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DOUGLAS

MISSILE & SPACE SYSTEMS DIVISION
DOUGLAS AIRCRAFT CO., INC.

ENGINEERING LABORATORIES & SERVICES
TECHNICAL MEMORANDUM

CATALOG NO. PDL 71368

TO: R. M. Gunn, A3-860

FROM: J. P. Loef, A-270, EXT. 2440/2441

SUBJECT: PROPULSIVE FUEL VENT BELLOWS, SCN 1A87152-1, FORMAL QUALIFICATION TEST

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REPORT NO. TM-DSV4B-ENV-R5776

DATE 11 October 1966

REQUESTED BY R. M. Gunn

E.W.O. 27554 TCD 1T02860, E

TEST PLAN & ITEM NO. SM-41412 FQ-H-17

SALES ORDER 5769-6404

CLASSIFICATION OR RESTRICTION: Unclassified

ORIGINATOR J. H. Brettnacher

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J. P. Loef, Section Chief, Environmental Test, Environmental Laboratories Branch

ATTACHMENTS:
Addendum A - Pages A-1 through A-86
Addendum B - Pages B-1 through B-2
Addendum C - Pages C-1 through C-4
Addendum D - Pages D-1 through D-33
Addendum E - Pages E-1 through E-158
Addendum F - Pages F-1 through F-2

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ABSTRACT

Formal qualification tests of the Propulsive Fuel Vent Bellows, Specification Control Number 1A87152-1, were conducted to demonstrate to National Aeronautics and Space Administration, Marshall Space Flight Center, the capability of a production specimen to meet the requirements of Test Control Drawing 1T02860 Revision E, when tested in accordance with Formal Qualification Test Procedure 1T02861, Revision C.

The test specimen was subjected to inspection and non-destructive environmental tests; i.e., proof pressure, leakage, spring rate, flow, repeat cycles consisting of pressure and deflection at low temperature, sinusoidal and random vibration, and mechanical shock. The bellows sustained minor angular permanent deformation near the end of the repeat cycles post test, as reported in Douglas Failure and Rejection Report A162586, which did not disqualify the test specimen for subsequent testing. Upon completion of the non-destructive environmental tests, the test specimen was pressurized internally until it failed.

The test specimen is considered to have met the requirements of Test Control Drawing 1T02860 Revision E, and to have satisfactorily completed tests to meet the requirements of Formal Qualification Test Program SM-46532, Item FQ-H-17 and General Test Plan SM-41412, Item FQ-H-17.

DESCRIPTORS

Saturn S-IVB	Duct
Bellows	Propulsion System

PREFACE

This report documents, in compliance with contractual requirements, the results of formal qualification tests performed on the Propulsive Fuel Vent Bellows, Specification Control Drawing 1A87152-1. The tests were conducted by Wyle Laboratories, El Segundo, California, from December 9, 1965 through April 11, 1966. The tests were performed under the surveillance of Douglas Aircraft Company, Inc., Engineering Laboratories and Services. All testing was witnessed by the Douglas Quality Control and by the Air Force Quality Assurance Representatives.

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1. INTRODUCTION

1.1 Purpose of Test

The purpose of the formal qualification test is to demonstrate to the National Aeronautics and Space Adminsitration, Marshall Space Flight Center, the ability of the Propulsive Fuel Vent Bellows, Douglas Specification Control Number 1A87152-1, to meet the requirements of Test Control Drawing, 1T02860 Revision E, when tested according to Test Procedure Drawing 1T02861, Revision C.

The tests were authorized under the Formal Qualification Test Program SM-46532, Item FQ-H-17 and General Test Plan SM-41412, Item FQ-H-17.

1.2 Description of Test Specimen

The Propulsive Fuel Vent Bellows, shown photographically on page B-1 of Addendum B, are two 4-inch ID convoluted sections, 3.5 inches long, joined by a tubular section into an assembly that is 10-inches long. The bellows was mounted on its next assembly, Douglas Part Number 1487436-501, during this test. It is located on the forward skirt at Station 615.7 of the Douglas S-IVB stage of the Saturn IB/V Space Flight Vehicle.

1.3 Function

The bellows allows thermal expansion and contraction of the fuel vent duct without the generation of excessive stresses in the duct or stage support structures.

2. TEST SPECIMEN, EQUIPMENT AND INSTRUMENTATION

2.1 Test Part

One production unit of the Propulsive Fuel Vent Bellows, Douglas Specification Control Number 1A87152-1, Fairchild Precision Metal Products Corp., P/N 41204 (F), S/N 042, was tested.

2.2 Test Equipment and Instrumentation

The test equipment and instrumentation used during the performance of the formal qualification tests are described in paragraph 5.3.3 of Addendum E, and are illustrated in the photographs shown on pages 30 through 67 of Addendum E. The test equipment and instrumentation used during the test program were current in certification and were within the test equipment tolerances specified in paragraph 3.1 of Addendum D.

3. TEST REQUIREMENTS

Environmental and instrumentation tolerances, ambient room conditons, gas conditions, temperature stabilization, and failure definition are specified in paragraphs 3.1 through 3.4 of Addendum D.

4. TEST PROCEDURE

4.1 Pretest Inspection

The test specimen was inspected in accordance with paragraph 5.7 of Addendum D.

4.2 Proof Pressure Test

The proof pressure test was performed in accordance with paragraph 5.8 of Addendum D, using the system shown photographically on page 30 of Addendum E, and schematically in figure 1 of Addendum C.

4.3 Leakage Test

The leakage test was performed in accordance with paragraph 5.9 of Addendum D, using the system shown photographically on pages 32 through 34 of Addendum E and schematically in figure 1 of Addendum C.

4.4 Spring Rate Test

The spring rate test was performed in accordance with paragraph 5.14 of Addendum D, using the system shown photographically on page 64 of Addendum E.

4.5 Flow (ΔP) Test

The flow test was performed in accordance with paragraph 5.10 of Addendum D, except that 3 runs were made at 4 pressure increments. The test system is shown photographically on pages 35 through 37 of Addendum E and schematically in figure 2 of Addendum C.

4.6 Repeat Cycle Test

4.6.1 Pressure Cycle Test

The pressure cycle test was performed in accordance with paragraphs 5.15.1, 5.15.2 and 5.15.3 of Addendum D, using the test system shown photographically on page 66 of Addendum E and schematically in figure 3 of Addendum C.

4.6.2 Deflection Cycle Test

The deflection cycle test was performed in accordance with paragraphs 5.15.1, 5.15.4 and 5.15.5, of Addendum D, using the test system shown photographically on pages 66 and 67 of Addendum E and schematically in figure 3 of Addendum C.

4.7 Vibration Test

The vibration test was performed in accordance with paragraph 5.11 of Addendum D, using the test system shown photographically on pages 38 through 40 of Addendum E and schematically on page 28 of Addendum E.

4.8 Shock Test

The shock test was performed on the vibration exciters in accordance with paragraph 5.12 of Addendum D, using the test system shown photographically on pages 38 through 40 of Addendum E and schematically on page 29 of Addendum E.

4.9 Post Vibration and Shock Tests

The post vibration test was performed in accordance with paragraph 5.12.4 of Addendum D.

4.10 Burst Test

The burst test was performed in accordance with paragraph 5.13 of Addendum D, using the test system shown photographically on pages 59 and 60 of Addendum E and schematically in figure 1 of Addendum C.

4.11 Post Test Inspection

The test specimen was inspected in accordance with paragraph 5.16 of Addendum D.

5. TEST RESULTS AND DISCUSSION

5.1 Pretest Inspection

The pretest inspection revealed no shipping or handling damage to the specimen. The results of this inspection are on page 81 of Addendum E. The test part (bellows) was an integral part of the next assembly, Douglas P/N 1A87436-501, for this test; therefore, it was not possible to obtain the weight of the test specimen bellows. During the post test inspection, a production part, 1A87152-1, S/N 033, was weighed and the weight, 2.7 lb, was recorded on data sheet V of Addendum A.

5.2 Proof Pressure Test

The test specimen, installed in and restrained by fixture 1T12844-501, was temperature-stabilized at 68°F and pressurized to 46 psig. These conditions were maintained for 5 minutes. No permanent deformation of the test specimen was evident. The results of this test are shown on page 82 of Addendum E.

5.3 Leakage Test

The test specimen, installed in and restrained by fixture 1T12844-501, was enclosed in a polyethylene bag. The bag was filled with water and the test specimen was temperature-stabilized at 68°F. The test specimen was pressurized to and held at 31 psig for 3 minutes, minimum. There was no evidence of leakage. The results of this test are shown on page 86 of Addendum E.

5.4 Spring Rate Test

The test specimen, installed in and guided by fixture 1T12844-501, was stabilized at 64°F and axially compressed 1-inch. The force required to compress the bellows 1 inch in an axial direction was 96 lb., which is 4 lbs. less than the requirement of 100 lbs maximum. The results of this test are shown on page 124 of Addendum E.

5.5 Flow (ΔP) Test

The test specimen, mounted in and restrained by fixture 1T12844-501, was installed in a pre-tared flow system and subjected to flows of helium gas ranging from 1.233 to 3.123 lb/sec at inlet pressures ranging from 12.3 to 31.5 psig. Because of temperature variations in the flow stream it was necessary to determine more points than originally required and to present the data graphically as $\frac{\Delta P_s}{P_s}$ versus $\frac{W\sqrt{T}}{P_s}$ rather than ΔP versus flow (W). This graph is plotted on page 92 of Addendum E. The requirement values were then used to calculate $\frac{W\sqrt{T}}{P_s}$ and find ΔP, which was 0.9 psid at an inlet pressure of 31 psig, inlet temperature of 70°F and a flow rate of 1.5 lb/sec of gaseous helium. The results of this test are shown on pages 90 through 96 of Addendum E.

5.6 Repeat Cycle Test

5.6.1 Pressure Cycle Test

The test specimen, installed in fixture 1T12844-501, was subjected to 200 pressure cycles at temperatures ranging from -379° to -400°F and with a deflection caused by an axial compression of 1 1/8 inches, a parallel offset of 1 5/16 inches and an angular deflection of 4 degrees. A

5.6.1 Pressure Cycle Test (Cont'd)

cycle consisted of pressurizing the specimen from zero to 32 psig and venting from 32 to zero psig. The specimen sustained no damage or permanent deformation during this cycling. The specimen did not deform nor leak when subjected to the proof pressure and leakage tests of paragraphs 4.2 and 4.3, respectively. The results of this test are shown on pages 83, 87, and 125 of addendum B.

5.6.2 Deflection Cycle Test

The test specimen, installed in fixture 1T12844-501, was subjected to 50 deflection cycles at ambient pressure and temperature. A cycle consisted of simultaneously producing with pneumatic actuators, an axial extension of 15/16 inch, a parallel offset of 1 5/16 inches and an angular deflection of 4 degrees, and then returning the specimen to the neutral position. There was no damage to or permanent deformation of the specimen.

The test specimen, deflected as described above, was temperature-stabilized at -400°F and pressurized to 31.5 psig; then 150 cycles, consisting of an axial extension of 1 1/8 inches and return to 15/16 inch (an additional extension of 3/16 inch) were performed. The specimen temperature was maintained at -379 to -400°F. There was no damage or permanent deformation of the test specimen due to these cycles.

Upon completion of the 200 deflection cycles the proof pressure and leakage tests of paragraphs 4.2 and 4.3, respectively, were performed. The test specimen sustained a permanent deformation after the proof pressure test. This deformation was reported on Failure and Rejection Report A162586, shown on pages F-1 and F-2 of Addendum F, and is shown

5.6.2 Deflection Cycle Test (Cont'd)

photographically on page B-2 of Addendum B and page 31 of Addendum E. The specimen was determined to be acceptable for engineering use and authorization was given to continue testing. The leakage test was performed and there was no evidence of leakage.

The results of these tests are shown on pages 84, 88, and 126 of addendum E.

5.7 Vibration Test

Sinusoidal and random vibration tests were performed on the test specimen in the following sequence: tangential (B), radial (A), and thrust (C) axes. Accelerometers were mounted as shown photographically on pages 41 through 58, Addendum E.

Upon completion of the radial axis vibration, it was discovered that the axis definition of paragraph 5.11.3 of Addendum D did not agree with the direction shown in figure 5 of Addendum D. Since the requirements have one level for the radial axis and another level for the tangential and thrust axes, the radial axis was undertested. The test system had already been changed to perform the thrust axis test; therefore, the vibration in that axis was completed before a retest of the radial axis was made. This retest consisted of a sine sweep at 1 octave per minute from 250 to 2000 to 250 cps at the Direction A levels of paragraph 5.11.4, of Addendum D, and a 12-minute random vibration per paragraph 5.11.5, of Addendum D, at the Direction A levels.

It was necessary to use a combination of automatic servo and manual control mode because of the required multi-shaker test setup and the

5.7 Vibration Test (Cont'd)

necessity of using separate power amplifiers to drive each shaker. Technicans stationed at each control console, reading true RMS voltmeters, adjusted the acceleration level, as feedback through the test specimen tended to cause high acceleration levels at the control points. For this reason, the response to changes in acceleration levels was slow and in many cases the level was allowed to exceed or fall below the specification limits.

The tangential axis sinusoidal vibration was controlled by accelerometer number 1 for the 249 vibration exciter and by accelerometer number 3 for the 246 vibration exciter. Accelerometer number 2 was placed at a second input point on the same fixture (which was driven by the 249 vibration exciter) as accelerometer number 1. Plots of Peak G versus Frequency for these accelerometers are on data sheets I-1 through I-3 of Addendum A. The plot for control accelerometer number 1 indicates an undertest; however, since accelerometer number 2 is an equivalent control location on the same fixture, these plots were overlayed for comparison and indicate the acceleration level was out of specification in only four narrow band areas. These band areas are 46 to 52 cps (2.1G), 94 to 97 cps (3.0G), 165 to 170 cps (2.4G), and 205 to 210 cps (2.7G). Plots of acceleration levels (G peak) versus frequency for response accelerometers are on data sheets I-3 through I-11 of Addendum A.

The random vibration was within -3db or exceeded +3db of the specification level. The full power, short burst PSD (power spectral density) plots from which determination of equalization was made are on pages 128 through

5.7 Vibration Test (Cont'd)

131 of Addendum E. Response accelerometer PSD plots are on data sheets I-12 through I-20 of Addendum A.

The radial axis sinusoidal vibration was controlled by accelerometer number of 2 for the 249 vibration exciter and accelerometer number 3 for the 246 vibration exciter. Accelerometer number 1 was placed at a second input point on the same fixture (which was driven by the 249 vibration exciter) as accelerometer number 1. Plots of Peak G versus Frequency for these accelerometers are on data sheets II-1 through II-3 (5 to 250 to 5 cps) and II-12 through II-14 (250 to 2000 to 250 cps) of Addendum A. The plot for control accelerometer number 2 indicates undertesting in several areas. Again using the overlay of accelerometers 1 and 2, the undertest area is determined to be of narrow frequency band and of short duration. These are 1305 to 1400 cps (4.7G), 1505 to 1515 (5.88G), and 1720 to 1920 (2.35G). Response Acceleration Level versus Frequency plots are on data sheets II-4 through II-11 (5 to 250 to 5 cps) and II-15 through II-22 (250 to 2000 to 250 cps) of Addendum A. The random vibration was within -3db or exceeded +3db of the specification level. The full power, short burst PSD plots from which determination of equalization was made are on pages 149 through 152 of Addendum E. Response accelerometer PSD plots are on data sheets II-23 through II-31 of Addendum A. As a matter of record, the PSD plots for equalization and response accelerometers are included on pages 132 through 135 of Addendum E and data sheets II-32 through II-40 of Addendum A, respectively.

