	OBE	10.0								
12	1 - 9	Z	De-en.	OBE	10.0							67	
13	1 - 9	Z	En.	OBE	10.0							68	
14	1 - 9	X	De-en.	OBE	10.0							68	
15	1 - 9	X	En.	OBE	10.0							68	
16	6	X	En./De-en.	SSE - Hi Pres.	26.0								
17	6	X	En./De-en.	SSE - Lo Pres.	13.0								
18	6	Y	En./De-en.	SSE - Hi Pres.	12.0								
19	6	Y	En./De-en.	SSE - Lo Pres.	45.0								
20	6	Z	En./De-en.	SSE - Hi & Lo Pres.	20.0								
21	2, 3	Z	En./De-en.	SSE - Hi & Lo Pres.	35.0								
22	2, 3	Y	En./De-en.	SSE - Hi & Lo Pres.	15.0								
23	2, 3	X	En./De-en.	SSE - Hi & Lo Pres.	25.0								
24	1, 7, 8	Z	En./De-en.	SSE - Lo Pres.	5.0								
25	1, 7, 8	Z	En./De-en.	SSE - Hi Pres.	3.0								
26	1, 7, 8	X	En./De-en.	SSE - Lo Pres.	6.0								
27	1, 7, 8	X	En./De-en.	SSE - Hi Pres.	4.0								
28	1, 7, 8	Y	En./De-en.	SSE - Hi Pres.	8.0								Note 1
29	1, 7, 8	Y	En./De-en.	SSE - Lo Pres.	5.0								Note 2

VIBRATION TEST SUMMARY

Seq.	Units DTB S/N	Axis	Ener. De-en.	Test Condition	Duration (min.)	Dwell Test Data: Freq. (Hz)	Input (± g's)	Test Point	Response (± g's): Start	Middle	End	Page No. of Graph (Enc 1)	Rem.
30	4, 5, 9	Z	En./De-en.	SSE - Lo Pres.	3.0								
31	4, 5, 9	Y	En./De-en.	SSE - Lo Pres.	4.0								
32	4, 5, 9	Y	En./De-en.	SSE - Hi Pres.	3.0								
33	4, 5, 9	Z	En./De-en.	SSE - Hi Pres.	3.0								
34	4, 5, 9	X	En./De-en.	SSE - Hi Pres.	2.0								
35	4, 5, 9	X	En./De-en.	SSE - Lo Pres.	2.0								

Note 1: Leakage occurred from Dayton T. Brown, Inc. #7 at 6.3, 12.5, 16.0, 20.0, and 25.0 Hz.

Note 2: Leakage occurred from Dayton T. Brown, Inc. #7 at 10.8 and 6.3 Hz.

Plotted by: [illegible]

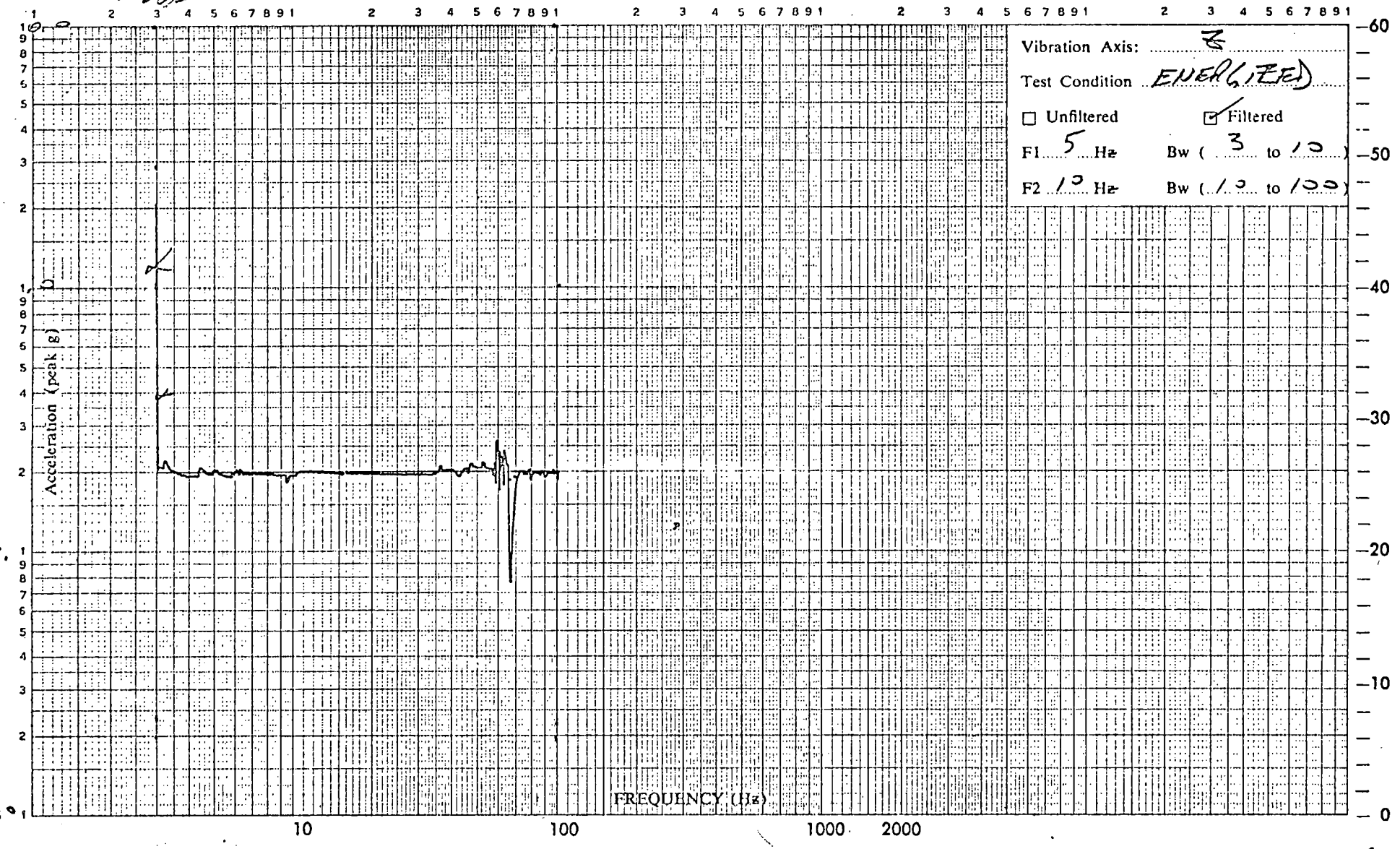
Checked by: WB

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 4793

Pickup Location: CONTROL

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☑ Live ☐ Tape

Job Number: 4-1797

Date: 1 OCT 77

Time: 1205

Graph Number: 7.7

1651 Enc 1 Pg 7

Lab Form D-24

Automatic Switch Co.

Plotted by: Wetts

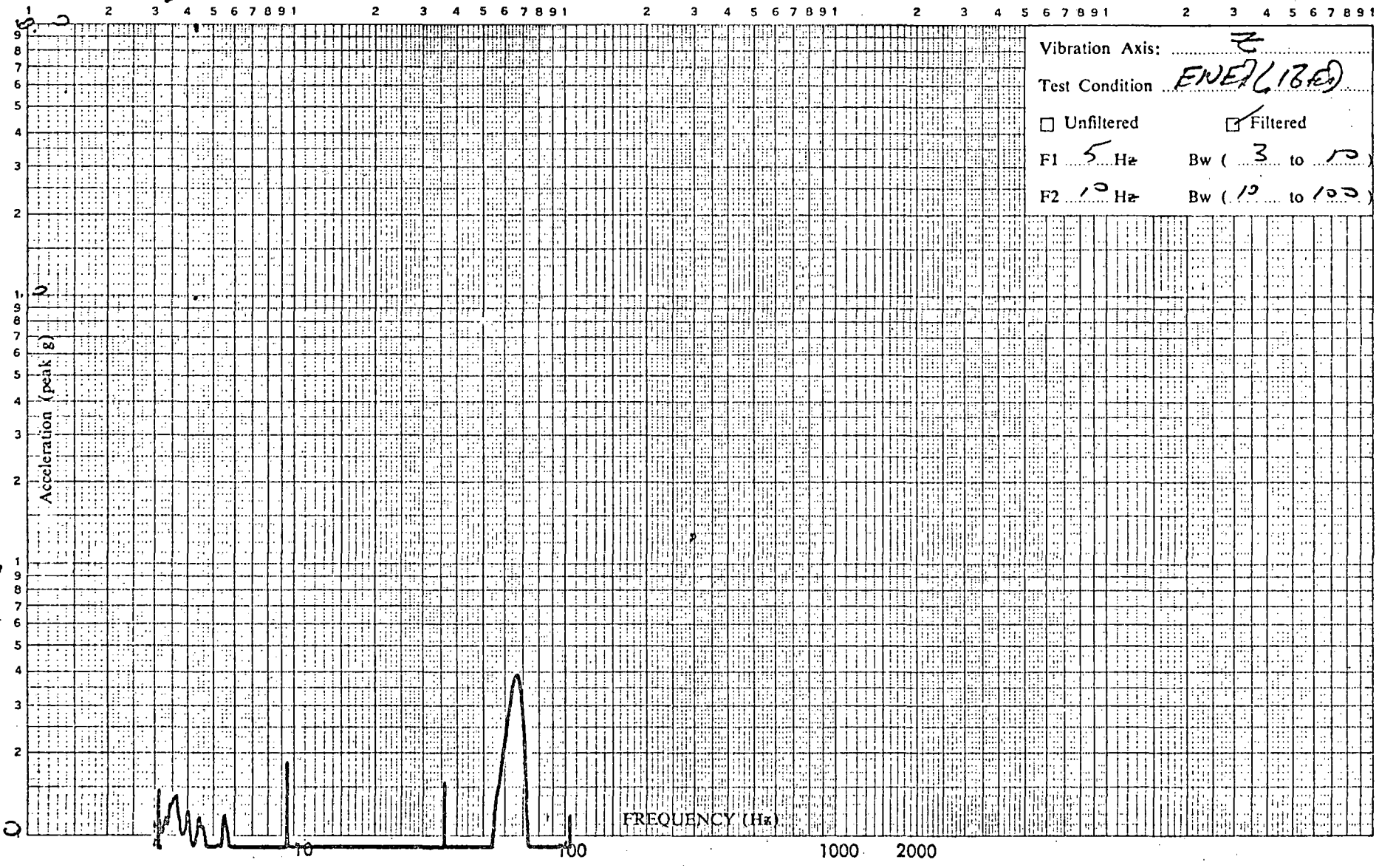
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 1679 X

Pickup Location: CONTROL

Pickup Sensing Axis: X

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☑ Live ☐ Tape

Job Number: 40.1797

Date: 10 OCT 77

Time: 1205

Graph Number: 23

1651 Enc 1 Pg 8

Lab Form D-24

Plotted by: R. Mercado

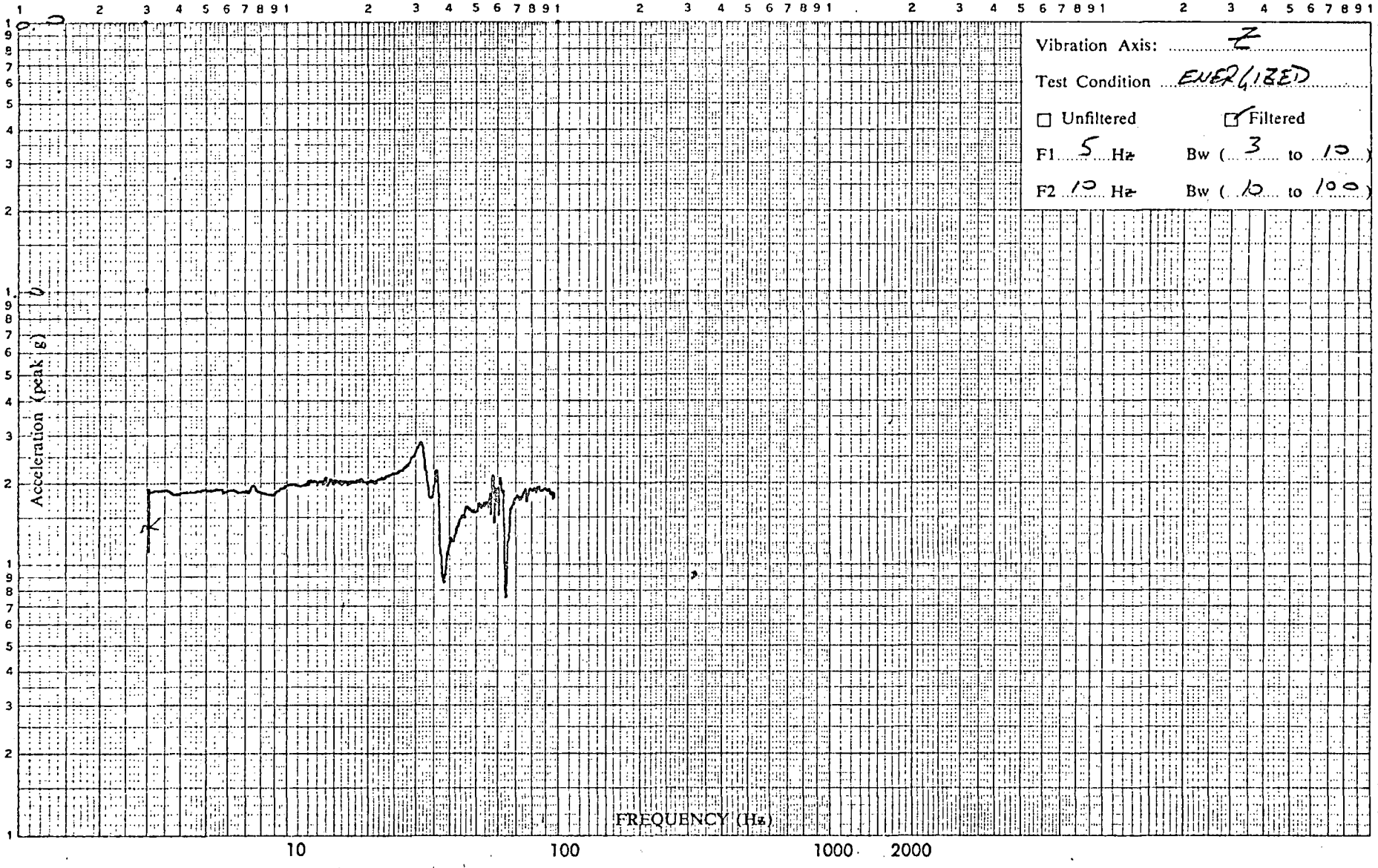
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 & 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 456

Pickup Location: TP1

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1205

Graph Number: 2C

Lab Form D-24.

1651 Enc 1 Pg 9

Plotted by: [signature]

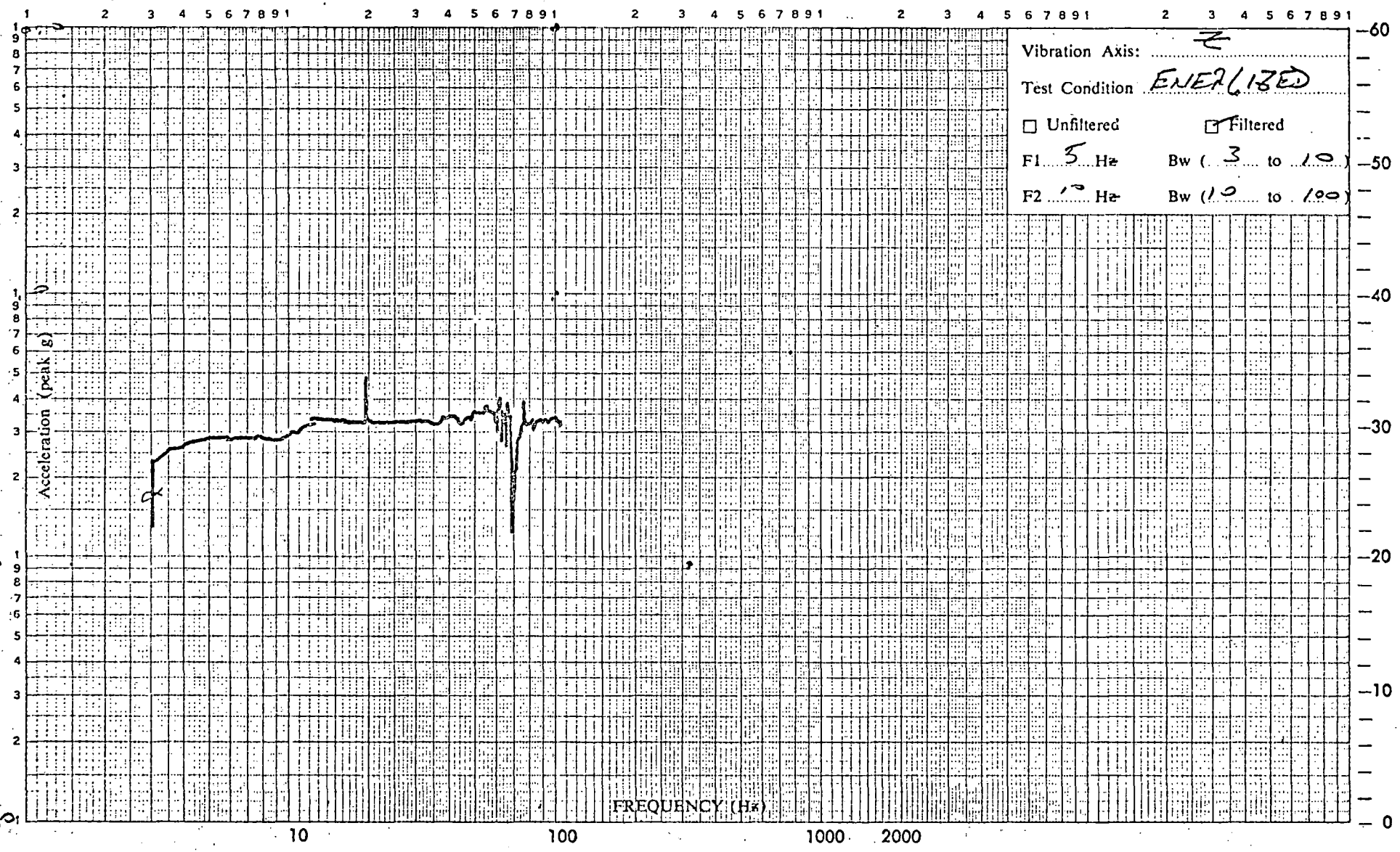
Checked by: [signature]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Relative db (20 db/decade)

Graph Number: 21

Pickup Serial Number: 224

Pickup Location: TP 2

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1205

1651 Enc 1 Pg 10

Lab Form D-24

Plotted by: J. Wells

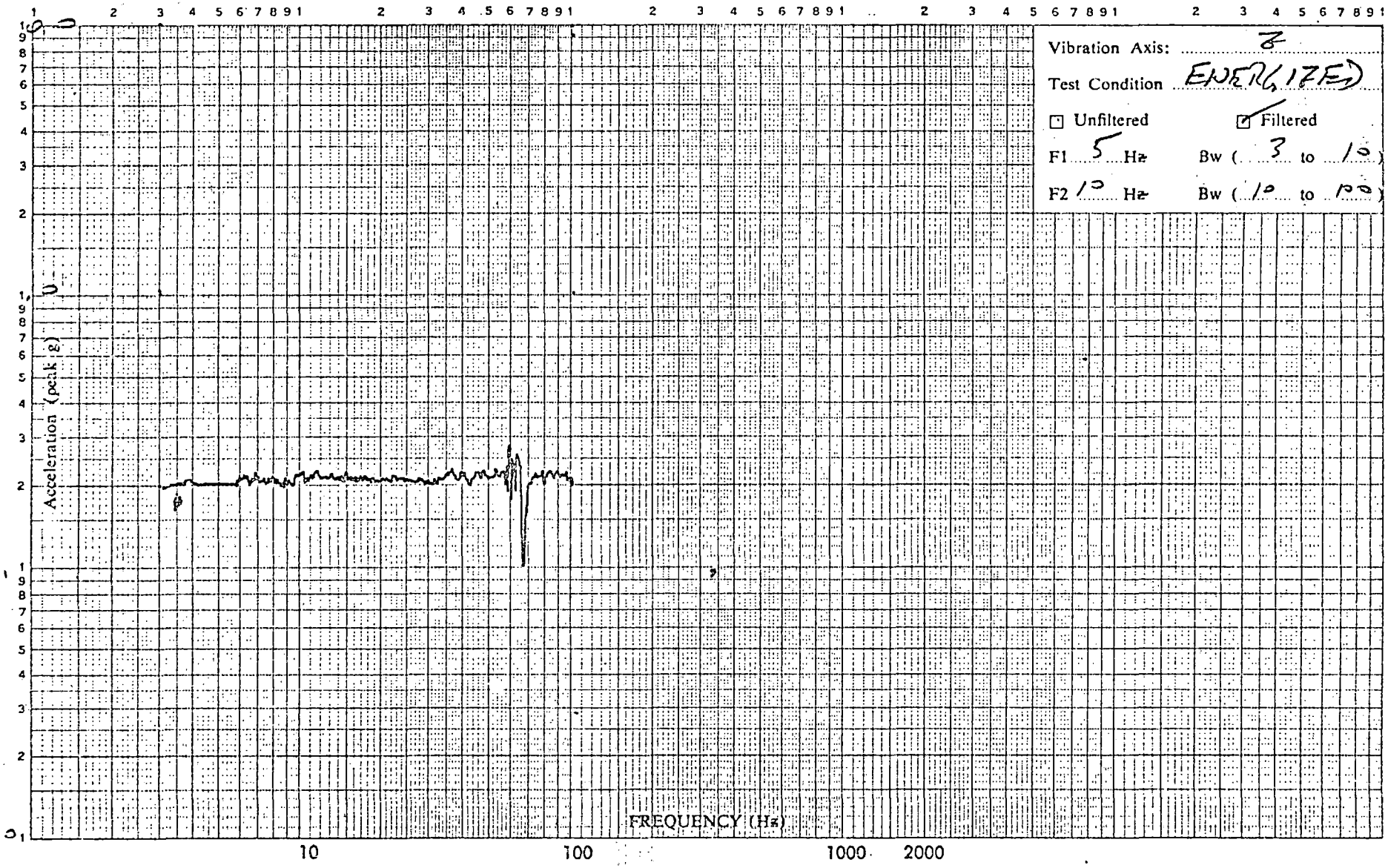
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: AB40

Pickup Location: TP 3

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1205

Graph Number: 27

1651 Enc 1 Pg 11

Lab Form D-24

Plotted by: [illegible]

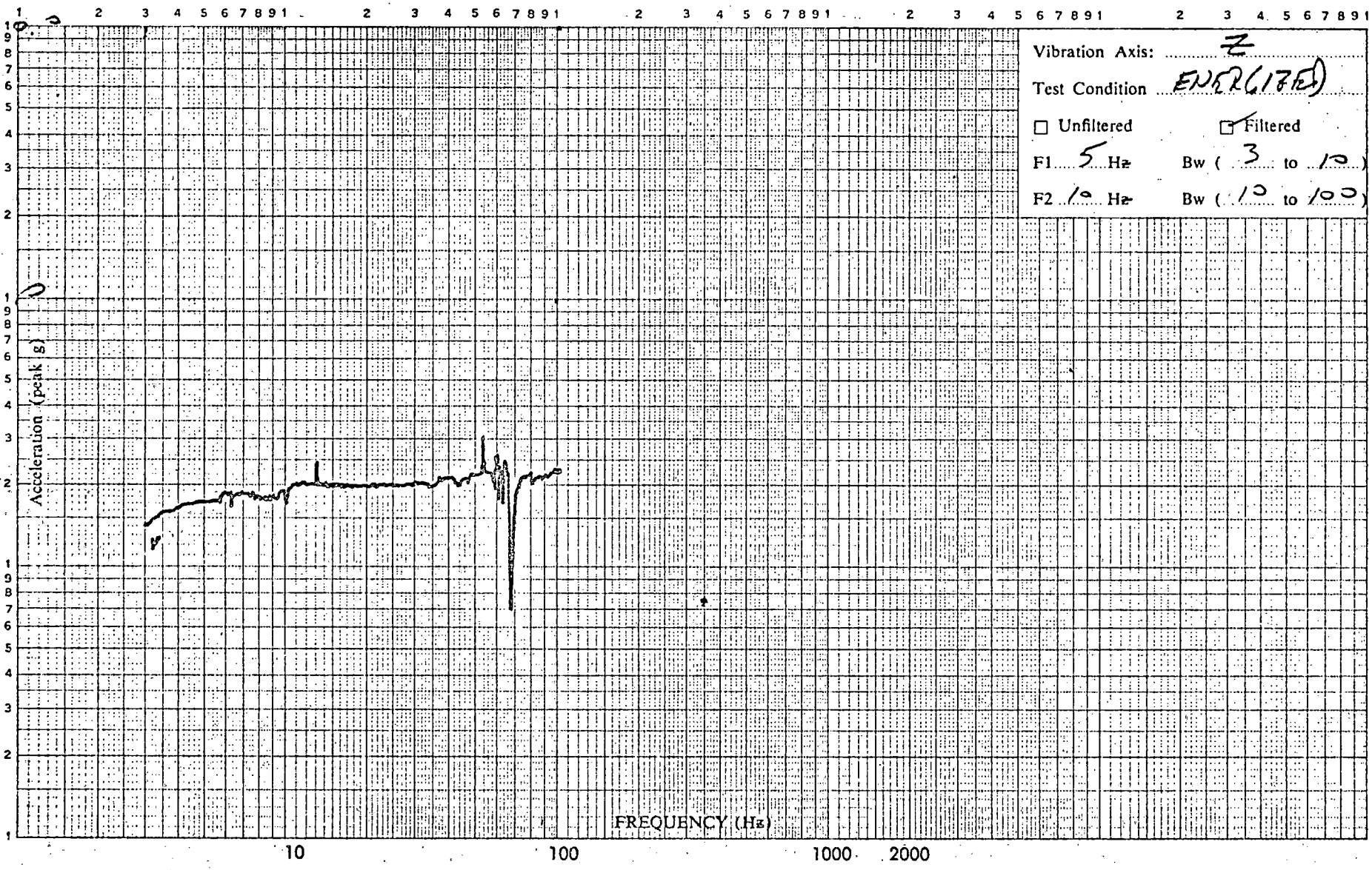
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 459

Pickup Location: TP 4

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1205

Graph Number: 24

1651 Enc 1 Pg 12

Lab Form D-24

Plotted by: Wells

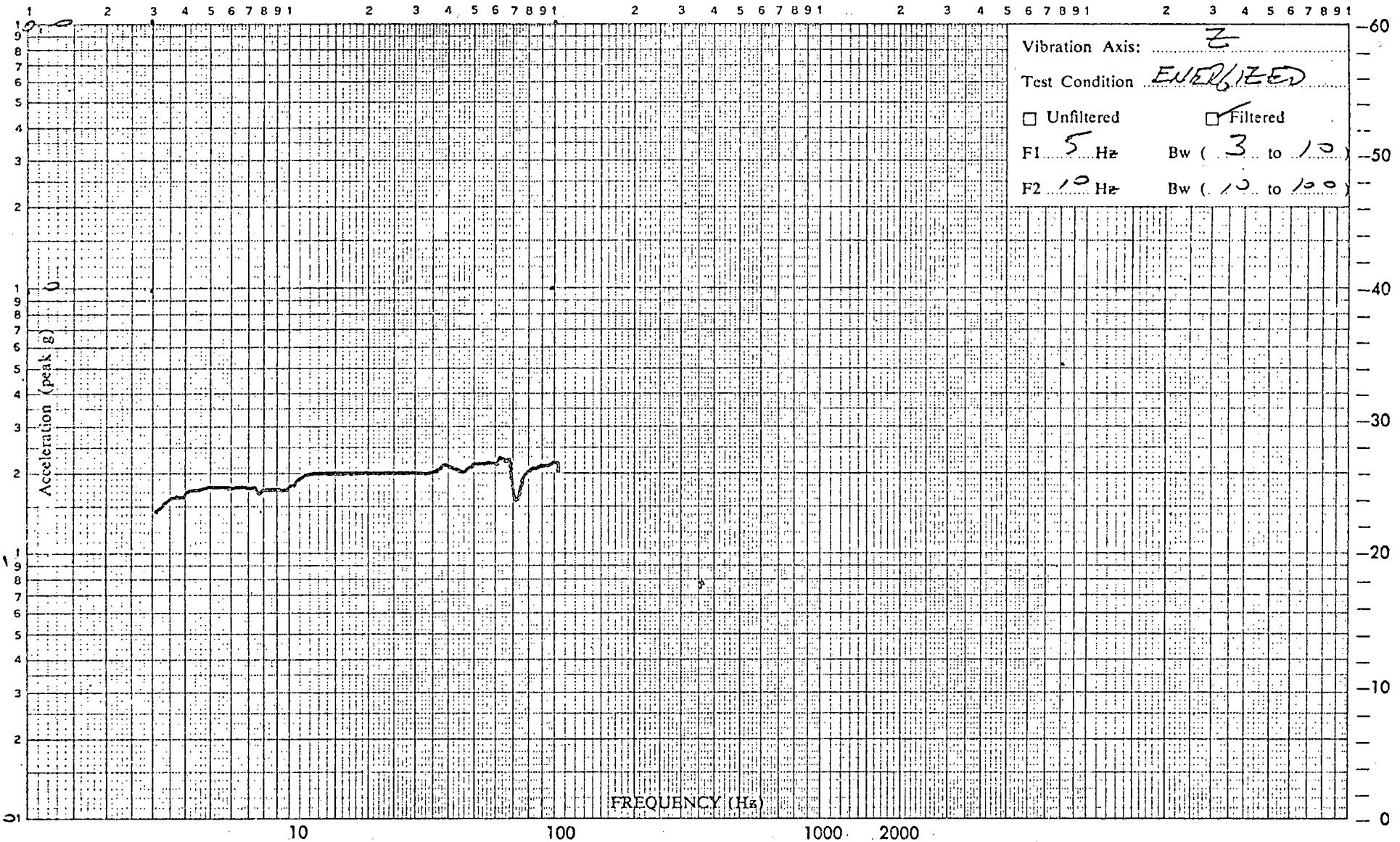
Checked by: MS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): STB #1-9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 246

Pickup Location: TP6

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 40.1797

Date: 1 OCT 77

Time: 1705

Graph Number: 26

1651 Enc 1 Pg 13

Lab Form D-24

Plotted by: J Heath

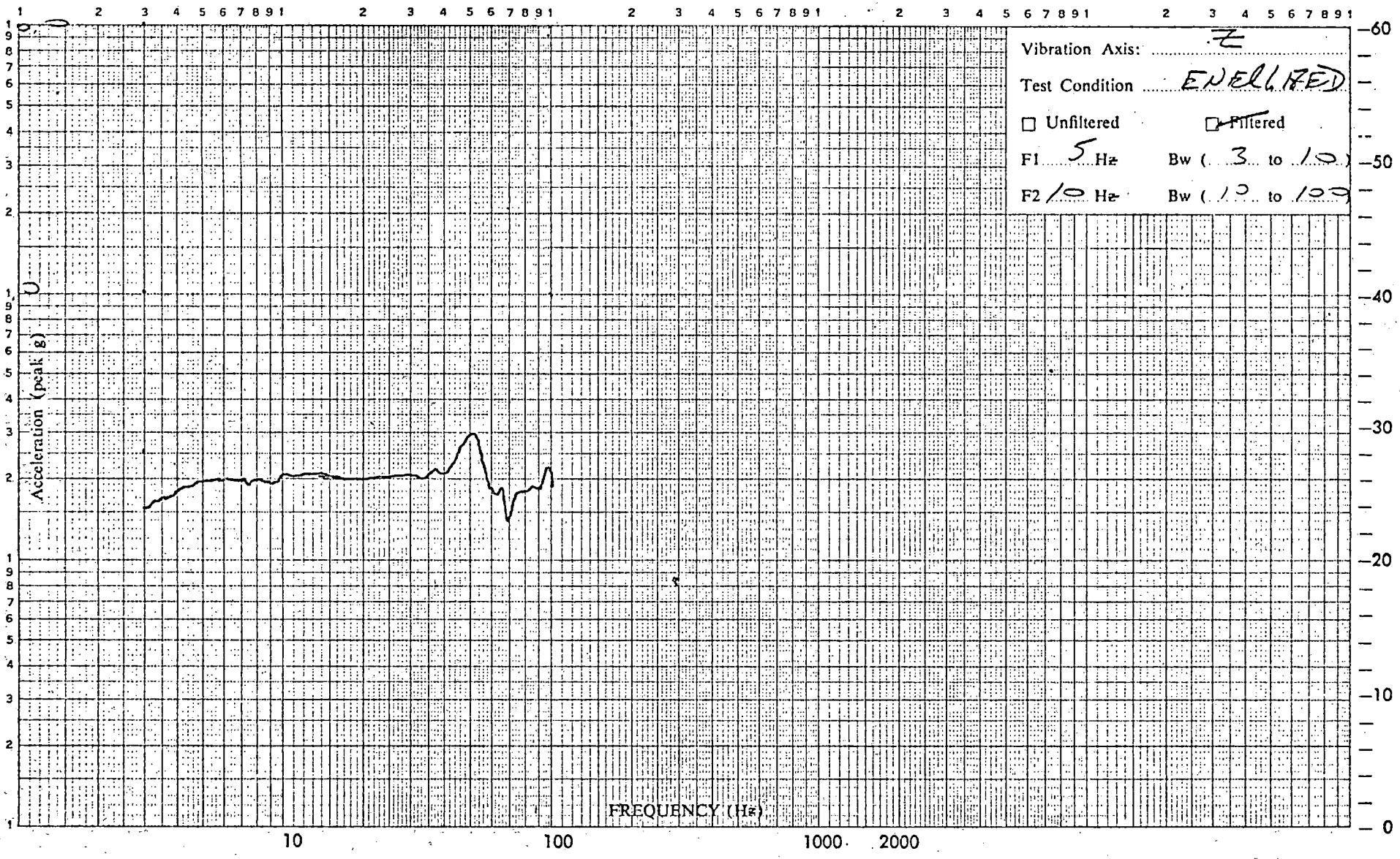
Checked by: W.

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB#1→9

Unit: Operational ☐ Non-operational ☐



Pickup Serial Number: 149209

Pickup Location: TP 7

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☐ Tape

Job Number: 40,797

Date: 10 OCT 77

Time: 1205

Graph Number: 2N

1651 Enc 1 Pg 14

Lab Form D-24

Plotted by: Watts

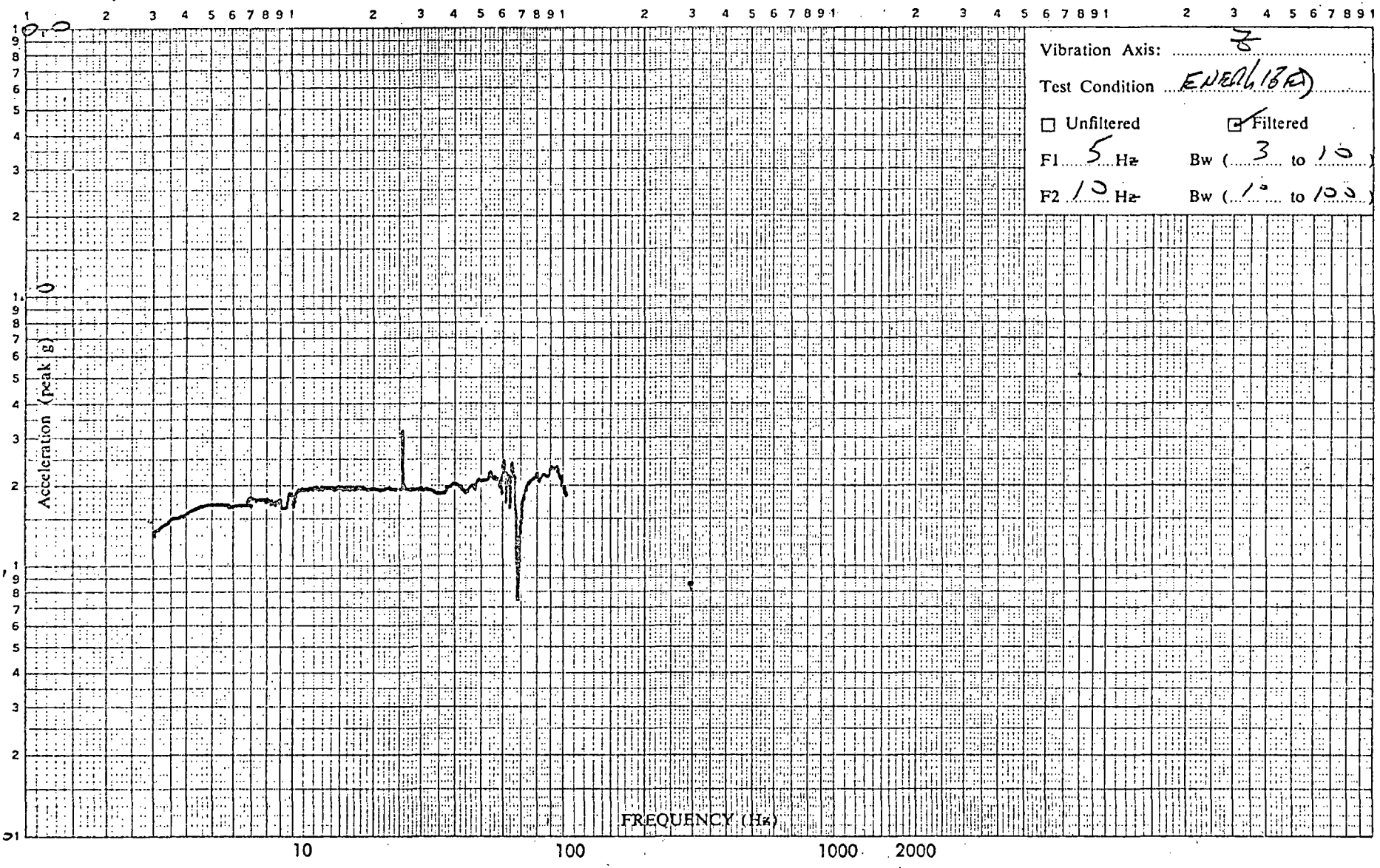
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVE

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: FH04

Pickup Location: TP 8

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1205

Graph Number: 21

1651 Enc 1 Pg 15

Lab Form D-24

Plotted by: Wetts

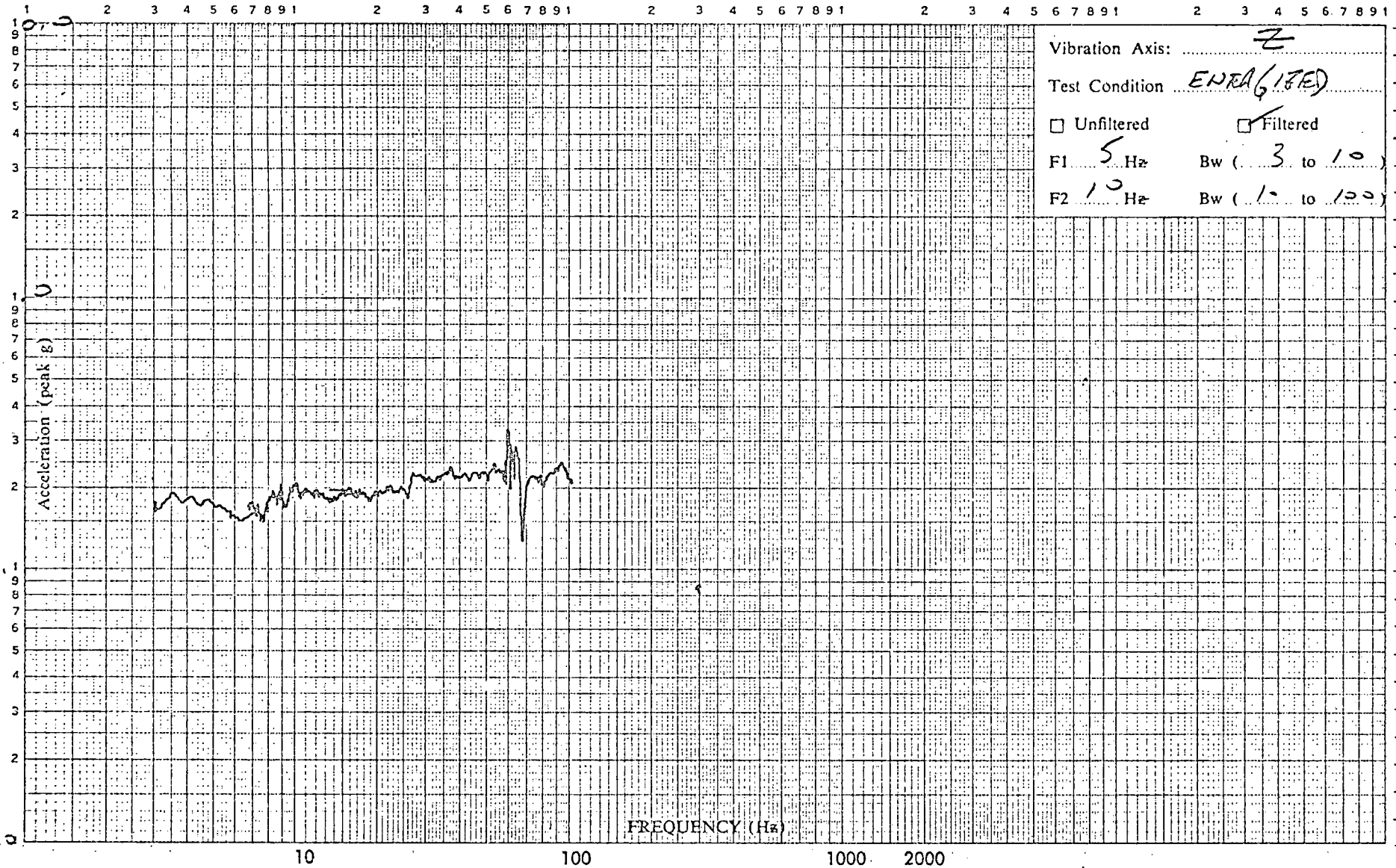
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVE

Serial Number(s): DTB # 179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CT68

Pickup Location: TP9

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 10 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1205