5.7 Vibration Test (Cont'd)

The thrust axis vibration utilized a three-shaker system. The system used for random vibration consisted of a 246 vibration exciter controlled by magnetic tape and accelerometer number 1, a 335 vibration exciter controlled by an ASDE-80 equalizer/analyzer and accelerometer number 2, and a 300 vibration exciter controlled by an ASDE-80 equalizer/analyzer and accelerometer number 3. The sinusoidal vibration system used the same accelerometers to control the shakers through their automatic servo systems. Both the sinusoidal and random vibration were within or exceeded the specified requirement.

Plots of Peak G versus Frequency for the control accelerometers are on data sheets III-1 through III-3 of Addendum A. Sinusoidal response accelerometer plots are on data sheets III-4 through III-11 of Addendum A. The full power, short burst PSD plots from which determination of equalization was made are on pages 136 through 148 of Addendum E. Response accelerometer PSD plots are on data sheets III-12 through III-19 of Addendum A.

All vibration test setups and acceleration levels were approved by the cognizant Douglas Acoustics and Structural Dynamics (A & SD) representative at the test site.

5.8 Shock Test

The shock test for each axis was performed on the vibration exciters upon completion of the sinusoidal and random excitation in that axis. Photographs of the shock pulses are on data sheets IV-1 through IV-6 of

5.8 Shock Test (Cont'd)

Addendum A. The pulse traces (data sheet VII-1) for the first shock pulse in the tangential axis are not discernible; however, no adjustments were made between this pulse and pulses No. 2 and 3; therefore, the photographs of pulses No. 2 and 3 verify the shock pulse amplitude and duration for all three pulses. During the third shock pulse (data sheet IV-3) in the radial axis, the 246 vibration exciter went off and no shock pulse was put into the specimen at that point. The specimen was then subjected to a fourth shock pulse which met the shock requirements.

5.9 Post Vibration and Shock Tests

At the conclusion of all vibration and shock tests, the specimen was subjected to proof pressure, leakage, and spring rate tests. The specimen met all the requirements of these tests. Data for these tests are on pages 85, 89 and 123, Addendum E.

5.10 Burst Test

The test specimen was placed in fixture 1T12844-501 to restrain axial movement. The specimen was filled with water, temperature stabilized at 67°F and then hydrostatically pressurized at 200 psig/minute until rupture occurred. The specimen ruptured at 471 psig which was 6 times greater than the requirement. The data are on page 122 of Addendum E. Photographs of the ruptured specimen are on pages 61 through 63 of Addendum E.

5.11 Post Test Inspection

The post test inspection revealed no damage to the test specimen other than that caused by the burst test. Results of this inspection are on page 127 of Addendum E.

6. CONCLUSIONS

Based upon the test results presented in this report, the Propulsive Fuel Vent Bellows, Douglas Specification Control Number 1A87152-1 has demonstrated that it continues to meet the test requirements necessary to qualify it for its intended use on the Saturn S-IVB Stage.

7. REFERENCES

No.	Company	Title
1A87152	Douglas Aircraft Company, Inc.	Specification Control Drawing
1A87436-501	Douglas Aircraft Company, Inc.	Propulsive Fuel Vent Exit Duct Assembly
1T02860, E	Douglas Aircraft Company, Inc.	Test Requirements Drawing
1T02861, C	Douglas Aircraft Company, Inc.	Test Procedure Drawing
SM41412	Douglas Aircraft Company, Inc.	General Test Plan Saturn S-IVB System
TM-DSV4B-PL-R4718	Douglas Aircraft Company, Inc.	Qualification, Bellows, Propulsive Fuel Vent, P/N 1A87152-1 (9-15-64)
TM-DSV4B-ENV-R5451-1	Douglas Aircraft Company, Inc.	Fuel Tank Vent System (External) Vibration and Shock Tests (3-25-66)

NOTE: Qualification vibration and shock tests for line item H-17 were performed as part of the H-4 system tests.

8. SYMBOLS

cps	cycles per second
db	decibels
°F	degrees Fahrenheit
g	acceleration due to gravity
Hg	Mercury
pph	pounds per hour
psi	pounds per square inch
psig	pounds per square inch gage
rms	root mean square
ΔP_s	differential pressure across duct in psid
P_s	static pressure in duct in psia
W	weight rate of flow in lb/sec
T	flow temperature in degrees Rankine
PSD	power spectral density

DATA SHEET I-1

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

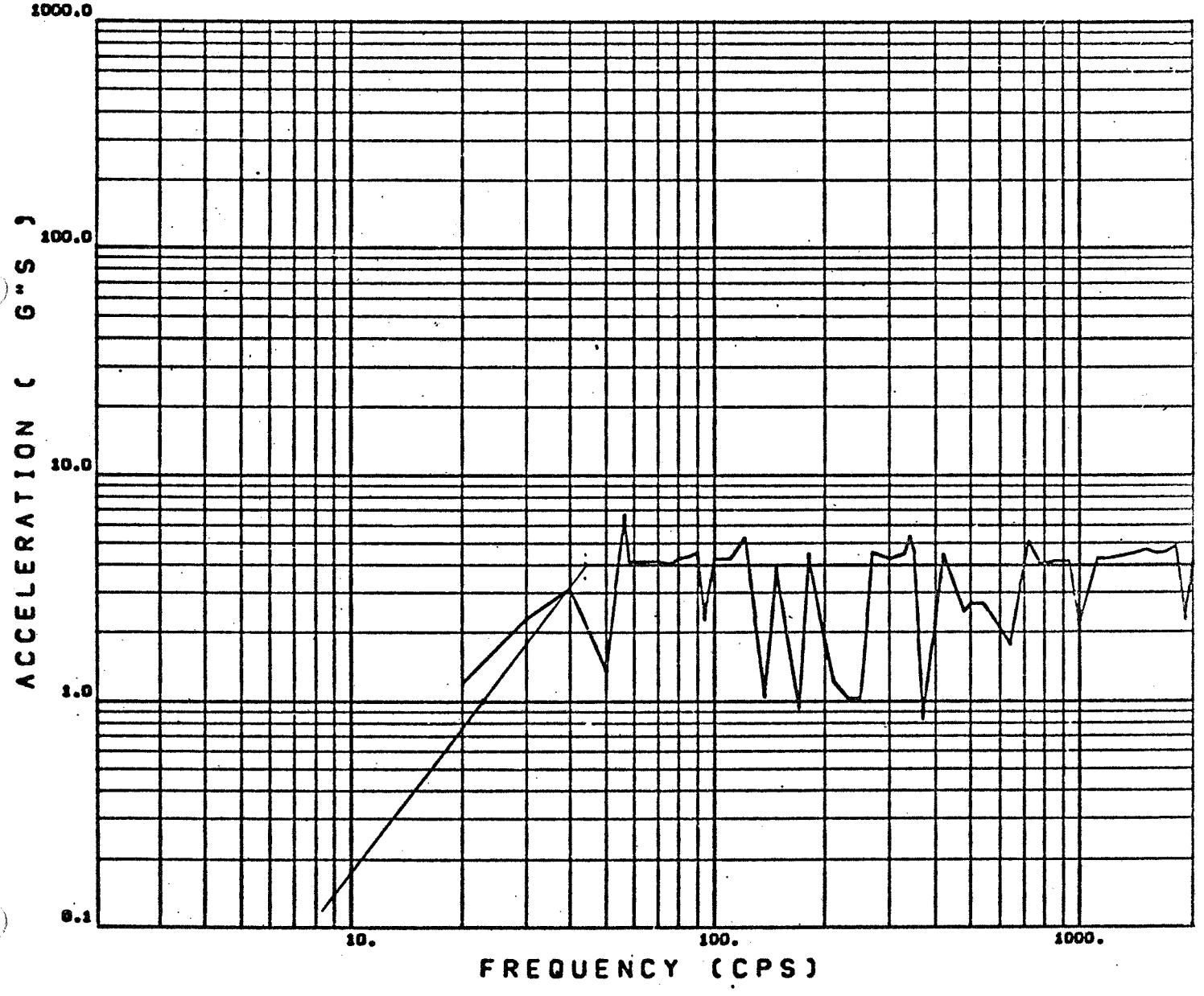
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (1)... 1 AE27
PICK UP RESPONSE..... 249 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-2

DOUGLAS AIRCRAFT COMPANY , INC.

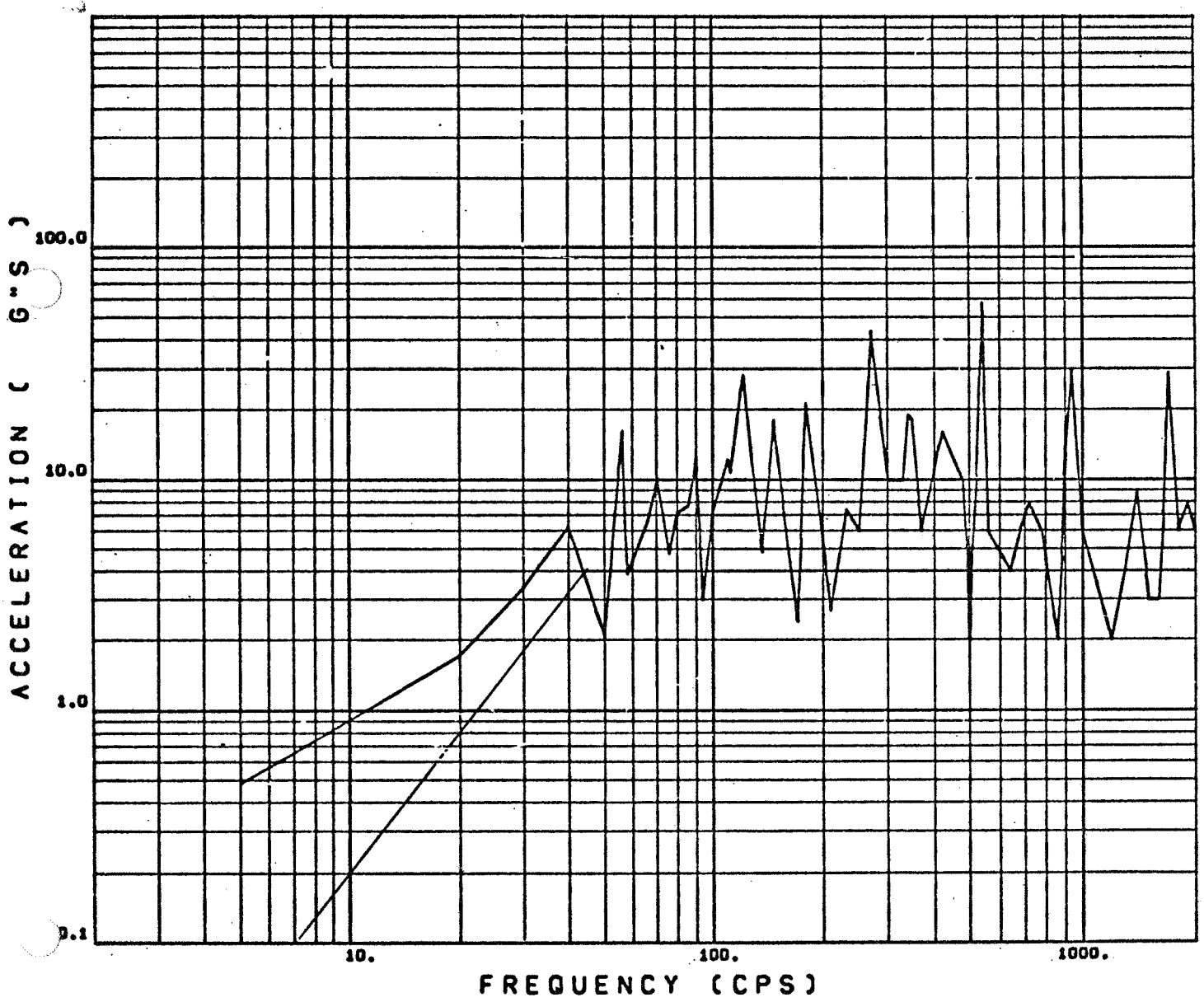
PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE
FOR [illegible] LOCATION

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (2)... 2 L885
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-3

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

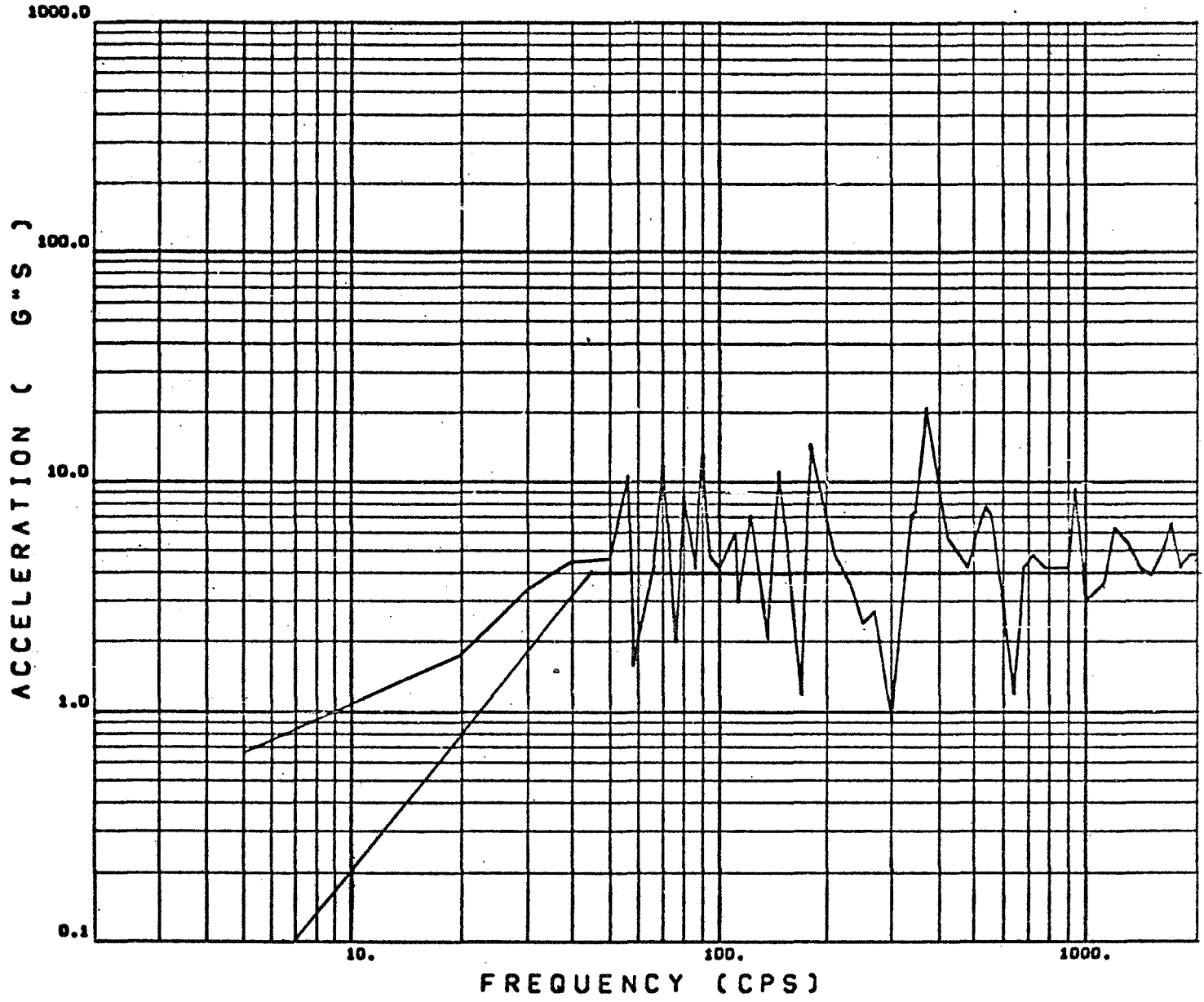
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (3)... 3 WY01
PICK UP RESPONSE..... 246 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-4

DOUGLAS AIRCRAFT COMPANY , INC.

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REPORT NO. _____

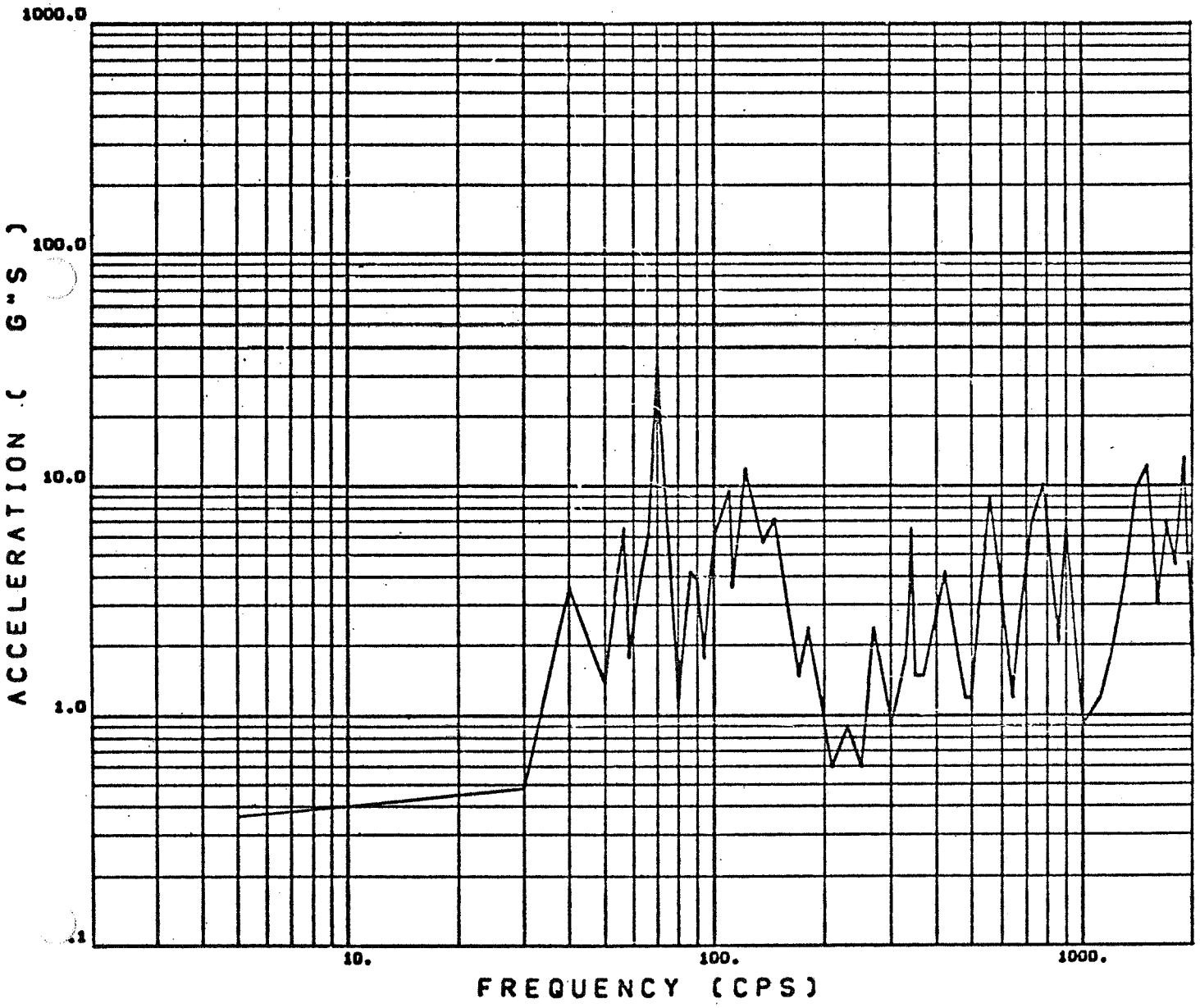
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (4)... 4 EA47
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-5

DOUGLAS AIRCRAFT COMPANY , INC.

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REPORT NO. _____

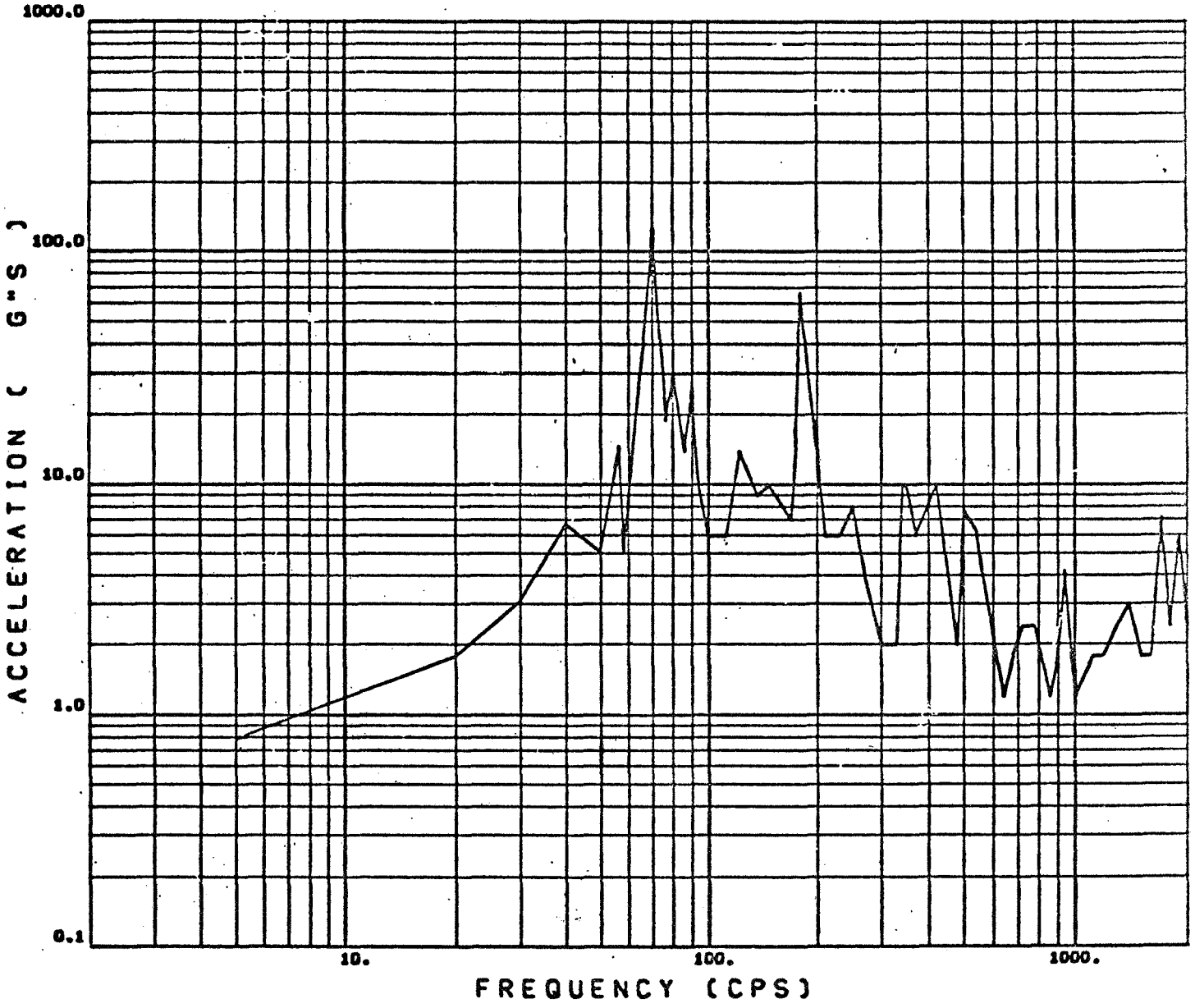
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (5)... 5 EA53
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-6

DOUGLAS AIRCRAFT COMPANY , INC.

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REPORT NO. _____

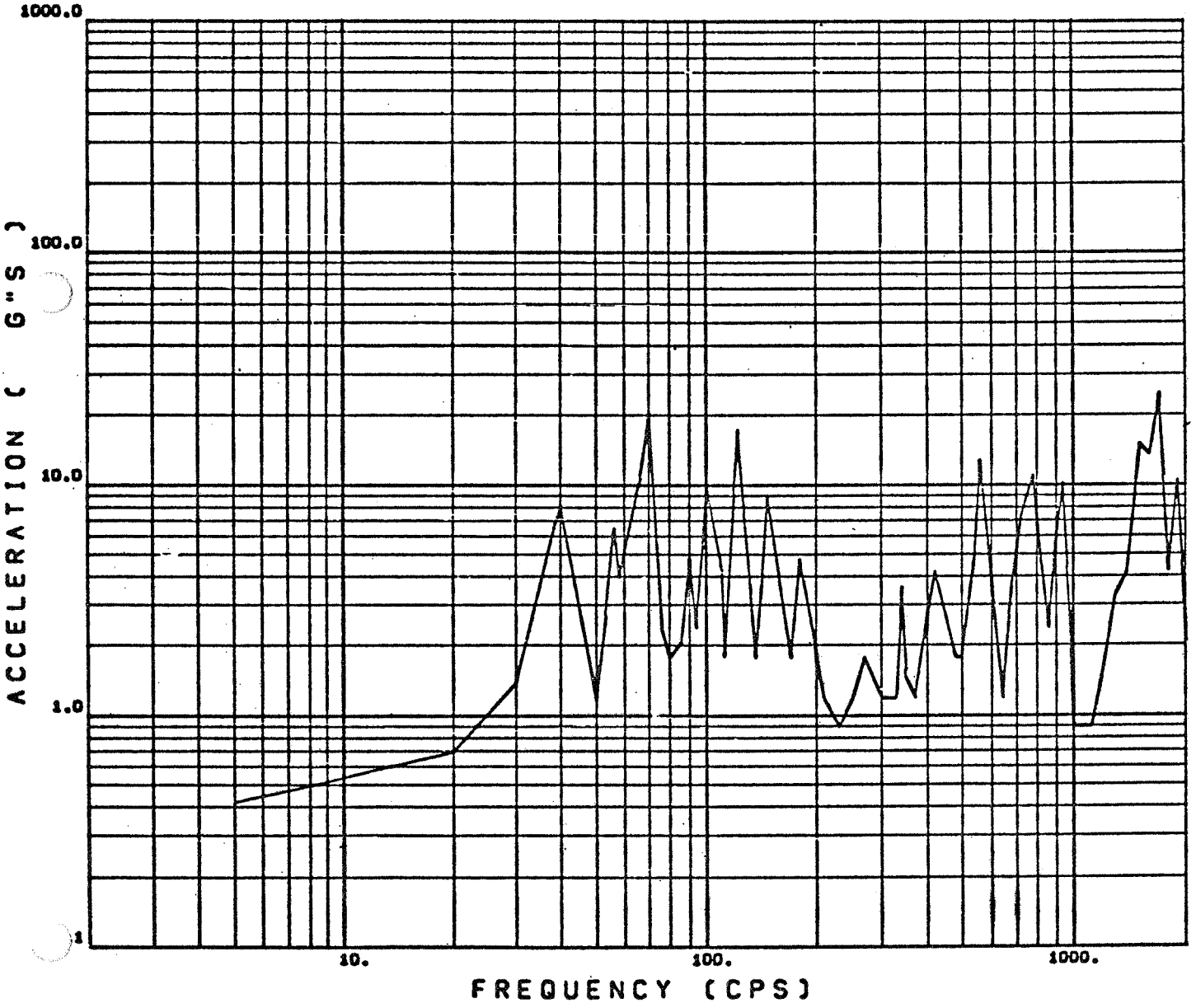
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (6)... 6 RC075
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-7

DOUGLAS AIRCRAFT COMPANY , INC.