Graph Number: 21

1651 Enc 1 Pg 16

Lab Form D-24

Plotted by: W Ellis

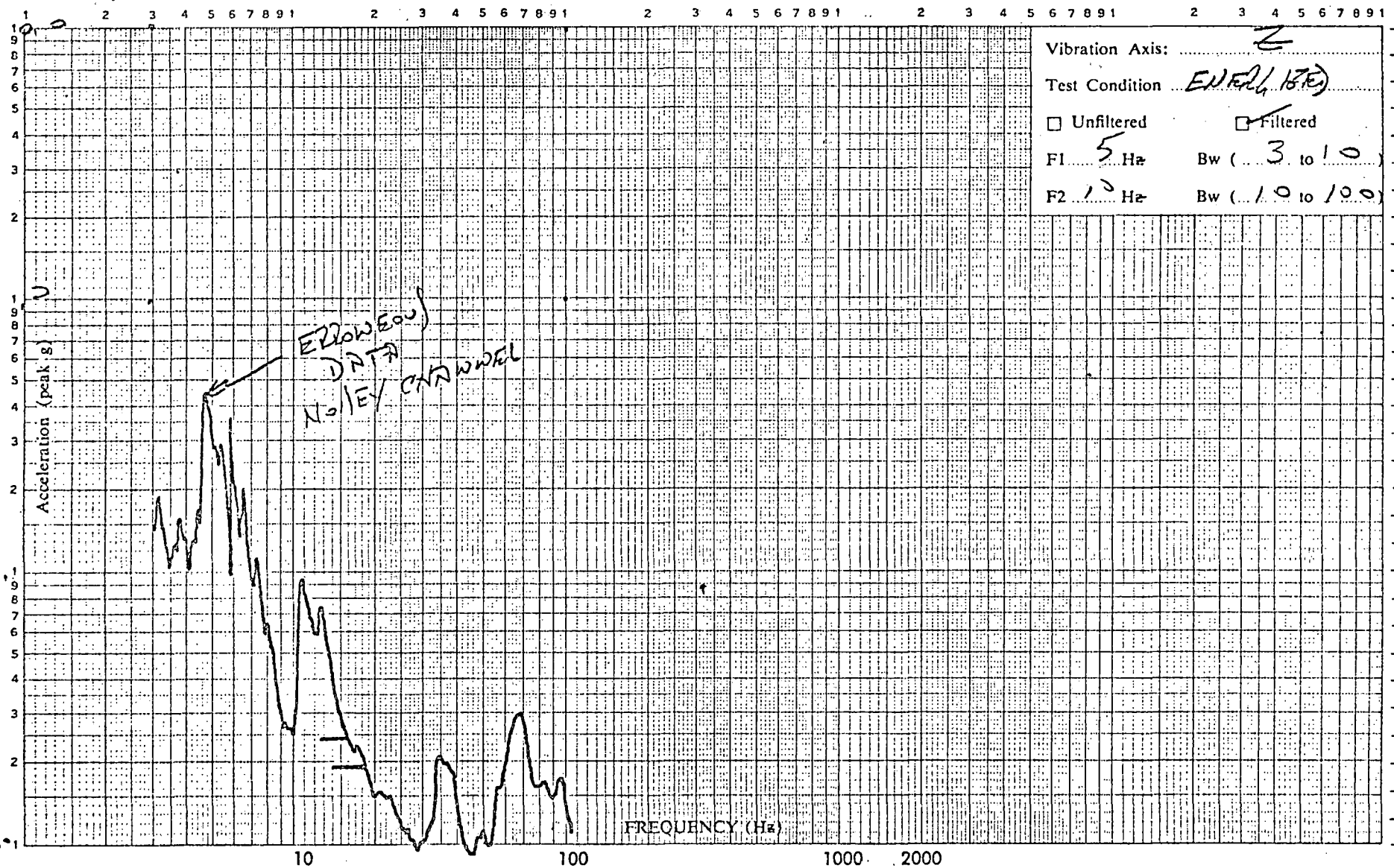
Checked by: WE

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: UNLVEL

Serial Number(s): DTB #1→9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: YG 79 Y

Pickup Location: CONTROL

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1205

Graph Number: 24

1651 Enc 1 Pg 17

Lab Form D-24

Plotted by: [illegible]

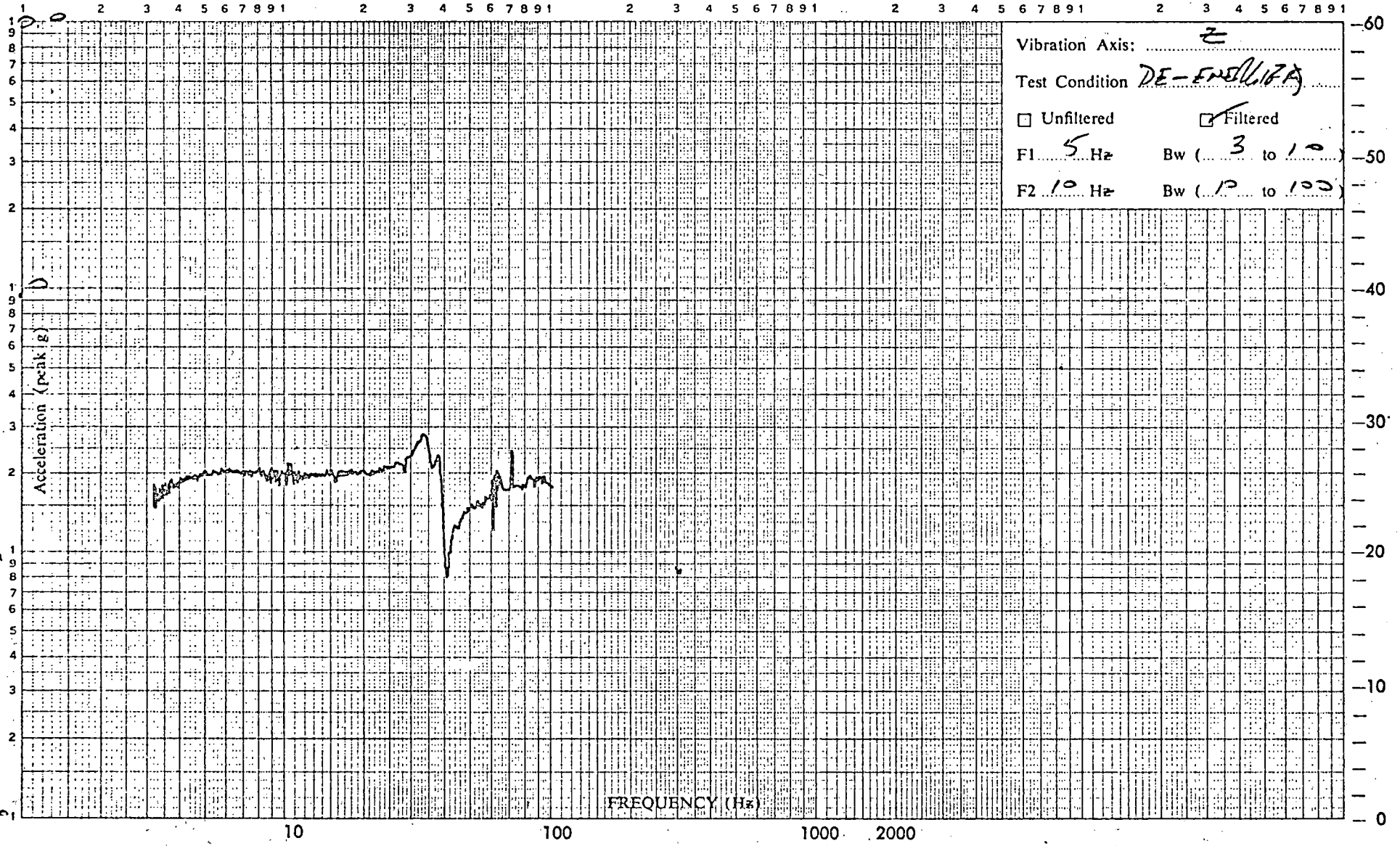
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVE1

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 456

Pickup Location: TP1

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 12 12

Graph Number: 26

1651 Enc 1 Pg 18

Lab Form D-24

Plotted by: Walt

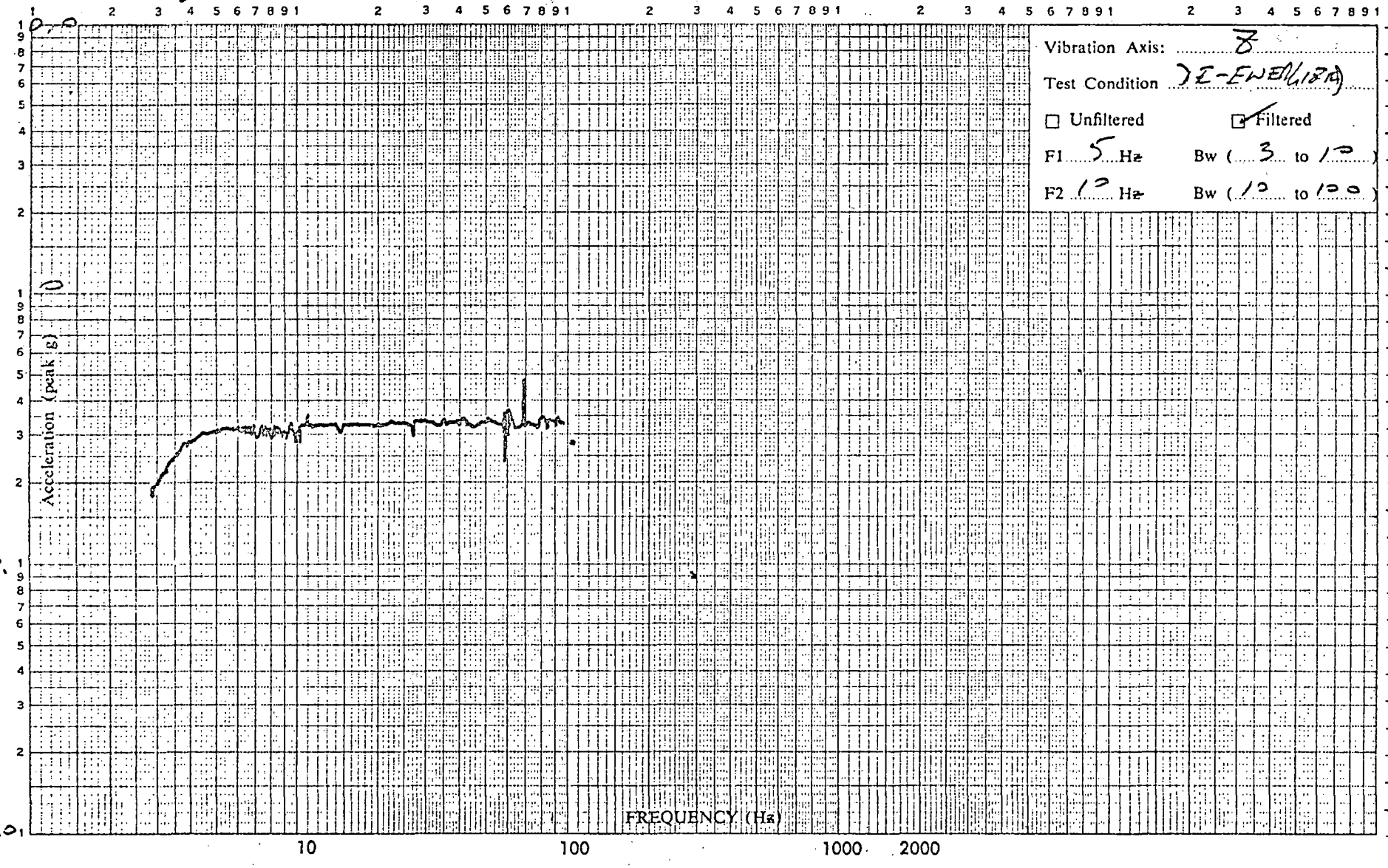
Checked by: W

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVE

Serial Number(s): DTB#1-9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 224

Pickup Location: TP2

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 1212

Graph Number: 2M

1651 Enc 1 Pg 19

Lab Form D-24

Plotted by: [illegible]

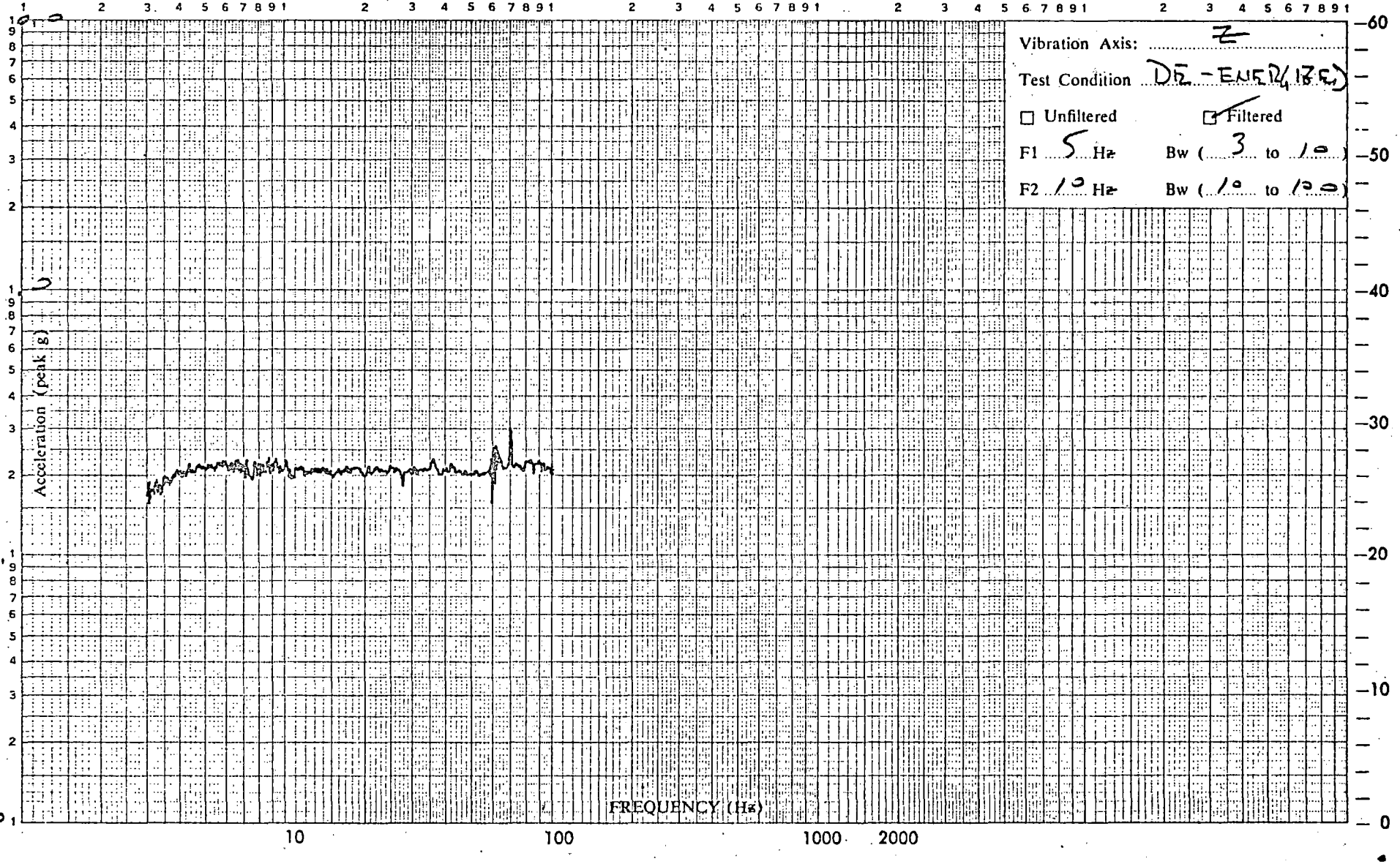
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit; Operational ☑ Non-operational ☐



Pickup Serial Number: RBY0

Pickup Location: TP 3

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☐ Tape

Job Number: 401797

Date: 1 OCT 97

Time: 1212

Graph Number: 24

1651 Enc 1 Pg 20

Lab Form D-24

Plotted by: [illegible]

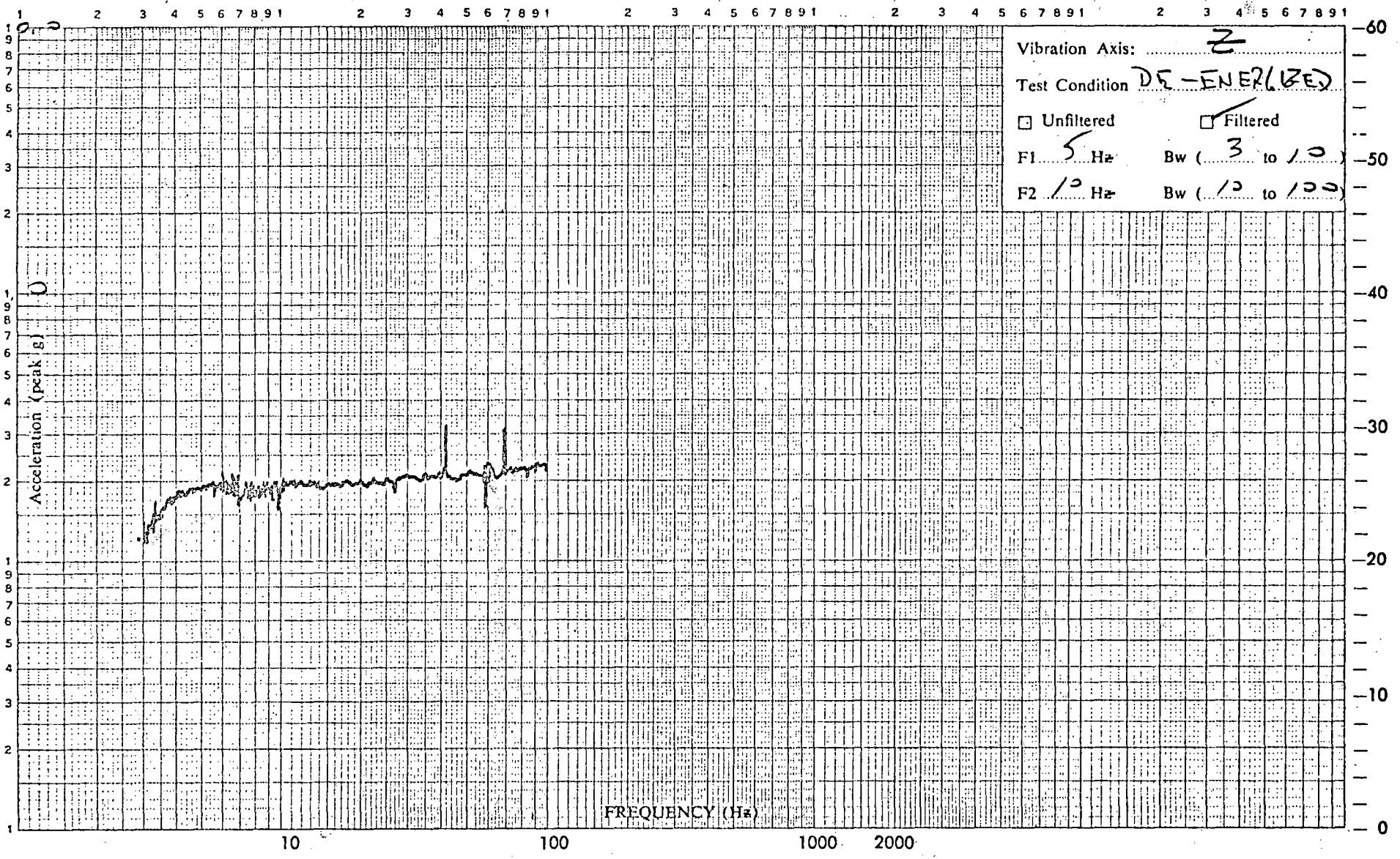
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTR#1 → 9,

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 459

Pickup Location: TP 4

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 10 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1212

Graph Number: 2 of 2

1651 Enc 1 Pg 21

Lab Form D-24

Plotted by: Wetta

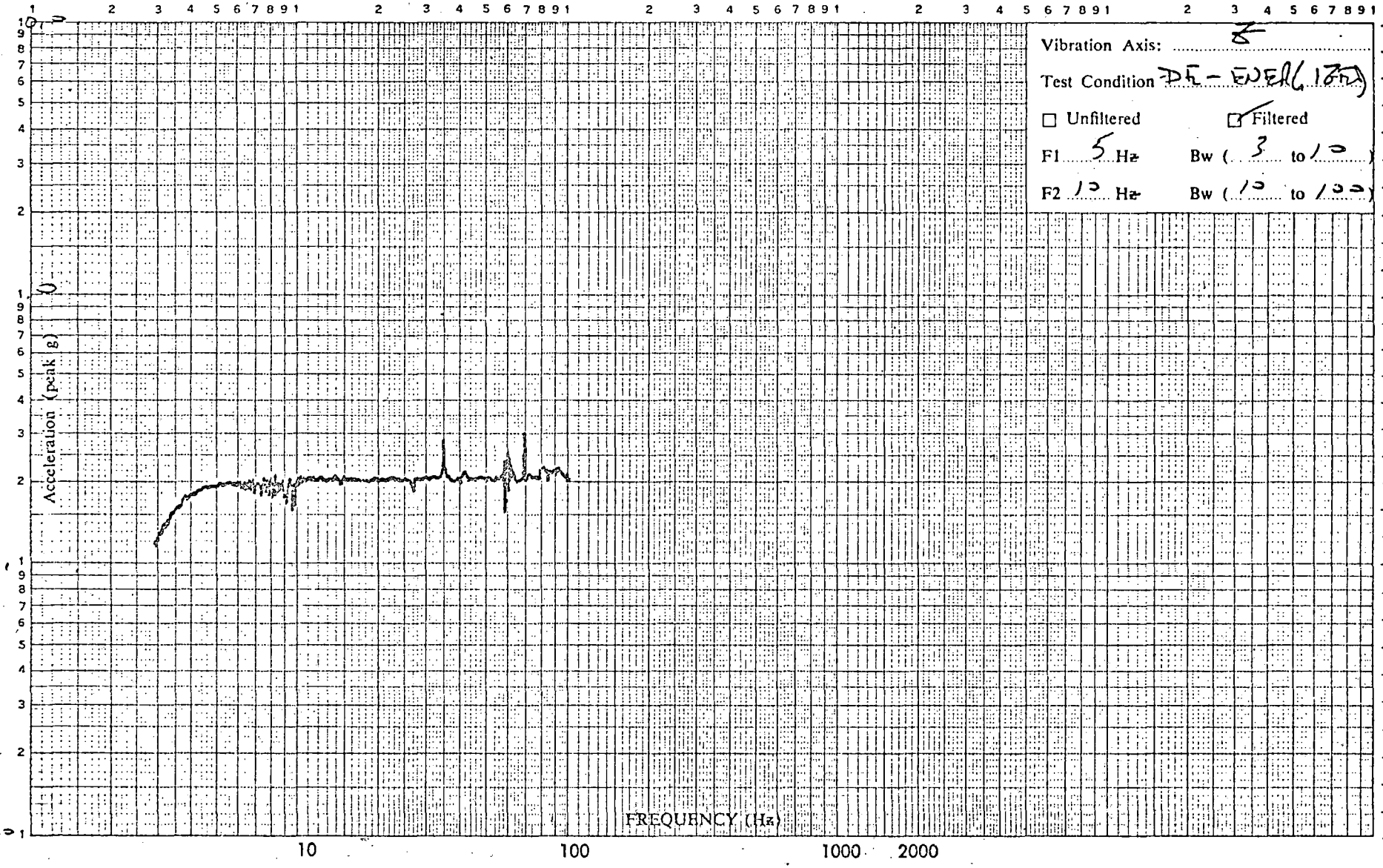
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVE

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Graph Number: 2P

Pickup Serial Number: 246

Pickup Location: TP 6

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1212

1651 Enc 1 Pg 22

Lab Form D-24

Plotted by: [illegible]

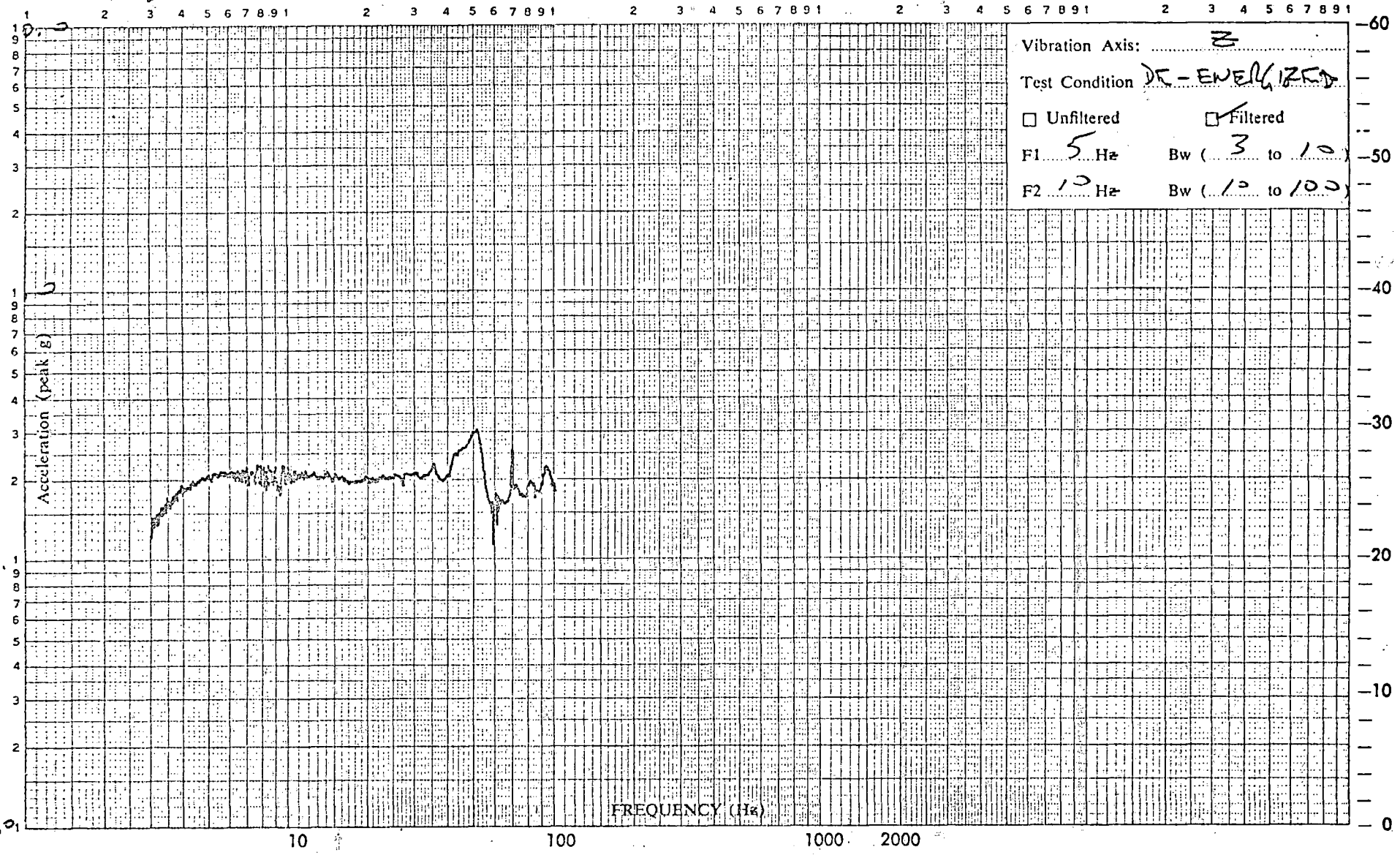
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVE

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 149209

Pickup Location: TP 7

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☐ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1212

1651 Enc 1 Pg 23

Lab Form D-24

Graph Number: 29

Plotted by: Wells

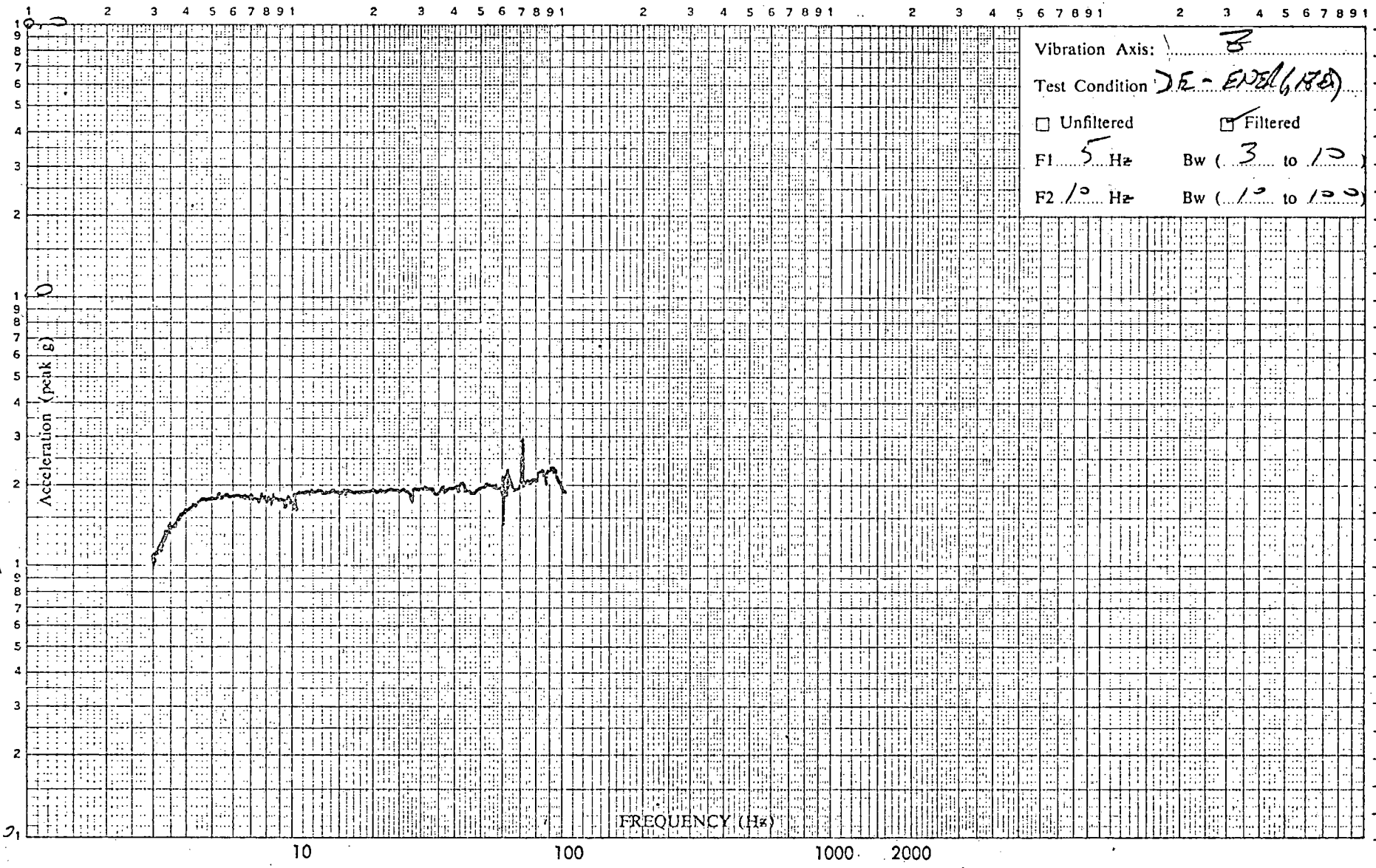
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVE1

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: FH04

Pickup Location: TP 8

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 40 1797

Date: 1 OCT 77

Time: 1212

Graph Number: 22

Lab Form D-24

1651 Enc 1 Pg 24

Plotted by: J Wetted

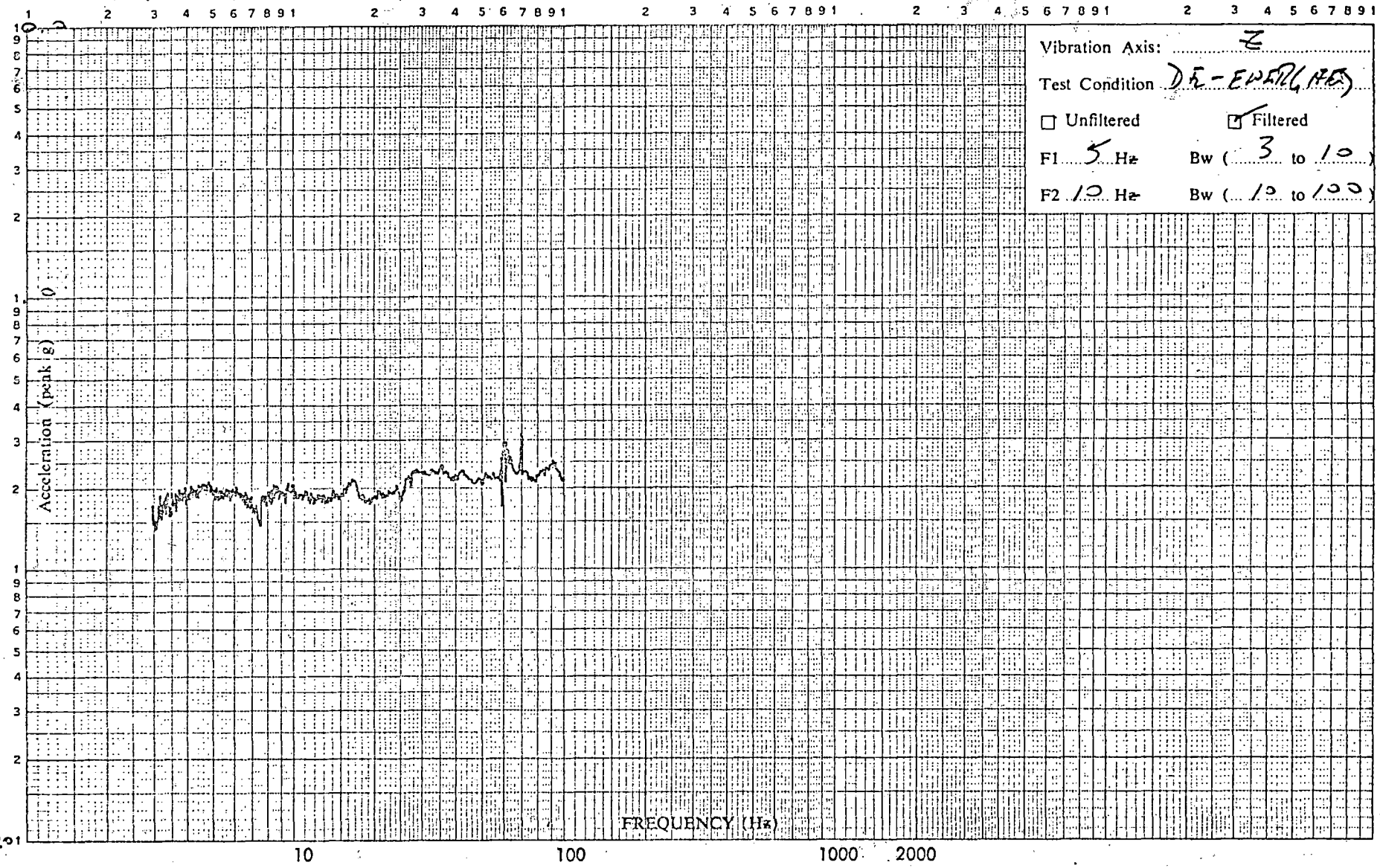
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CT68

Pickup Location: TP 9

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 40.1797

Date: 1 OCT 77

Time: 1212

Graph Number: 25

1651 Enc 1 Pg 25

Lab Form D-24

Plotted by: W. Watts

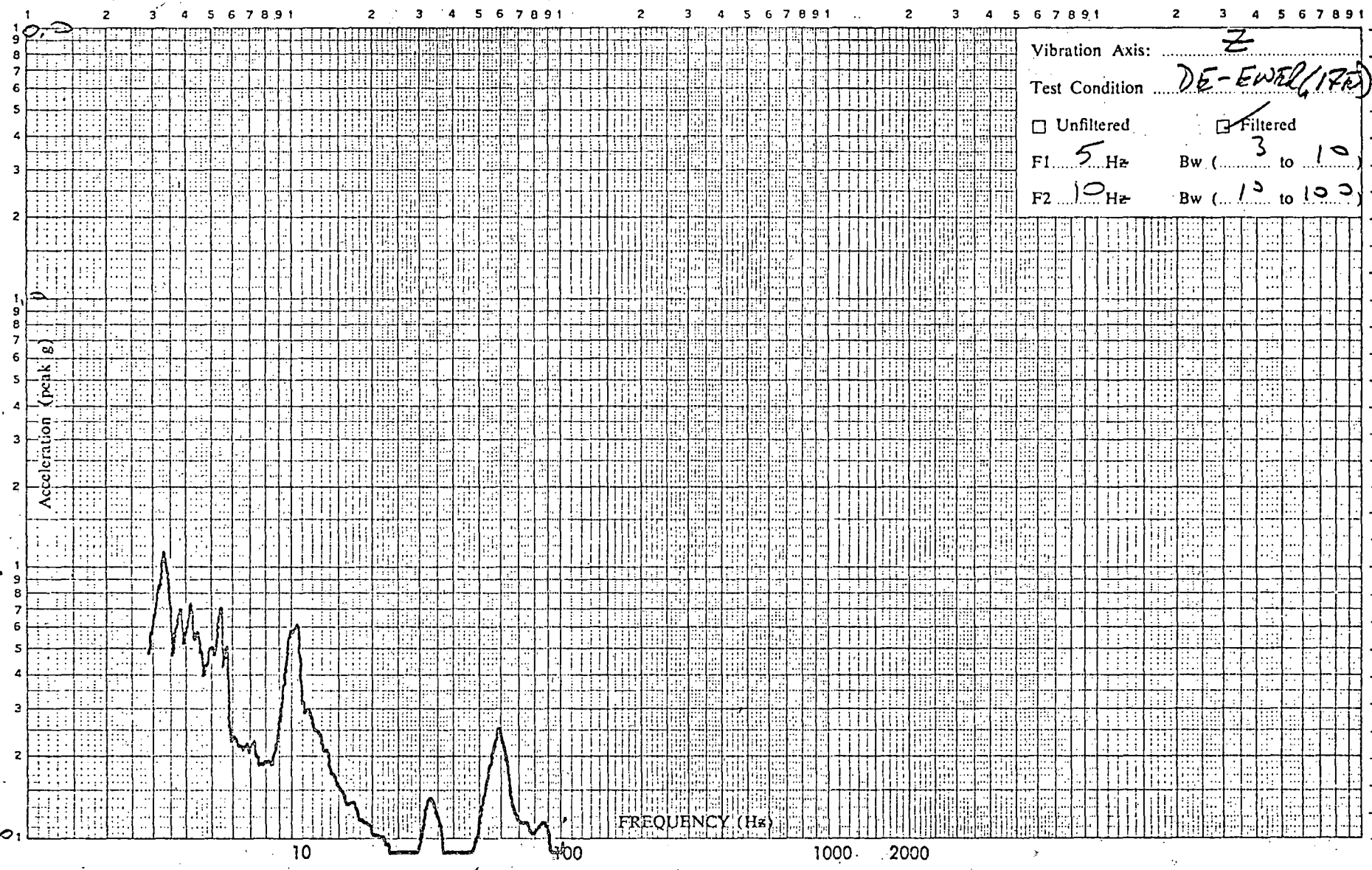
Checked by: WG

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVE

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: Y679Y

Pickup Location: CONTROL

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 4-1797

Date: 1 OCT 77

Time: 1212

Graph Number: 21

1651 Enc 1 Pg 26

Lab Form D-24

Plotted by: G HEINLEIN

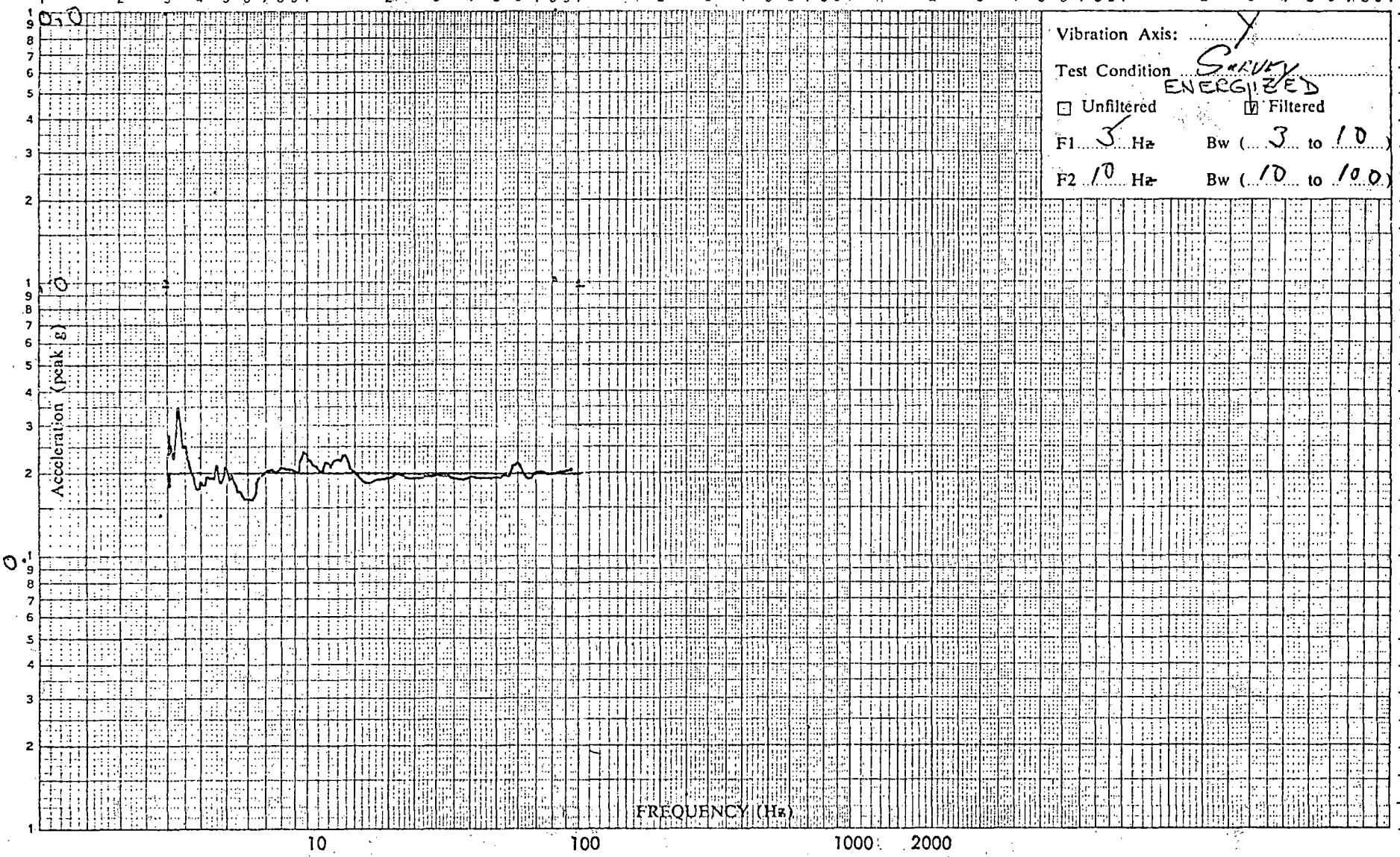
Checked by: WG

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: YG79Y

Pickup Location: Control

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☑ Live ☐ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 1950