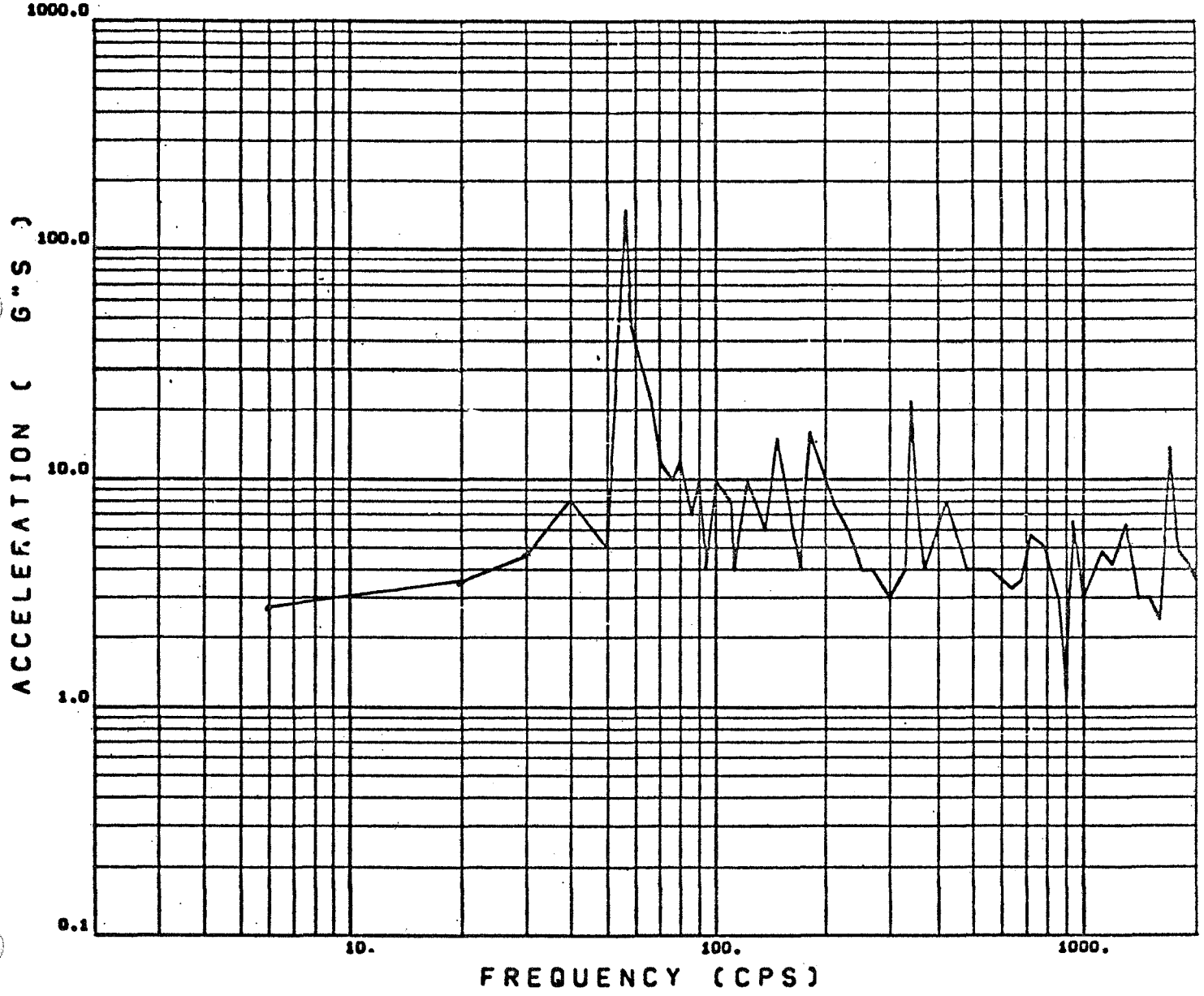
PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP
SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (7)... 7 WY38
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-8

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

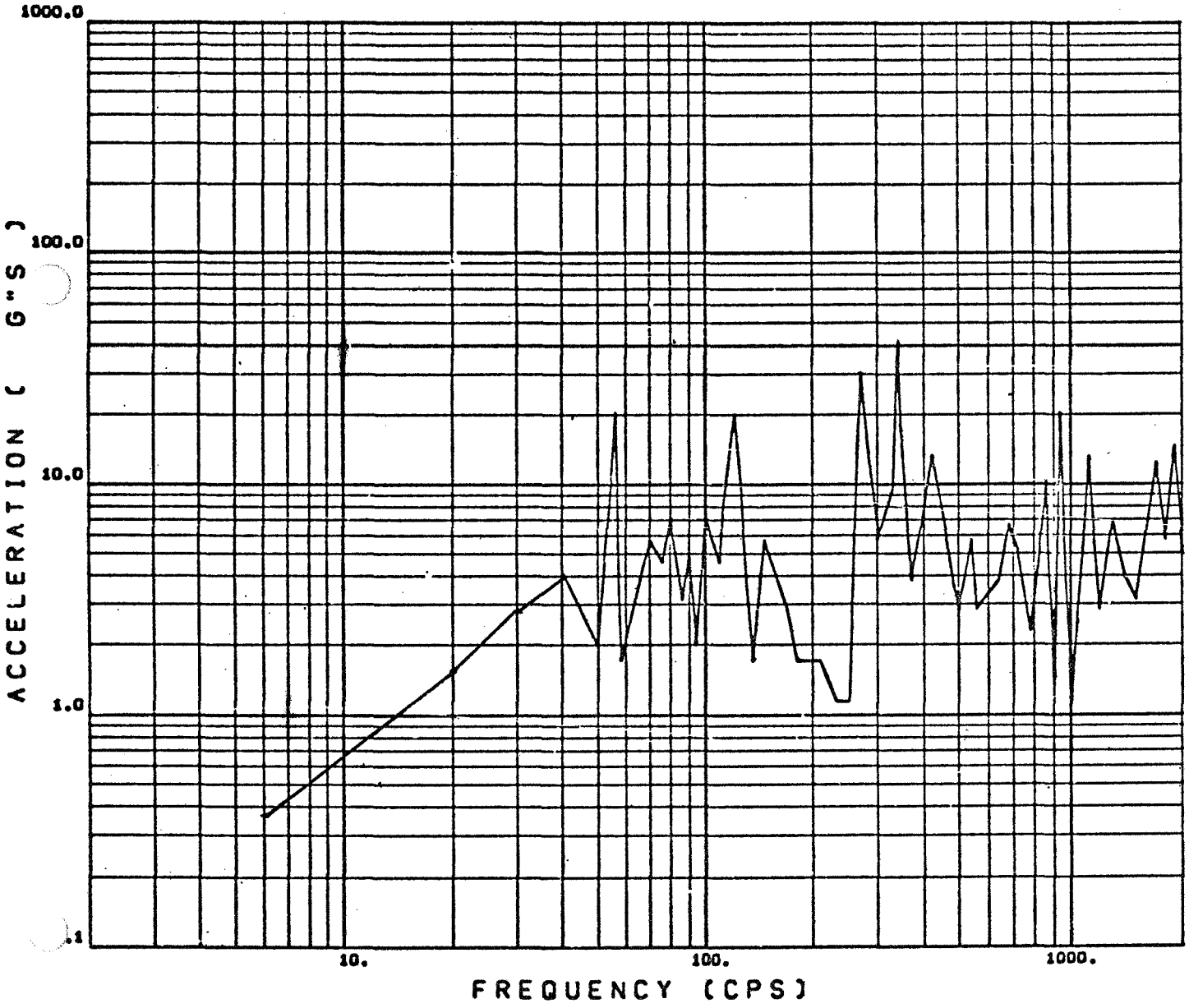
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (8)... 8 EA45
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-9

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

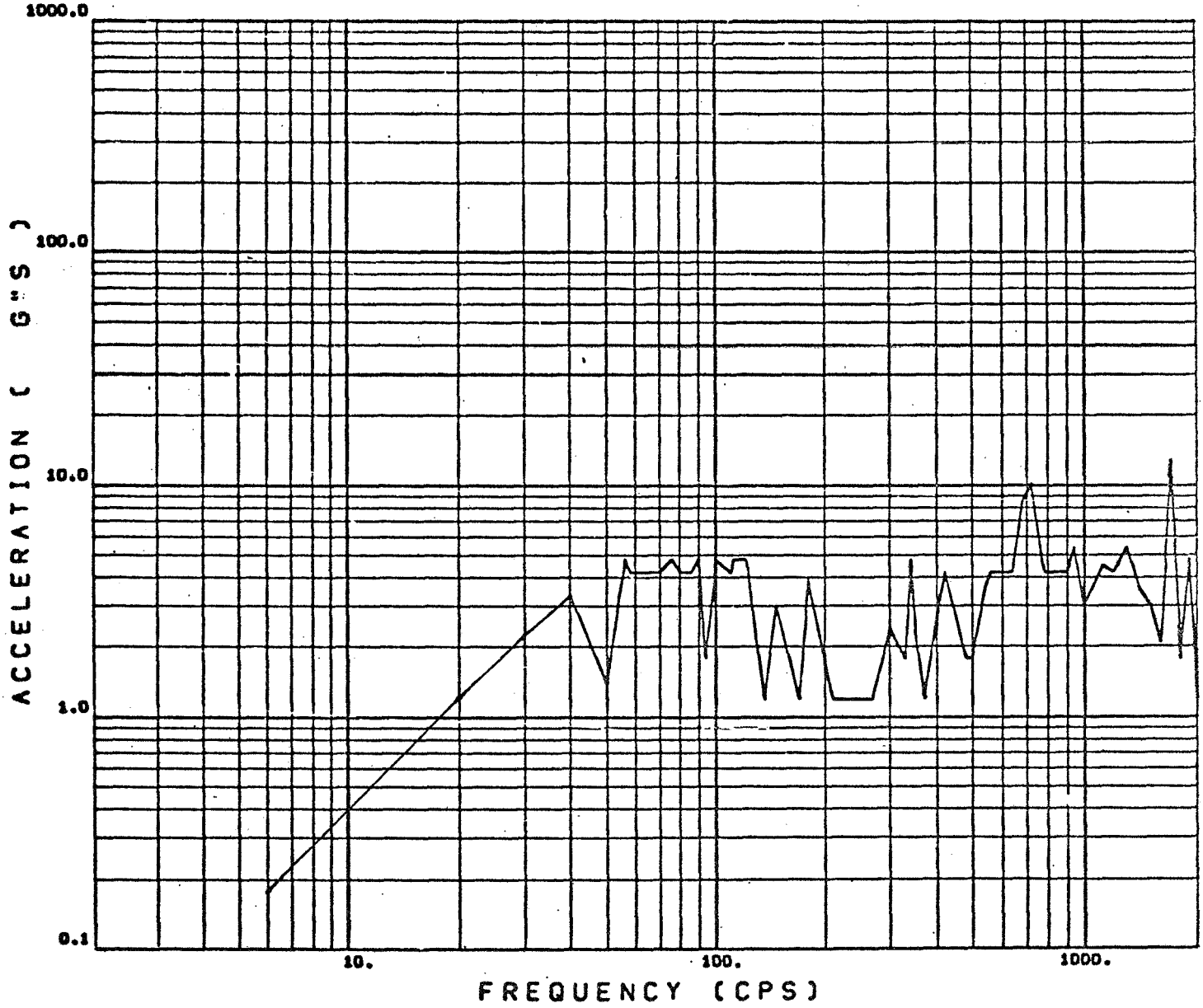
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (9)... 9 EA55
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



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DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

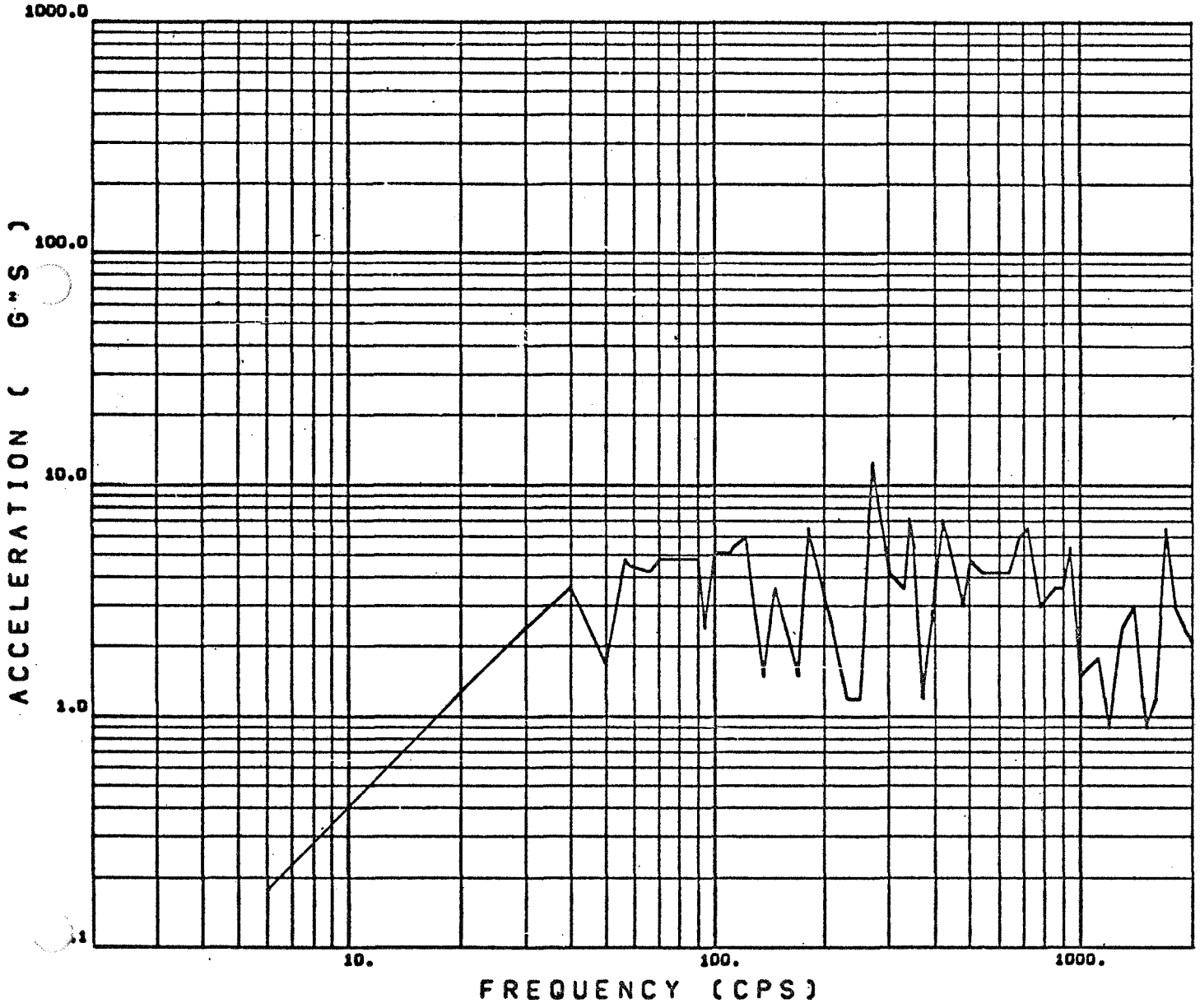
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (10)... 10 EA57
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET I-11