Graph Number: 49

1651 Enc 1 Pg 27

Lab Form D-24

Plotted by: G. HEINLEIN

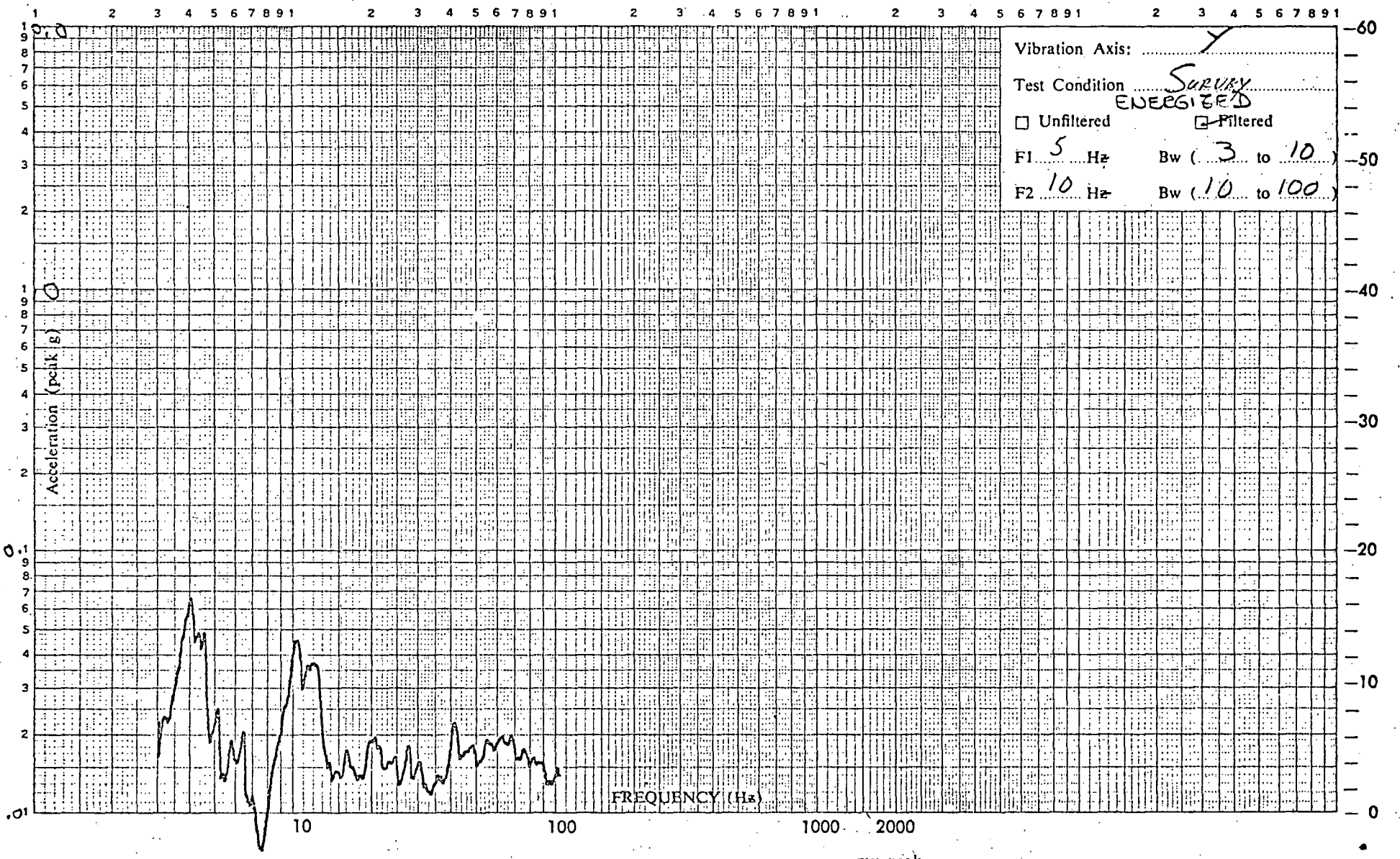
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): STB#179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: YG79Z

Pickup Location: Control X-Talk

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☑ Live ☐ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 1950

1651 Enc 1 Pg 28

Lab Form D-24

Graph Number: 43

Plotted by: PEUCH

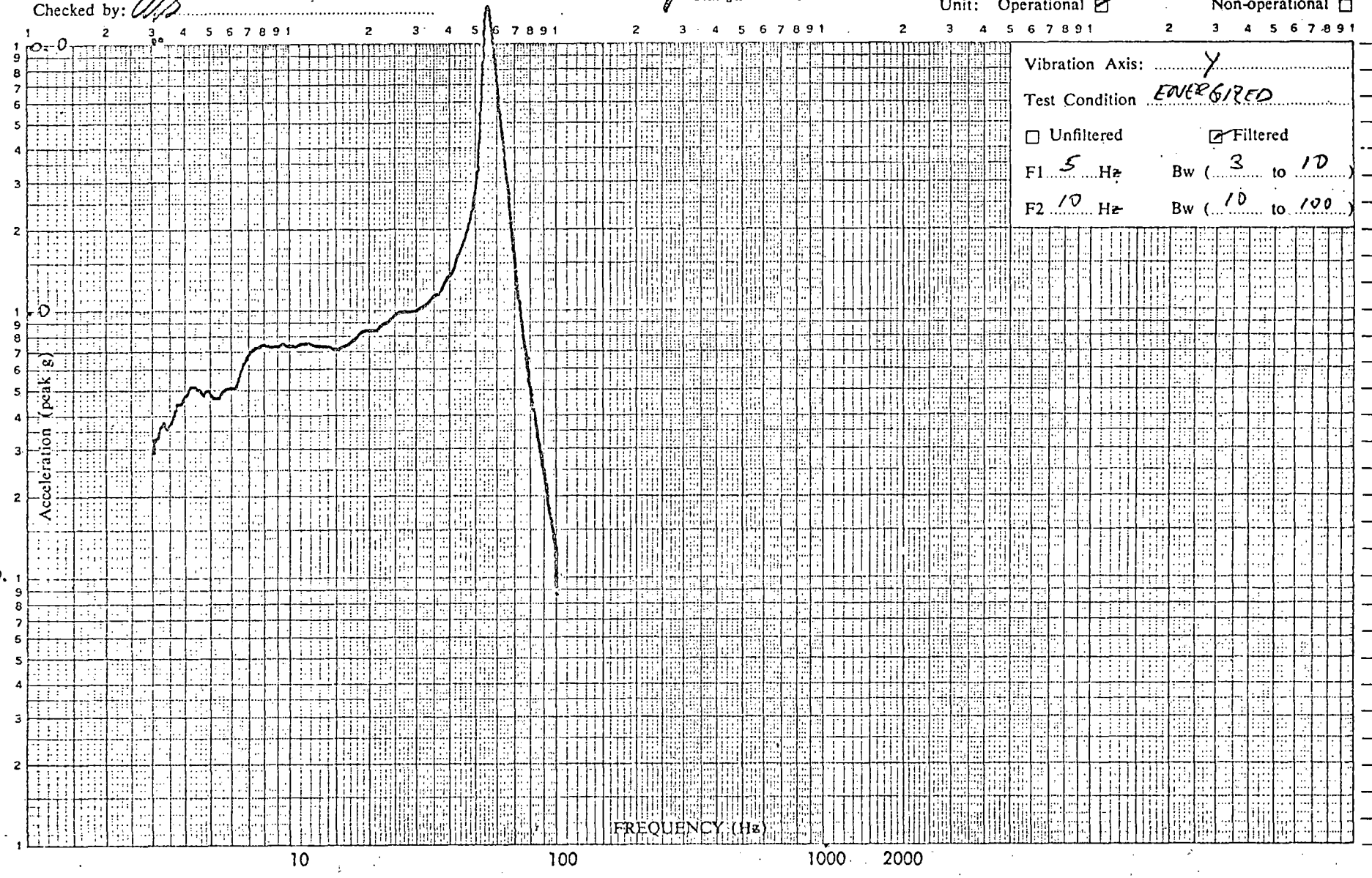
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 456

Pickup Location: VALVE 1

Pickup Sensing Axis: Y

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1950

Graph Number: 4C

1651 Enc 1 Pg 29

Lab Form D-24

Plotted by: G HEINLEIN

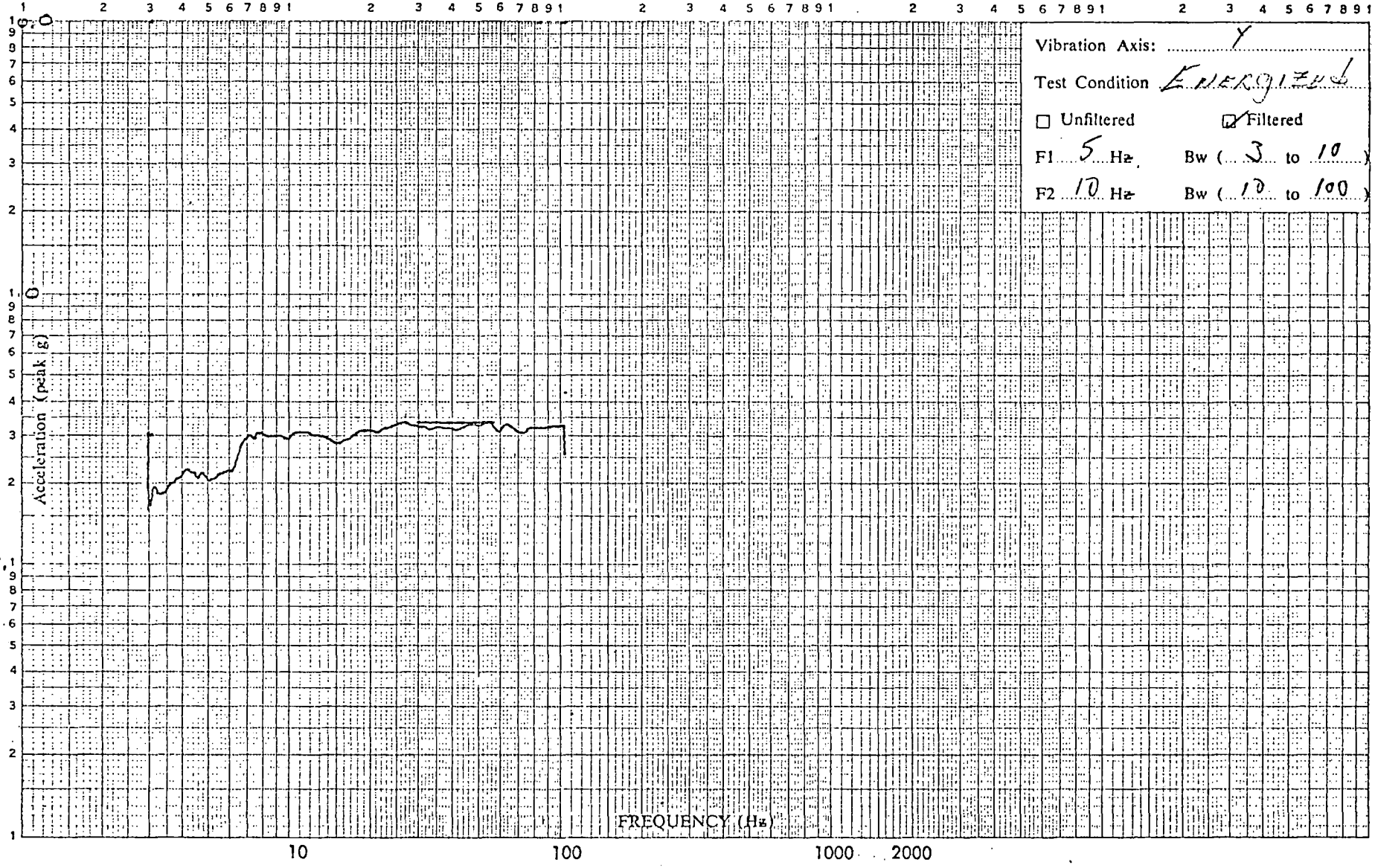
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: Valves

Serial Number(s): DTB #1 → 9

Unit: Operational ☒ Non-operational ☐



Pickup Serial Number: 224

Pickup Location: Valve #2

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☒ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1950

Graph Number: 47

1651 Enc 1 Pg 30

Lab Form D-24

Plotted by: G. HEINLEIN

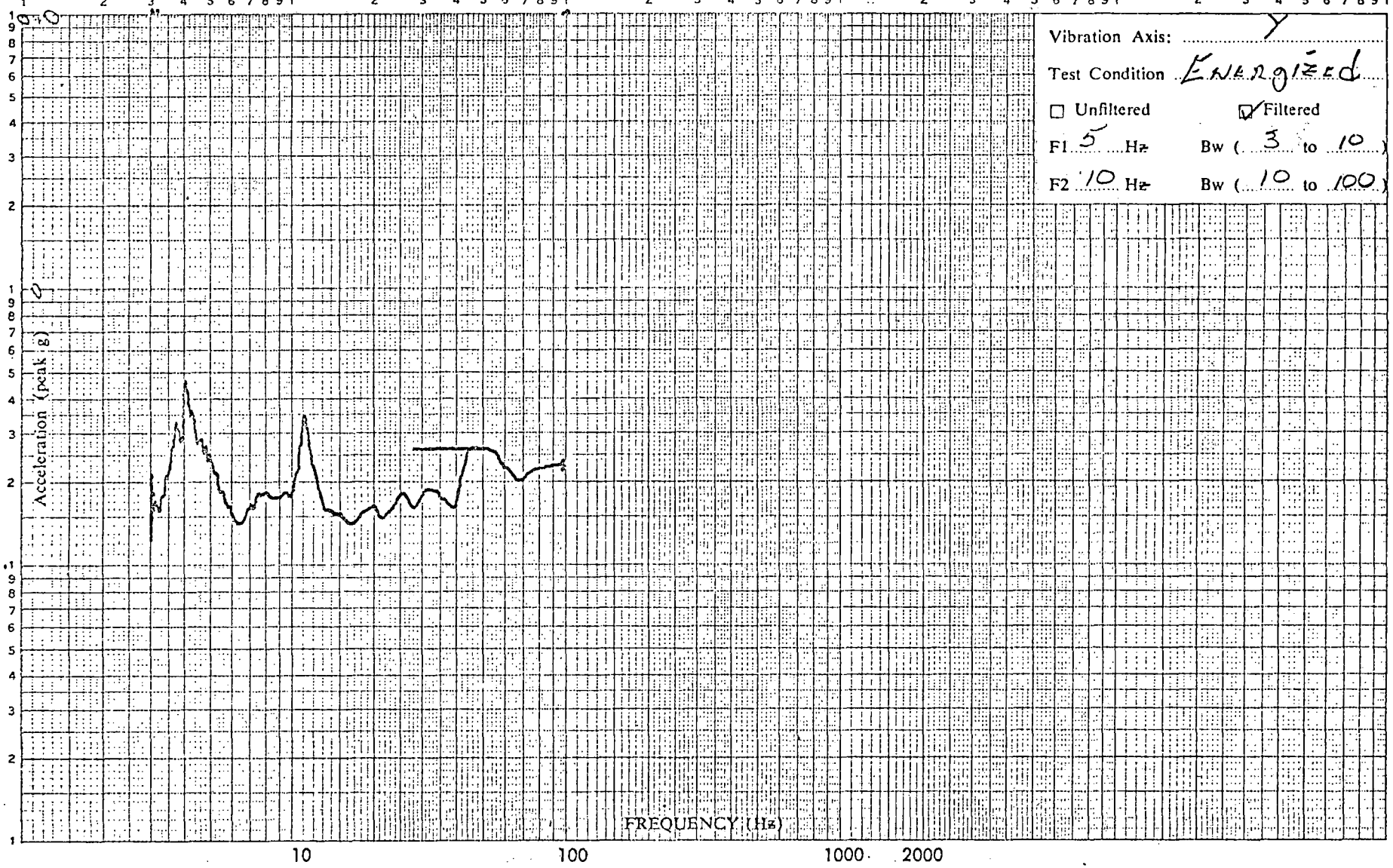
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: Valves

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: AK40

Pickup Location: Valve #3

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1950

Graph Number: 45

1651 Enc 1 Pg 31

Lab Form D-24

[redacted] Autom[redacted]ch Co. [redacted]

Plotted by: W. PELLETZ

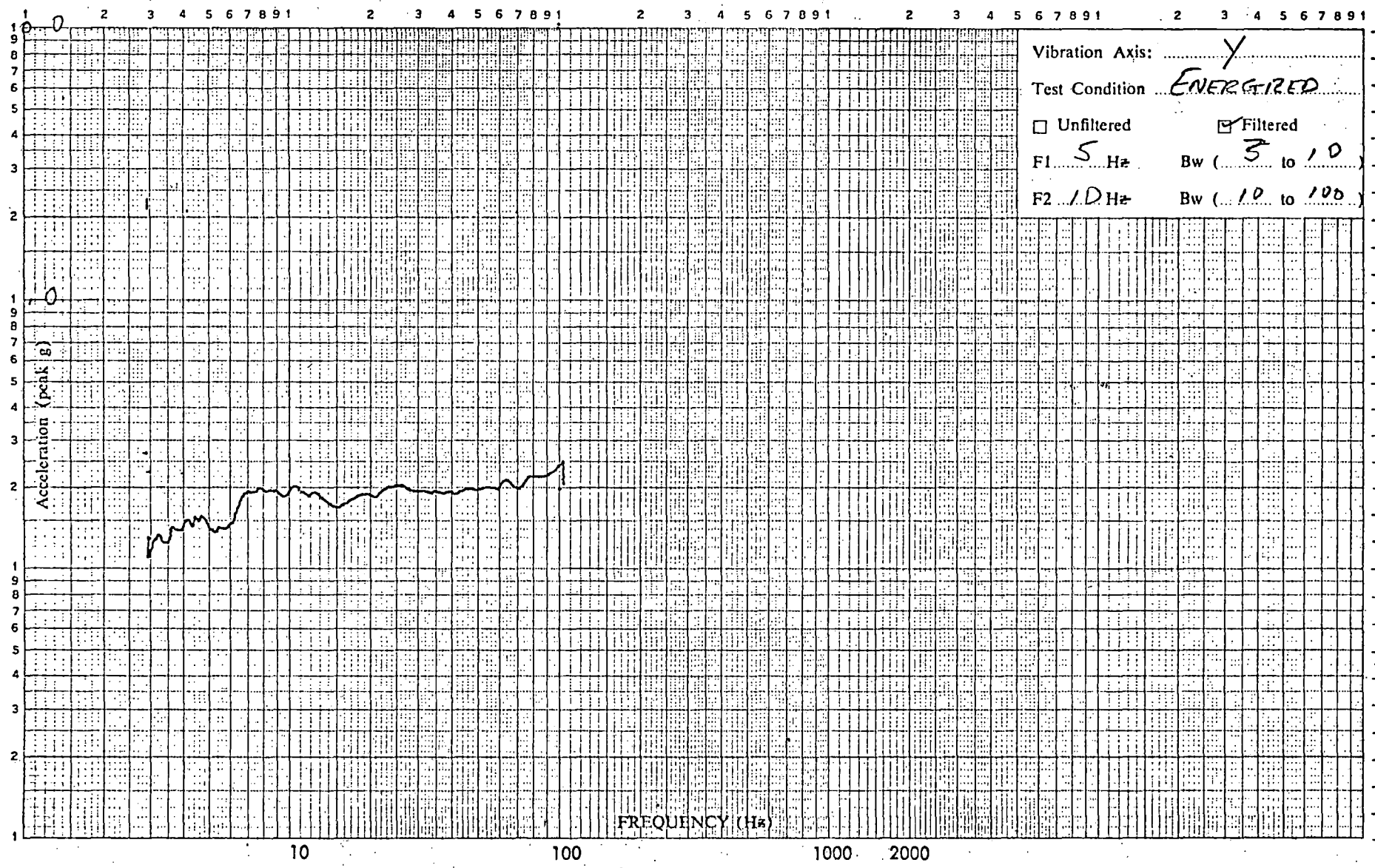
Checked by: W.S

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): STR #159

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 459

Pickup Location: VALVE 4

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 Oct 77

Time: 1950

Graph Number: 45

1651 Enc 1 Pg 32

Lab Form D-24

Plotted by: G. Heinlein

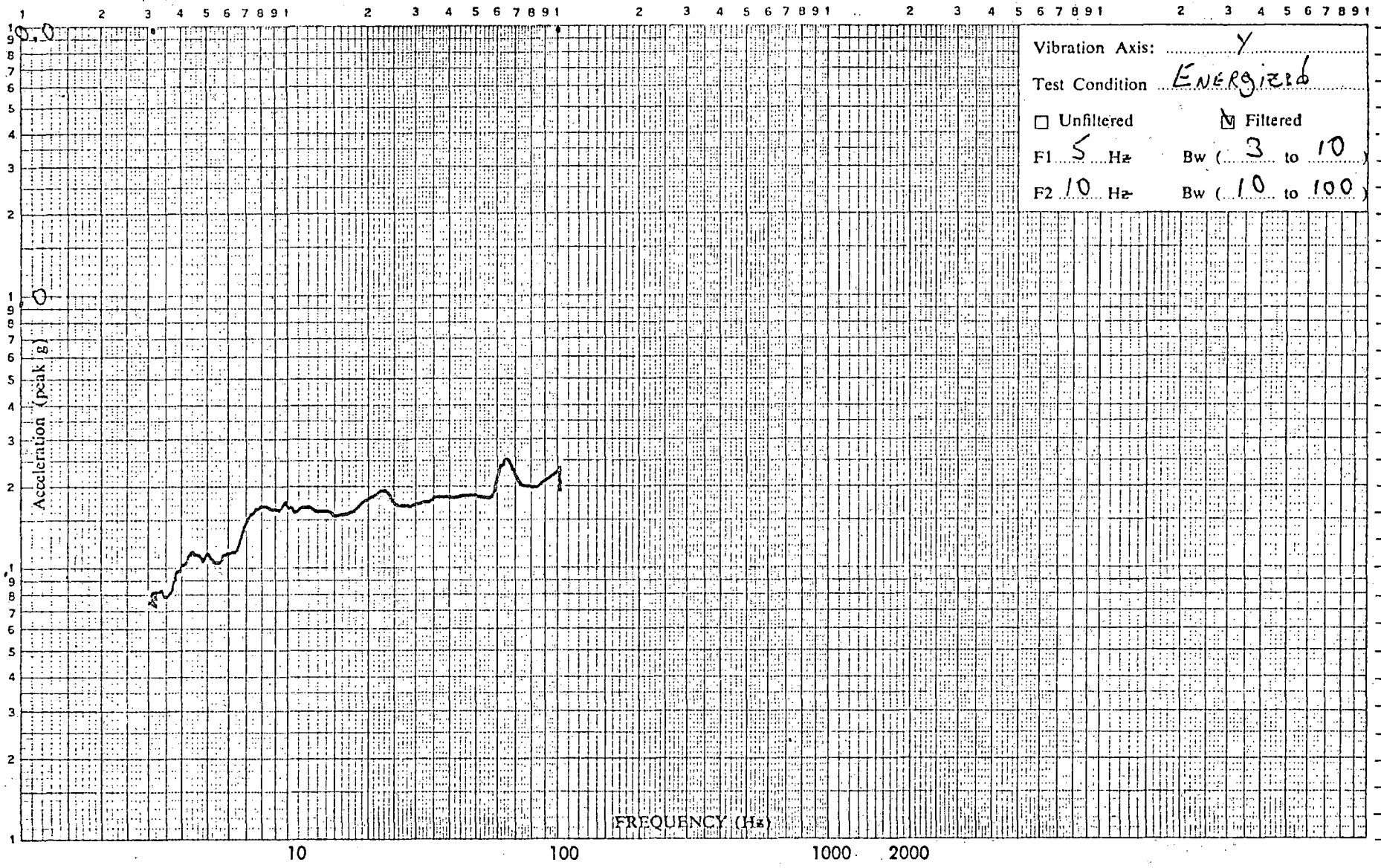
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 & 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CQ43

Pickup Location: VALVE #5

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☒ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 1950

1651 Enc 1 Pg 33

Lab Form D-24

Graph Number: 46

Plotted by: G HEINLEIN

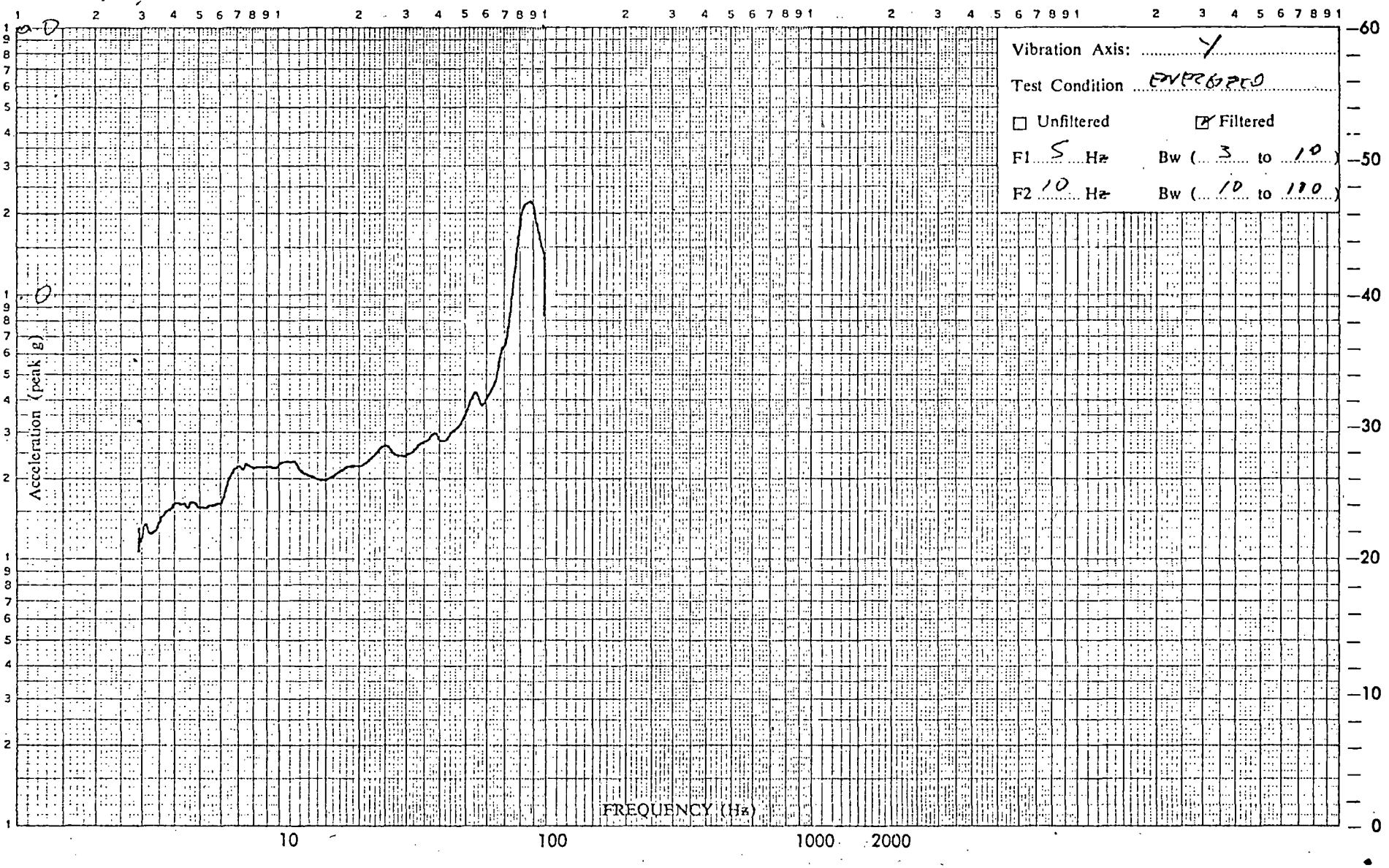
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 246

Pickup Location: VALVE 6

Pickup Sensing Axis: Y

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☐ Tape

Job Number: 401797

Date: 10077

Time: 1950

Graph Number: 44

1651 Enc 1 Pg 34

Lab Form D-24

Plotted by: G HEINLEIN

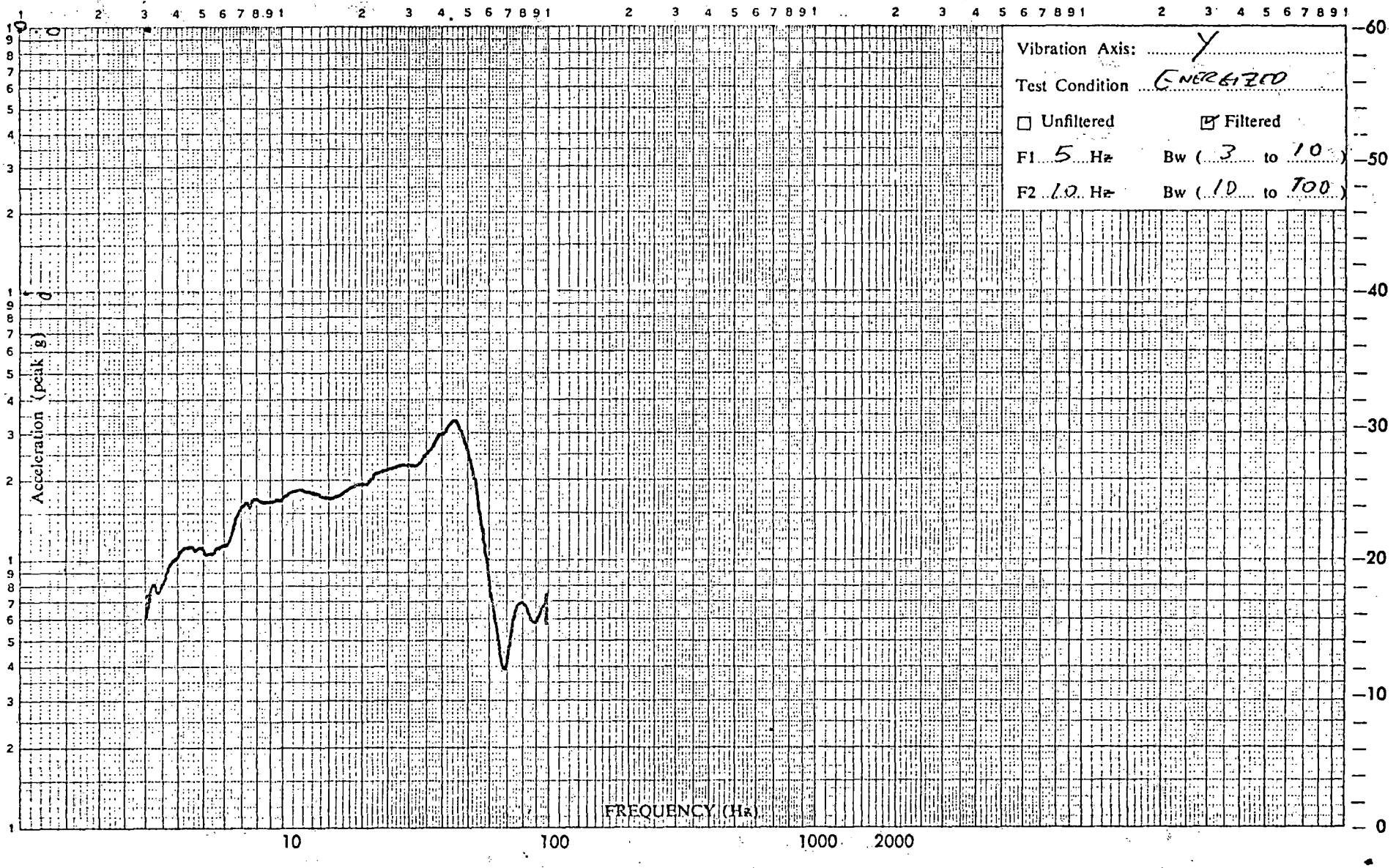
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 149209

Pickup Location: VALVE 7

Pickup Sensing Axis: Y

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 Oct 77

Time: 1950

Graph Number: 4H

1651 Enc 1 Pg 35

Lab/Form D-24

Plotted by: PELLER

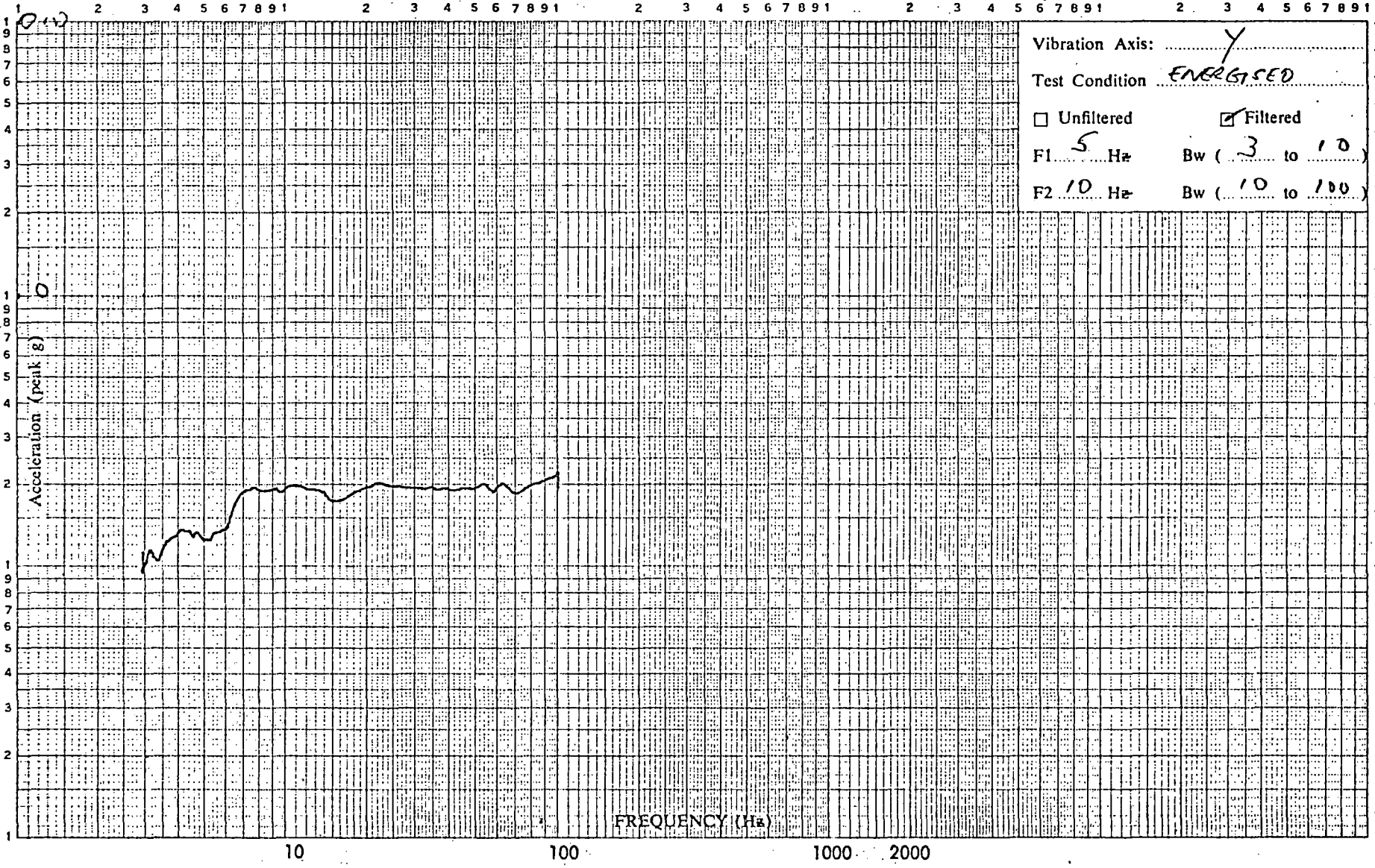
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 179

Unit: Operational ☑ Non-operational ☐



Vibration Axis: Y

Test Condition ENERGISED

☐ Unfiltered ☑ Filtered

F1 5 Hz Bw (3 to 10)

F2 10 Hz Bw (10 to 100)

1651 Enc 1 Pg 36

Lab Form D-24

Graph Number: 4-1

Pickup Serial Number: FA04

Pickup Location: VALVE 8

Pickup Sensing Axis: Y

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 1950

Plotted by: G HEINLEIN

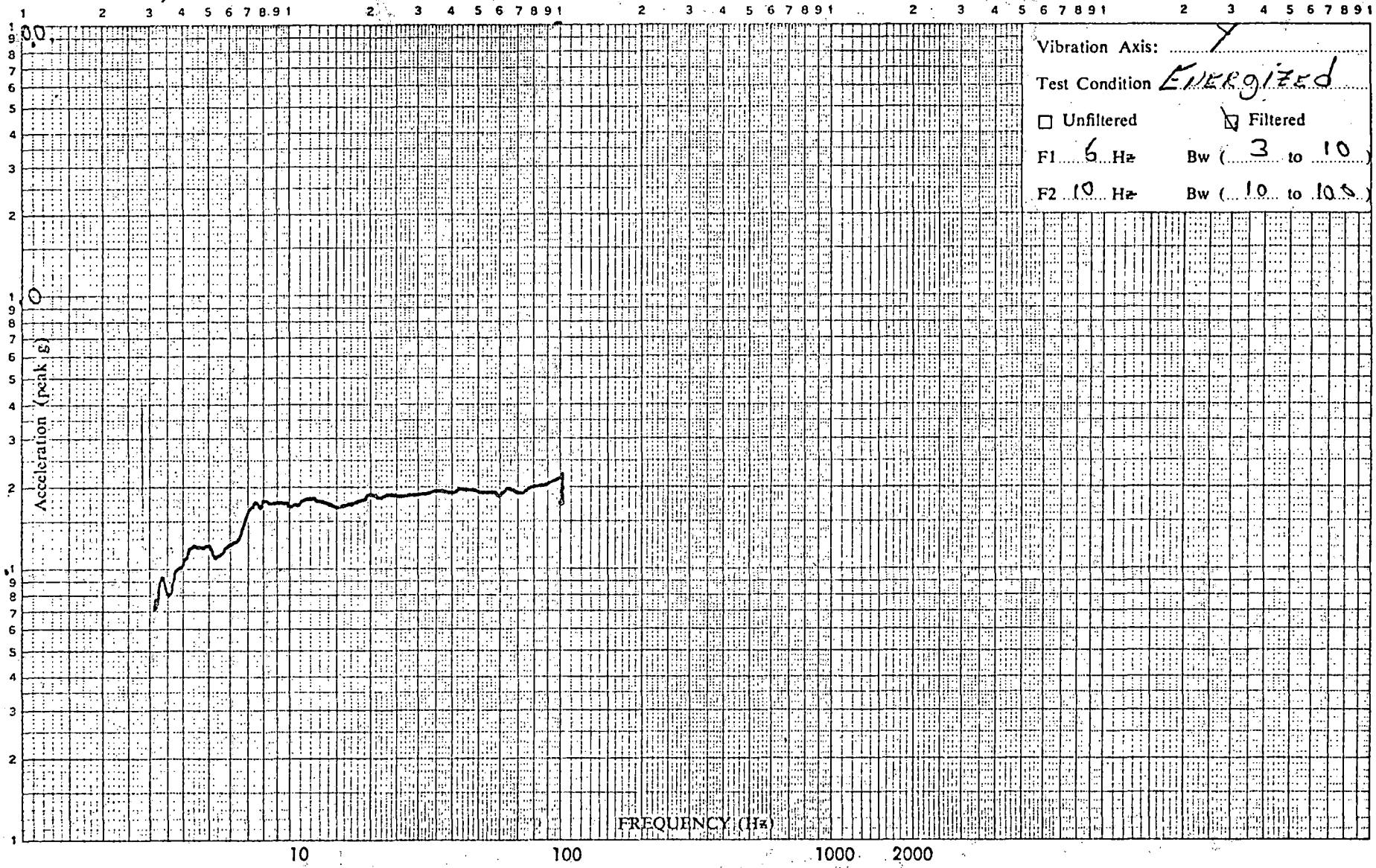
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CTG8