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

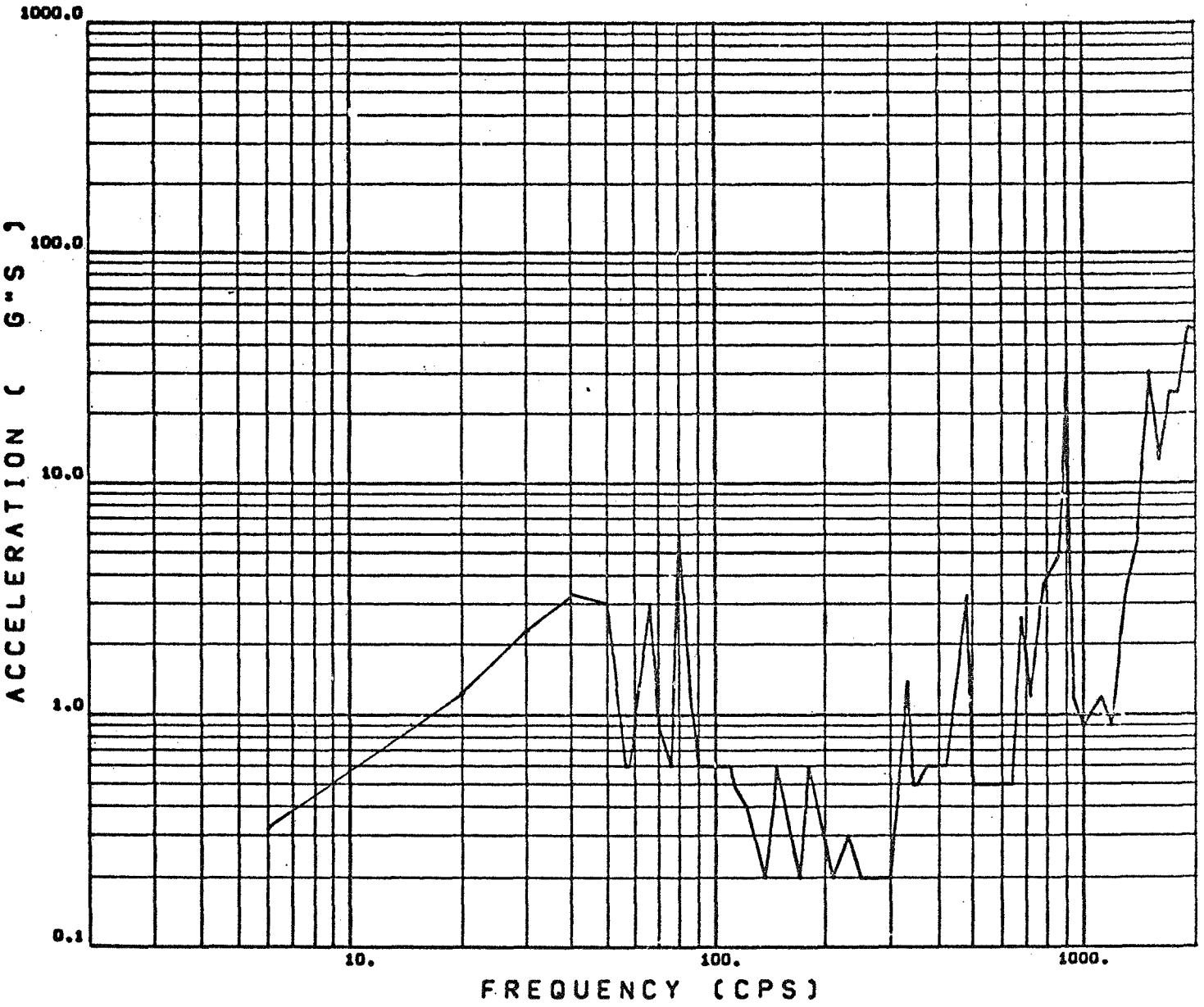
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-26-66
AXIS OF EXCITATION.... B
PICK UP NUMBER (11)... 11 EA48
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE..



DOUGLAS AIRCRAFT COMPANY, INC.

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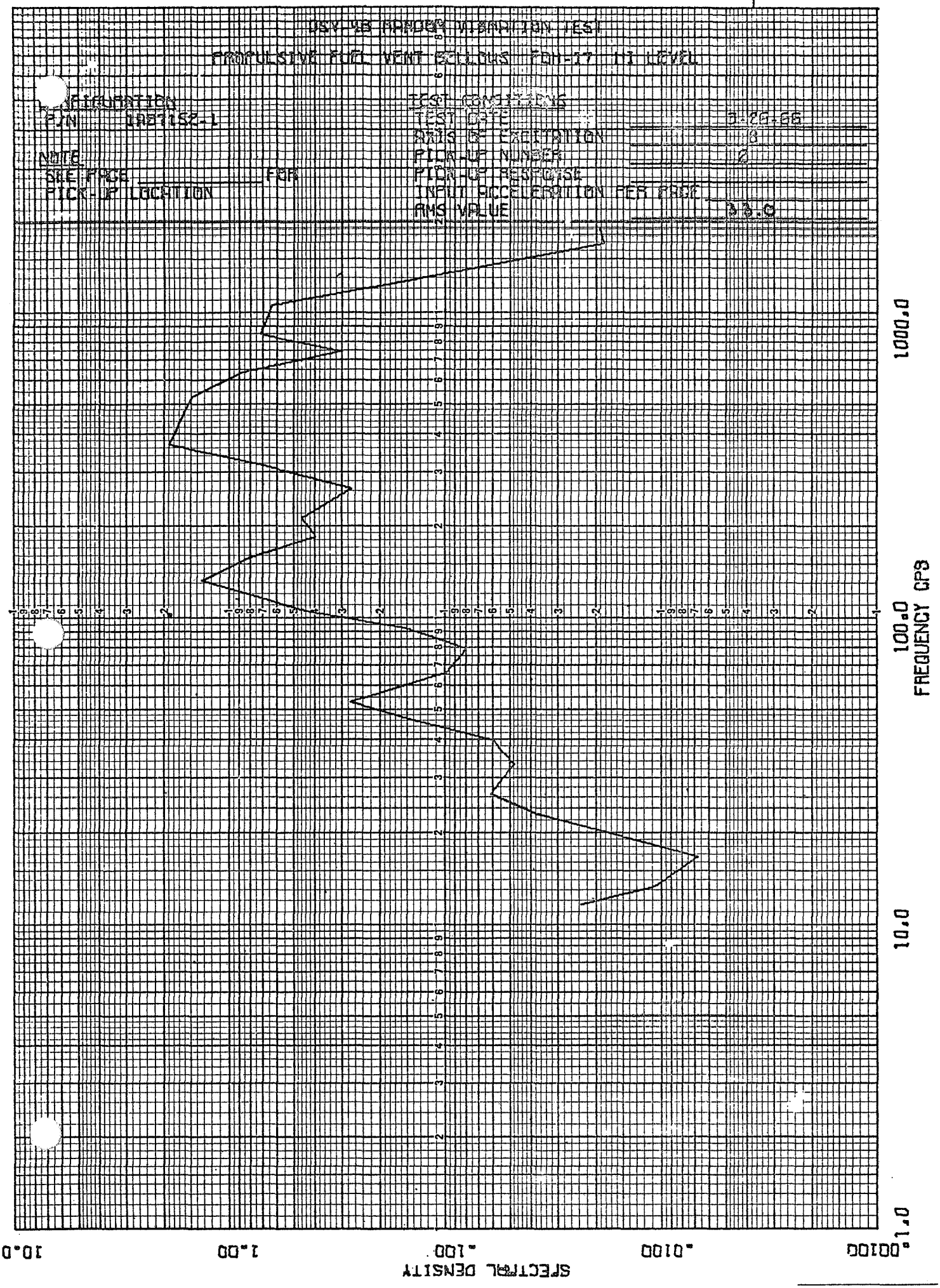
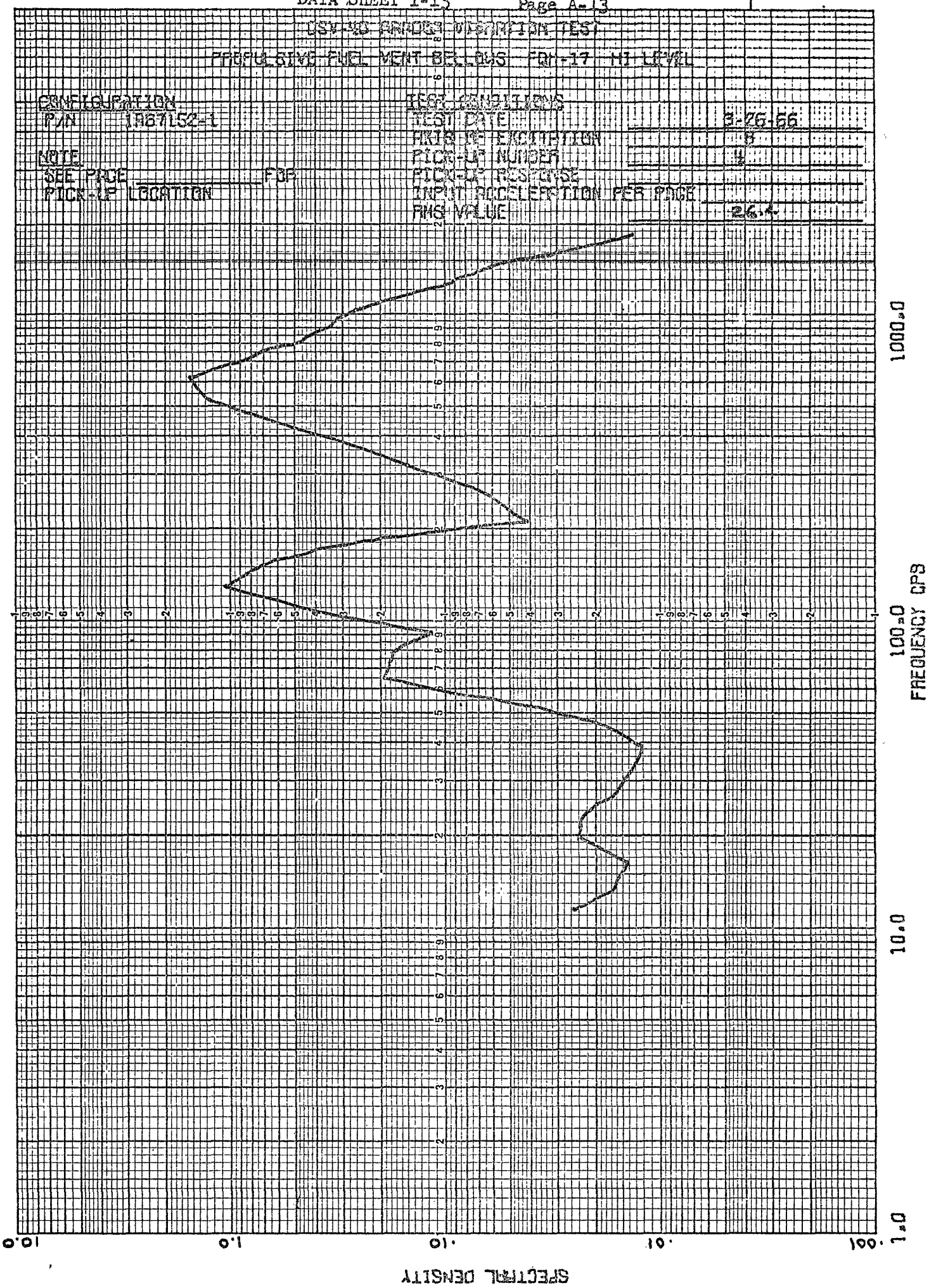
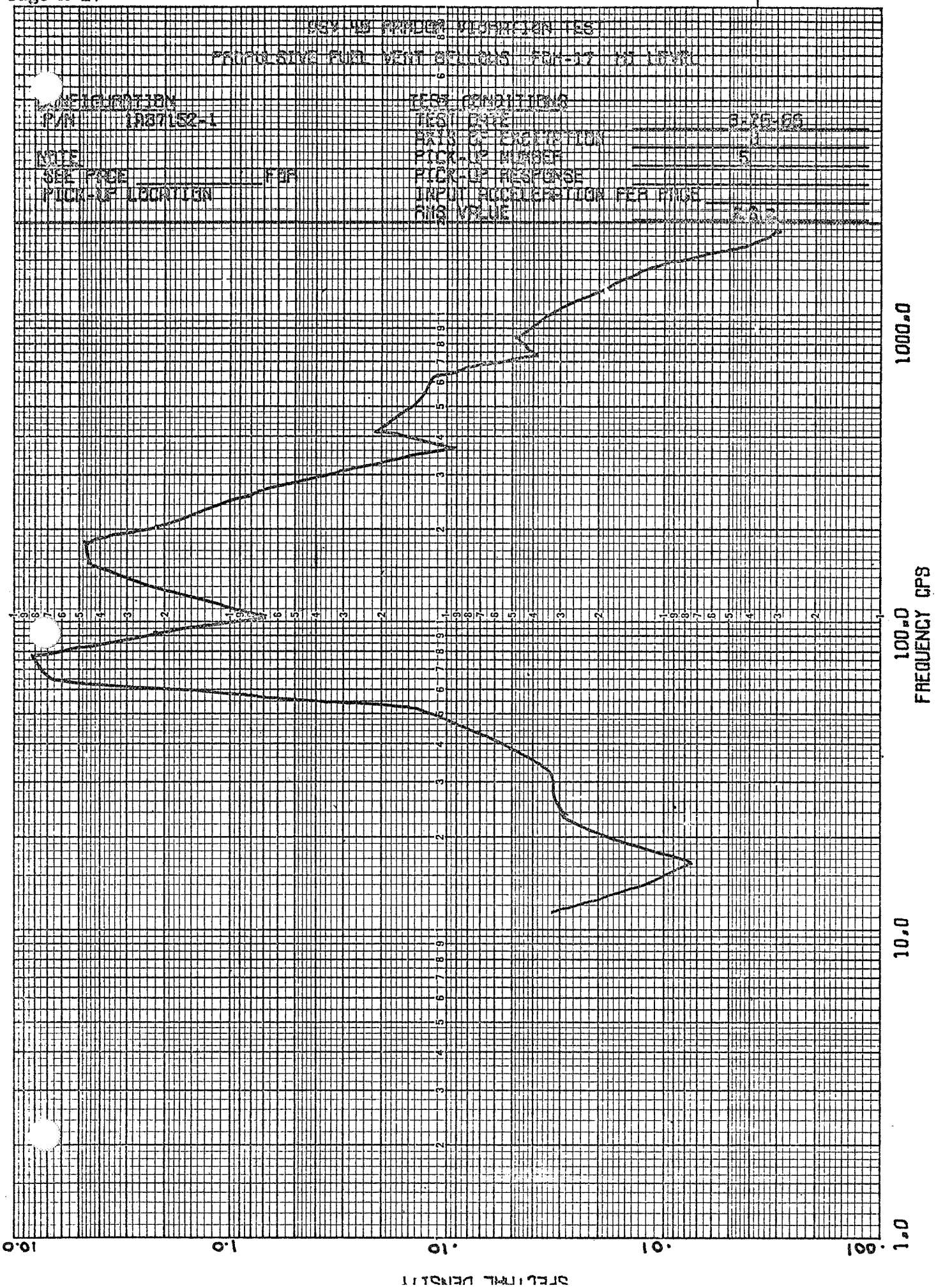
PAGE NO.
REPORT NO.