Pickup Location: 9

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 Oct 77

Time: 1950

Graph Number: 4K

1651 Enc 1 Pg 37

Lab/Form D-24

Plotted by: PEWR

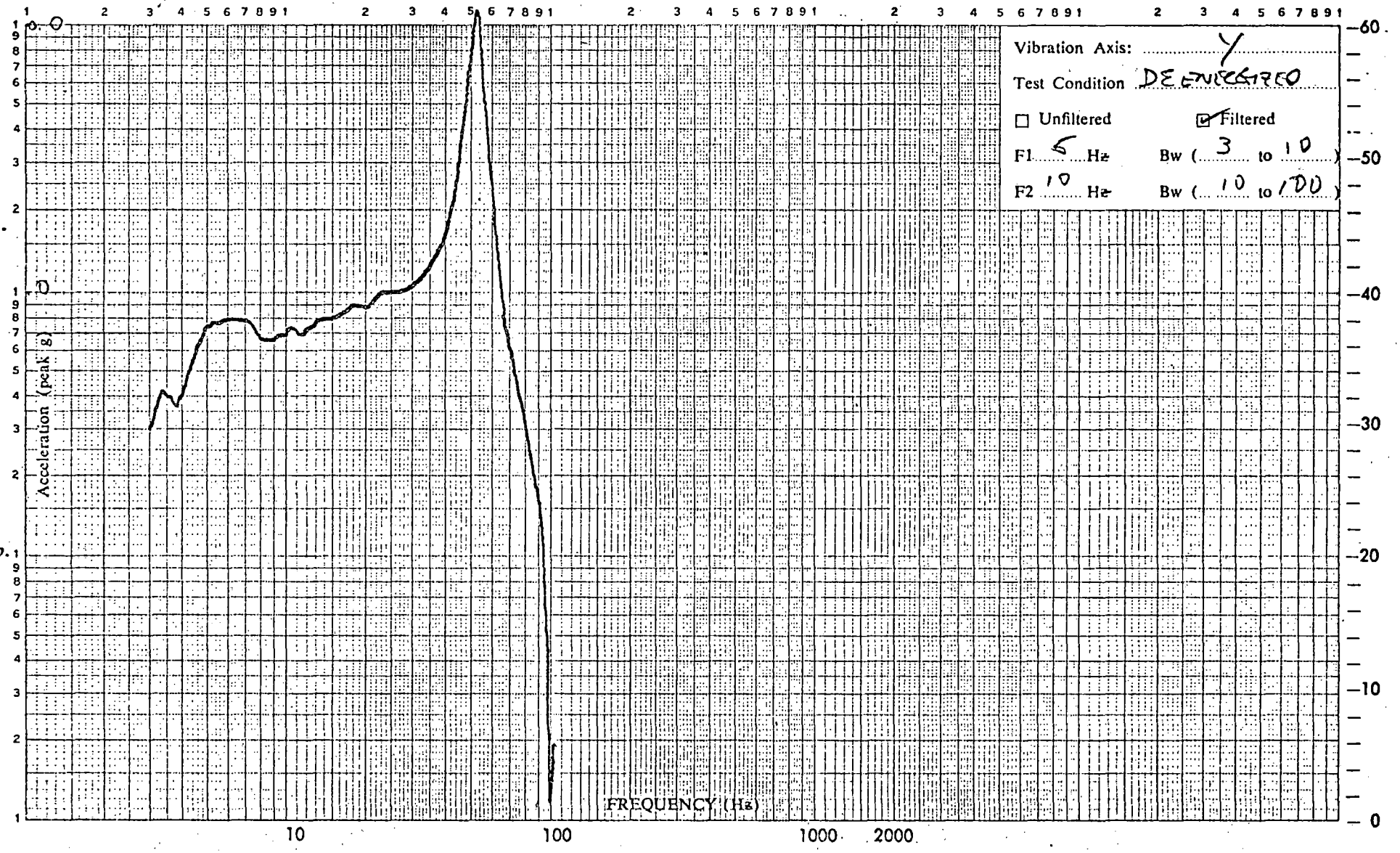
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 456

Pickup Location: VALVE 1

Pickup Sensing Axis: Y

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10CT77

Time: 2000

Graph Number: 4L

1651 Enc 1 Pg 38

Lab Form D-24

Plotted by: W. PELLENT

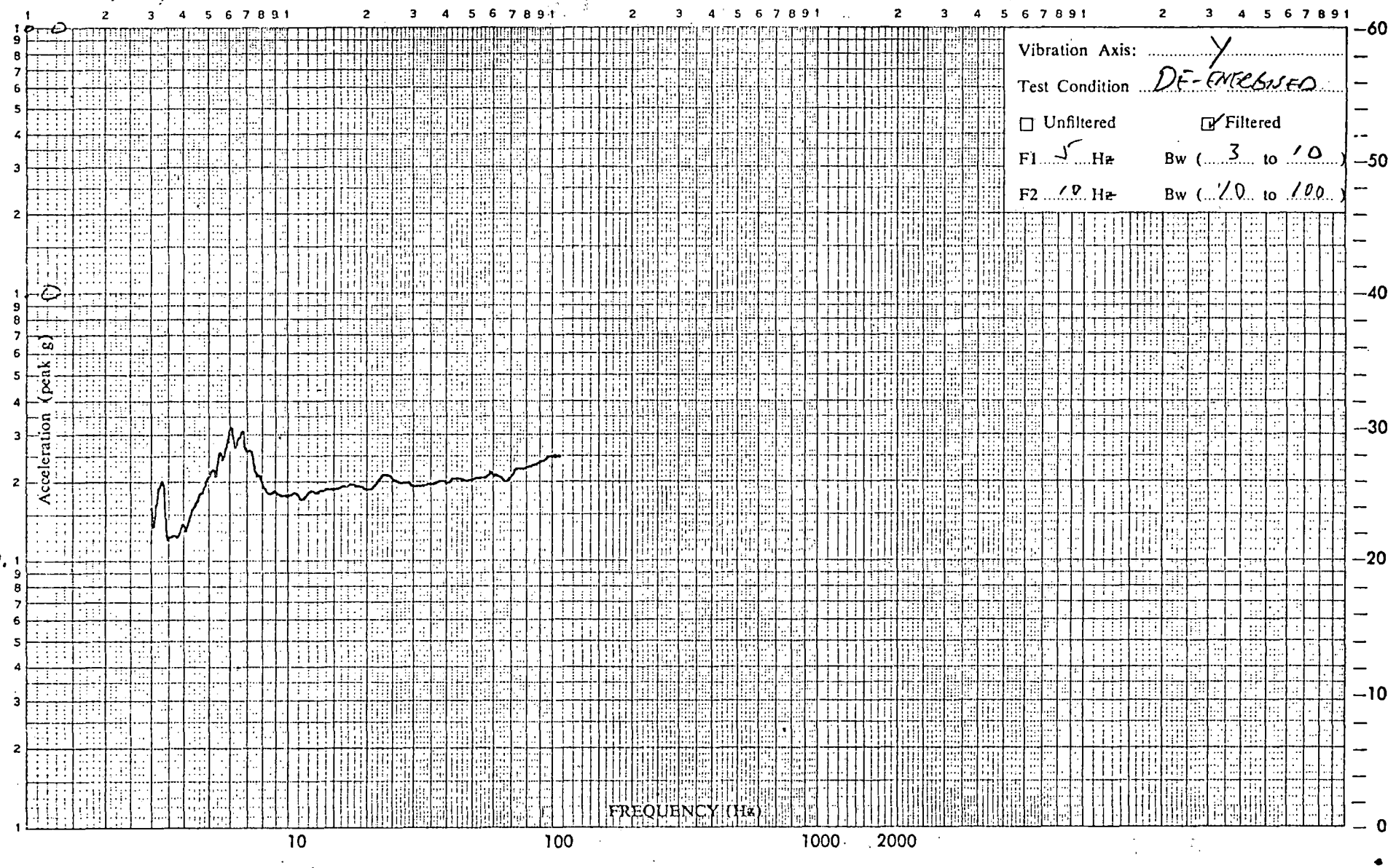
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 224

Pickup Location: VALVE 2

Pickup Sensing Axis: Y

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 Oct 77

Time: 1000

Graph Number: 40

1651 Enc 1 Pg 39

Lab Form D-24

Plotted by: W. PELLENZ

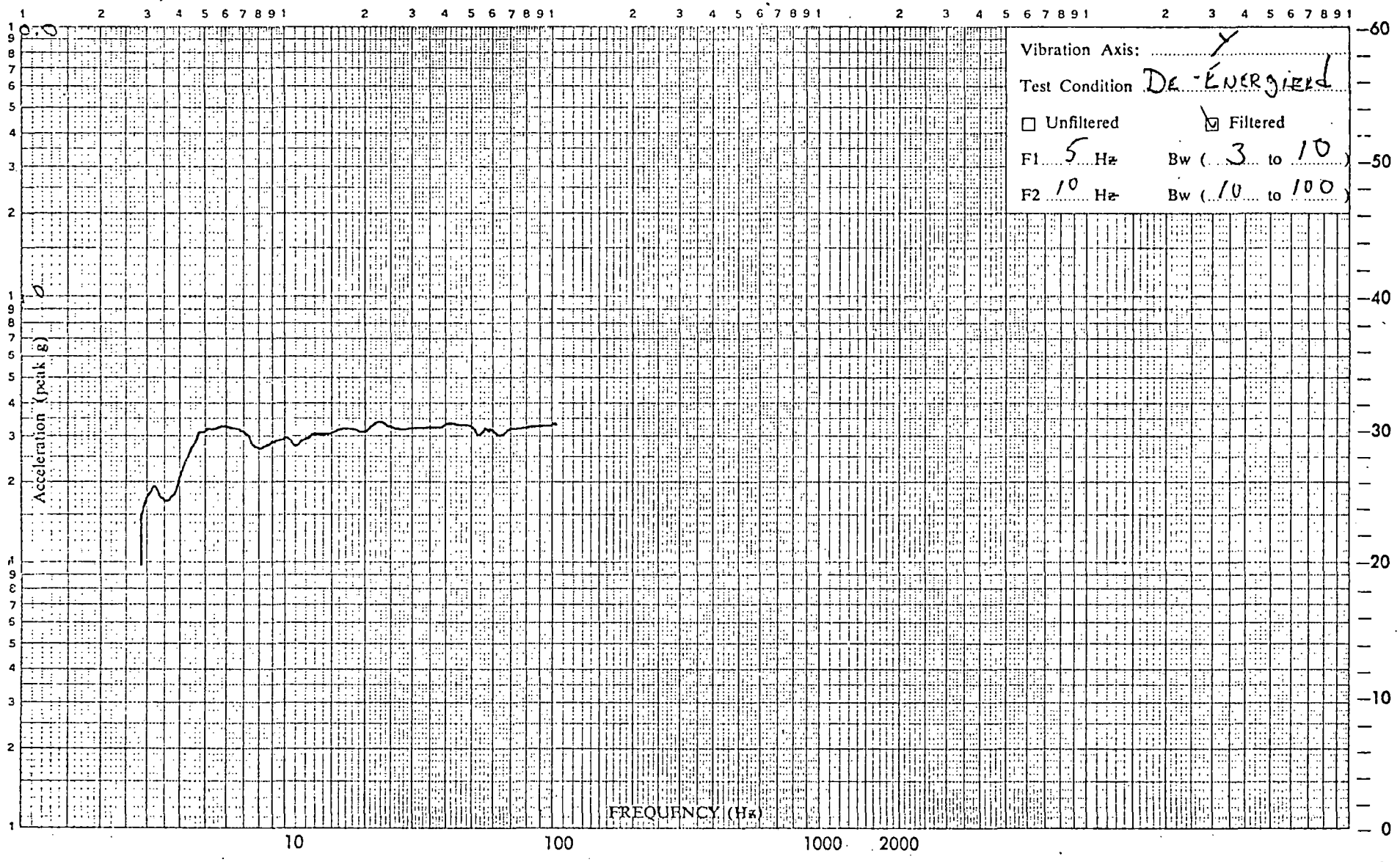
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☒ Non-operational ☐



Pickup Serial Number: AB40

Pickup Location: VALVE #3

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☒ Tape

Job Number: 401.797

Date: 1 Oct 77

Time: 2000

Graph Number: 40

1651 Enc 1 Pg 40

Lab Form D-24

Plotted by: W. PELLENZ

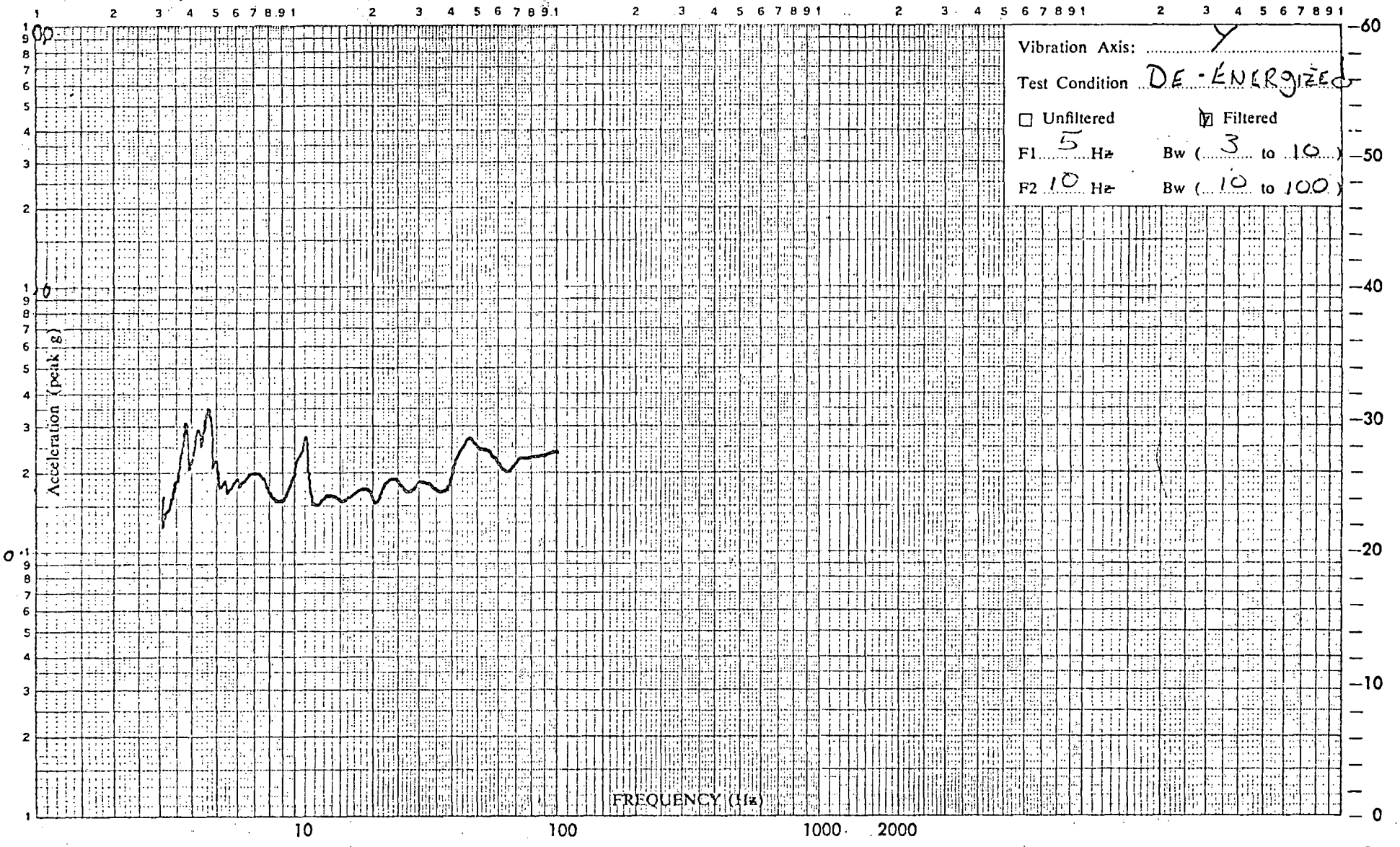
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☒ Non-operational ☐



Pickup Serial Number: 459

Pickup Location: Valve #4

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☒ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 2000

Graph Number: 4N

1651 Enc 1 Pg 41

Lab Form D-24

Plotted by: W. PELLENZ

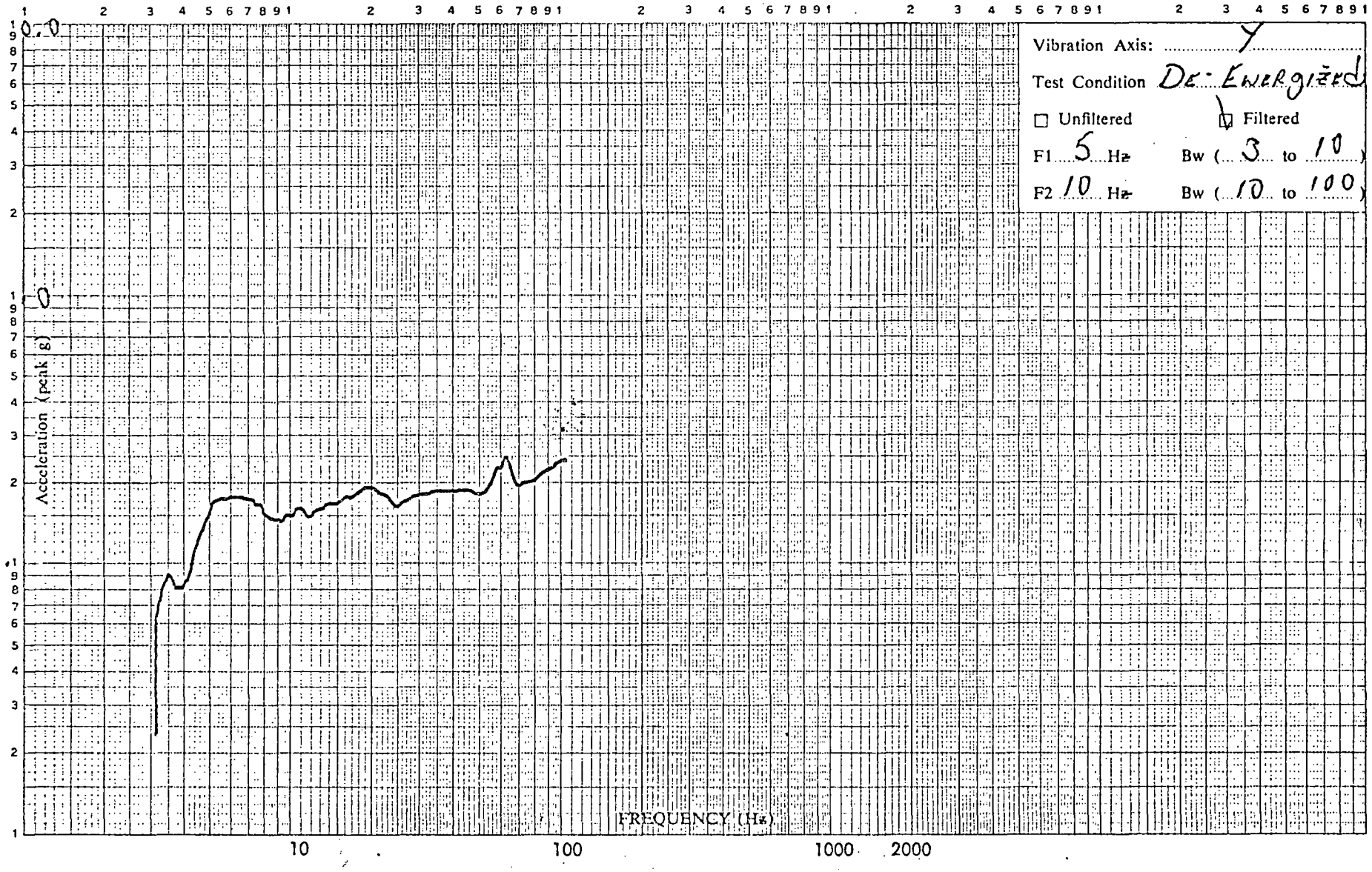
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CQ43

Pickup Location: VALVE #5

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 2000

Graph Number: 42

1651 Enc 1 Pg 42

Lab Form D-24

Plotted by: W. PELLENZ

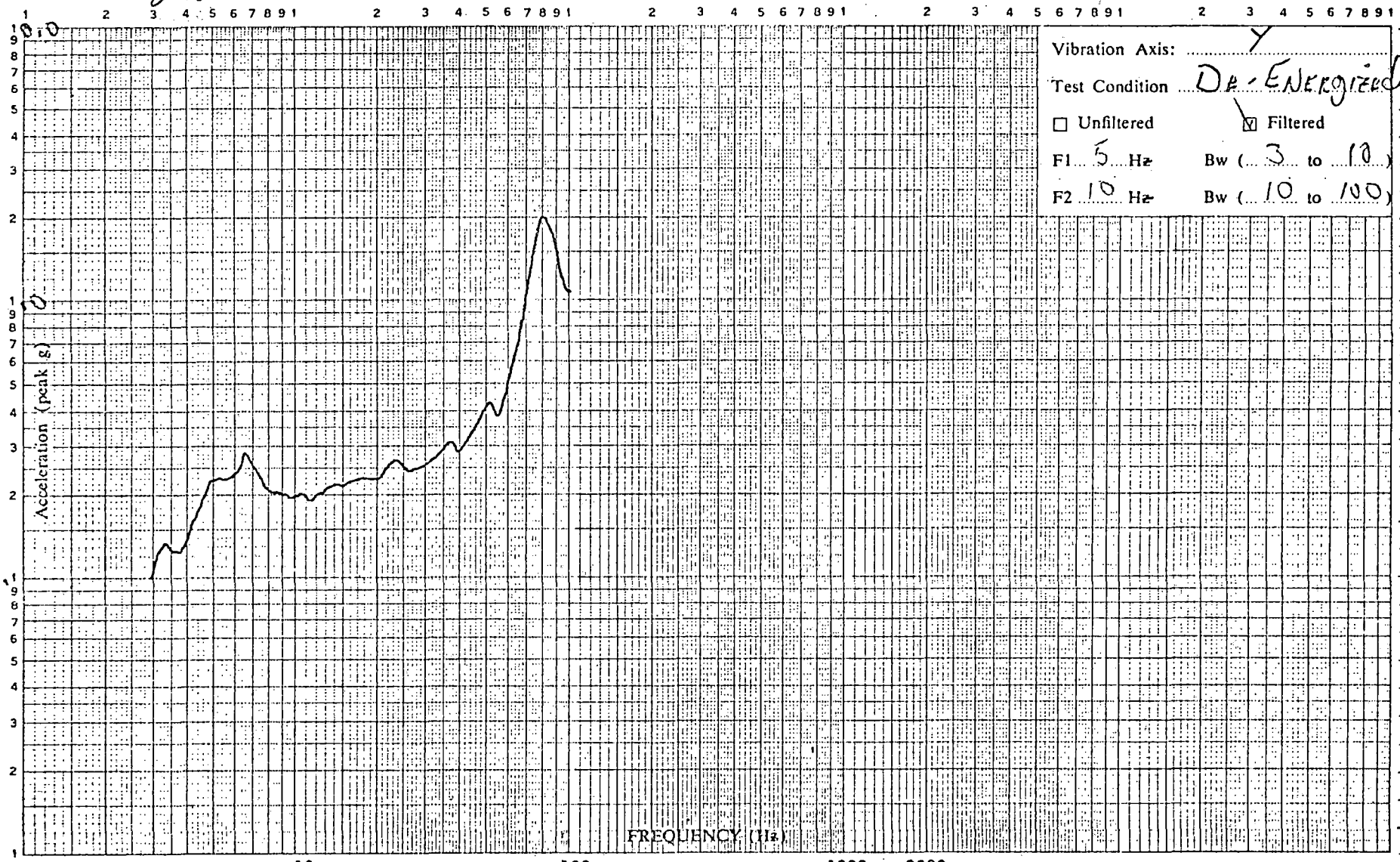
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Vibration Axis: Y

Test Condition: DE-ENERGIZED

☐ Unfiltered ☑ Filtered

F1 5 Hz Bw (3 to 10)

F2 10 Hz Bw (10 to 100)

Pickup Serial Number: 246

Pickup Location: VALVE #C

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 1000

1651 Enc 1 Pg 43

Lab Form D-24

Graph Number: 49

[redacted] Automa[redacted]ch Co. [redacted] Rights Reserved [redacted]

Plotted by: PELLENZ

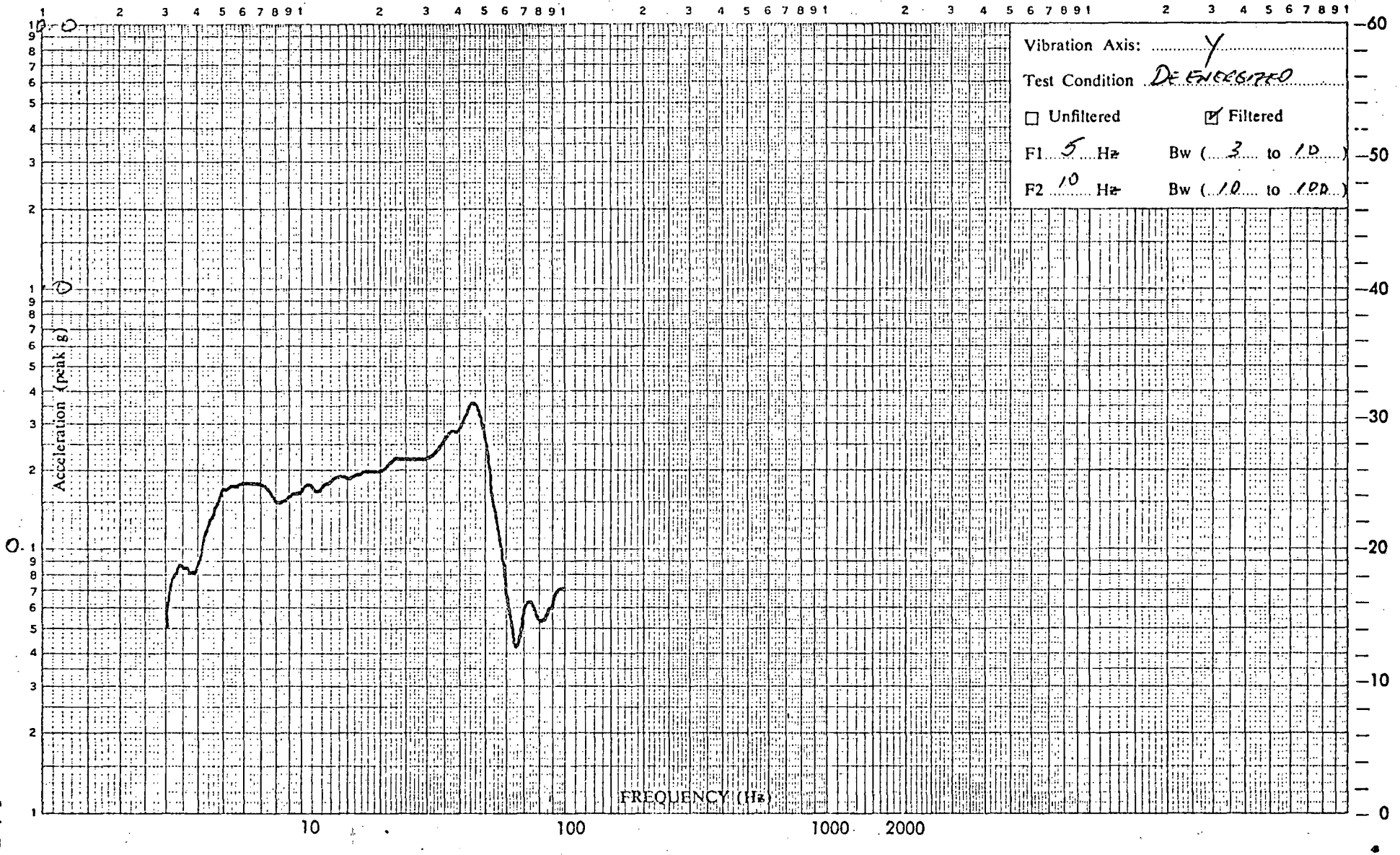
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB II 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 149209

Pickup Location: VALVE 7

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 Oct 77

Time: 2000

Graph Number: 42

1651 Enc 1 Pg 44

Lab Form D-24

Plotted by: W. Pellett

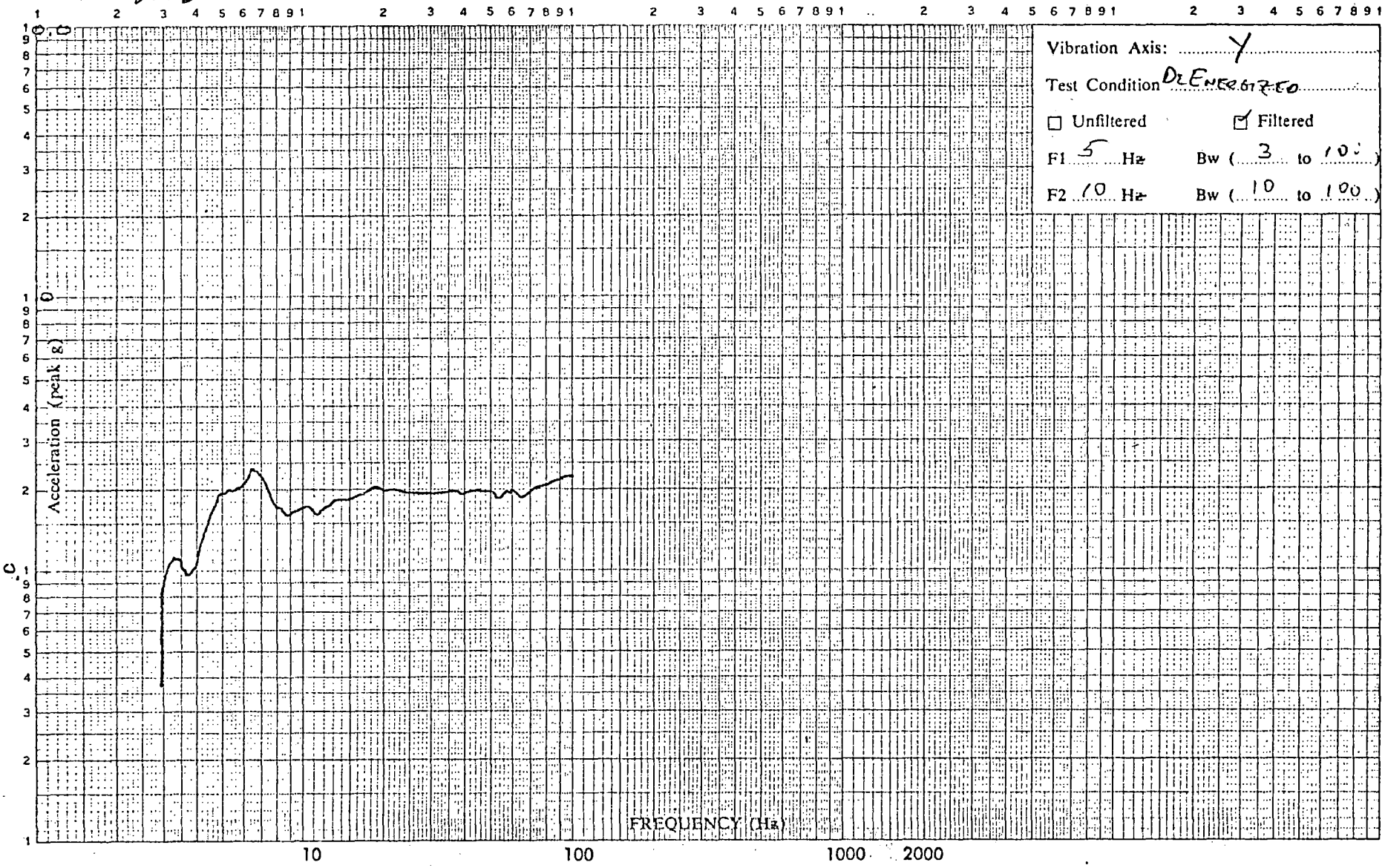
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: FA04

Pickup Location: VALVE 8

Pickup Sensing Axis: Y

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1. oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 2000

1651 Enc 1 Pg 45

Lab Form D-24

Graph Number: 48

Plotted by: PELLENZ

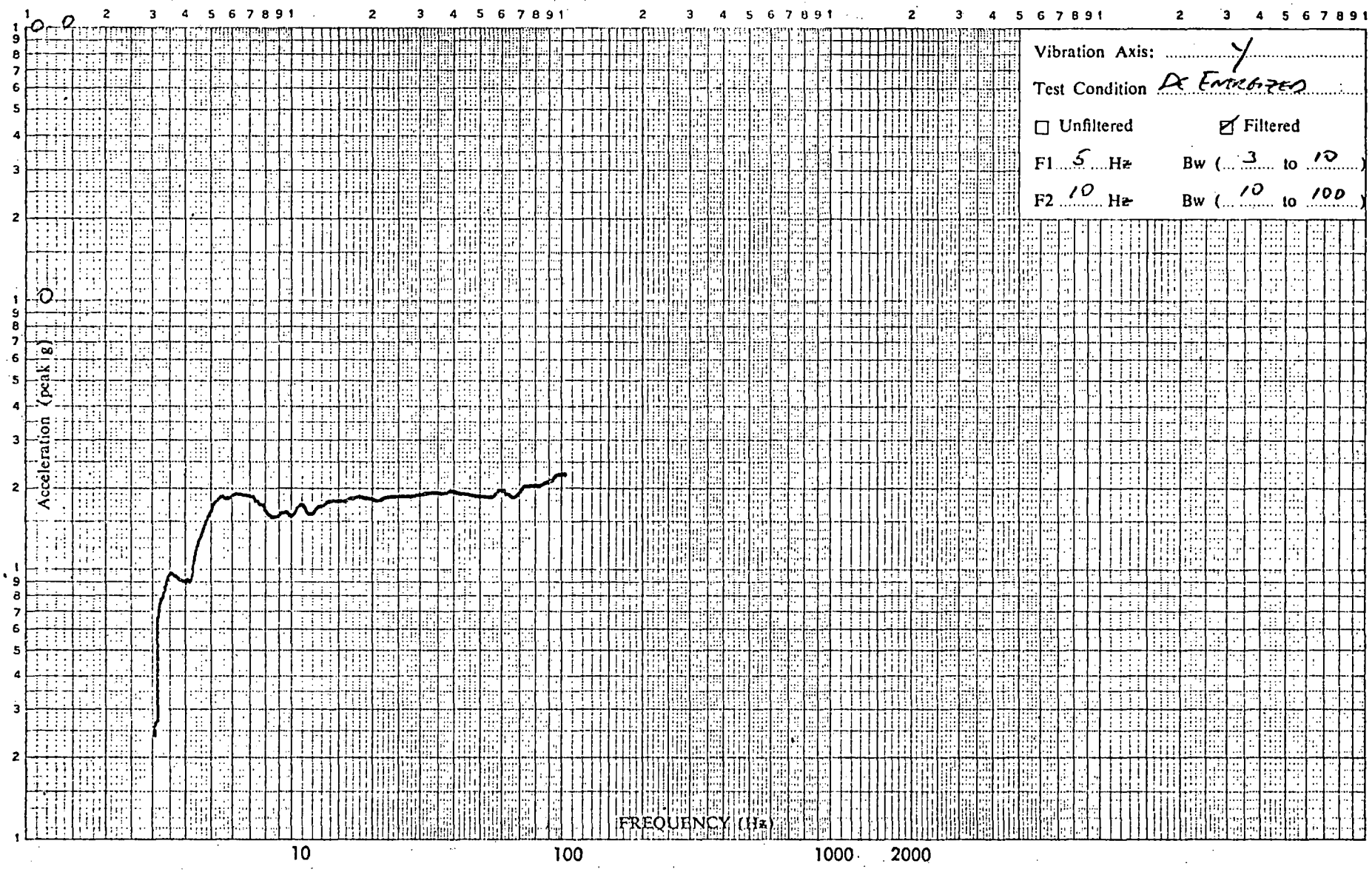
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CT68

Pickup Location: VALVE 9

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 2000

Graph Number: 41

1651 Enc 1 Pg 46

Lab Form D-24

Plotted by: W PENCE

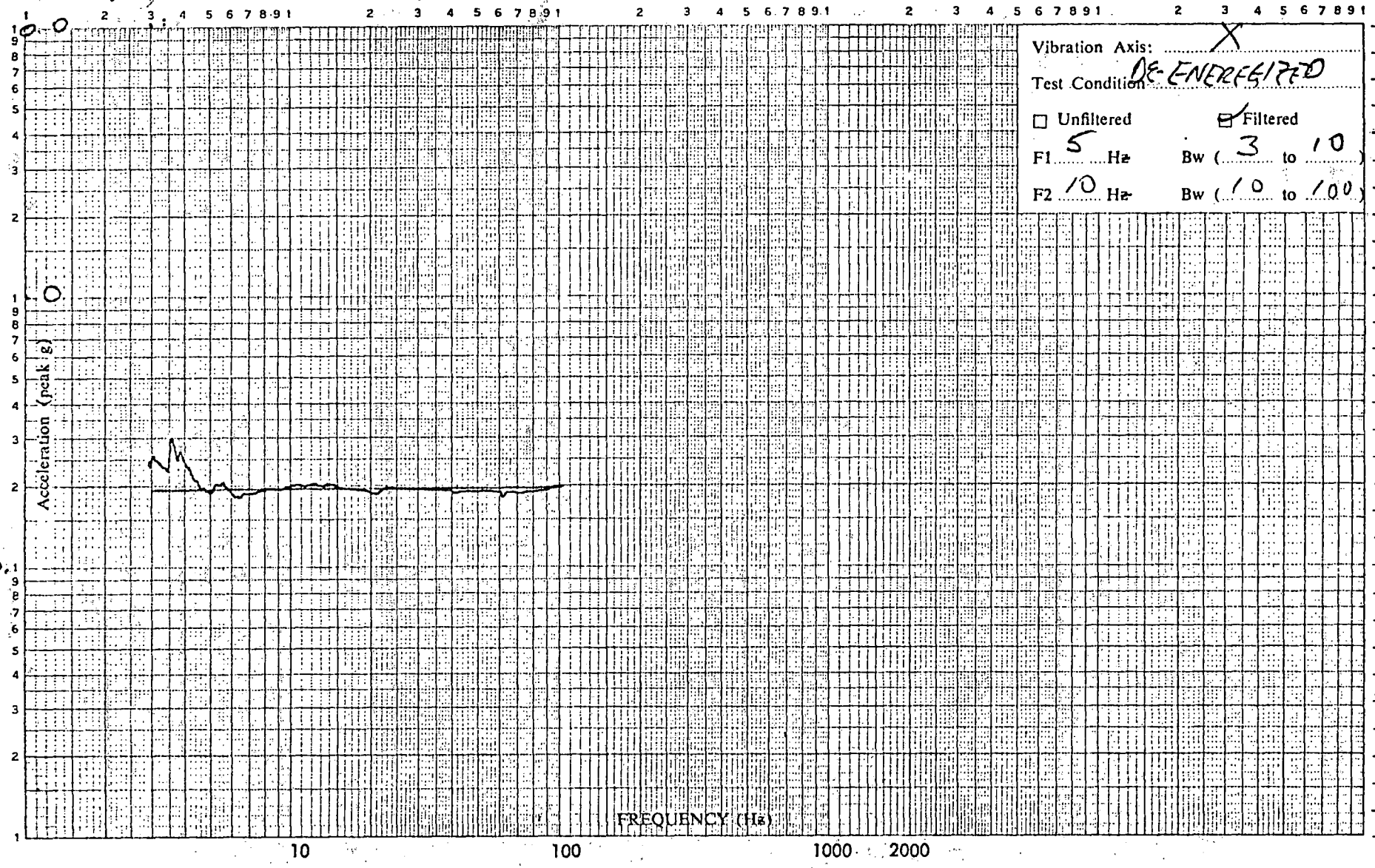
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



1651 Enc 1 Pg 47

Lab Form D-24

Graph Number: 69

Pickup Serial Number: YG79X

Pickup Location: CONTROL

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401097

Date: 10 CT 77

Time: 2225

Plotted by: PELLENZ

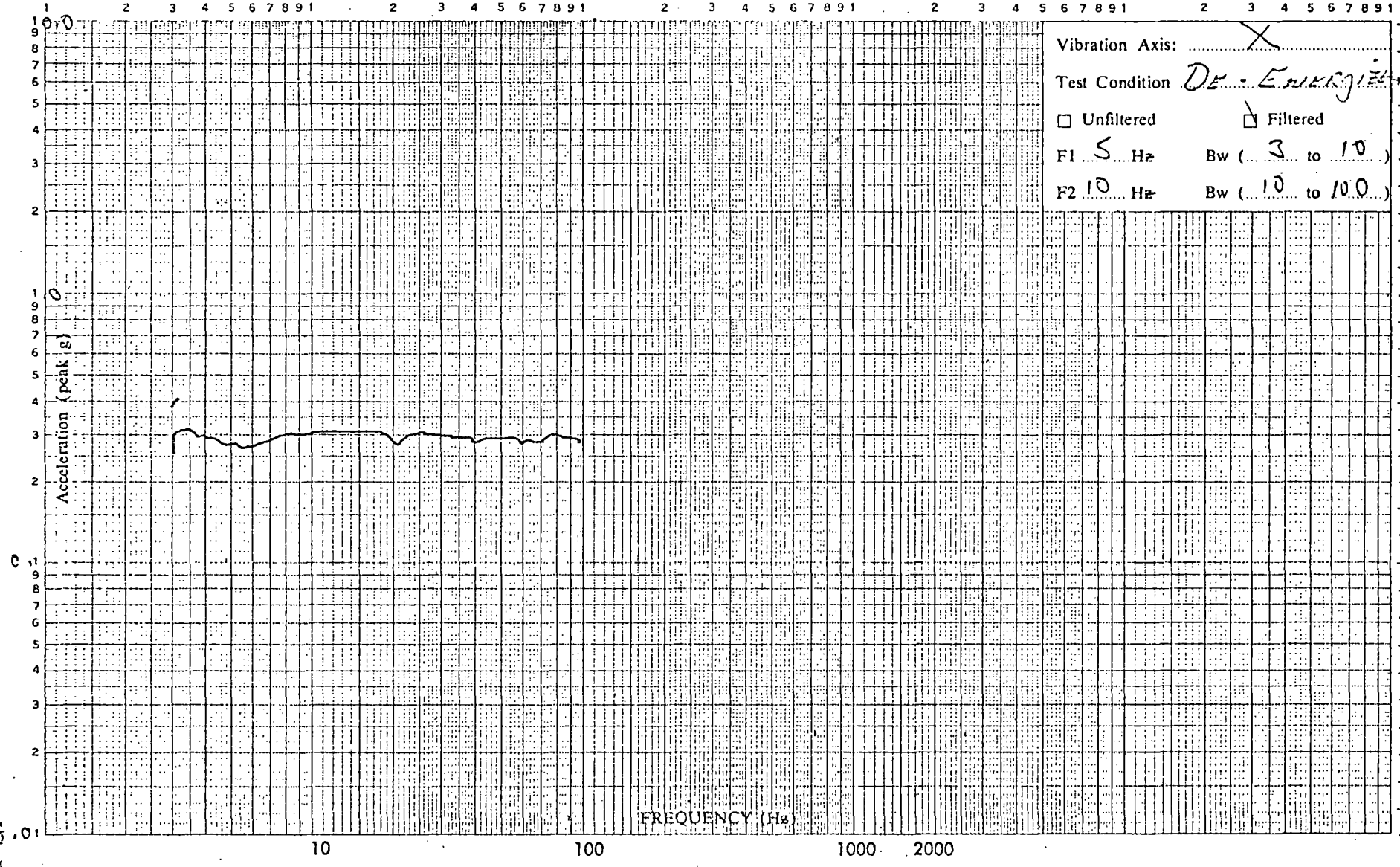
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 2221