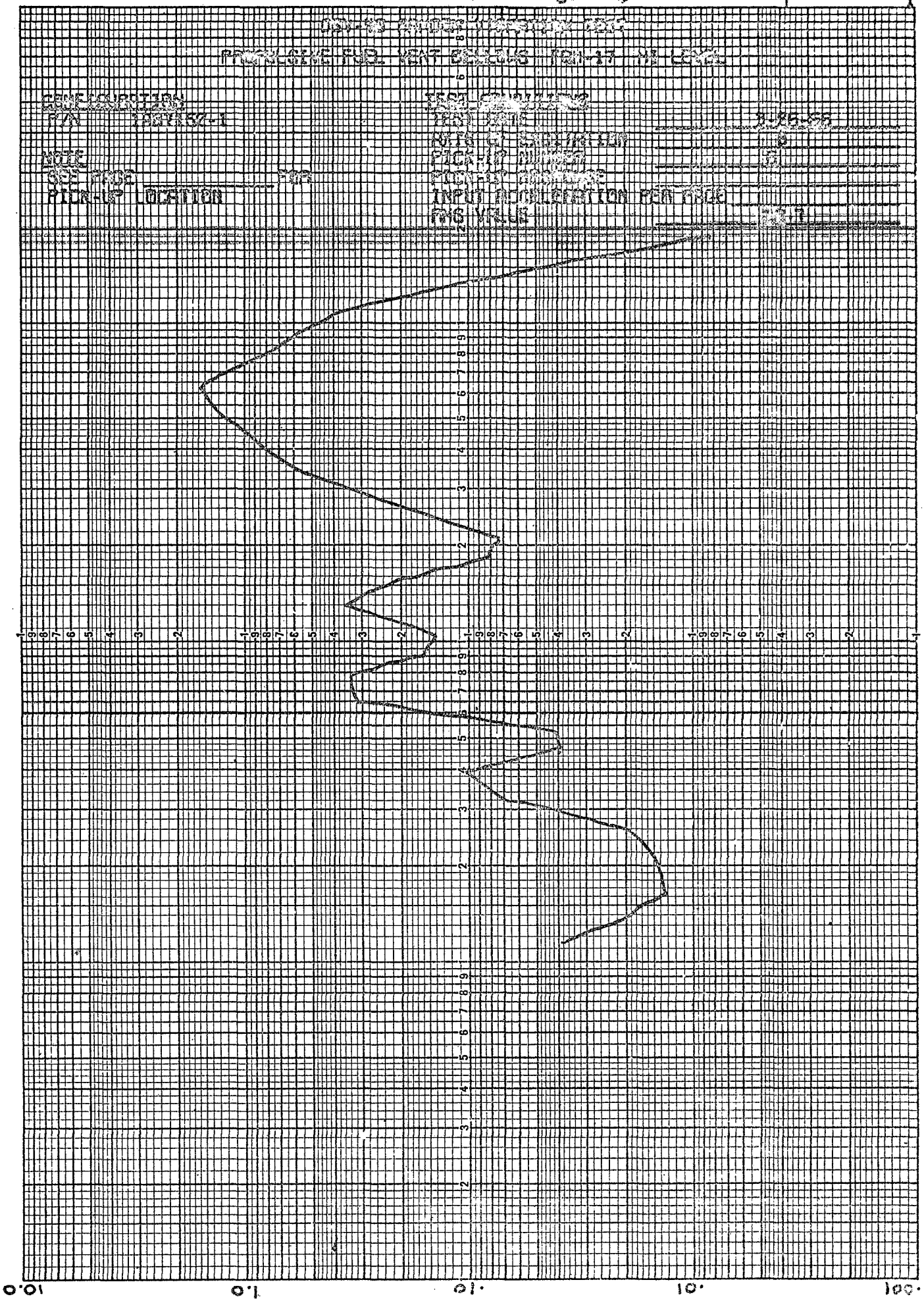



DSV-4B RANDOM VIBRATION TEST
PROPULSIVE FUEL VENT BELLOWS FDM-17 HI LEVEL
CONFIGURATION
P/N 1A87152-1
NOTE
SEE PAGE FOR
PICK-UP LOCATION
TEST CONDITIONS
TEST DATE 3-26-66
AXIS OF EXCITATION B
PICK-UP NUMBER 4
PICK-UP RESPONSE
INPUT ACCELERATION PER PAGE
RMS VALUE 26.4
FREQUENCY CPS
1.0
10.0
100.0
1000.0
SPECTRAL DENSITY
10.0
1.0
.10
.01
.001

DOUGLAS AIRCRAFT COMPANY, INC.
DATA SHEET I-14

PAGE NO
REPORT NO




PROPULSIVE FUEL VENT BELLOWS
GENERATION
P/N
NOTE
SEE PAGE
PICK-UP LOCATION
TEST DATE
INPUT ACCELERATION PER PAGE
RMS VALUE
1000.0
100.0
10.0
1.0
FREQUENCY CPS
0.01
0.1
1.0
10.
100.

DOUGLAS AIRCRAFT COMPANY, INC.

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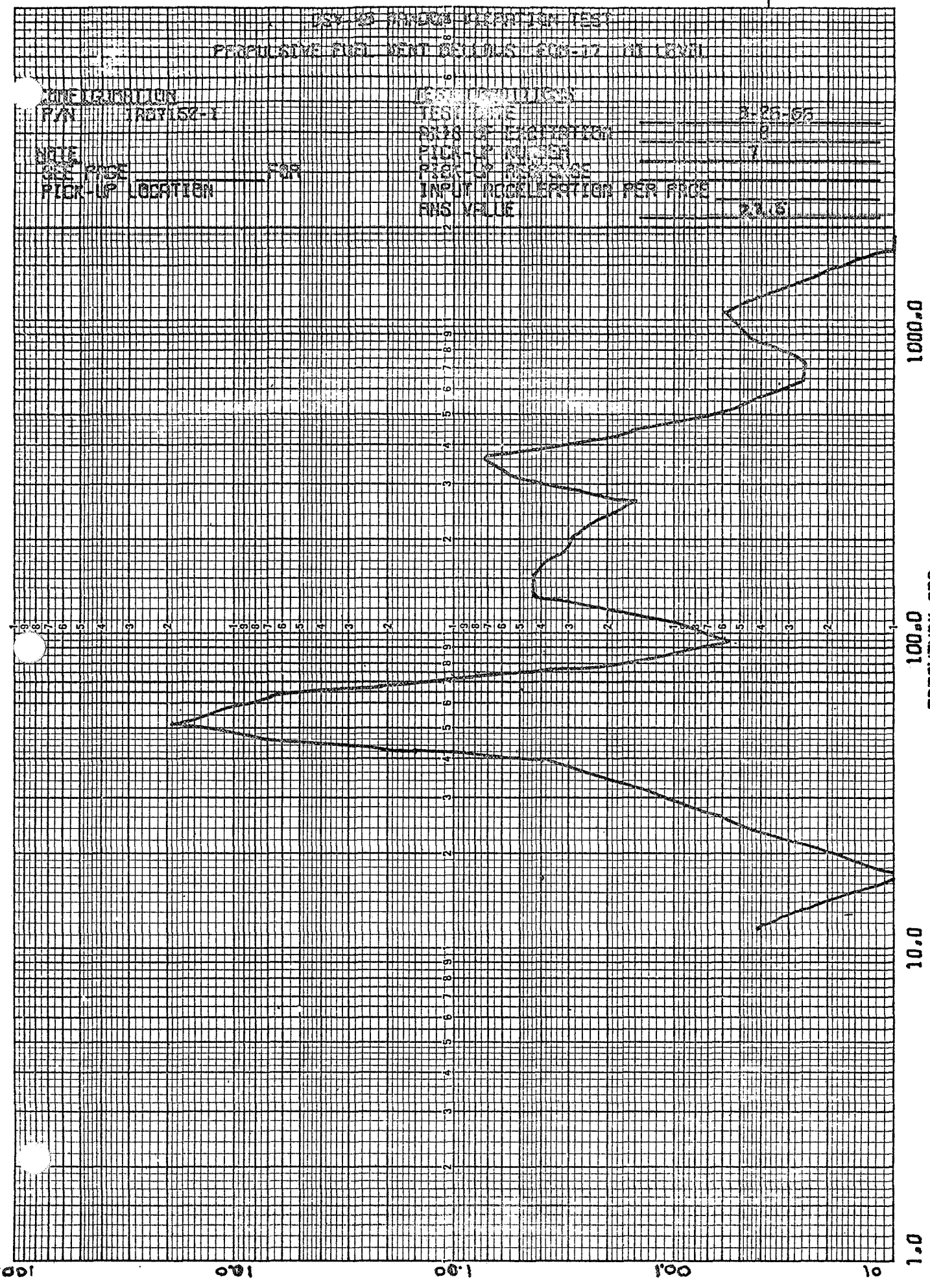
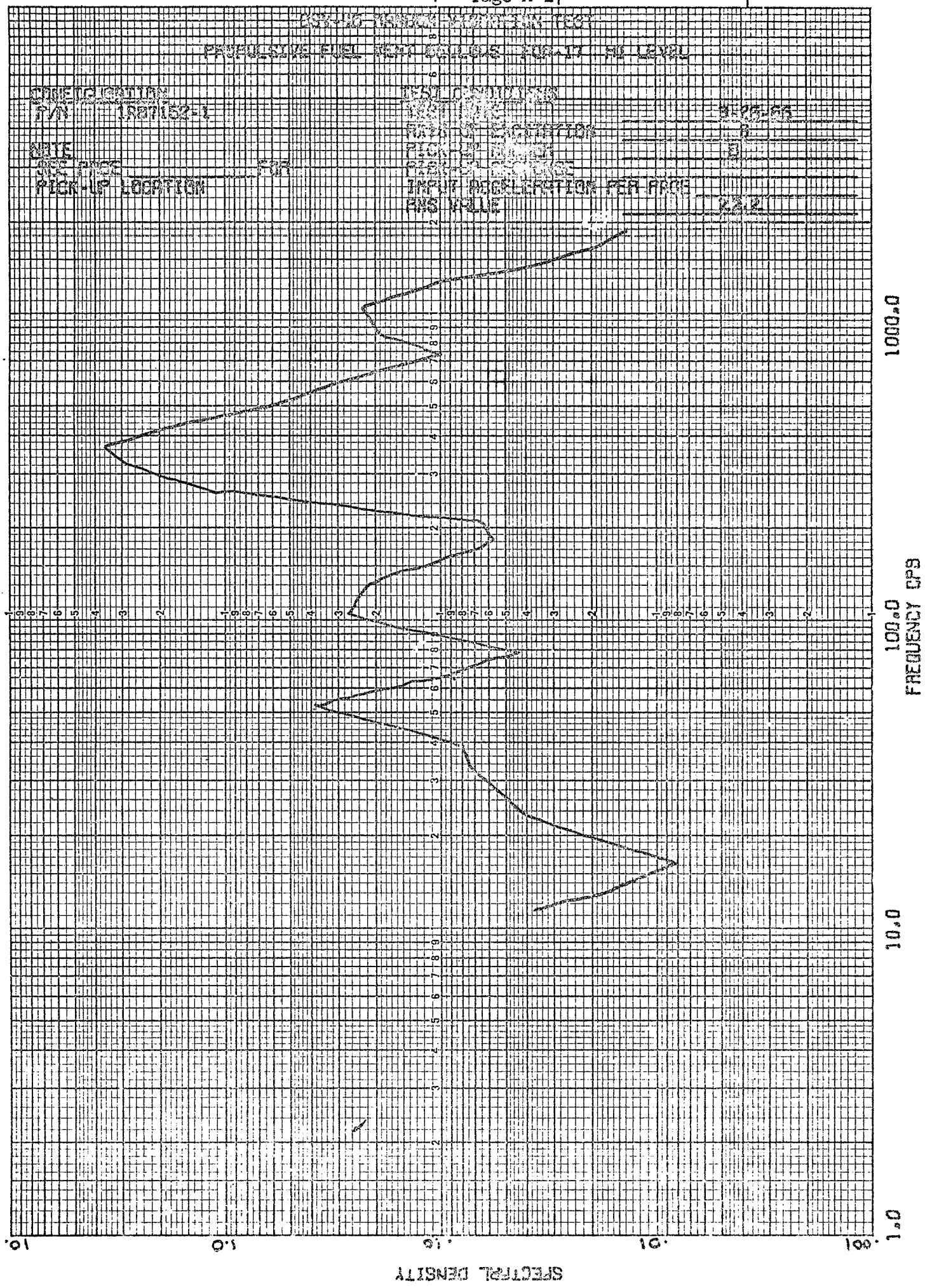
PAGE NO.
REPORT NO.

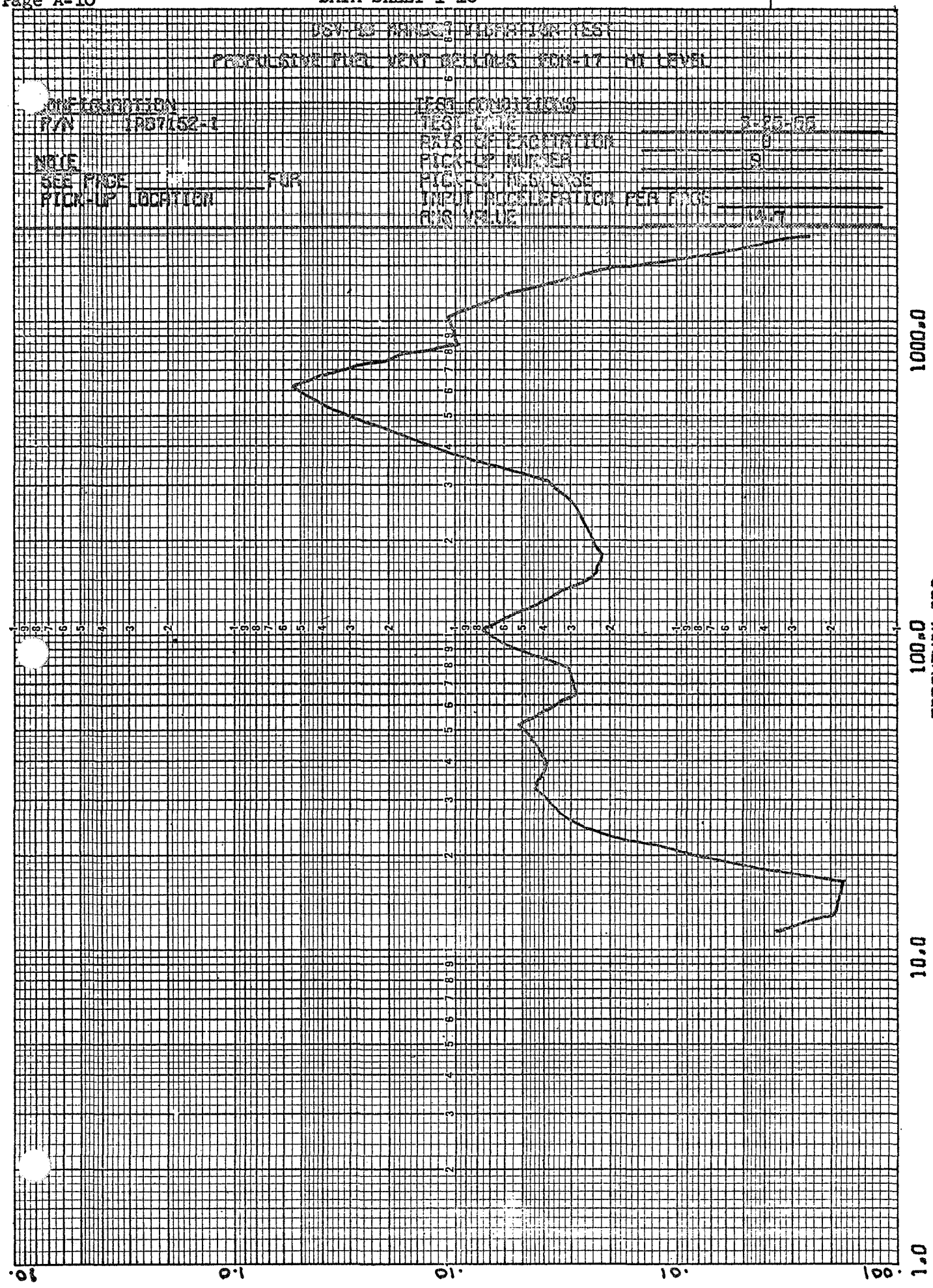


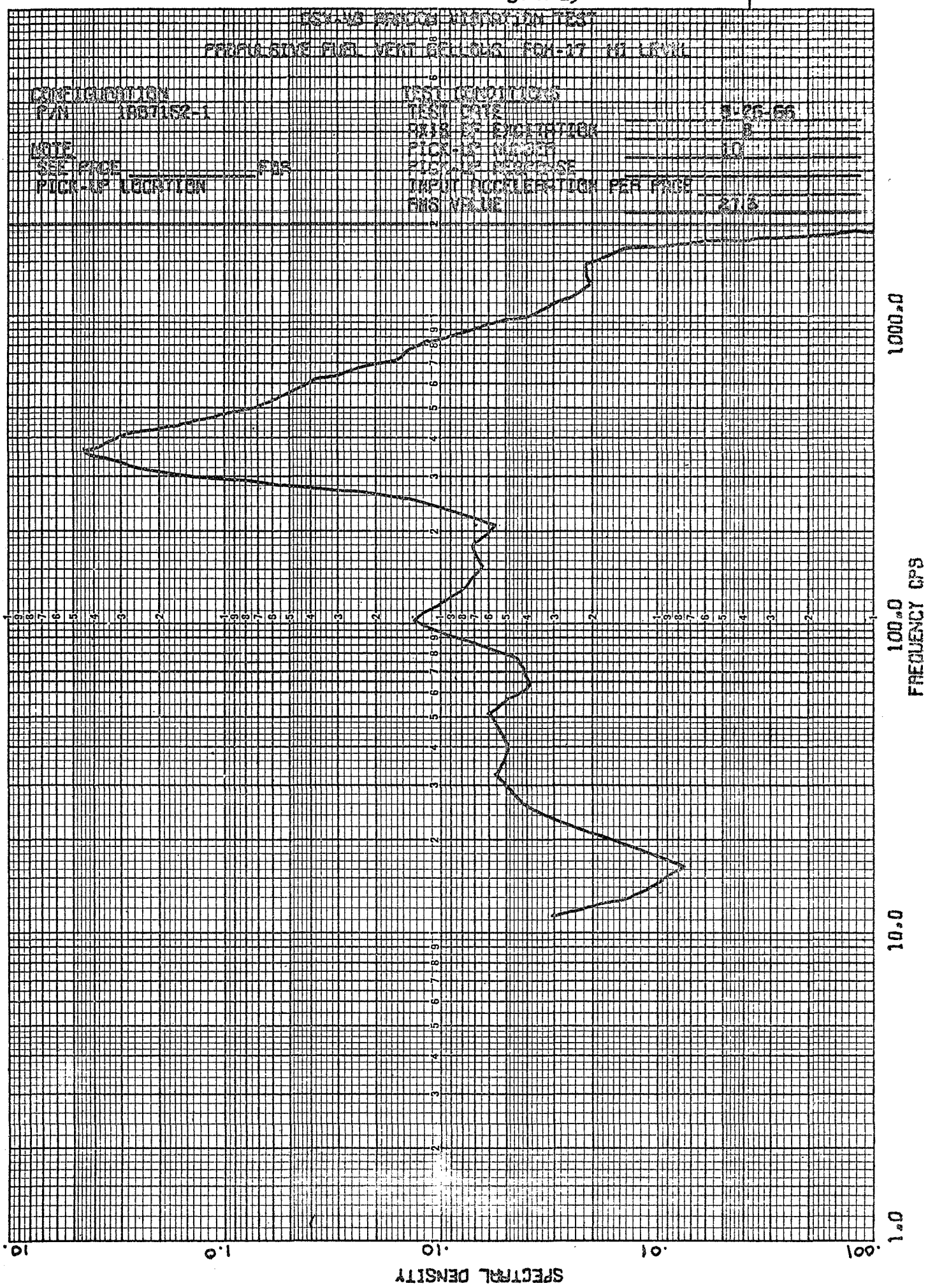

ESTIMATED RANDOM VIBRATION TEST
PROPULSIVE FUEL REPLENISH TOP-17 PA LEVEL
CONFIGURATION
P/N 1R87152-1
NOTE
SEE PICK
PICK-UP LOCATION FOR
TEST CONDITIONS
TEST TIME
RMS OF ACCELERATION
PICK-UP
PICK-UP
PICK-UP
INPUT ACCELERATION FOR RMS
RMS VALUE
9.25 GR
8
8
2.2.2
1000.0
100.0
10.0
1.0
FREQUENCY CPS
SPECTRAL DENSITY

DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET I-18

PAGE NO.
REPORT NO.




DSV-4B RANDOM VIBRATION TEST
PROPULSIVE FUEL VENT BELLOWS FOX-17 HI LEVEL
CONFIGURATION
P/N 1807152-1
NOTE
SEE PAGE FOR
PICK-UP LOCATION
TEST CONDITIONS
TEST DATE 9-26-66
AXIS OF EXCITATION 8
PICK-UP NUMBER 10
PICK-UP RESPONSE
INPUT ACCELERATION PER PAGE
RMS VALUE 27.3
1000.0
100.0
10.0
1.0
FREQUENCY CPS
10.
1.0
.10
.01
100.
SPECTRAL DENSITY

DOUGLAS AIRCRAFT COMPANY, INC.
DATA SHEET I-20

PAGE NO.
REPORT NO.

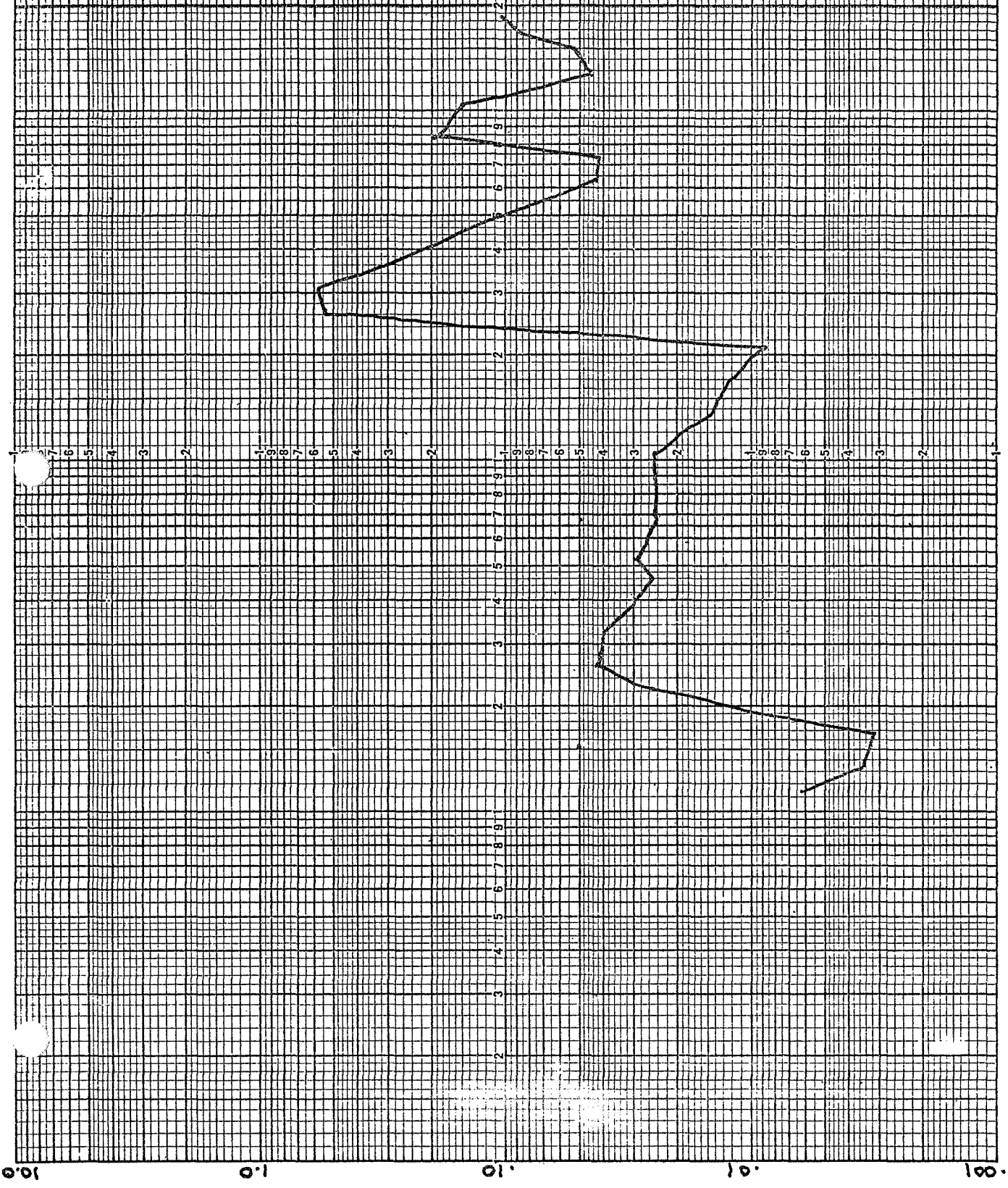
DSV-4B RANDOM VIBRATION TEST

PROPULSIVE FUEL VENT BELLOWS FOM-17 HI LEVEL

CONFIGURATION
P/N 1R07152-1

NOTE
SEE PAGE _____ FOR
PICK-UP LOCATION

TEST CONDITIONS
TEST DATE 1-26-66
AXIS OF EXCITATION Z
PICK-UP NUMBER 11
PICK-UP RESPONSE
INPUT ACCELERATION PER PAGE
RMS VALUE 14.2



DATA SHEET II-1

DOUGLAS AIRCRAFT COMPANY

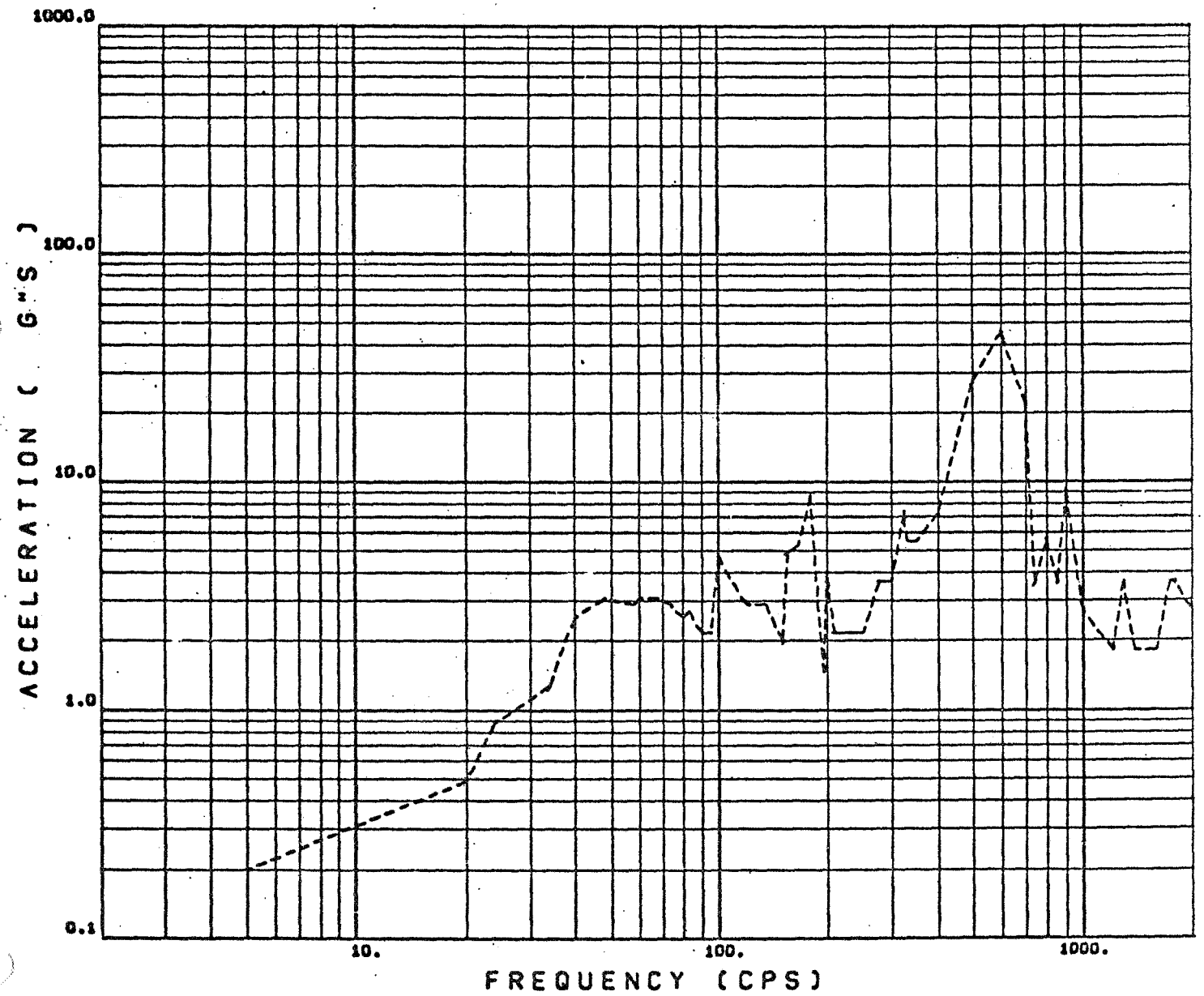
PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP
SIV-B PROPULSIVE FUEL VENT BELLOWS
(H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A (5 TO 250 TO 5 CPS)
PICK UP NUMBER (1)... 1
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-2

DOUGLAS AIRCRAFT COMPANY , INC.