Pickup Location: Valve #2

Pickup Sensing Axis: X

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☒ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 2225

Graph Number: 613

1651 Enc 1 Pg 48

Lab Form D-24

Plotted by: Pellenz

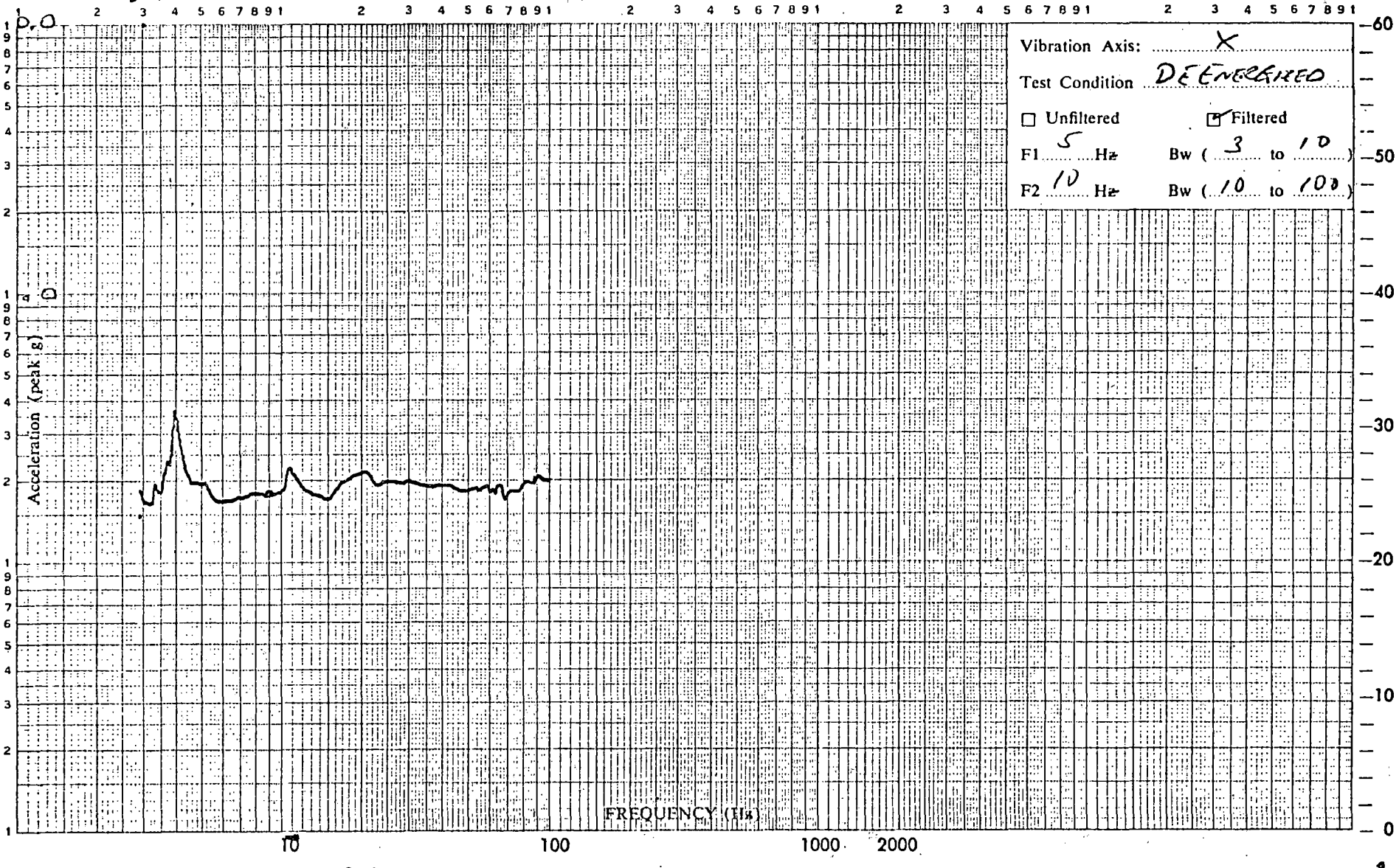
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: AB40

Pickup Location: VALVES

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 2225

Graph Number: 6C

1651 Enc 1 Pg 49

Lab Form D-24

[redacted] Auton[redacted]itch Co. [redacted]

Plotted by: PELLENZ

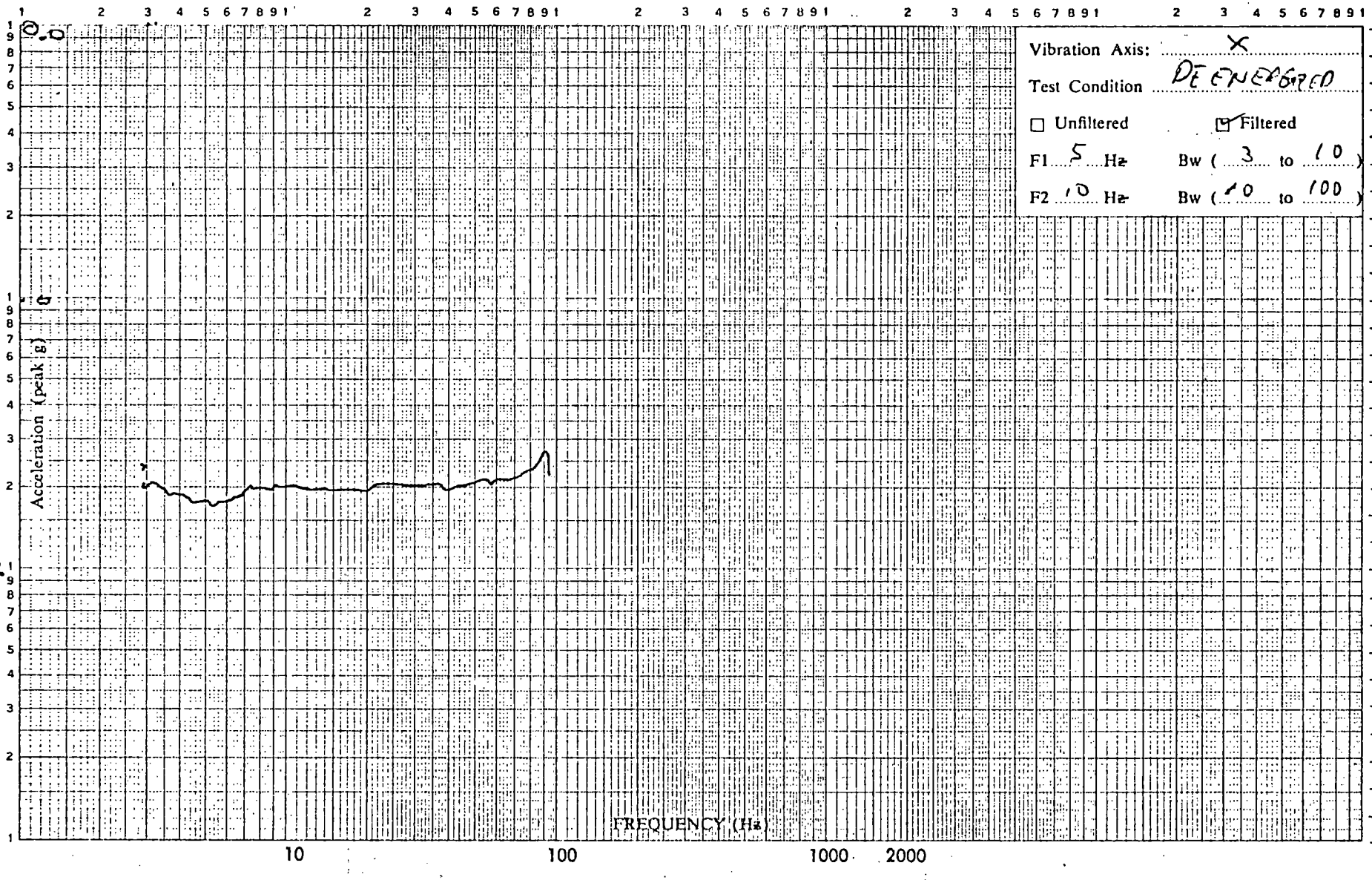
Checked by: WE

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 459

Pickup Location: VALVE 4

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 0225

Graph Number: 42

1651 Enc 1 Pg 50

Lab Form D-24

Plotted by: PELLENZ

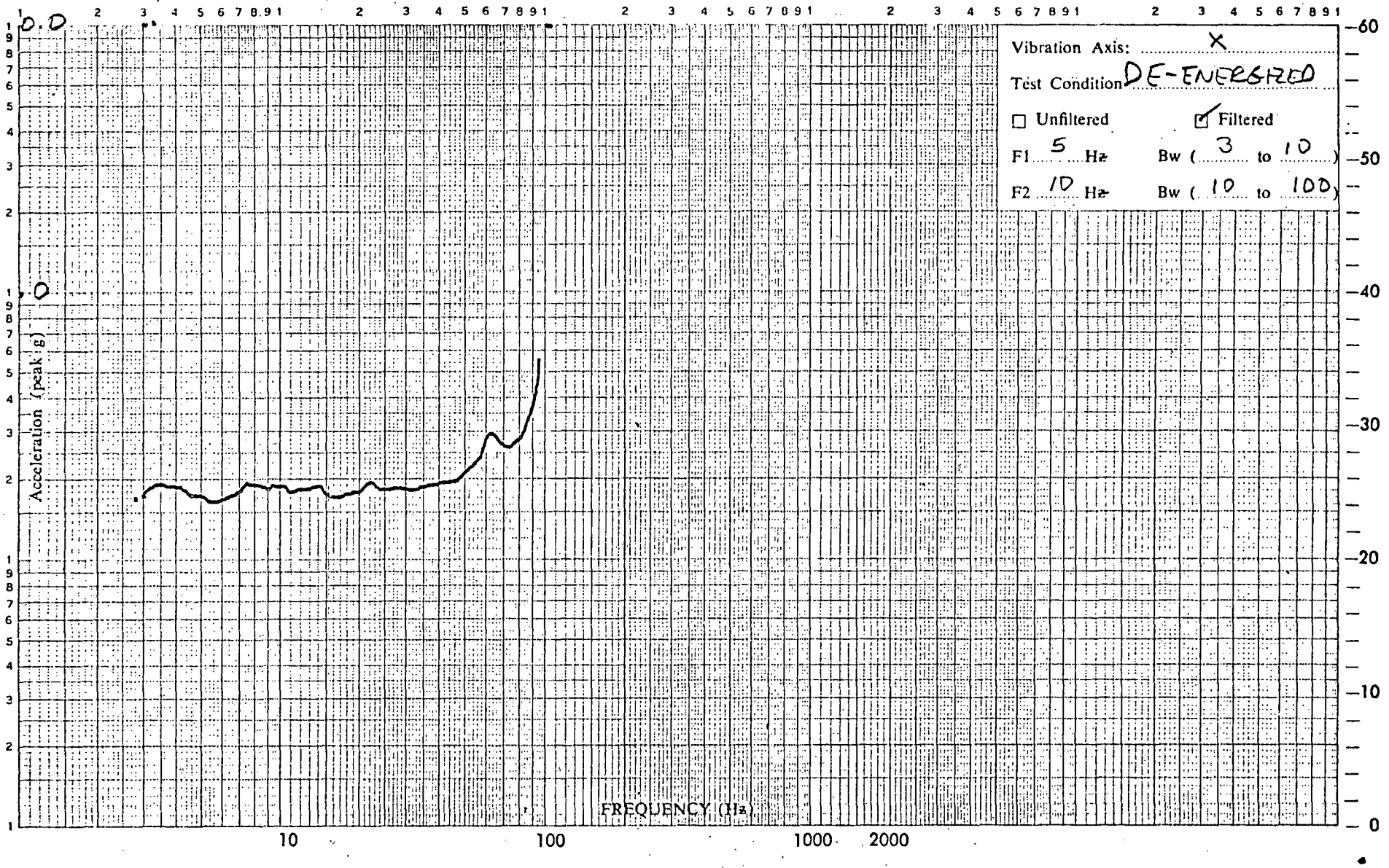
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1-79

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CQ43

Pickup Location: VALVE 5

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 2225

Graph Number: 6E

1651 Enc 1 Pg 51

Lab Form D-24

Plotted by: PELLENZ

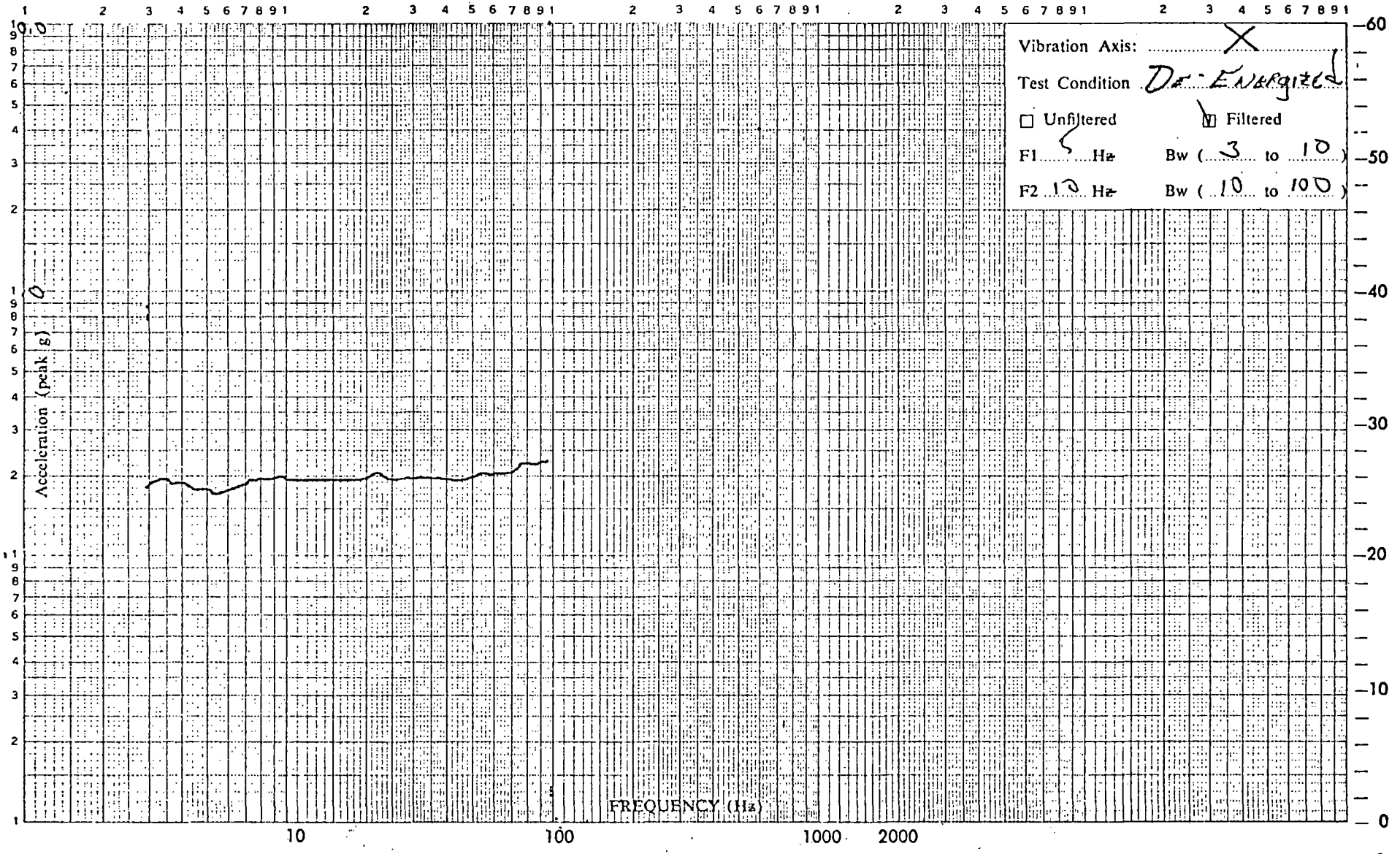
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 246

Pickup Location: VALVE #6

Pickup Sensing Axis: X

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 2225

1651 Enc 1 Pg 52

Lab Form D-24

Graph Number: 6F

Plotted by: PELLENZ

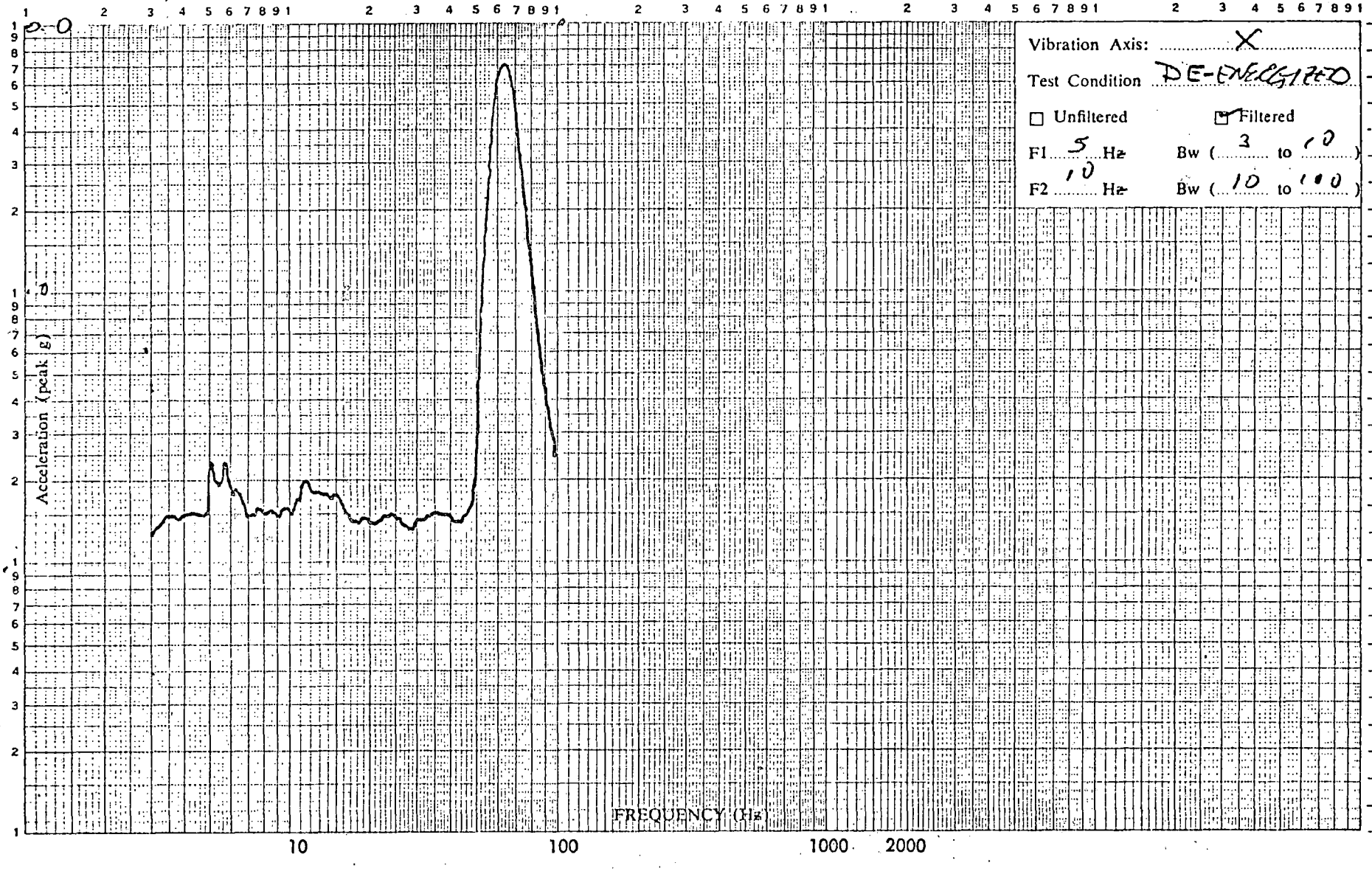
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 149209

Pickup Location: VALVE 7

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1. oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 CT 77

Time: 2225

Graph Number: 66

1651 Enc 1 Pg 53

Lab Form D-24

Plotted by: BELLENZ

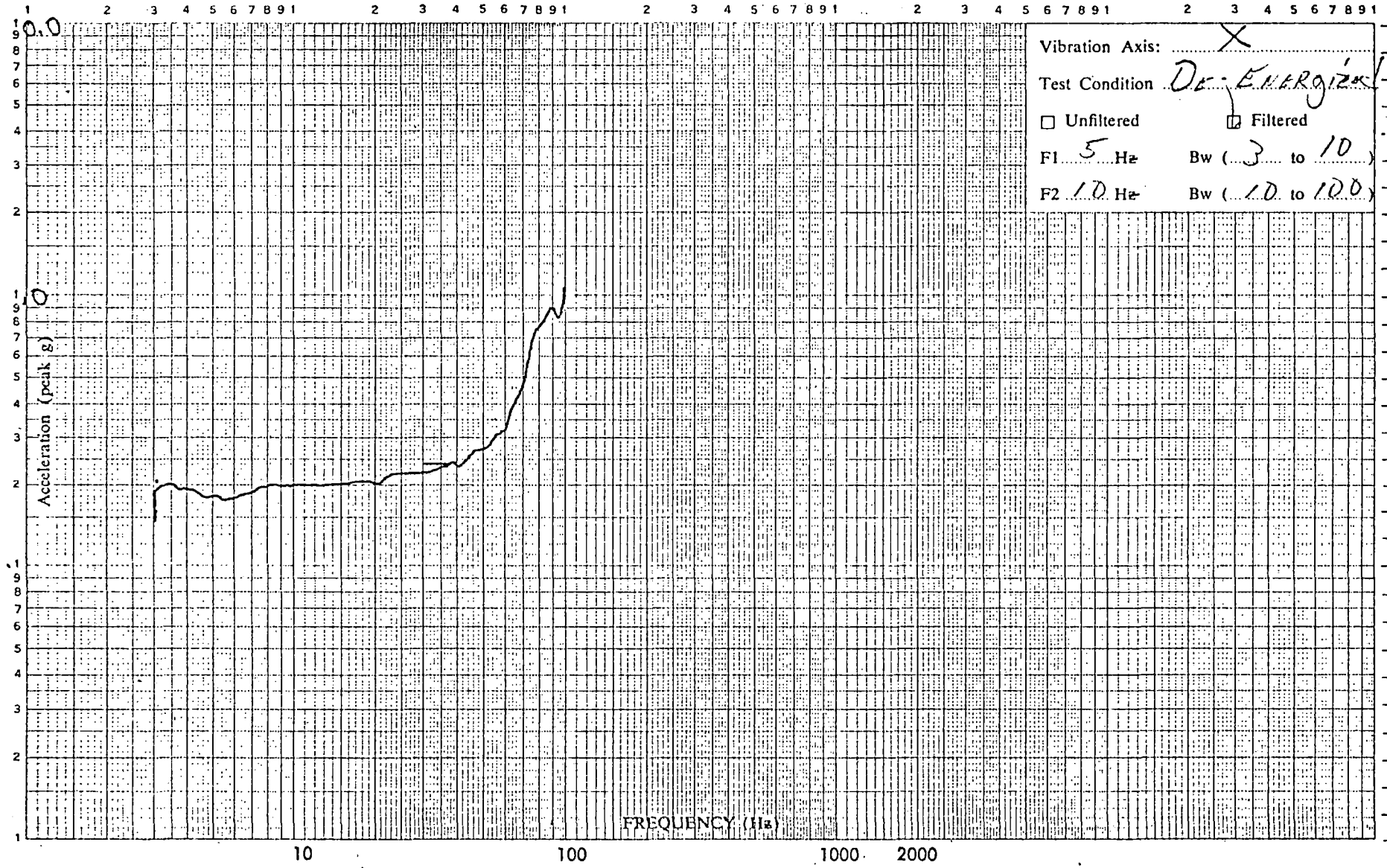
Checked by: WB

DAYTON T. BROWN, INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: FH04

Pickup Location: Valve 8

Pickup Sensing Axis: X X

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 Oct 77

Time: 2225

Graph Number: GH

1651 Enc 1 Pg 54

Lab Form D-24

Plotted by: PELLENZ

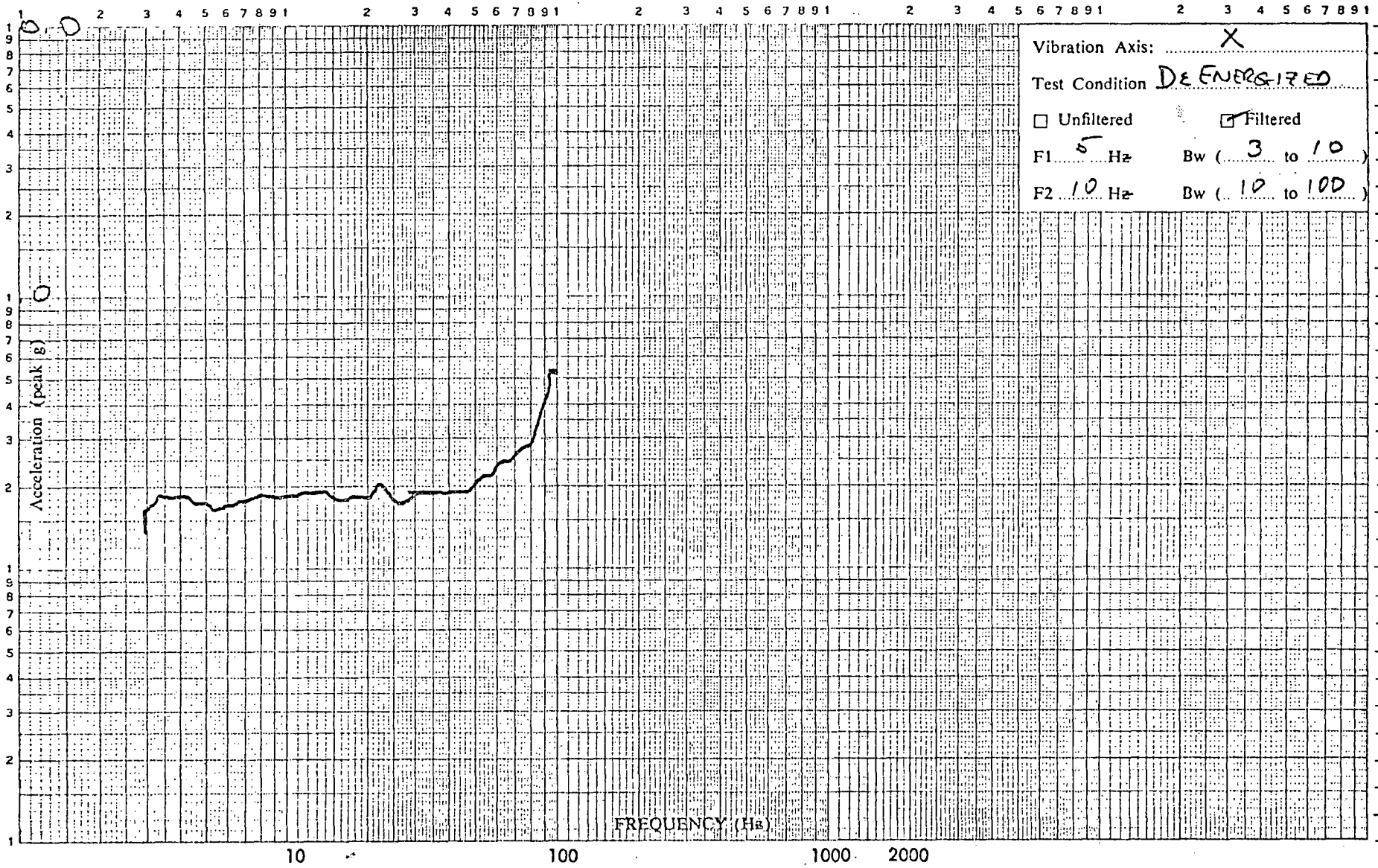
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CT68

Pickup Location: VALVE 9

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 Oct 77

Time: 2225

Graph Number: 67

1651 Enc 1 Pg 55

Lab Form D-24

Plotted by: PELLENZ

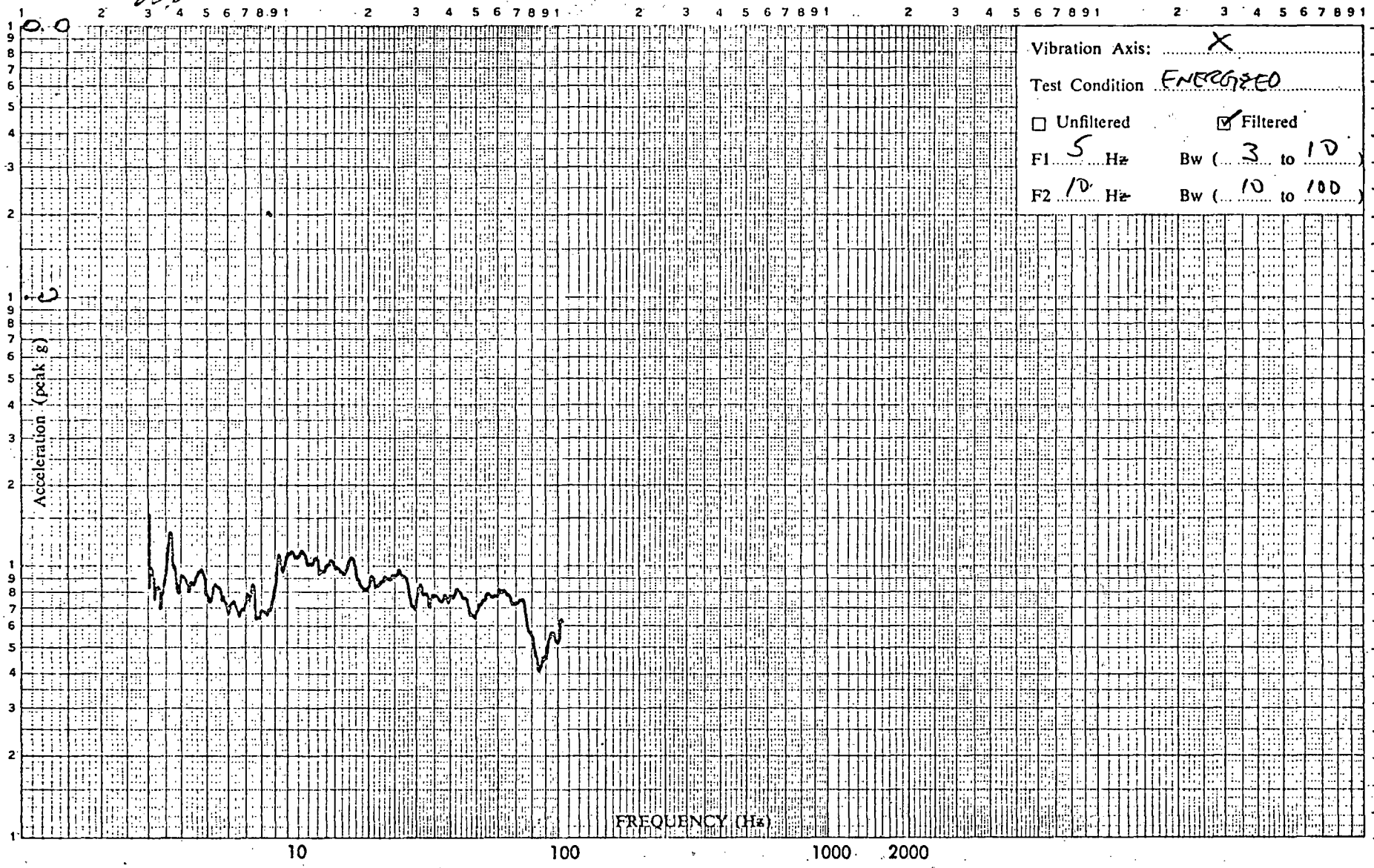
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Vibration Axis: X

Test Condition ENERGIZED

☐ Unfiltered ☑ Filtered

F1 5 Hz Bw (3 to 10)

F2 10 Hz Bw (10 to 100)

Pickup Serial Number: 4697

Pickup Location: CONTROL

Pickup Sensing Axis: Z

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 2240

Graph Number: 62

1651 Enc 1 Pg 56

Lab Form D-24

Plotted by: G. HEINLEIN

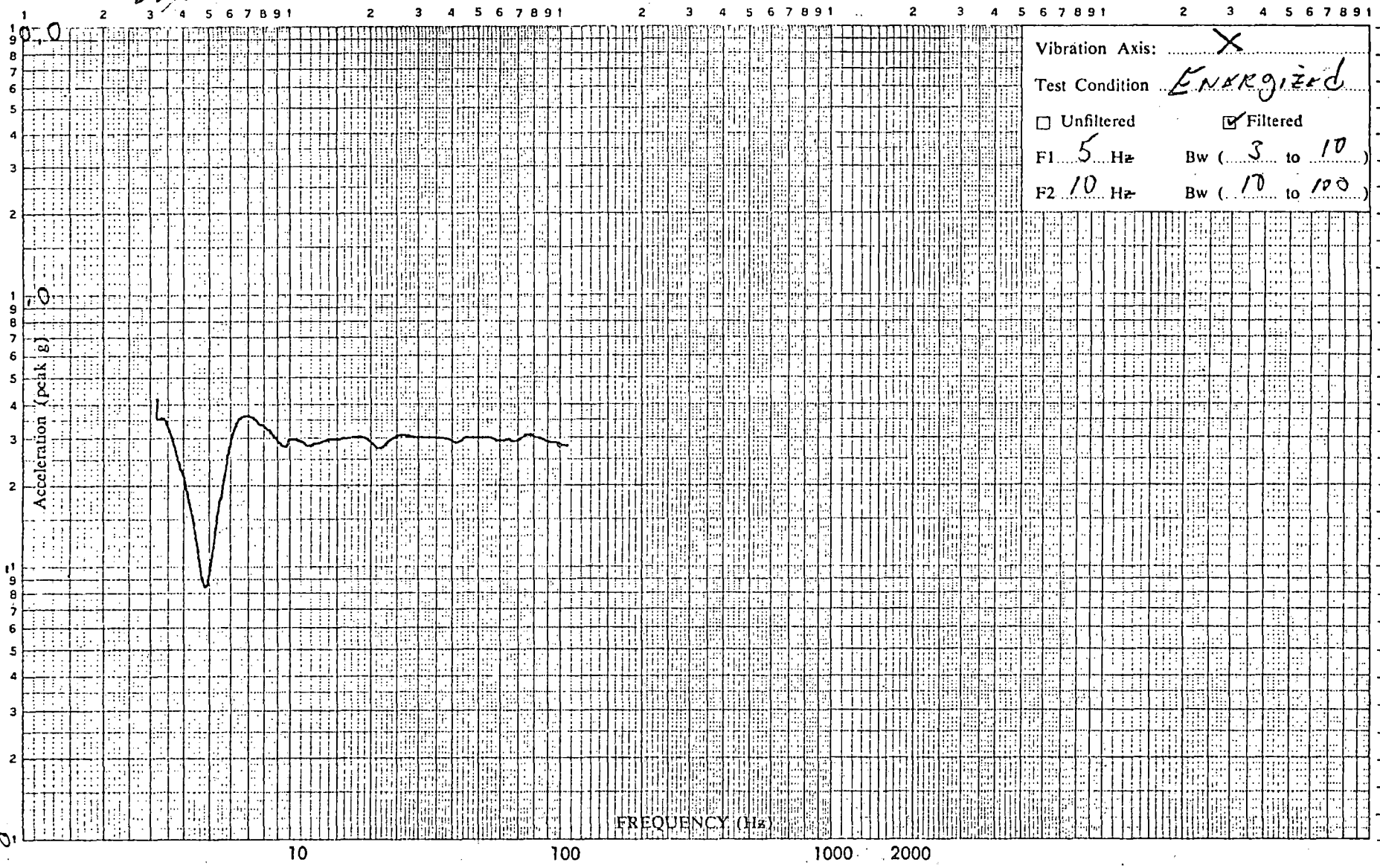
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 179

Unit: Operational ☒ Non-operational ☐



Graph Number: 6K

Pickup Serial Number: 224

Pickup Location: Valve #2

Pickup Sensing Axis: X

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 2240

1651 Enc 1 Pg 57

Lab Form D-24

Plotted by: PELLETT

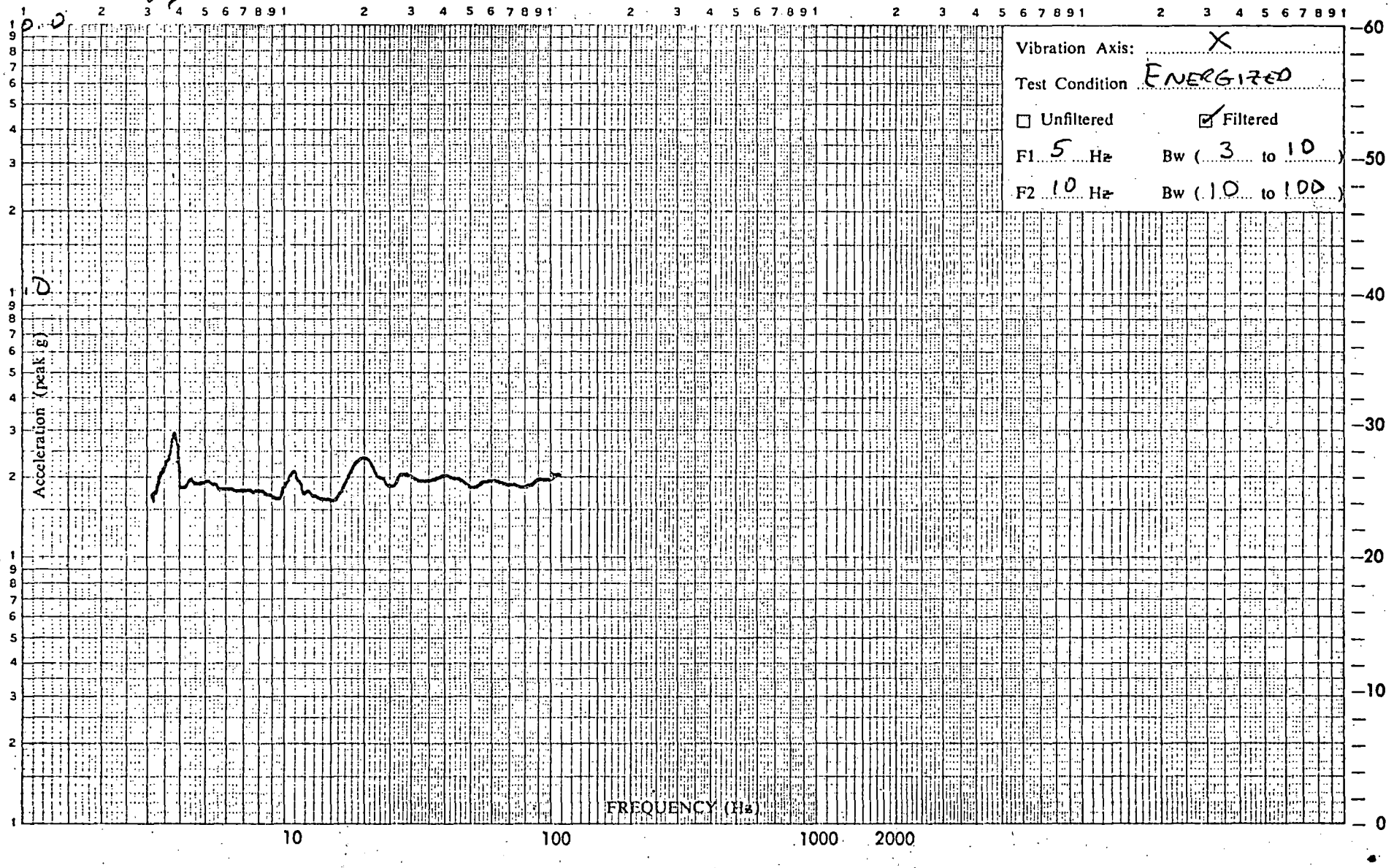
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: A340

Pickup Location: VALVE 3

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 77

Time: 2240

Graph Number: LL

1651 Enc 1 Pg 58

Lab Form D-24

Plotted by: G. HEINLEIN

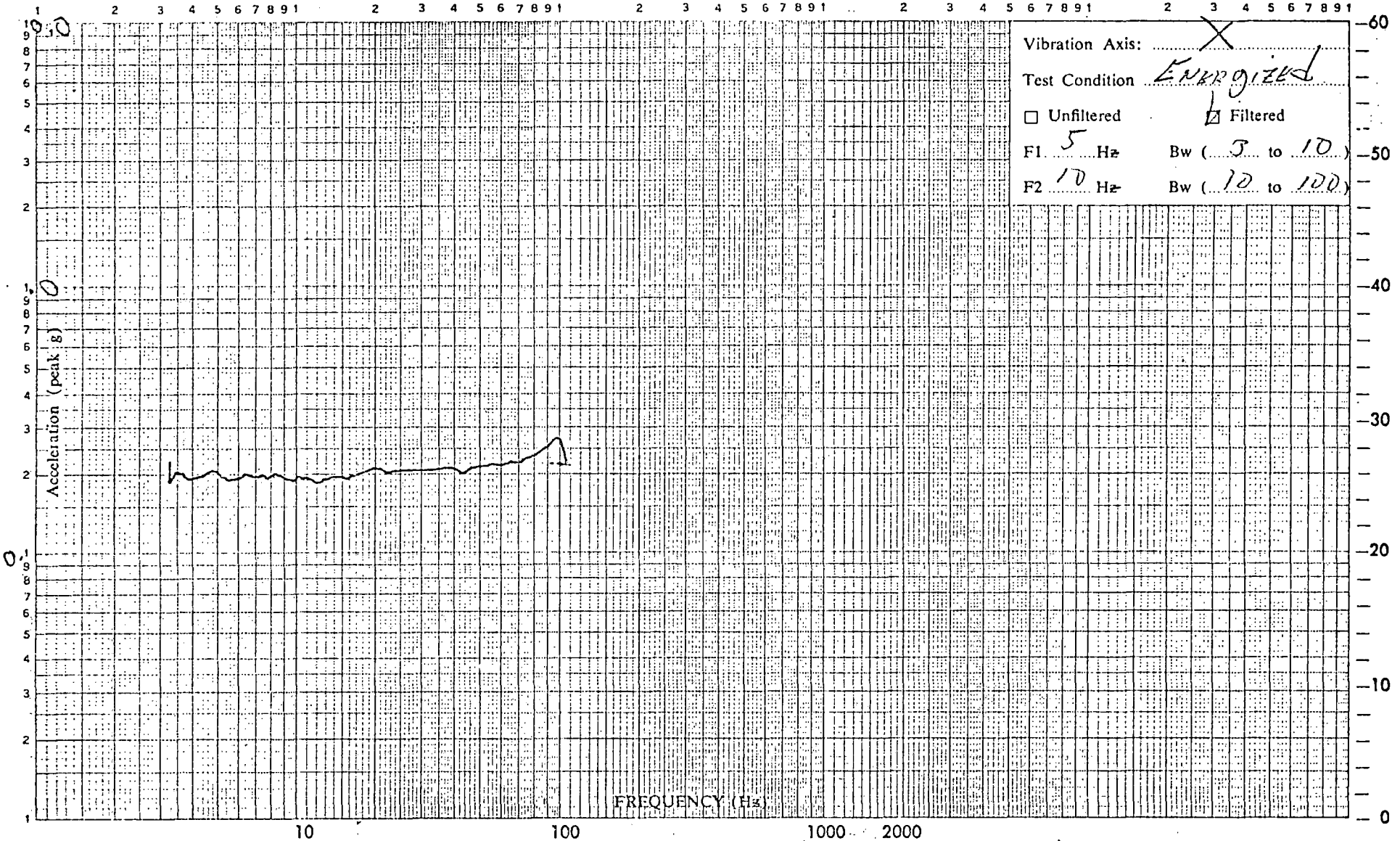
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 459

Pickup Location: VALVE #4

Pickup Sensing Axis: X

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 2240

Graph Number: Lem

1651 Enc 1 Pg 59

Lab Form D-24

[redacted]

Plotted by: PELLENZ

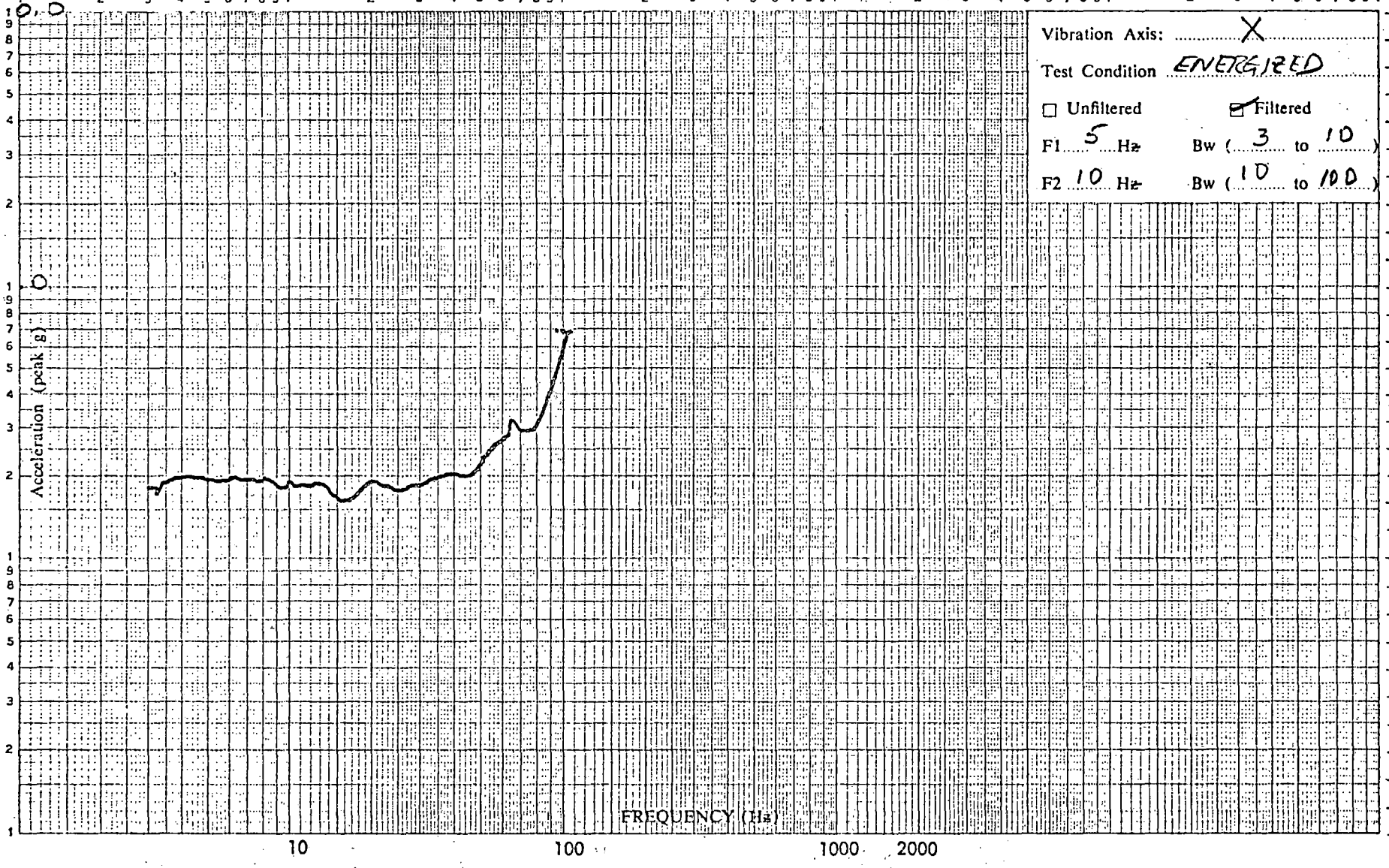
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DT13 #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CQ43

Pickup Location: VALVE 5

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 2240

Graph Number: 4N

1651 Enc 1 Pg 60

Lab Form D-24

Plotted by: HINLEIN

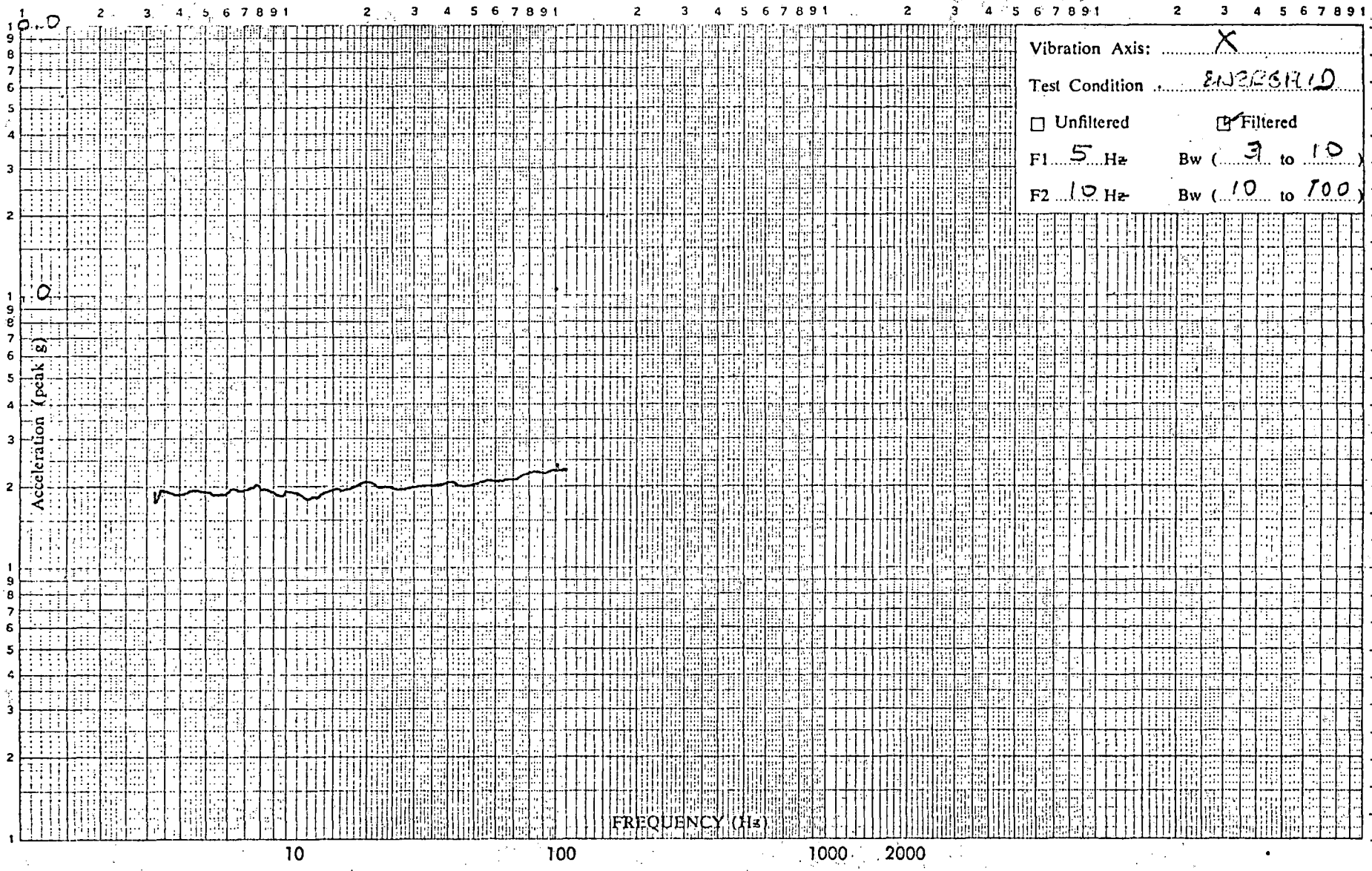
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: 246

Pickup Location: VALVE 6

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 Oct 77

Time: 2240

Graph Number: 60

1651 Enc 1 Pg 61

Lab Form D-24

Plotted by: PELLENZ

Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB # 1 → 9

Unit: Operational ☑ Non-operational ☐

Pickup Serial Number: 149209

Pickup Location: VALVE 7

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 OCT 97

Time: 2240

Graph Number: 6P

1651 Enc 1 Pg 62

9

Lab Form D-24

Plotted by: G HEINLEIN

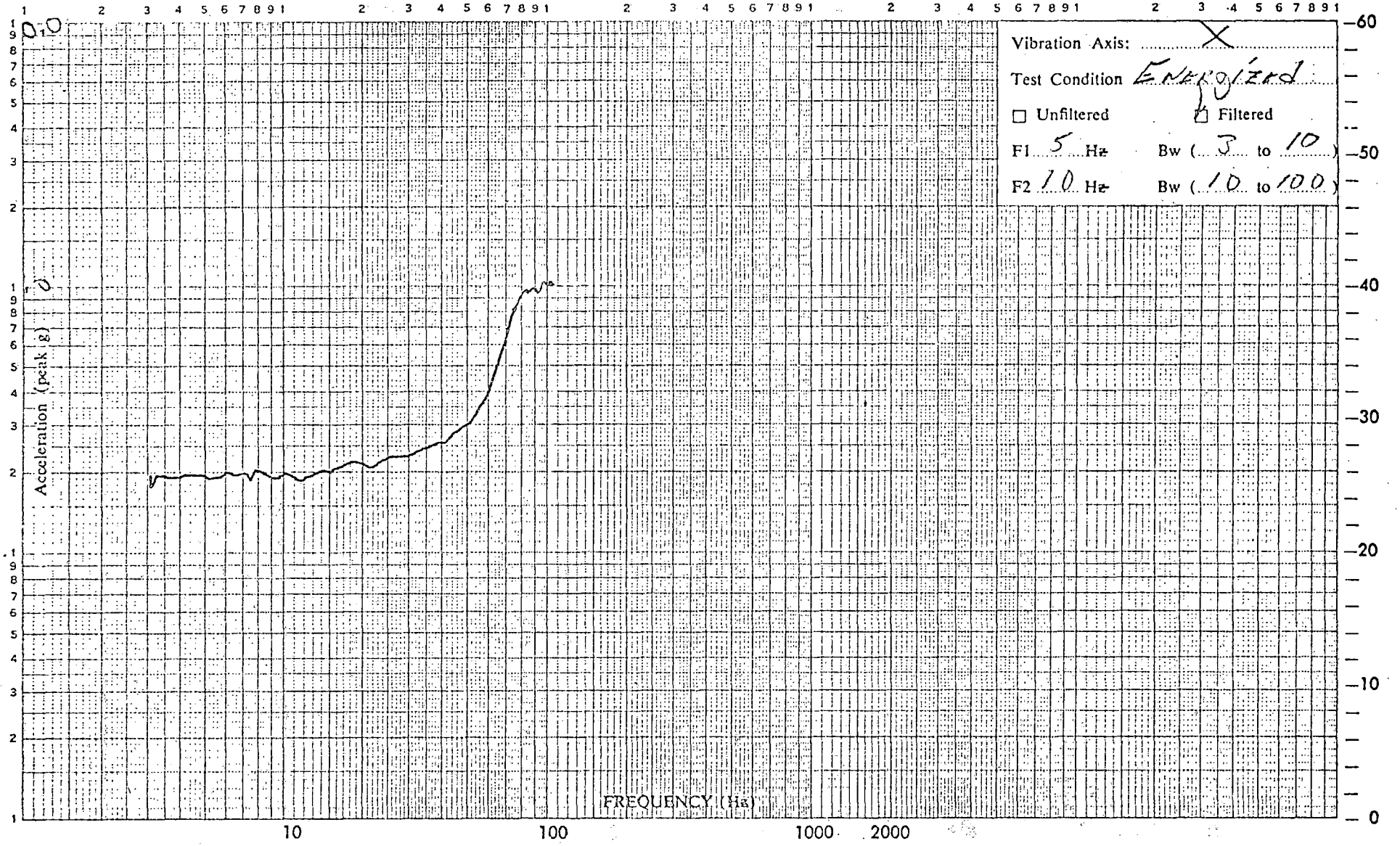
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: FH04

Pickup Location: VALVE #8

Pickup Sensing Axis: X

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 1 Oct 77

Time: 2240

Graph Number: 69

1651 Enc 1 Pg 63

Lab Form D-24

Plotted by: PELLENT

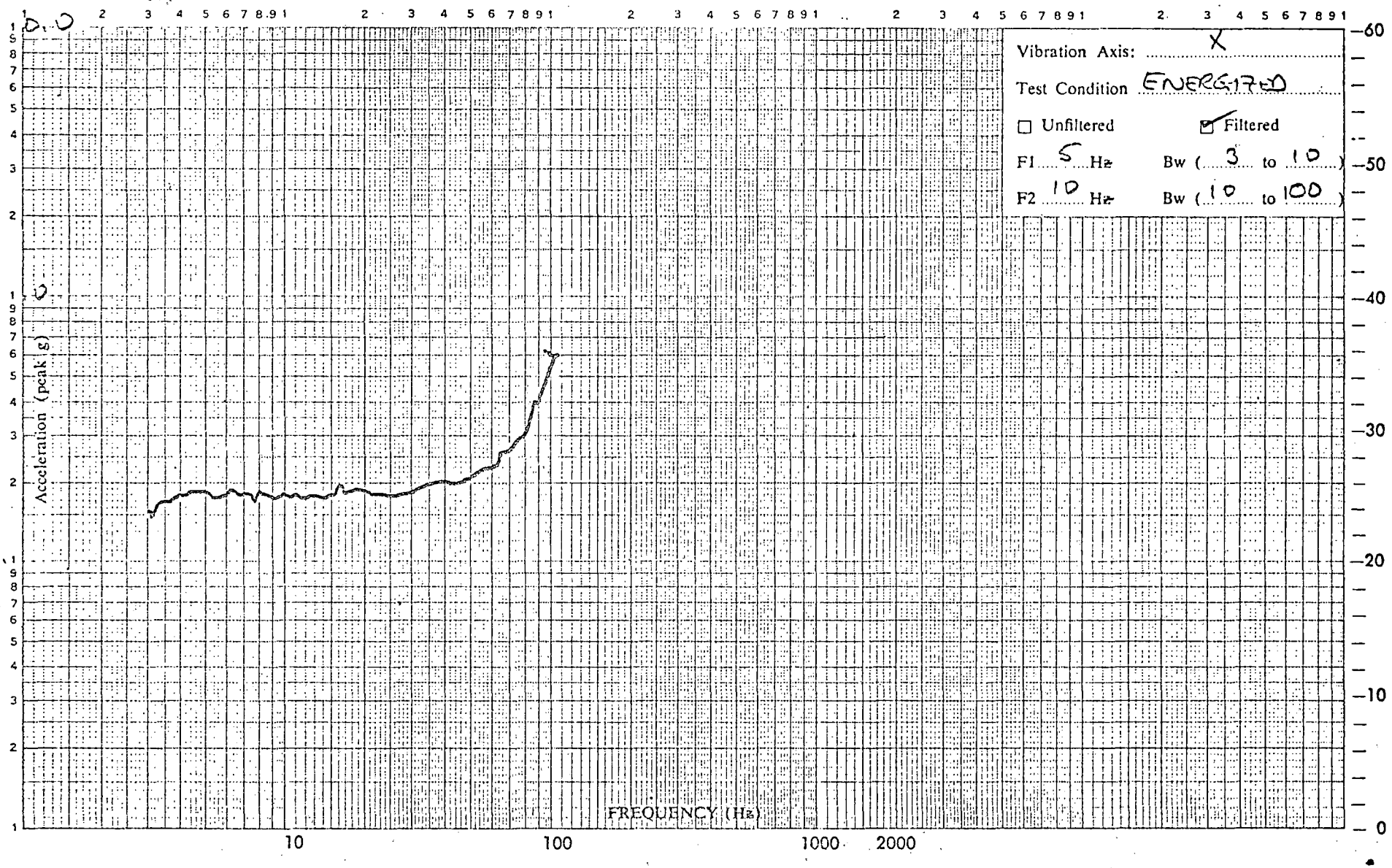
Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: CT68

Pickup Location: VALVE 9

Pickup Sensing Axis: X

Pickup Sensitivity: 100 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 2240

Graph Number: L&R

1651 Enc 1 Pg 64

Lab Form D-24

Plotted by: PELLEW

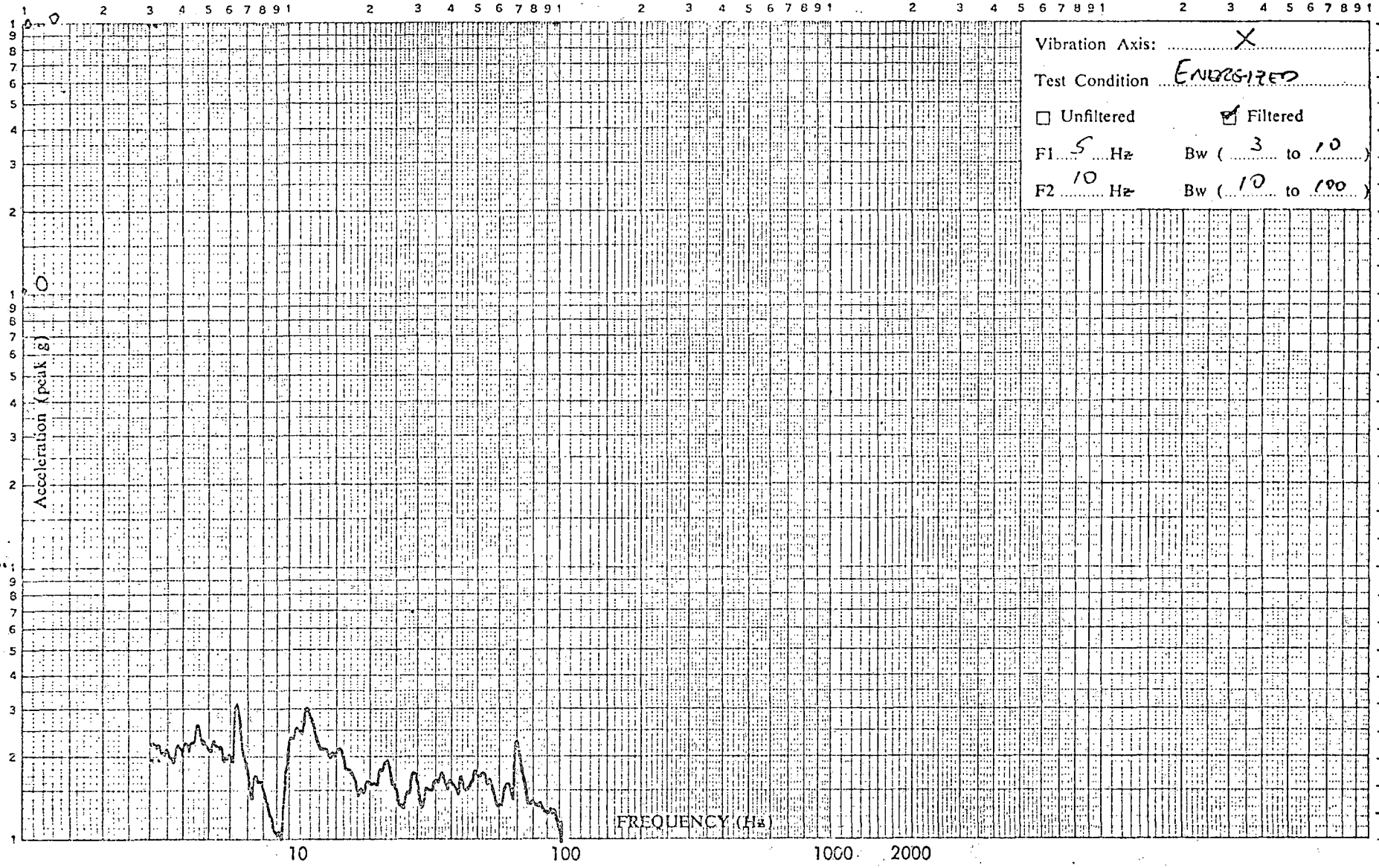
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #129

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: YG 79 Y

Pickup Location: CONTROL

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☐ Live ☑ Tape

Job Number: 401797

Date: 10 OCT 77

Time: 2240

Graph Number: 65

1651 Enc 1 Pg 65

Lab Form D-24

[redacted] Autom[redacted]tch Co. [redacted] All Rights Re[redacted]

Plotted by: R. Rankin

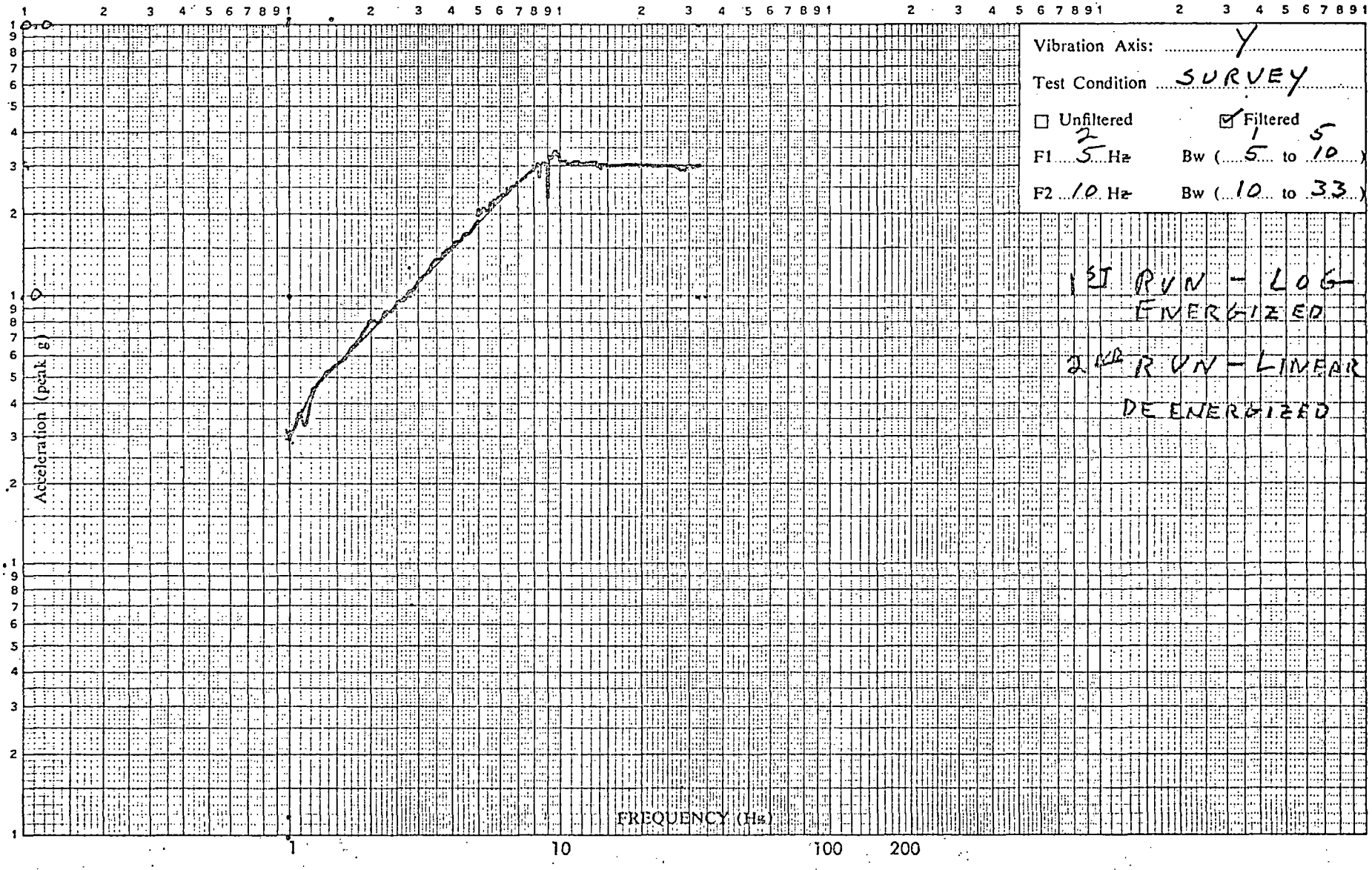
Checked by: WC

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB# 179

Unit: Operational ☑ Non-operational ☐



Pickup Serial Number: YG79 Y

Pickup Location: CONTROL

Pickup Sensing Axis: Y

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☑ Live ☐ Tape

Job Number: 401797

Date: 5 OCT 77

Time: 1430

1651 Enc 1 Pg 66

Lab Form D-24

Relative db (20 db/decade)

Graph Number: SA

Plotted by: E. Rankin

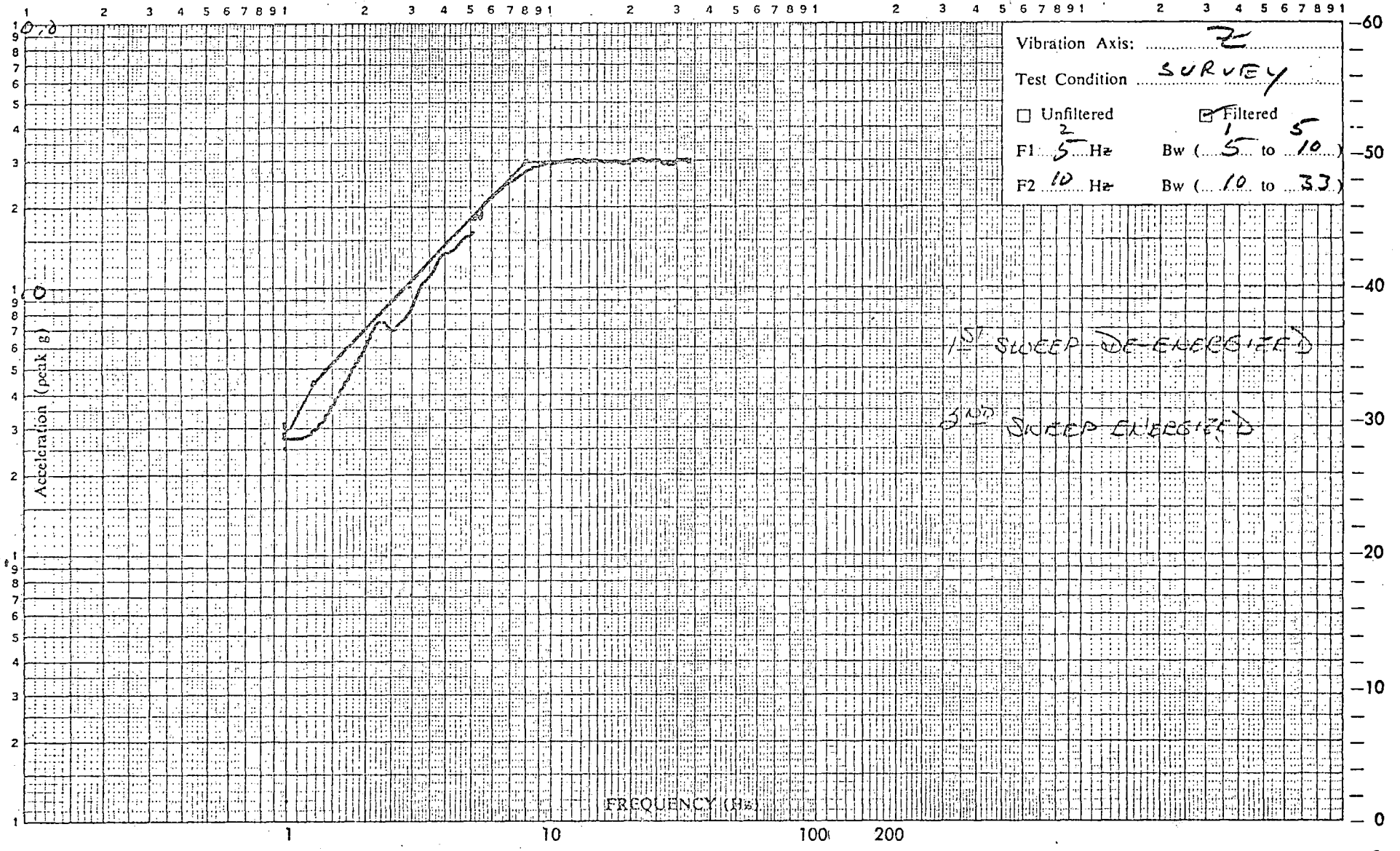
Checked by: [illegible]

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB#1→9

Unit: Operational ☑ Non-operational ☐



1651 Enc 1 Pg 67

Lab Form D-24

Graph Number: 94

Pickup Serial Number: YG792

Pickup Location: CONTROL

Pickup Sensing Axis: Z

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☑ Live ☐ Tape

Job Number: 401797

Date: 5 Oct 77

Time: 1547

Plotted by: W. PELLEW

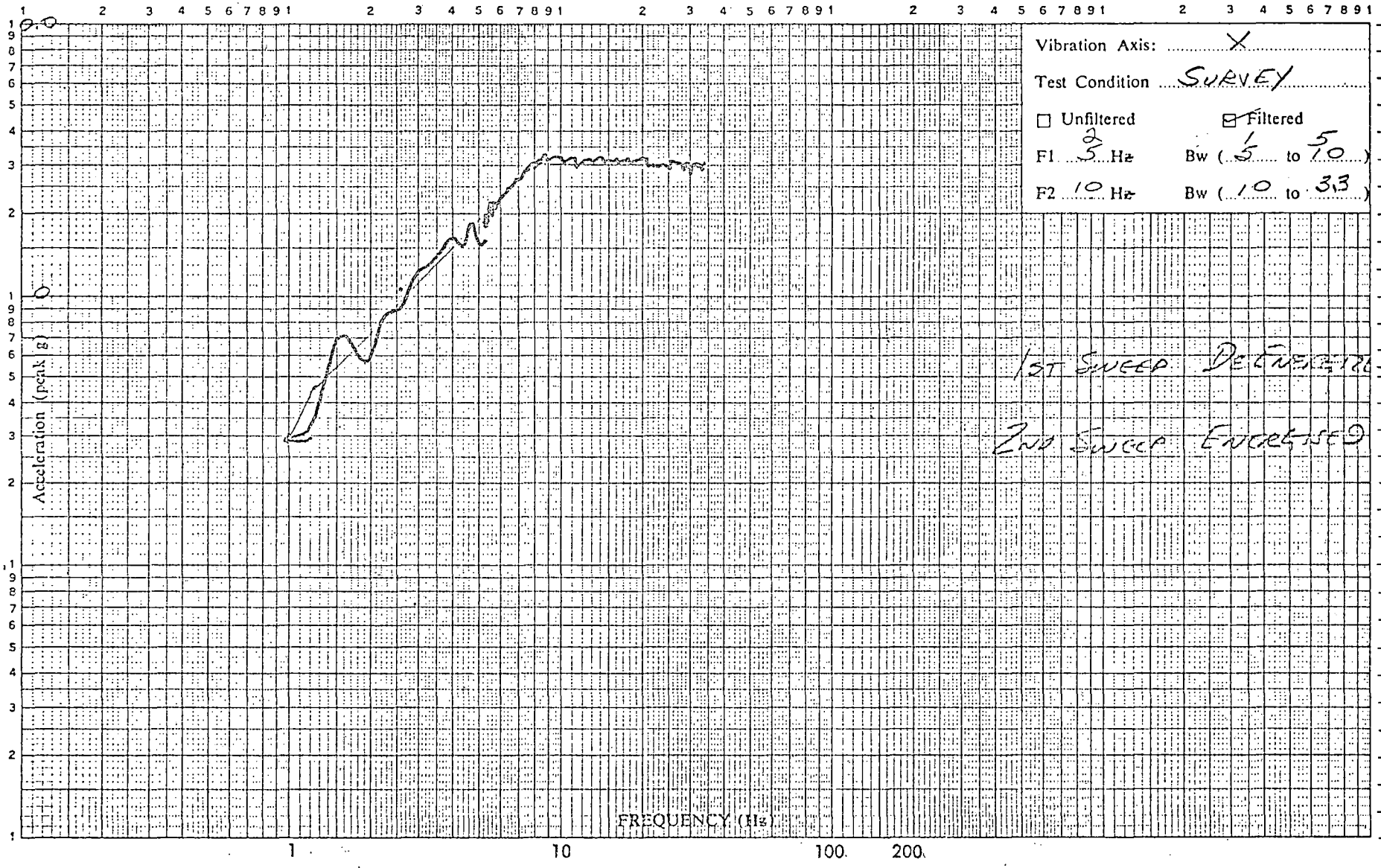
Checked by: WS

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES

Serial Number(s): DTB #1 → 9

Unit: Operational ☐ AS NOTED BELOW Non-operational ☐



1651 Enc 1 Pg 68

Lab Form D-24

Graph Number: 6A

Pickup Serial Number: YG79X

Pickup Location: CONTROL

Pickup Sensing Axis: X

Pickup Sensitivity: 100.0 mv peak / g peak

Sweep Speed: 1.0 oct/minute

☒ Live ☐ Tape

Job Number: 401797

Date: 5 OCT 77

Time: 1700

DAYTON T. BROWN INC.

TEST EQUIPMENT

TEST: VIBRATION

ITEM	MANUFACTURER	MODEL	S/N	ACCURACY
Vibration Exciter	M. B. Electronics	C-126	178	Transfer Instrument
Power Amplifier	M. B. Electronics	4450	205	Transfer Instrument
Sweep Oscillator	Spectral Dynamics	SD104A-5	187	± 2%
Servo Monitor	Spectral Dynamics	SD105A	140	± 4%
TRMS Voltmeter	Ballantine	N321	403	± 4%
Electronic Counter	Monsanto	103A	503	± 1 Count
Dynamic Analyzer	Spectral Dynamics	SD101B	53	± 0.25 dB
Dynamic Analyzer	Spectral Dynamics	SD101B	675	± 0.25 dB
Filter	Spectral Dynamics	AR-5	289	Mfr. Spec.
Filter	Spectral Dynamics	AR-5	290	Mfr. Spec.
Filter	Spectral Dynamics	AR-10	711	Mfr. Spec.
Filter	Spectral Dynamics	AR-10	055	Mfr. Spec.
Log Converter	Hewlett Packard	7562A	1211A 01452	± 1 dB
Log Converter	Hewlett Packard	7562A	1211A 01452	± 1 dB
X-Y Recorder	Hewlett Packard	7035B	1543A11 724	± 1%

Test equipment utilized for the program reported herein was within its assigned interval of calibration. Details are on file at Dayton T. Brown, Inc. and will be made available upon request.

TEST EQUIPMENT

TEST: VIBRATION

ITEM	MANUFACTURER	MODEL	S/N	ACCURACY
X-Y Recorder	Hewlett Packard	7035B	1320A 07559	± 1%
Timer	Dimco Gray	171	47-120	± 1 Second
Charge Amplifier	Unholtz Dickie	11MGV SLF1	EO-44	± 5%
Charge Amplifier	Unholtz Dickie	8PMCV	50-64	± 5%
Charge Amplifier	Unholtz Dickie	8PMCV	50-66	± 5%
Charge Amplifier	Unholtz Dickie	8PMCV	50-68	± 5%
Charge Amplifier	Unholtz Dickie	8PMCV	50-70	± 5%
Charge Amplifier	Unholtz Dickie	11MGV SLF1	EO 46	± 5%
Charge Amplifier	Unholtz Dickie	8PMCV	50-47	± 5%
Charge Amplifier	Unholtz Dickie	8PMCV	50-53	± 5%
Charge Amplifier	Unholtz Dickie	11MGV SLF1	EO 40	± 5%
Charge Amplifier	Unholtz Dickie	11MGV SLF1	EO 49	± 5%
Charge Amplifier	Unholtz Dickie	D11MSV 82	C467	± 5%
Charge Amplifier	Unholtz Dickie	D11MSV 82	C470	± 5%
Accelerometer	Unholtz Dickie	5D21	199	± 5%

Test equipment utilized for the program reported herein was within its assigned interval of calibration. Details are on file at Dayton T. Brown, Inc. and will be made available upon request.

DAYTON T. BROWN INC

TEST EQUIPMENT

TEST: VIBRATION

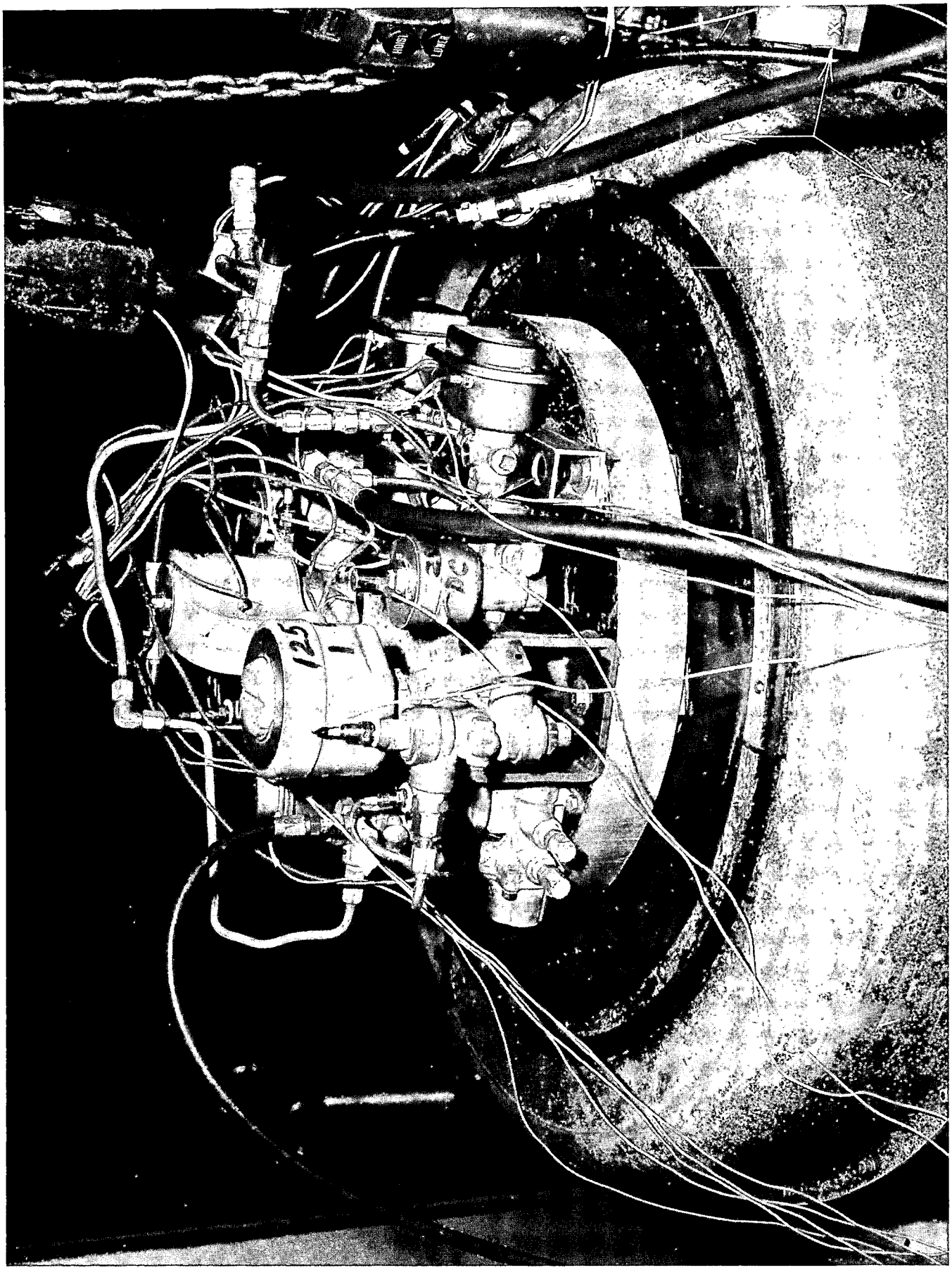
ITEM	MANUFACTURER	MODEL	S/N	ACCURACY
Accelerometer	Unholtz Dickie	5D21	224	± 5%
Accelerometer	Unholtz Dickie	5D21-8	246	± 5%
Accelerometer	Unholtz Dickie	5D21	456	± 5%
Accelerometer	Unholtz Dickie	5D21	459	± 5%
Accelerometer	M.B. Electronics	303	149209	± 5%
Accelerometer	Endevco	2226C	AB40	± 5%
Accelerometer	Endevco	2226C	CQ43	± 5%
Accelerometer	Endevco	2226C	CT68	± 5%
Accelerometer	Endevco	2228C	YG79	± 5%
Accelerometer	Endevco	2233	FH04	± 5%

Test equipment utilized for the program reported herein was within its assigned interval of calibration. Details are on file at Dayton T. Brown, Inc. and will be made available upon request.

DAYTON T. BROWN INC.

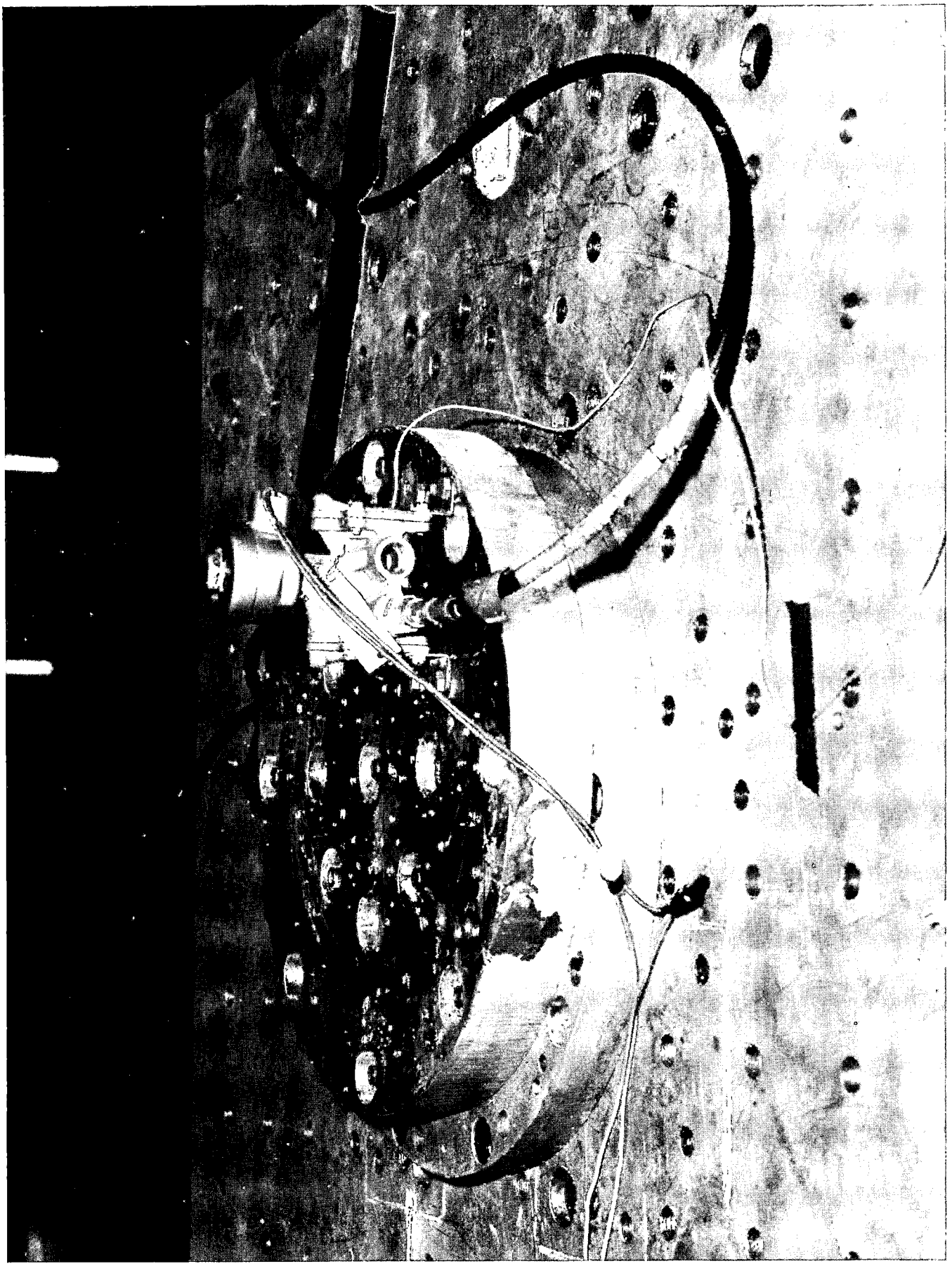
Enclosure 2

Photographs



TESTED FOR: ISOMEDIX INC. ITEM: SOLENOID VALVES S/N: DTB# 1 - 9
TYPICAL VIBRATION TEST SETUP
AXES DESIGNATION
JOB NO: 401797-00-000 FILE NO: 1516 DATE: 1 OCTOBER 1977
DTB04R77-1651 ENCLOSURE: 2 PHOTO: 1

DAYTON T. BROWN INC.
Testing Laboratories



TESTED FOR: ISOMEDIX INC. ITEM: SOLENOID VALVE S/N: DTB# 6
TYPICAL VIBRATION TEST SETUP
JOB NO: 401797-00-000 FILE NO: 1541 DATE: 6 OCTOBER 1977
DTB04R77-1651 ENCLOSURE: 2 PHOTO: 2

DAYTON T. BROWN INC.
Testing Laboratories

F/12

MA-206-380-3RF 0-150 PSIG

AC Solenoid pressure at port 2

Solenoid energized - check for pressure decrease at port 1

Solenoid de-energized - check for pressure increase at port 1

check for proper shifting at each cycle.

F/11 G-LEVELS REACHED FOR % BAG PRES

FREQ	MIN PEAK RIM PSI G D.A	Y-AXIS DE-EN. 0	5%	10%	Y-AXIS ENERG. 0	5%	10%	Z-AXIS DE-EN. 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENER. 0	5%
		0			0.25			0			0.25			0			0.25	
1	.30	OK			OK			OK			OK			OK			OK	
1 1/3	.56																	
1 2/3	.85 V.																	
2	1.2																	
2 2/3	1.5																	
3 1/3	1.8																	
4	2.3																	
5 1/3	2.9																	
6 2/3	3.8																	
8	4.5																	
10 2/3																		
13 1/3																		
16																		
21 1/3																		
26 2/3																		
32																		
33	4.5																	

VALVE NO 4 TYPE: SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 0.25 PART* AT I.D. WHEN SHAKING: Y-AXIS

*PART MAY BE: LEVER. DIAPHR. & PISTON PARTS I.D. &

F/10 G-LEVELS REACHED FOR % BACK PRESS.

	MIN PEAK RIM	% INCREASE Y-AXIS % DECREASE						Z-AXIS						X-AXIS					
		DE-EN.			ENERG.			DE-EN			ENERG.			DE-EN			ENERG.		
FREQ		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	PSI	0	8	15	150	142	135	0	8	15	150	142	135	0	8	15	150	142	135
	D.A																		
1	.30	OK			OK			OK			OK			OK			OK		
1 1/3	.56																		
1 2/3	.85 V.																		
2	1.2																		
2 2/3	1.5																		
3 1/3	1.8																		
4	2.3																		
5 1/3	2.9																		
6 2/3	3.8																		
8	4.5																		
10 2/3	↓																		
13 1/3																			
16																			
21 1/3																			
26 2/3																			
32																			
33	4.5																		

VALVE N° 4 TYPE: HV206-380-3RF SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 150 PART* AT I.D. WHEN SHAKEN: Y-AXIS

102 VAC

*PART MAY BE: (LEVER) DIAPHR. ℄, PISTON, PORTS 1 & 2 ℄

F/9

XFT831654V 10-125 PSIG

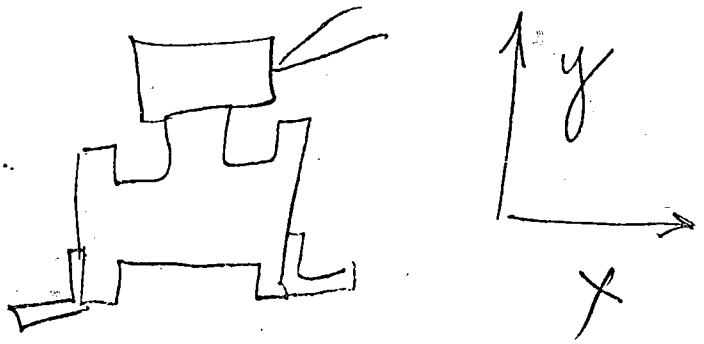
AC Solenoid Pressure at port P

Solenoid energized - check for pressure decrease at port A

Solenoid de-energized - check for pressure increase at port A

Check for proper shifting at each cycle

BACK OF F/8



F/8 G-LEVELS REACHED FOR % BACK PRESS.

	MIN / PEAK RIM	Y-AXIS % INCREASE				Y-AXIS % DECREASE			Z-AXIS						X-AXIS					
		DE-EN.			ENERG.				DE-EN			ENERG.			DE-EN			ENERG.		
REQ	PSI / D.A	0	5%	10%	0	5%	10%		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
		0	6	12.5	125	119	112		0	6	12.5	125	119	112	0	6	12.5	125	119	112
1	.30	OK			OK				OK			OK			OK			OK		
1 1/3	.56	OK			OK				OK			OK			OK			OK		
1 2/3	.85	OK			OK				OK			OK			OK			OK		
2	V. 1.2	OK			OK				OK			OK			OK			OK		
2 2/3	1.5	OK			OK				OK			OK			OK			OK		
3 1/3	1.8	OK			OK				OK			OK			OK			OK		
4	2.3	OK			OK				OK			OK			OK			OK		
5 1/3	2.9	OK			OK				OK			OK			OK			OK		
6	3.8	OK			OK				OK			OK			OK			OK		
8	4.5	OK			OK				OK			OK			OK			OK		
10 2/3	↑	OK			OK				OK			OK			OK			OK		
13 1/3		OK			OK				OK			OK			OK			OK		
16		OK			OK				OK			OK			OK			OK		
21 1/3		OK			OK				OK			OK			OK			OK		
26 2/3		OK			OK				OK			OK			OK			OK		
32		OK			①				OK			OK			OK			OK		
33	↓ 4.5	OK			①				OK			OK			OK			OK		

NOTED INSTANTANEOUS PULSATIONS TO 110-120 PSIG

Note: All testing applied at machine limit.

VALVE N° 3 TYPE: XFT8316 54V SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 125 PART* AT I.D. WHEN SHAKING: Y-AXIS

102 VAC

*PART MAY BE: LEVER, DIAPHR. ℄, PISTON, PORTS 1 & 2 ℄

F/7 G-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK G RIM PSI G's D.A	Y-AXIS DE-EN 0	5%	10%	Y-AXIS ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENER. 0	5%	10%
		0	0.5	1.0	10	9.5	9.0	0	0.5	1.0	10	9.5	9.0	0	0.5	1.0	10	7.5	9.0
1	.30	OK			OK			OK			OK			OK			OK		
1 1/3	.56	OK			OK			OK			OK			OK			OK		
1 2/3	.85 V.	OK			OK			OK			OK			OK			OK		
2	1.2	OK			OK			OK			OK			OK			OK		
2 2/3	1.5	OK			OK			OK			OK			OK			OK		
3 1/3	1.8	OK			OK			OK			OK			OK			OK		
4	2.3	OK			OK			OK			OK			OK			OK		
5 1/3	2.9	OK			OK			OK			OK			OK			OK		
6 2/3	3.8	OK			OK			OK			OK			OK			OK		
8	4.5	OK			OK			OK			OK			OK			OK		
10 2/3	4	OK			OK			OK			OK			OK			OK		
13 1/3		OK			OK			OK			OK			OK			OK		
16		OK			OK			OK			OK			OK			OK		
21 1/3		OK			OK			OK			OK			OK			OK		
26 2/3		OK			OK			OK			OK			OK			OK		
32		OK			OK			OK			OK			OK			OK		
43	4.5	OK			OK			OK			OK			OK			OK		

Note: only function of machine limit

VALVE N° 3 TYPE: XFT8316 54V SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 10 PART* A/D WHEN SHAKE: Y-AXIS

*PART MAY BE: LEVER. DIAPHR. & PISTON PORTION &

F/6

NP8344A7/E 10-125 PSIG

D.C. Solenoid pressure at port P

Solenoid energized - check for pressure decrease at port B and increase at port A

Solenoid de-energized - check for pressure pressure increase at port B and decrease at port A.

Check for proper shifting at each cycle.

F/5 g-LEVELS REACHED FOR % BAL' PRESS.

MIN PEAK : RIM		Y-AXIS						Z-AXIS						X-AXIS					
		DE-EN.			ENERG.			DE-EN			ENERG.			DE-EN			ENER.		
REQ		0	5%	10%	0	5%	90%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10
	g / PSI D.A	0	0.5	1.0	10	9.5	9.0	0	0.5	1.0	10	9.5	9.0	0	0.5	1.0	10	9.5	9.0
1	.30	OK			OK			OK			OK				OK		OK		
1⅓	.56	OK			OK			OK			OK				OK		OK		
1⅔	.85	OK			OK			OK			OK				OK		OK		
2	V. 1.2	OK			OK			OK			OK				OK		OK		
2⅔	1.5	OK			OK			OK			OK				OK		OK		
3⅓	1.8	OK			OK			OK OK			OK				OK		OK		
4	2.3	OK			OK			OK			OK				OK		OK		
5⅓	2.9	OK			OK			OK			OK				OK		OK		
6⅔	3.8	OK			OK			OK			OK				OK		OK		
8	g 4.5	OK			OK			OK			OK				OK		OK		
10⅔	↑	OK			OK			OK			OK				OK		OK		
13⅓		OK			OK			OK			OK				OK		OK		
16		OK			OK			OK			OK				OK		OK		
21⅓		OK			OK			OK			OK				OK		OK		
26⅔		OK			OK			OK			OK				OK		OK		
32	↓	OK			OK			OK			OK				OK		OK		
33	4.5	OK			OK			OK			OK				OK		OK		

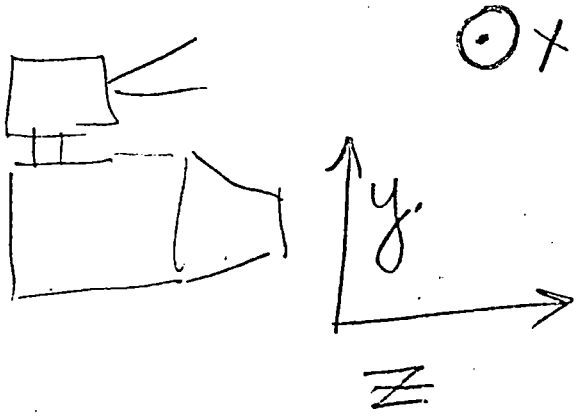
Note: All testing direct at machine limit

VALVE N° 2 TYPE: SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 10. PART* ATTD. WHEN SHAK'G: Y-AXIS

*PART MAY BE: LEVER. DIAPHR. & PISTON PORTS 1 & 2 &

BACK OF F/4



F/4 g-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RIM PSI sq. D.A	Y-AXIS % INCREASE DE-EN. 0	5%	10%	Y-AXIS % DECREASE ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENERG. 0	5%	10%
		0	6	12.5	125 0	119	112	0	6	12.5	125 0	119	112	0	6	12.5	125 0	119	112
1	.30	OK			OK			OK			OK			OK			OK		
1 1/3	.56	OK			OK			OK			OK			OK			OK		
1 2/3	.85	OK			OK			OK			OK			OK			OK		
2	1.2	OK			OK			OK			OK			OK			OK		
2 2/3	1.5	OK			OK			OK			OK			OK			OK		
3 1/3	1.8	OK			OK			OK			OK			OK			OK		
4	2.3	OK			OK			OK			OK			OK			OK		
5 1/3	2.9	OK			OK			OK			OK			OK			OK		
6 2/3	3.8	OK			OK			OK			OK			OK			OK		
8	4.5	OK			OK			OK			OK			OK			OK		
10 2/3	↑	OK			OK			OK			OK			OK			OK		
13 1/3		OK			OK			OK			OK			OK			OK		
16		OK			OK			OK			OK			OK			OK		
21 1/3		OK			OK			OK			OK			OK			OK		
26 2/3		OK			OK			OK			OK			OK			OK		
32	↓	OK			OK			OK			OK			OK			OK		
33	4.5	OK			OK			OK			OK			OK			OK		

Multi-Cell Solenoid Valve Chart

VALVE N° 2 TYPE: NP8344A71E SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 125 PART* A'T'D. WHEN SHAKEN: Y-AXIS

90 VDC

*PART MAY BE: LEVER, DIAPHR. & PISTON, PORTS 1 & 2 &

F/3

HVA-206-381-6F 0-125 PSIG

DC Solenoid pressure at port C

Solenoid energized - check for pressure decrease at port A

Solenoid de-energized - check for pressure increase at port A

check for proper shifting at each cycle

F/2 g-LEVELS REACHED FOR % BAL' PRESS.

FREQ	MIN PEAK RIM PSI / D.A	Y-AXIS % INCREASE DE-EN. 0	5%	10%	Y-AXIS % DECREASE ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENER. 0	5%
		0			0.25			0			0.25			0			0.25	
1	.30	OK		OK				OK			OK			OK			OK	
1 1/3	.56							OK			OK							
1 2/3	.85 V.							OK			OK							
2	1.2							OK			OK							
2 2/3	1.5							OK			OK							
3 1/3	1.8							OK			OK							
4	2.3							OK			OK							
5 1/3	2.9							OK			OK							
6 2/3	3.8							OK			OK							
8	4.5							OK			OK							
10 2/3								OK			OK							
13 1/3								OK			OK							
16								OK			OK							
21 1/3								OK			OK							
26 2/3								OK			OK							
32								OK			OK							
33	4.5							OK			OK							

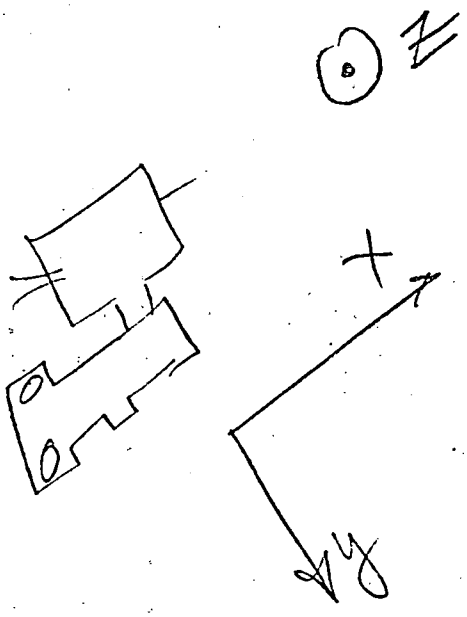
+ Part Tilted At this Point 7/14

VALVE NO 1 TYPE: SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 0.25 PART* AT I.D. WHEN SHAKING Y-AXIS

*PART MAY BE: LEVER. DIAPHR. & PISTON PORTS I.D. &

BACK OF F/1



11-25 F/1 G-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RIM PSI / G D.A	% INCREASE Y-AXIS DE-EN. 0	5%	10%	% DECREASE Y-AXIS ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENERG. 0	5%	10%
		0	6	12.5	0	6	12.5	0	6	12.5	0	6	12.5	0	6	12.5	0	6	12.5
					112	119	112				112	119	112				112	119	112
1	.30	OK			OK			OK			OK			OK			OK		
1 1/3	.56							OK			OK								
1 2/3	.85 V.							OK			OK								
2	1.2							OK			OK								
2 2/3	1.5							OK			OK								
3 1/3	1.8							OK			OK								
4	2.3							OK			OK								
5 1/3	2.9							OK			OK								
6 3	3.8							OK			OK								
8 9	4.5							OK			OK								
10 2/3	A							OK			OK								
13 1/3								OK			OK								
16								OK			OK								
21 1/3								OK			OK								
26 2/3								OK			OK								
32								OK			OK								
33	4.5							OK			OK								

PLATE #4

VALVE N° 1 TYPE: HV206-381-6F SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 125 PART* A T D. WHEN SHAKING Y-AXIS

90 V DC

*PART MAY BE: (LEVER), DIAPHR. &, PISTON, PORTS 1 & 2 &

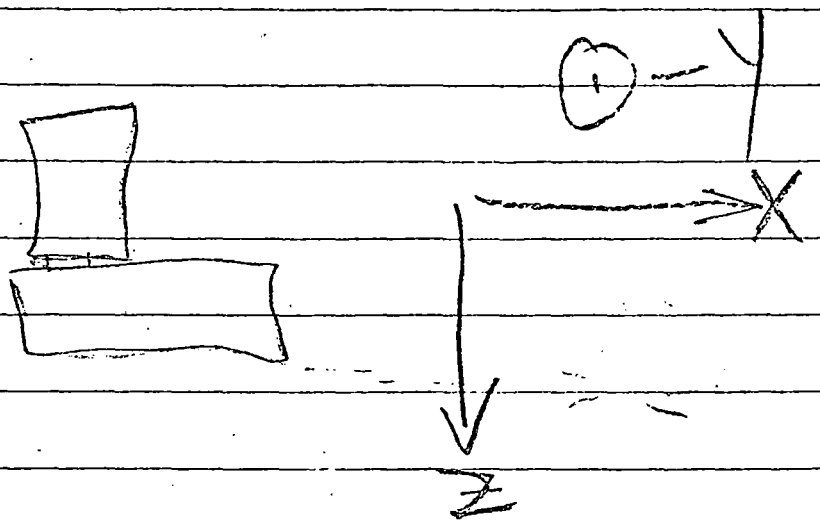
APPENDIX F

OPERATIONAL DATA AT 'DAYTON T. BROWN'

Isomedix, Inc. • 25 Eastmans Road, Parsippany, New Jersey 07054 (201) 887-4700

Chicago, Illinois • 7828 Nagle Ave., Morton Grove, Illinois 60053 (312) 966-1160
Columbus, Mississippi • Post Office Box 2044, Industrial Park South, Columbus, Mississippi 39701 (601) 327-8015

BACK OF F/12



F/13 g-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RIM PSI g D.A	% INCREASE Y-AXIS % DECREASE DE-EN. 0	5%	10%	ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	ENERG. 0	5%	10%
		0	8	15	30	142	135	0	8	15	30	142	135	0	8	15	30	142	135
1	.30				ok			ok			ok			ok			ok		
1 1/3	.56																		
1 2/3	.85																		
2	1.2																		
2 2/3	1.5																		
3 1/3	1.8																		
4	2.3																		
5 1/3	2.9																		
6 2/3	3.8																		
8	4.5 g																		
10 2/3	A																		
13 1/3																			
16																			
21 1/3																			
26 2/3																			
32																			
33	4.5																		

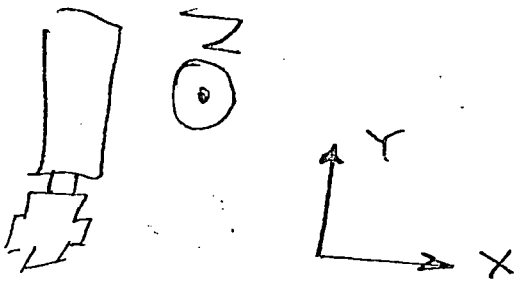
VALVE N° 5 TYPE: NP8320A184E SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 150 PART* AT I.D. WHEN SHAKING: Y-AXIS

102 VAC

*PART MAY BE: LEVER, DIAPHR. ℄, PISTON, PORTS 1, 2 ℄

BACK OF F/13



F/14 g-LEVELS REACHED FOR % BAL' PRESS.

FREQ	MIN PEAK RIM PSI / g D.A	Y-AXIS DE-EN. 0	Y-AXIS DE-EN. 5%	Y-AXIS DE-EN. 10%	Y-AXIS ENERG. 0	Y-AXIS ENERG. 5%	Y-AXIS ENERG. 10%	Z-AXIS DE-EN 0	Z-AXIS DE-EN 5%	Z-AXIS DE-EN 10%	Z-AXIS ENERG. 0	Z-AXIS ENERG. 5%	Z-AXIS ENERG. 10%	X-AXIS DE-EN 0	X-AXIS DE-EN 5%	X-AXIS DE-EN 10%	X-AXIS ENER 0	X-AXIS ENER 5%
	0 / 0				0.25						0.25						0.25	
1	.30							OK			OK			OK			OK	
1 1/3	.56																	
1 2/3	.85 V.																	
2	1.2																	
2 2/3	1.5																	
3 1/3	1.8																	
4	2.3																	
5 1/3	2.9																	
6 2/3	3.8																	
8	9 4.5																	
10 2/3																		
13 1/3																		
16																		
21 1/3																		
26 2/3																		
32																		
33	4.5																	

VALVE N° 5 TYPE: SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 0.25 PSI PART* AT D. WHEN SHAK'G: Y-AXIS

*PART MAY BE: LEVER. DIAPHR. & PISTON PARTS I.D. &

F/15

NP8320A184E 0-150 PSIG

A.C. Solenoid pressure at part 2

Solenoid energized - check for pressure decrease at part 1

Solenoid de-energized - check for pressure increase at part 1

Check for proper shifting at each cycle

F/16 G-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RIM PSI G's D.A	Y-AXIS DE-EN 0	5%	10%	Y-AXIS ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENERG. 0	5%	10%
		0	1/2	1	10	9.5	9	0	1/2	1	10	9.5	9	0	1/2	1	10	7.5	9
1	.30	OK			OK			OK			OK			OK			OK		
1 1/3	.56	OK			OK			OK			OK			OK			OK		
1 2/3	.85 V.	OK			OK			OK			OK			OK			OK		
2	1.2	OK			OK			OK			OK			OK			OK		
2 2/3	1.5	OK			OK			OK			OK			OK			OK		
3 1/3	1.8	OK			OK			OK			OK			OK			OK		
4	2.3	OK			OK			OK			OK			OK			OK		
5 1/3	2.9	OK			OK			OK			OK			OK			OK		
6	3.8	OK			OK			OK			OK			OK			OK		
8	4.5	OK			OK			OK			OK			OK			OK		
10 2/3		OK			OK			OK			OK			OK			OK		
13 1/3		OK			OK			OK			OK			OK			OK		
16		OK			OK			OK			OK			OK			OK		
21 1/3		OK			OK			OK			OK			OK			OK		
26 2/3		OK			OK			OK			OK			OK			OK		
32		OK			OK			OK			OK			OK			OK		
33	4.5	OK			OK			OK			OK			OK			OK		

Note: all tests made at machine limit

VALVE N°6 TYPE:

INLET PRESSURE 10

SOLENOID ATTITUDE: Z-AXIS

PART* AT D. WHEN SHAK'G: Y-AXIS

*PART MAY BE: LEVER, DIAPHR. &, PISTON, PORTS 1 & 2 &

10-6-77 R Powell

F/17-9 - LEVELS REACHED FOR % BACK PRESS.

REQ	MIN PEAK RIM PSI / SQ D.A	Y-AXIS DE-EN 0	5%	10%	Y-AXIS ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENERG. 0	5%	10%
		0	9	17,5	135	166	158	0	9	17,5	135	166	158	0	9	17,5	135	166	158
1	.30	OK		OK	OK			OK			OK			OK			OK		
1 1/3	.56	OK		OK	OK			OK			OK			OK			OK		
1 2/3	.85 V.	OK		OK	OK			OK			OK			OK			OK		
2	1.2	OK		OK	OK			OK			OK			OK			OK		
2 2/3	1.5	OK		OK	OK			OK			OK			OK			OK		
3 1/3	1.8	OK		OK	OK			OK			OK			OK			OK		
4	2.3	OK		OK	OK			OK			OK			OK			OK		
5 1/3	2.9	OK		OK	OK			OK			OK			OK			OK		
6 2/3	3.8	OK		OK	OK			OK			OK			OK			OK		
8	4.5	OK		OK	OK			OK			OK			OK			OK		
10 2/3		OK		OK	OK			OK			OK			OK			OK		
13 1/3		OK		OK	OK			OK			OK			OK			OK		
16		OK		OK	OK			OK			OK			OK			OK		
21 1/3		OK		OK	OK			OK			OK			OK			OK		
26 2/3		OK		OK	OK			OK			OK			OK			OK		
32		OK		OK	OK			OK			OK			OK			OK		
33	4.5	OK		OK	OK			OR			OK			OK			OK		

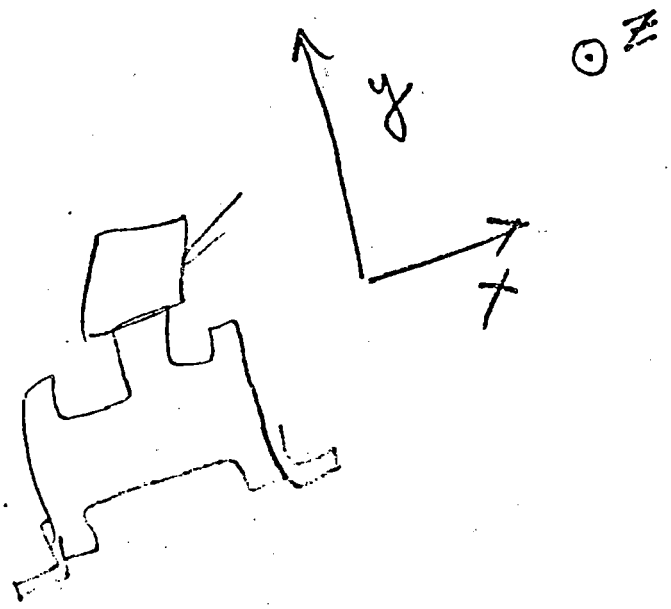
Note: Left Limit Line at maximum Limit

VALVE N° 6 TYPE: NP 831665E SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 90 VDC 175 PART* AT I.D. WHEN SHAKING: Y-AXIS

*PART MAY BE: LEVER, DIAPHR. ℄, PISTON, PORTS 1 & 2 ℄

BACK OF F/17



F/18

NP 8316655E 10-175 PSIG

DC solenoid pressure at port P

Solenoid energized - check for pressure decrease at port A

Solenoid de-energized - check for pressure increase at port A

check for proper shifting at each cycle

4A. F/19 G-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RIM PSI & D.A	Y-AXIS % INCREASE DE-EN 0	5%	10%	Y-AXIS % DECREASE ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENERG. 0	5%	10%
		0	10	20	200	190	180	0	10	20	200	190	180	0	10	20	200	190	180
1	.30	OK						OK			OK			OK			OK		
1 1/3	.56							OK			OK								
1 2/3	.85 V.							OK			OK								
2	1.2							OK			OK								
2 2/3	1.5							OK			OK								
3 1/3	1.8							OK			OK								
4	2.3							OK			OK								
5 1/3	2.9							OK			OK								
6 2/3	3.8							OK			OK								
8	4.5	OK						OK			OK								
10 2/3								OK			OK								
13 1/3				50				OK			OK								
16		OK						OK			OK								
21 1/3				140 PSI				OK			OK								
26 2/3				200 PSI				OK			OK								
32		OK						OK			OK								
33	4.5							OK			OK								

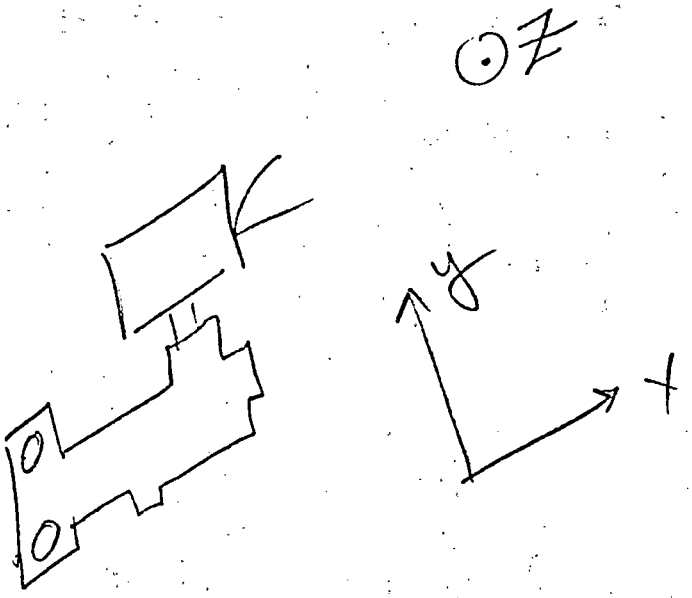
VALVE NO 7 TYPE: HV202-300-2RF SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 200 PART* AT D. WHEN SHAKING Y-AXIS

90 VDC

*PART MAY BE: (LEVER), DIAPHR. &, PISTON, PORTS 1 & 2 &

BACK OF F/19



F/20 g-LEVELS REACHED FOR % BAL. PRESS.

FREQ	MIN PEAK g D.A. / PSI	Y-AXIS DE-EN. 0	5%	10%	Y-AXIS ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENER. 0	5%
	PSI	0			0.25			0			0.25			0			0.25	
1	.30	OK			OK			OK			OK			OK			OK	
1 1/3	.56							OK			OK			OK			OK	
1 2/3	.85							OK			OK			OK			OK	
2	1.2							OK			OK			OK			OK	
2 2/3	1.5							OK			OK			OK				
3 1/3	1.8							OK			OK			OK				
4	2.3							OK			OK			OK				
5 1/3	2.9	↓						OK			OK			OK				
6 2/3	3.8	—	.04					OK			OK			OK				
8	4.5	—	.05					OK			OK			OK				
10 2/3		—	↑	.07				OK			OK			OK				
13 1/3		OK						OK			OK			OK				
16								OK			OK			OK				
21 1/3								OK			OK			OK				
26 2/3								OK			OK			OK				
32								OK			OK			OK				
33	4.5	↓			↓			OK			OK			OK			↓	

Balance 5 the [illegible] AH

VALVE N° 7 TYPE: [illegible] SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 0.25 PART* AT'D. WHEN SHAK'G: Y-AXIS

*PART MAY BE: LEVER. DIAPHR. & PISTON PARTS 1 & 2 &

F/21

HV-202-300-2RF 0-200 PSIG

DC Solenoid pressure apart 2

Solenoid energized - check for pressure decrease at part 1

Solenoid de-energized - check for pressure increase at part 1

Check for proper shifting at each cycle.

F/22 g-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RIM PSI SQ. D.A	% INCREASE Y-AXIS % DECREASE DE-EN. 0	5%	10%	ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	ENERG. 0	5%	10%
		0	10	20	200	190	180	0	10	20	200	190	180	0	10	20	200	190	180
1	.30	OK			OK			OK			OK			OK			OK		
1 1/3	.56							OK			OK								
1 2/3	.85 V.							OK			OK								
2	1.2							OK			OK								
2 2/3	1.5							OK			OK								
3 1/3	1.8							OK			OK								
4	2.3							OK			OK								
5 1/3	2.9							OK			OK								
6 3	3.8							OK			OK								
8 g	4.5							OK			OK								
10 2/3	A							OK			OK								
13 1/3								OK			OK								
16								OK			OK								
21 1/3								OK			OK								
26 2/3								GK			OK								
32								OK			OK								
33	4.5							OK			OK								

+ Plate

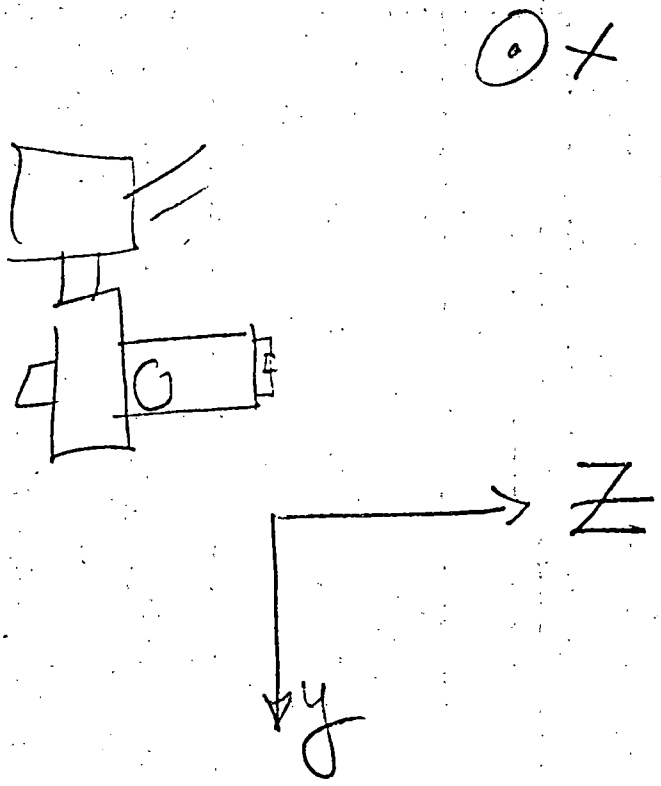
VALVE N°2 TYPE: NP 8321A5E SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 200 PART* AT D. WHEN SHAKING Y-AXIS

90 VDC

*PART MAY BE: LEVER, DIAPHR. & (PISTON) PORTS 1 & 2 &

BACK OF F/22



F/23 g-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RIM PSI / SQ. D.A	Y-AXIS % INCREASE DE-EN 0	5%	10%	Y-AXIS % DECREASE ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENERG. 0	5%	10%
		0	0.5	1.0	10	9.5	9.0	0	0.5	1.0	10	9.5	9.0	0	0.5	1.0	10	9.5	9.0
1	.30	OK			OK			OK			OK			OK			OK		
1 1/3	.56							OK			OK			OK			OK		
1 2/3	.85							OK			OK			OK			OK		
2	1.2							OK			OK			OK			OK		
2 2/3	1.5							OK			OK			OK			OK		
3 1/3	1.8							OK			OK			OK			OK		
4	2.3							OK			OK			OK			OK		
5 1/3	2.9							OK			OK			OK			OK		
6 3/4	3.8													OK			OK		
8	4.5							OK			OK			OK			OK		
10 2/3	A							OK			OK			OK			OK		
13 1/3								OK			OK			OK			OK		
16								OK			OK			OK			OK		
21 1/3								OK			OK			OK			OK		
26 2/3								OK			OK			OK			OK		
32								OK			OK			OK			OK		
33	4.5							OK			OK			OK			OK		

1 PLATE USED AT THE FOR 1/4

VALVE N° 8 TYPE:

INLET PRESSURE 10

SOLENOID ATTITUDE: Z-AXIS

PART* AT D. WHEN SHAKG: Y-AXIS

*PART MAY BE: LEVER, DIAPHR. &, PISTON, PORTS 1 & 2 &

F/24

NP8321A5E 10-200 PSIG

DC Solenoid pressure at port P

Solenoid energized - check for pressure decrease at port A

Solenoid de-energized - check for pressure increase at port A

Check for proper shifting at each cycle.

F/25 G-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RIM PSI / G D.A	Y-AXIS % INCREASE DE-EN. 0	5%	10%	Y-AXIS % DECREASE ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENERG. 0	5%	10%
		0	2	4	40	38	36	0	2	4	40	38	36	0	2	4	40	38	36
1	.30	OK			OK			OK			OK			OK			OK		
1 1/3	.56																		
1 2/3	.85 V.																		
2	1.2																		
2 2/3	1.5																		
3 1/3	1.8																		
4	2.3																		
5 1/3	2.9																		
6 3	3.8																		
8	4.5																		
10 2/3	↑																		
13 1/3																			
16																			
21 1/3																			
26 2/3																			
32	↓																		
33	4.5																		

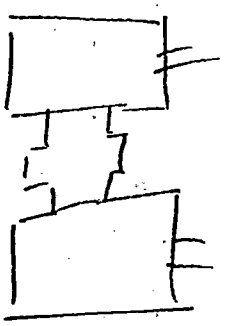
VALVE N° 9 TYPE: NP 8323A39E SOLENOID ATTITUDE: Z-AXIS

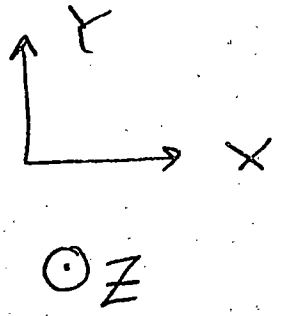
INLET PRESSURE 0-40 PART* AT I.D. WHEN SHAKEN: Y-AXIS

102 AC/90 DC

*PART MAY BE: LEVER, DIAPHR. &, PISTON, PORTS 1 & 2 &

BACK OF F/25





F/26 G-LEVELS REACHED FOR % BACK PRESS.

FREQ	MIN PEAK RMS G's / PSI D.A	Y-AXIS DE-EN 0	5%	10%	Y-AXIS ENERG. 0	5%	10%	Z-AXIS DE-EN 0	5%	10%	Z-AXIS ENERG. 0	5%	10%	X-AXIS DE-EN 0	5%	10%	X-AXIS ENER. 0	5%
		0			0.25			0			0.25			0			0.25	
1	.30	OK						OK			OK			OK				
1 1/3	.56																	
1 2/3	.85																	
2	1.2																	
2 2/3	1.5																	
3 1/3	1.8																	
4	2.3																	
5 1/3	2.9																	
6 2/3	3.8																	
8	4.5																	
10 2/3	↑																	
13 1/3																		
16																		
21 1/3																		
26 2/3																		
32	*																	
33	4.5	↓			↓			↓			↓			↓			↓	

VALVE N°9 TYPE:

SOLENOID ATTITUDE: Z-AXIS

INLET PRESSURE 0.25

PART* AT I.D. WHEN SHAKING: Y-AXIS

*PART MAY BE: LEVER. DIAPHR. & PISTON PARTS 1 & 2

F/27

NP 8323A39E 0-40 PSIG

Sol A AC Pressure at port 2
Sol B DC

Test as follows:

Sol. A energized - check for pressure decrease at part 1

Sol. B energized - check for pressure decrease at part 1

Both Sol. A & B energized - check for pressure decrease at part 1

Both Sol A + B de-energized - check for pressure increase at part 1

check for proper shifting at each cycle

APPENDIX G

'ASCO' SEISMIC TESTS SUMMARY

AND OPERATIONAL DATA

Isomedix, Inc. • 25 Eastmans Road, Parsippany, New Jersey 07054 (201) 887-4700

Chicago, Illinois • 7828 Nagle Ave., Morton Grove, Illinois 60053 (312) 966-1160
Columbus, Mississippi • Post Office Box 2044, Industrial Park South, Columbus, Mississippi 39701 (601) 327-8015

Summary of SEISMIC TESTS conducted at Automatic Switch Co.

The nine valves were seismic fragility tested per Para 9.4.2 .4.2.3 of ASCO Qualification Specification AQS-21678 Revision B (Appendix A). They were individually mounted with solenoids in vertical upright position and rigidly fastened to the seismic shaker for sinusoidal vibration in horizontal and vertical axes.

The valves were connected electrically, inlet to instrument grade air supply, and cylinder port to small reservoir. They were tested with single frequency sinusoidal motion at one-third octave intervals from 1 to 33 Hz to minimum limit shown of Fig. 9.1 of ASCO Qualification Specification AQS-21678 Revision B to a maximum of 10g or onset of malfunction, which is defined as a change of 10% of inlet pressure from the nominal pressure at the cylinder port.

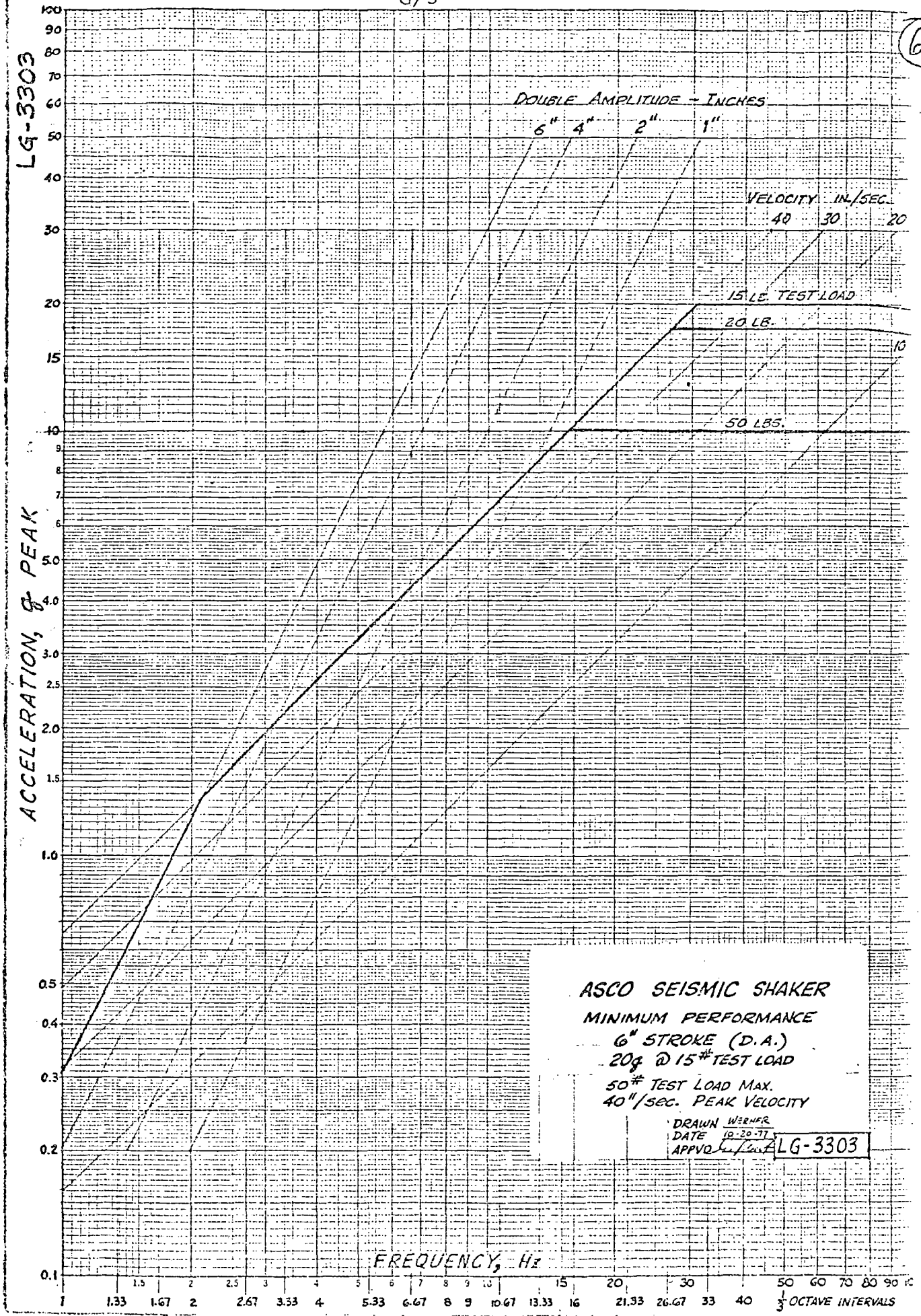
Acceleration forces (g-levels) were limited by the machine capability of 6" maximum displacement, 40"/sec. maximum velocity and an arbitrarily selected 10g maximum acceleration. See Figure attached.

All the valves (except valve No. 7) passed the functional requirements. Following is the summary of the g-levels reached in energized and de-energized states and pressures:

Valve No.	Pressure	g-level Energized	g-level De-energized
1	7" water	10	7.0
	125 psi	10	5.5
2	10 psi	10	8.5
	125 psi	10	10
3	10 psi	9.7	10
	125 psi	10	10
4	7" water	10	4.7
	150 psi	10	6.5
5	7" water	10	10
	150 psi	10	10
6	10 psi	10	10
	175 psi	10	10
7	7" water	10	1.4
	200 psi	10	3.0
8	10 psi	10	10
	200 psi	10	10
9	7" water	10	9.0
	40 psi	10	8.8

(6B)

LG-3303



ASCO SEISMIC SHAKER

MINIMUM PERFORMANCE

6" STROKE (D.A.)

20g @ 15# TEST LOAD

50# TEST LOAD MAX.

40"/sec. PEAK VELOCITY

DRAWN WERNER
DATE 10-20-77
APPVD

LG-3303

6/4

		Y AXIS						Z AXIS						X AXIS					
		DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
H_z	G	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
		0 PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI	0 PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI	0 PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI
1	.31	OK			OK			OK			OK			OK			OK		
1-1/3	.54																		
1-2/3	.85																		
2	1.23																		
2-2/3	1.7																		
3-1/3	2.2																		
4	2.6																		
5-1/3	3.5																		
6-2/3	4.3																		
8	5.2																		
10-2/3	6.9	5.5	5.5	5.5															
13-1/3	8.7	6.0	6.0	6.0															
16	10	5.5	5.5	5.5															
21-1/3		5.5	5.5	5.5															
26-2/3		5.5	5.5	5.5															
33		5.5	6.3	6.7															
40		3.5	7.0	8.5															

VALVE #206-381-6F TYPE DC .154 Amps LWO 2908
INLET PRESSURE (125 PSI) IX #1 DATE 10-24-77

G/S

Hz	$\frac{\Delta P_{cyl}}{P_{in}}$	Y AXIS DE-ENERGIZED 0	Y AXIS DE-ENERGIZED 5%	Y AXIS DE-ENERGIZED 10%	Y AXIS ENERGIZED 0	Y AXIS ENERGIZED 5%	Y AXIS ENERGIZED 10%	Z AXIS DE-ENERGIZED 0	Z AXIS DE-ENERGIZED 5%	Z AXIS DE-ENERGIZED 10%	Z AXIS ENERGIZED 0	Z AXIS ENERGIZED 5%	Z AXIS ENERGIZED 10%	X AXIS DE-ENERGIZED 0	X AXIS DE-ENERGIZED 5%	X AXIS DE-ENERGIZED 10%	X AXIS ENERGIZED 0	X AXIS ENERGIZED 5%	X AXIS ENERGIZED 10%
	"H_2O	0 PSI	.35" PSI	.70 PSI	7" PSI	6.7 PSI	6.3 PSI	0 PSI	.35 PSI	.70 PSI	7" PSI	6.7 PSI	6.3 PSI	0 PSI	.35 PSI	.70 PSI	7" PSI	6.7 PSI	6.3 PSI
1	.31	OK			OK			OK			OK			OK			OK		
1-1/3	.54																		
1-2/3	.85																		
2	1.23																		
2-2/3	1.7																		
3-1/3	2.2																		
4	2.6																		
5-1/3	3.5																		
6-2/3	4.3																		
8	5.2																		
10-2/3	6.9																		
13-1/3	8.7																		
16	10	9.9	10	OK															
21-1/3		7.0	10	OK															
26-2/3		7.0	7.0	7.0															
33		OK																	
40		↓			↓			↓			↓			↓			↓		

VALVE # 206-381-6F TYPE DC .154 Amps LWO 2907
INLET PRESSURE 0-125 PSI (7" H_2O) IX # 1 DATE 12-24-77

6/6

(7)

"B"

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. RT PRESSURE WITH RESPECT TO INLET PRESSURE	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	0 PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI	0 PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI	0 PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI
Hz / g																		
1 .31	OK			OK			OK			OK			OK			OK		
1-1/3 .54																		
1-2/3 .85																		
2 1.23																		
2-2/3 1.7																		
3-1/3 2.2																		
4 2.6																		
5-1/3 3.5																		
6-2/3 4.3																		
8 5.2																		
10-2/3 6.9																		
13-1/3 8.7																		
16 10																		
21-1/3																		
26-2/3																		
33																		
40	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

VALVE #8344A71E; TYPE DC .074 Amps LWO 2823

INLET PRESSURE 125 psi IX #2 DATE 10-19-77

6/7 (8)

"B"

		Y AXIS						Z AXIS						X AXIS					
		DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. PRESSURE WITH RESPECT TO INLET PRESSURE		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
		0 PSI	15 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI	0 PSI	15 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI	0 PSI	15 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI
Hz	g																		
1	.31	OK			OK			OK			OK			OK			OK		
1-1/3	.54																		
1-2/3	.85																		
2	1.23																		
2-2/3	1.7																		
3-1/3	2.2																		
4	2.6																		
5-1/3	3.5																		
6-2/3	4.3																		
8	5.2																		
10-2/3	6.9																		
13-1/3	8.7																		
16	10	8.7	8.7	9															
21-1/3		8.7	8.7	9															
26-2/3		8.9	8.9	9															
33		7	7	8.5															
40		9	9	9.5															

VALVE #8344A71E TYPED(.074 Amps (10 psi)

INLET PRESSURE

IX#2 LWO 2823

DATE 10-19-77

G/8

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. RT PRESSURE WITH RESPECT TO INLET PRESSURE	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI	PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI	PSI	6 PSI	12.5 PSI	125 PSI	119 PSI	112 PSI
Hz g																		
1 .31	OK			OK			OK			OK			OK			OK		
1-1/3 .54																		
1-2/3 .85																		
2 1.23																		
2-2/3 1.7																		
3-1/3 2.2																		
4 2.6																		
5-1/3 3.5																		
6-2/3 4.3																		
8 5.2																		
10-2/3 6.9																		
13-1/3 8.7																		
16 10																		
21-1/3																		
26-2/3																		
33																		
40																		

VALVE #8316541 TYPE AC 102/60

INLET PRESSURE (125 PSI) IX#3 DATE 10-27-77

6/9

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. RT PRESSURE WITH RESPECT TO INLET PRESSURE	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	PSI	.5 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI	PSI	.5 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI	PSI	.5 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI
Hz g																		
1 .31	OK			OK			OK			OK			OK			OK		
1-1/3 .54																		
1-2/3 .85																		
2 1.23																		
2-2/3 1.7																		
3-1/3 2.2																		
4 2.6																		
5-1/3 3.5																		
6-2/3 4.3																		
8 5.2																		
10-2/3 6.9																		
13-1/3 8.7																		
16 10																9.5	9.5	9.
21-1/3																OK		
26-2/3																		
33																		
40																		

VALVE # 8316540 ; TYPE AC ; 102/60

INLET PRESSURE (10 PSI)

IX #3

DATE 10-27-77

G/10

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
ANGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	PSI	8 PSI	15 PSI	150 PSI	142 PSI	135 PSI	PSI	8 PSI	15 PSI	150 PSI	142 PSI	135 PSI	PSI	8 PSI	15 PSI	150 PSI	142 PSI	135 PSI
Hz g																		
1 .31	OK			OK			OK			OK			OK			OK		
1-1/3 .54																		
1-2/3 .85																		
2 1.23																		
2-2/3 1.7																		
3-1/3 2.2																		
4 2.6																		
5-1/3 3.5																		
6-2/3 4.3																		
8 5.2																		
10-2/3 6.9																		
13-1/3 8.7	6.8	7.2	75															
16 10	6.8	9.2	9.7															
21-1/3	7.1	9.5	10															
26-2/3	7.8	9.5	10															
33	5.5	6.5	6.5															
40	5.7	19.0	19.8															

VALVE #206-380-3RF TYPE AC 102/60 LWO 2907

INLET PRESSURE 150psi IX# 4 DATE 10-19-77

6/11

		Y AXIS						Z AXIS						X AXIS					
		DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
CHANGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
		0 PSI	.35 PSI	.70 PSI	7" PSI	6.7 PSI	6.3 PSI	0 PSI	.35 PSI	.70 PSI	7 PSI	6.7 PSI	6.3 PSI	0 PSI	.35 PSI	.70 PSI	7 PSI	6.7 PSI	6.3 PSI
Hz	g																		
1	.31	OK			OK			OK			OK			OK			OK		
1-1/3	.54																		
1-2/3	.85																		
2	1.23																		
2-2/3	1.7																		
3-1/3	2.2																		
4	2.6																		
5-1/3	3.5	3.2	3.5	OK															
6-2/3	4.3	3.0	3.3	5.0															
8	5.2	3.5	4.5	4.8															
10-2/3	6.9	4.0	4.7	5.3															
13-1/3	8.7	4.2	5.5	5.7															
16	10	4.3	4.5	5.3															
21-1/3		4.5	5.5	6.2															
26-2/3		3.0	3.7	4.7															
33		2.5	3.2	5.0															
40		4.7	17.2	10															

VALVE #206-380-3RFNPE AC ; 102/60 LWO 2407

INLET PRESSURE 7"H2O IX#4 DATE 10-19-77

9/12 19 25

		Y AXIS						Z AXIS						X AXIS					
		DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
		PSI	3 PSI	11 PSI	150 PSI	142 PSI	135 PSI	PSI	8 PSI	15 PSI	150 PSI	142 PSI	135 PSI	PSI	8 PSI	15 PSI	150 PSI	142 PSI	135 PSI
Hz	g																		
1	.31	OK			OK			OK			OK			OK			OK		
1-1/3	.54																		
1-2/3	.85																		
2	1.23																		
2-2/3	1.7																		
3-1/3	2.2																		
4	2.6																		
5-1/3	3.5																		
6-2/3	4.3																		
8	5.2																		
10-2/3	6.9																		
13-1/3	8.7																		
16	10																		
21-1/3																			
26-2/3																			
33																			
40	↓	↓			↓			↓			↓			↓			↓		

VALVE #8320A184E TYPE AC 102/60
INLET PRESSURE (150 psi) IX# 5 DATE 10-27-77

6/13

18 g 25

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NCE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE	0 PSI	5% .035" PSI	10% .07" PSI	0 7" PSI	5% 6.7" PSI	10% 6.3" PSI	0 PSI	5% .035" PSI	10% .07" PSI	0 7" PSI	5% 6.7" PSI	10% 6.3" PSI	0 PSI	5% .035" PSI	10% .07" PSI	0 7" PSI	5% 6.7" PSI	10% 6.3" PSI
Hz g																		
1 .31	OK			OK			OK			OK			OK			OK		
1-1/3 .54																		
1-2/3 .85																		
2 1.23																		
2-2/3 1.7																		
3-1/3 2.2																		
4 2.6																		
5-1/3 3.5																		
6-2/3 4.3																		
8 5.2																		
10-2/3 6.9																		
13-1/3 8.7																		
16 10																		
21-1/3																		
26-2/3																		
33																		
40																		

VALVE #8330A184E; TYPE AC 102/60

INLET PRESSURE 7" H2O

IX #5

DATE 10-27-77

G/14 3344

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE	0 PSI	5% .5 PSI	10% 1 PSI	0 10 PSI	5% 9.5 PSI	10% 9 PSI	0 PSI	5% .5 PSI	10% 1 PSI	0 10 PSI	5% 9.5 PSI	10% 9 PSI	0 PSI	5% .5 PSI	10% 1 PSI	0 10 PSI	5% 9.5 PSI	10% 9 PSI
Hz / g																		
1 .31	OK			OK			OK			OK			OK			OK		
1-1/3 .54																		
1-2/3 .85																		
2 1.23																		
2-2/3 1.7																		
3-1/3 2.2																		
4 2.6																		
5-1/3 3.5																		
6-2/3 4.3																		
8 5.2																		
10-2/3 6.9																		
13-1/3 8.7																		
16 10																		
21-1/3																		
26-2/3																		
33																		
40																		

VALVE #8316GE3 TYPE DC .074 Amps.
INLET PRESSURE 10 psi. IX#6 DATE 10-27-77

G/15

		Y AXIS						Z AXIS						X AXIS					
		DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
		PSI	9 PSI	175 PSI	175 PSI	166 PSI	158 PSI	PSI	9 PSI	175 PSI	175 PSI	166 PSI	158 PSI	PSI	9 PSI	175 PSI	175 PSI	166 PSI	158 PSI
Hz	g																		
1	.31	OK			OK			OK			OK			OK			OK		
1-1/3	.54																		
1-2/3	.85																		
2	1.23																		
2-2/3	1.7																		
3-1/3	2.2																		
4	2.6																		
5-1/3	3.5																		
6-2/3	4.3																		
8	5.2																		
10-2/3	6.9																		
13-1/3	8.7																		
16	10																		
21-1/3																			
26-2/3																			
33																			
40																			

VALVE #8316 65 E TYPE DC .074 Amps

INLET PRESSURE (175)

IX#6

DATE - 10-27-77

6/16

34 y (88

		Y AXIS						Z AXIS						X AXIS					
		DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
ANGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
		0 PSI	10 PSI	20 PSI	200 PSI	190 PSI	180 PSI	0 PSI	10 PSI	20 PSI	200 PSI	190 PSI	180 PSI	0 PSI	10 PSI	20 PSI	200 PSI	190 PSI	180 PSI
Hz	g																		
1	.31	OK			OK			OK			OK			OK			OK		
1-1/3	.54	OK																	
1-2/3	.85																		
2	1.23																		
2-2/3	1.7																		
3-1/3	2.2																		
4	2.6																		
5-1/3	3.5	✓																	
6-2/3	4.3	2.7	3.4	4.3															
8	5.2	2.7	4.7	5.0															
10-2/3	6.9	2.7	4.0	4.0															
13-1/3	8.7	2.5	3.0	3.0															
16	10	2.5	4.0	4.0															
21-1/3		1.5	2.5	3.5															
26-2/3		2.2	5.0	6.5															
33		4.5	10	OK															
40	↓	9.5	10	OK				↓			↓			↓			↓		

VALVE #202300-2RF TYPE DC 1.177 Rads LWO 2907

INLET PRESSURE 200 psi IX# 7 DATE 10-18-77

6/17

(33.0)

		Y AXIS						Z AXIS						X AXIS					
		DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	"H_2O ~~PSI~~	0	.35	.90	7	6.7	6.3	0	.35	.70	7	6.7	6.3	0	.35	.70	7	6.7	6.3
Hz	g																		
1	.31	OK			OK			OK			OK			OK			OK		
1-1/3	.54																		
1-2/3	.85																		
2	1.23																		
2-2/3	1.7	1.2	1.3	1.4															
3-1/3	2.2	1.5	1.6	1.6															
4	2.6	1.5	1.6	1.6															
5-1/3	3.5	1.6	1.8	1.8															
6-2/3	4.3	1.7	1.8	1.9															
8	5.2	1.8	2.0	2.0															
10-2/3	6.9	2.0	2.3	2.3															
13-1/3	8.7	2.0	2.0	2.0															
16	10	2.0	2.0	2.0															
21-1/3		2.0	2.3	2.4															
26-2/3		2.7	3.9	4.0															
33		3.2	3.7	3.7															
40		3.7	9	9															

VALVE #202-300-2RF TYPE DC .177 Amps LWO 2902

INLET PRESSURE 7" H20 IX #7 DATE 10-18-77

6/18

13 of 17

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
NGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	0 PSI	10 PSI	20 PSI	200 PSI	190 PSI	180 PSI	0 PSI	10 PSI	20 PSI	200 PSI	190 PSI	180 PSI	0 PSI	10 PSI	20 PSI	200 PSI	190 PSI	180 PSI
Hz g																		
1 .31	OK			OK			OK			OK			OK			OK		
1-1/3 .54																		
1-2/3 .85																		
2 1.23																		
2-2/3 1.7																		
3-1/3 2.2																		
4 2.6																		
5-1/3 3.5																		
6-2/3 4.3																		
8 5.2																		
10-2/3 6.9																		
13-1/3 8.7																		
16 10																		
21-1/3																		
26-2/3																		
33																		
40	↓			↓			↓			↓			↓			↓		

VALVE #8321A1E TYPE DC 1.074 Amps LWO 2703

INLET PRESSURE 200 PSI IX #8 DATE 10-25-77

9/19 12/17

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
CHANGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	0 PSI	.5 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI	0 PSI	.5 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI	0 PSI	.5 PSI	1 PSI	10 PSI	9.5 PSI	9 PSI
Hz g																		
1 .31	OK			OK			OK			OK			OK			OK		
1-1/3 .54																		
1-2/3 .85																		
2 1.23																		
2-2/3 1.7																		
3-1/3 2.2																		
4 2.6																		
5-1/3 3.5																		
6-2/3 4.3																		
8 5.2																		
10-2/3 6.9																		
13-1/3 8.7																		
16 10																		
21-1/3																		
26-2/3																		
33																		
40																		

VALVE #832/A1E TYPE DC .074 Amps LW0 2703

INLET PRESSURE (10 PSI) IX #8 DATE 10-25-77

6/20

	Y AXIS						Z AXIS						X AXIS					
	DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
CHANGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	0 PSI	2 PSI	4 PSI	40 PSI	38 PSI	36 PSI	0 PSI	2 PSI	4 PSI	40 PSI	38 PSI	36 PSI	0 PSI	2 PSI	4 PSI	40 PSI	38 PSI	36 PSI
Hz / g																		
1 / .31	OK			OK			OK			OK			OK			OK		
1-1/3 / .54																		
1-2/3 / .85																		
2 / 1.23																		
2-2/3 / 1.7																		
3-1/3 / 2.2																		
4 / 2.6																		
5-1/3 / 3.5																		
6-2/3 / 4.3																		
8 / 5.2																		
10-2/3 / 6.9																		
13-1/3 / 8.7	↓																	
16 / 10	7.5	7.5	8.8															
21-1/3	OK																	
26-2/3																		
33																		
40 / ↓	↓			↓			↓			↓			↓			↓		

VALVE #8323A39E TYPE AC/DC 102/.074 Amps

INLET PRESSURE 40 psi IX*9

DATE 10-27-77

W.O 2834

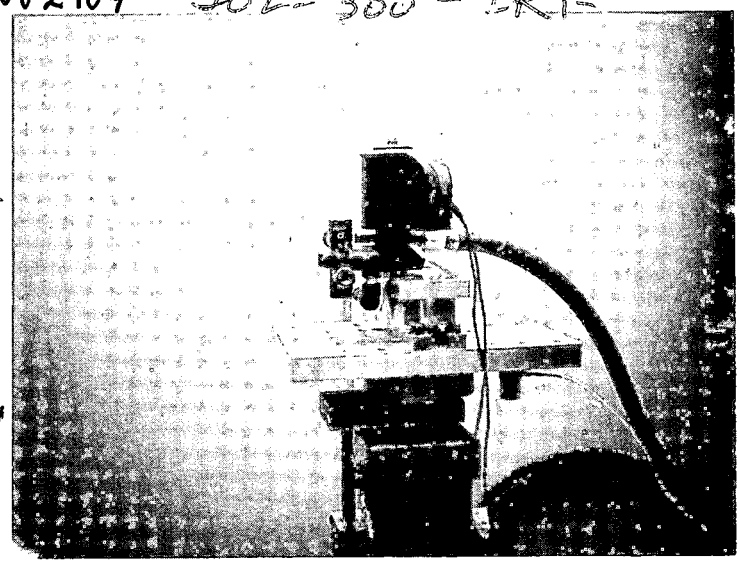
G/21

		Y AXIS						Z AXIS						X AXIS					
		DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED			DE-ENERGIZED			ENERGIZED		
ANGE IN CYL. PORT PRESSURE WITH RESPECT TO INLET PRESSURE		0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%	0	5%	10%
	H_2O	0 PSI	.35" PSI	.7" PSI	7" PSI	6.7" PSI	6.3" PSI	0 PSI	.35" PSI	.7" PSI	7" PSI	6.7" PSI	6.3" PSI	0 PSI	.35" PSI	.7" PSI	7" PSI	6.7" PSI	6.3" PSI
Hz	g																		
1	.31	ok			ok			ok			ok			ok			ok		
1-1/3	.54																		
1-2/3	.85																		
2	1.23																		
2-2/3	1.7																		
3-1/3	2.2																		
4	2.6																		
5-1/3	3.5																		
6-2/3	4.3																		
8	5.2																		
10-2/3	6.9																		
13-1/3	8.7																		
16	10	8.1	8.1	9															
21-1/3		OK																	
26-2/3																			
33																			
40																			

VALVE #8323A39E TYPE AC/DC 102/60 / .074Amps DATE 10-27-77

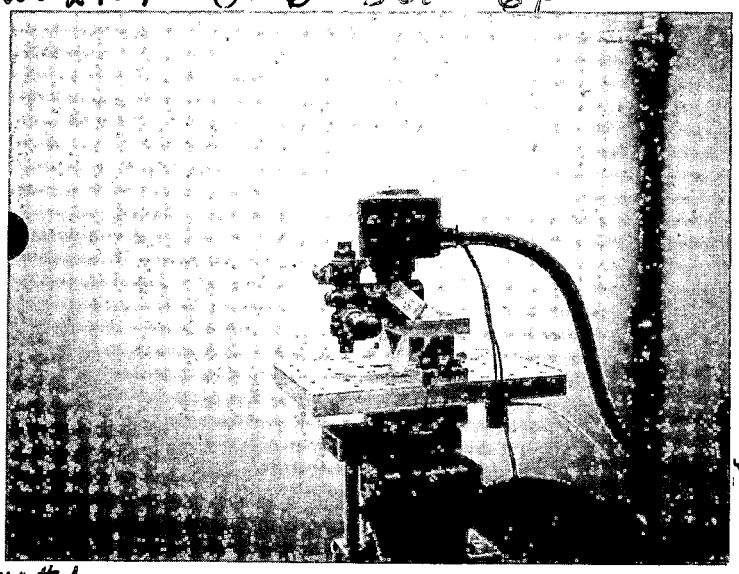
INLET PRESSURE 7"H2O IX*9 WO 2834

LWO 2907 202-300-3RE



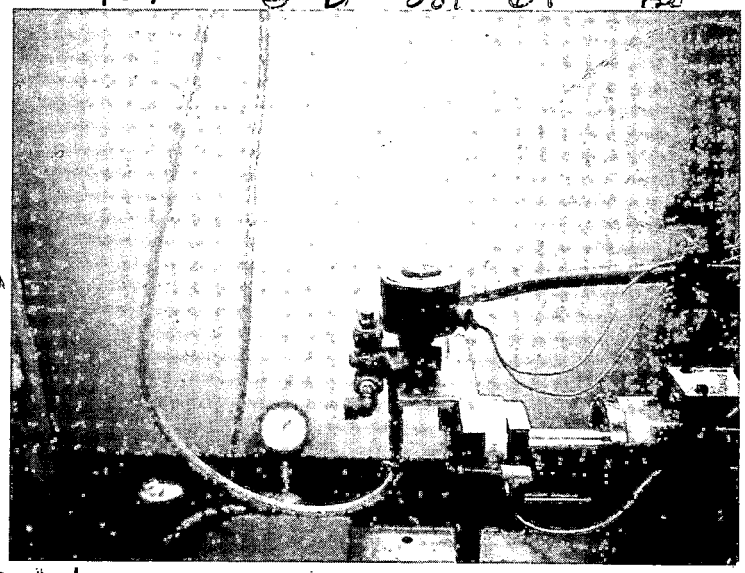
IX #7 ← X 10-18-77

LWO 2907 206-381-6F



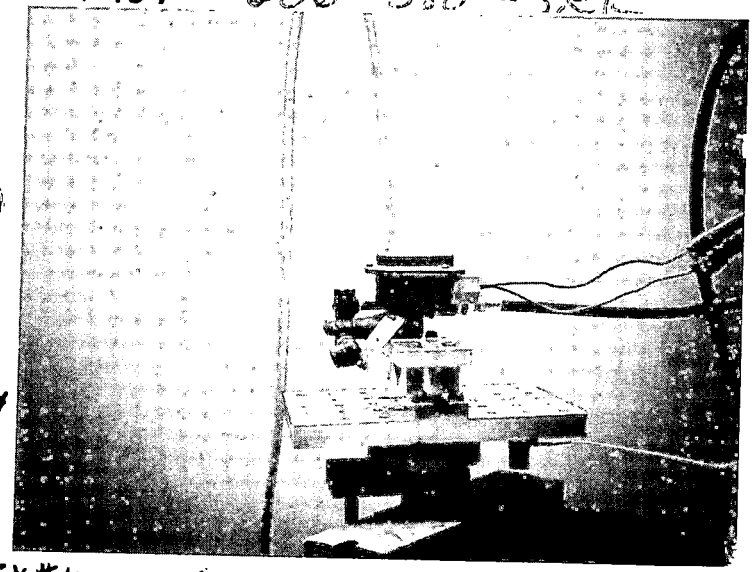
IX #1 ← X 10-18-77

LWO 2907 206-381-6F RF



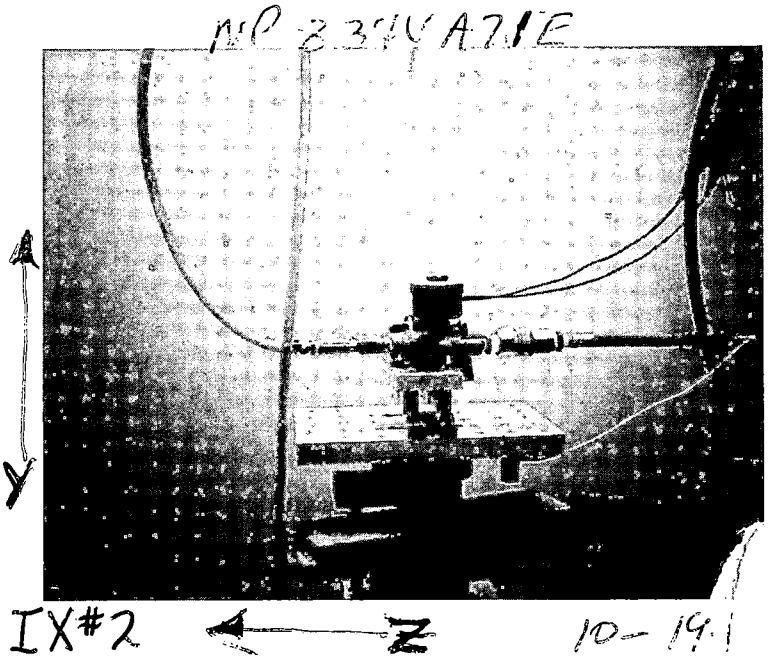
IX #1 ← X 10-14-77

LWO 2907 206-380-3RE

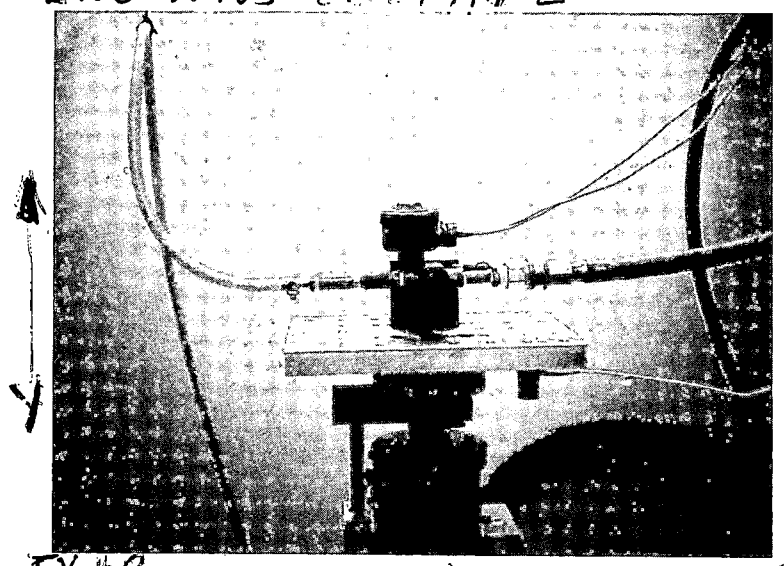


IX #4 ← X 10-19-77

G/23

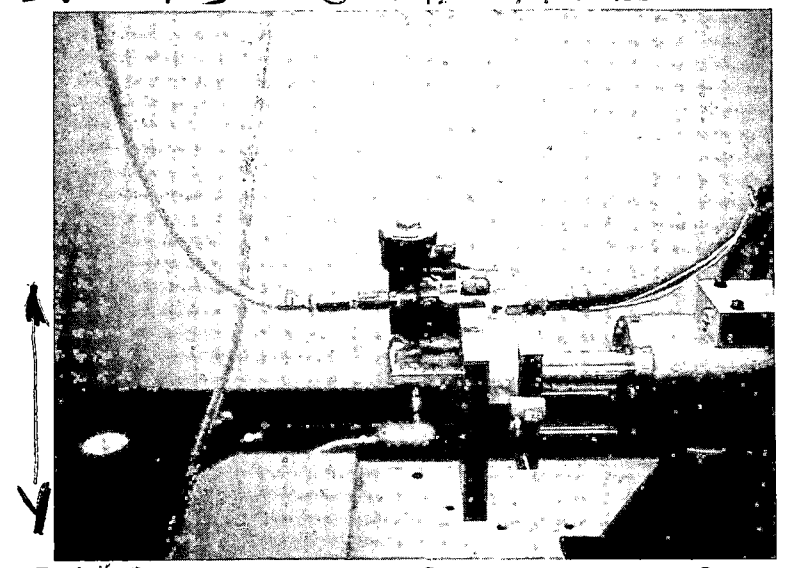


LWO 2703 8321 A I E



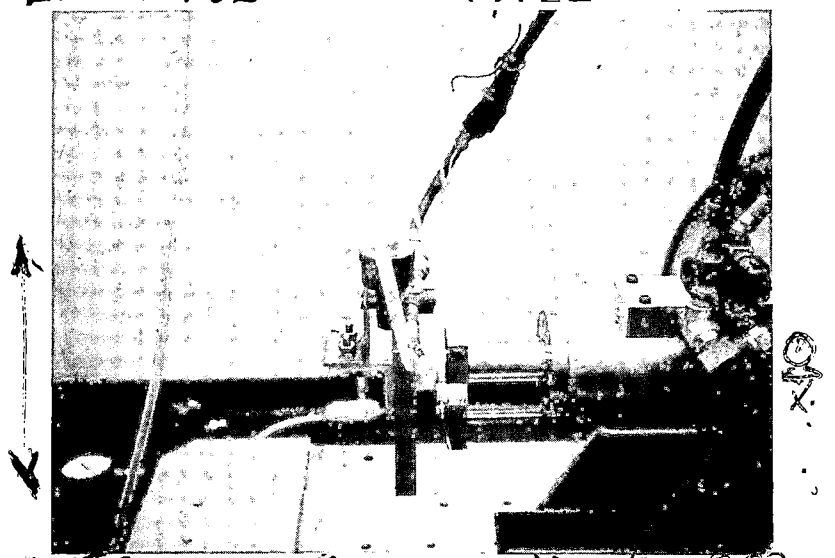
IX#8 10-20-77

LWO 2703 8321 A I E



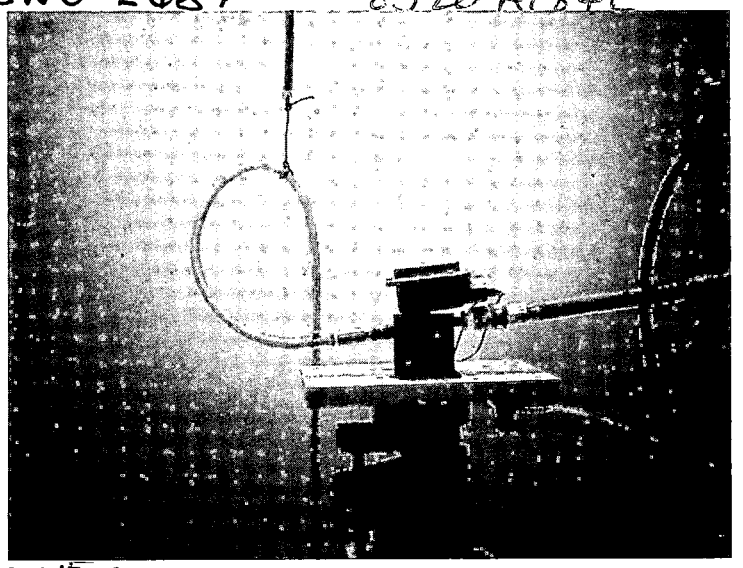
IX#8 10-25-77

LWO 2703 8321 A I E



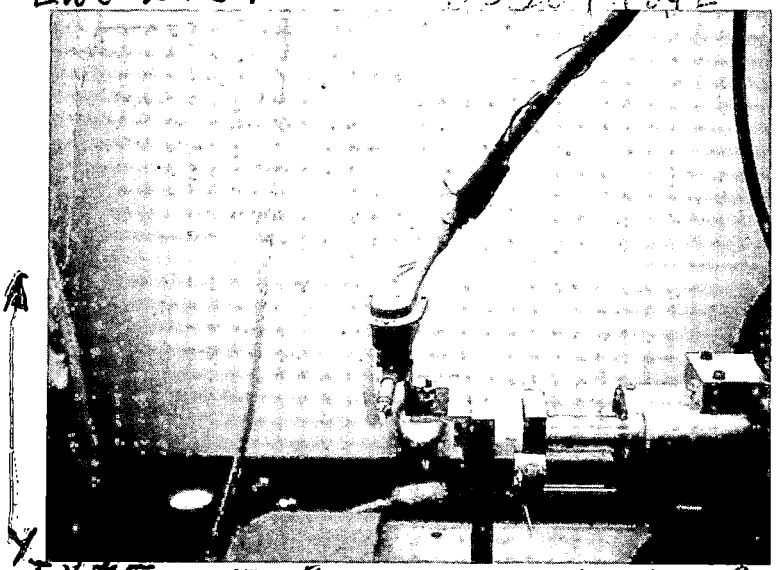
IX#8 10-25-77

LWO 2687 8320A184E



IX#5 Y Z 10-20-77

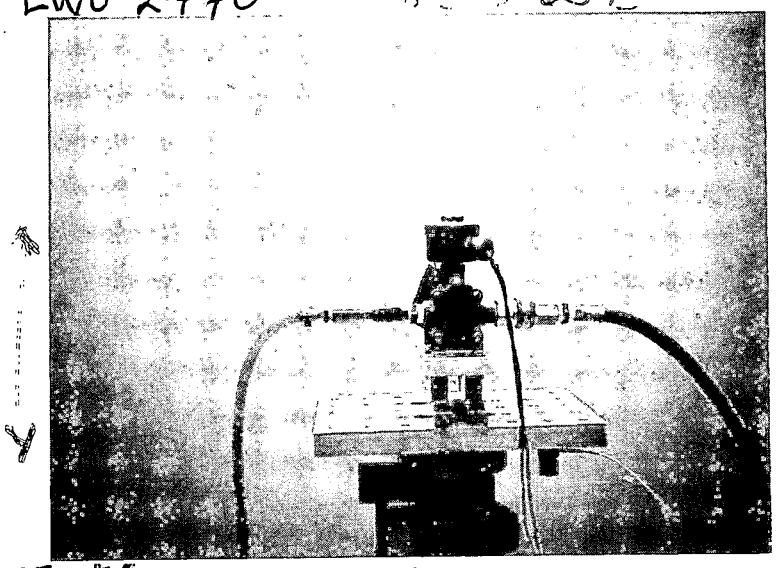
LWO 2687 8320A184E



IX#5 Y Z Z 10-28-77

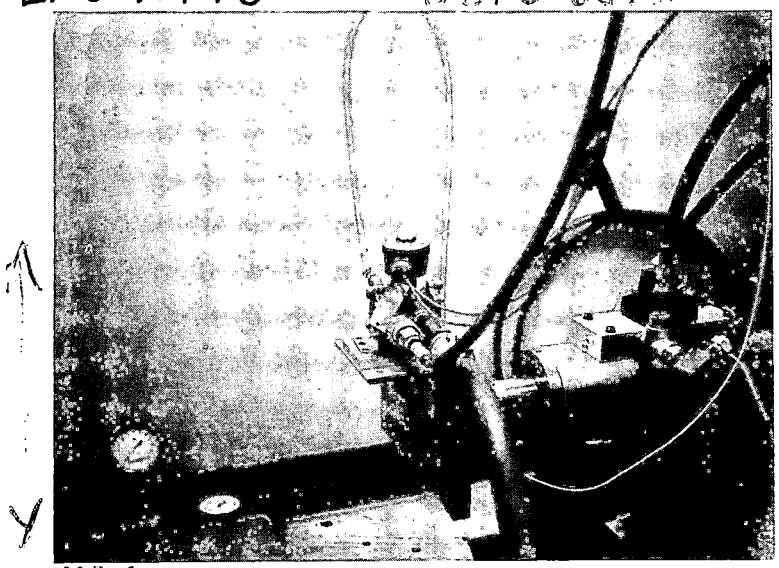
G/26

LWO 2776 83'' 65E



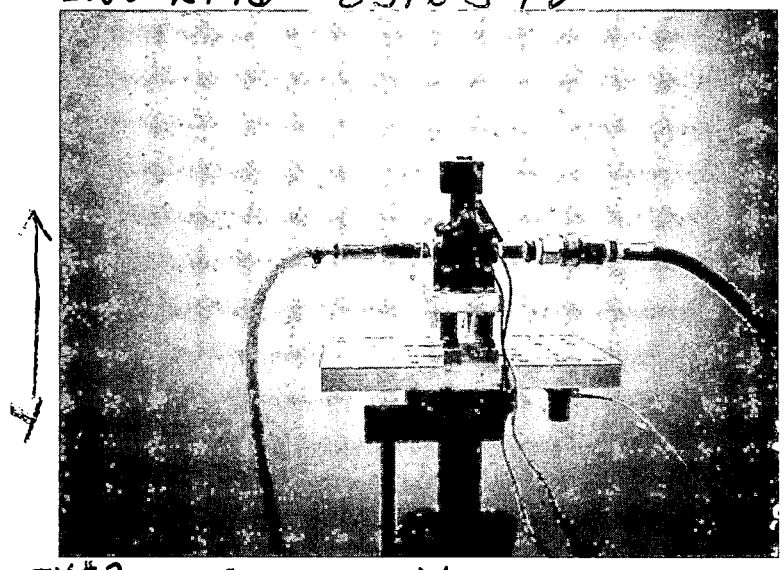
IX#6 ← Z X 10-18-77

LWO 2776 8316 65E



IX#6 ← Z

LWO 2776 8316 54V



IX#3 ← X 10-18-77