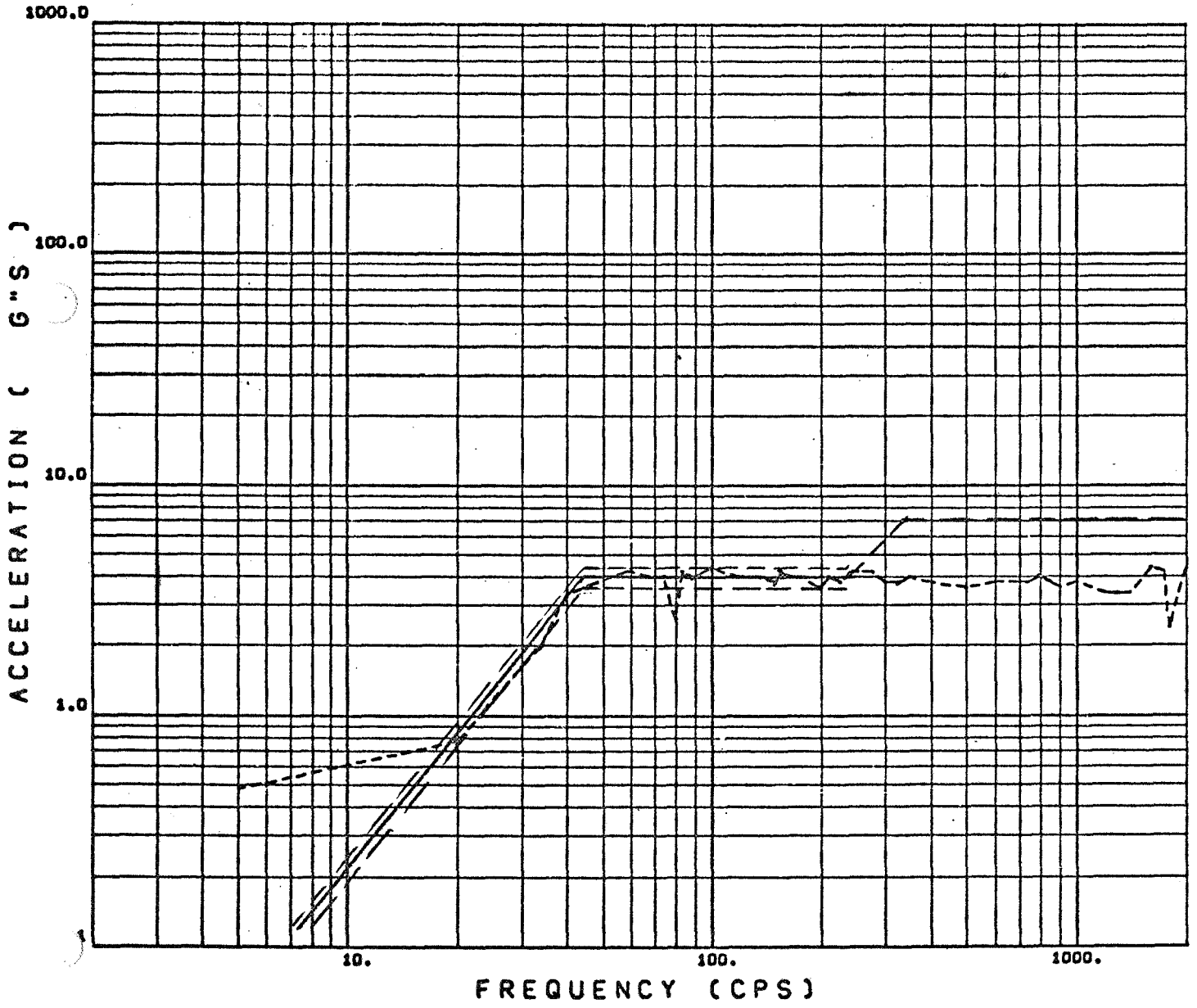
PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP
SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ------
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A (5 TO 250 TO 5 CPS)
PICK UP NUMBER (2)... 2
PICK UP RESPONSE..... 249 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-3

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

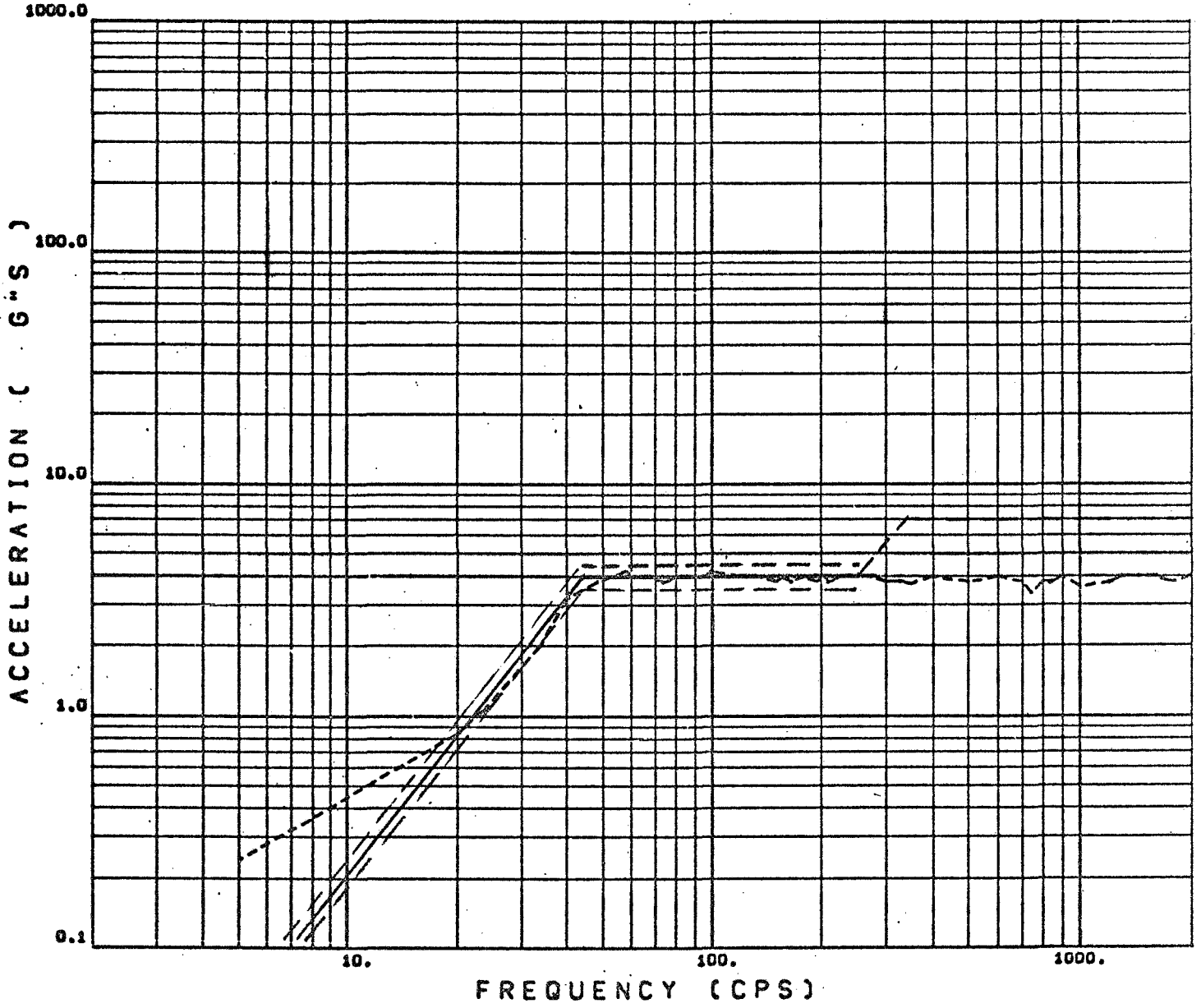
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A(5 TO 250 TO 5 CPS)
PICK UP NUMBER (3)... 3
PICK UP RESPONSE..... 246 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-4

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

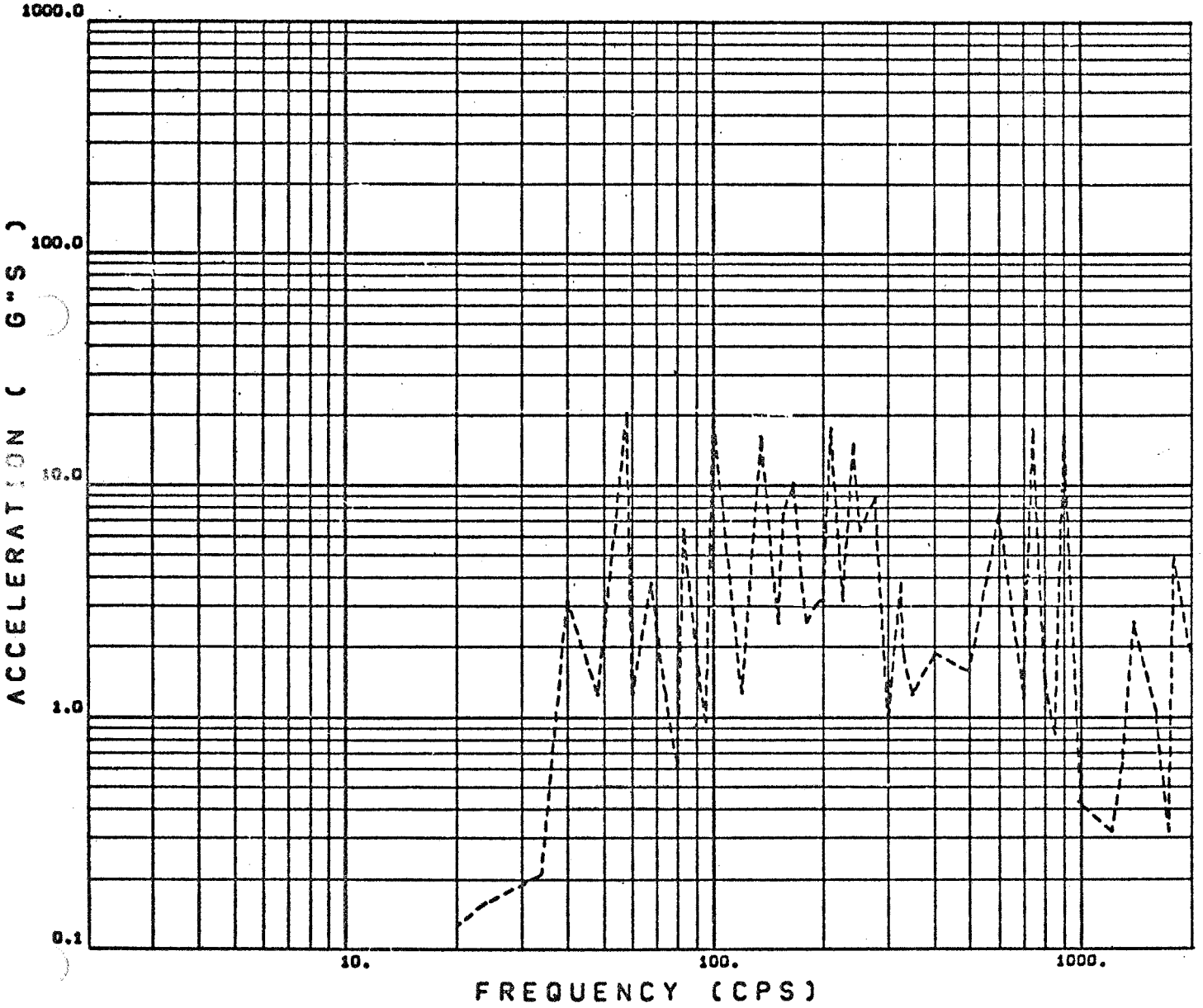
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A (5 TO 250 TO 5 CPS)
PICK UP NUMBER (4)... 4
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-5

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

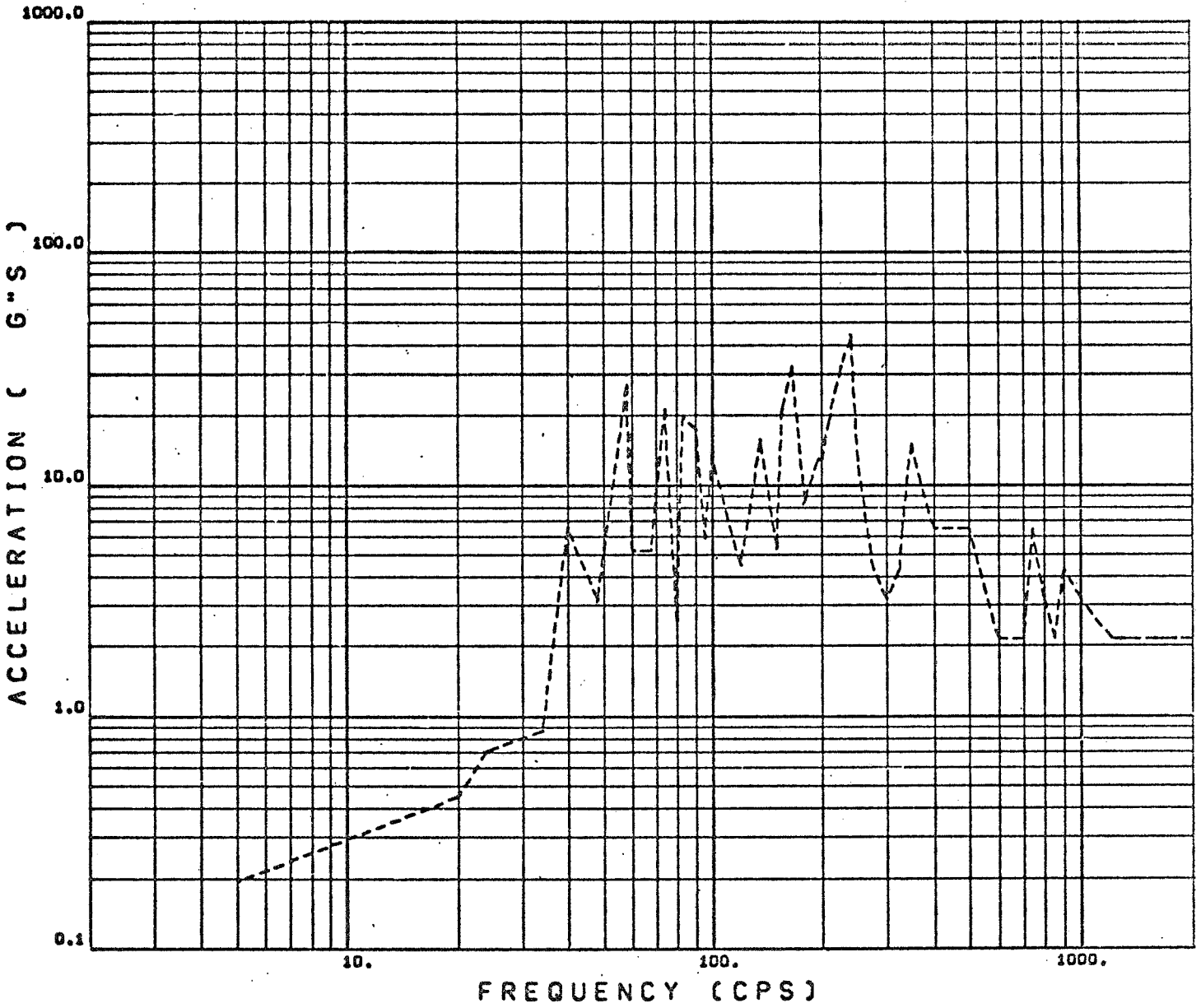
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... Z (5 TO 250 TO 5 0.5)
PICK UP NUMBER (5)... 5
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-6

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

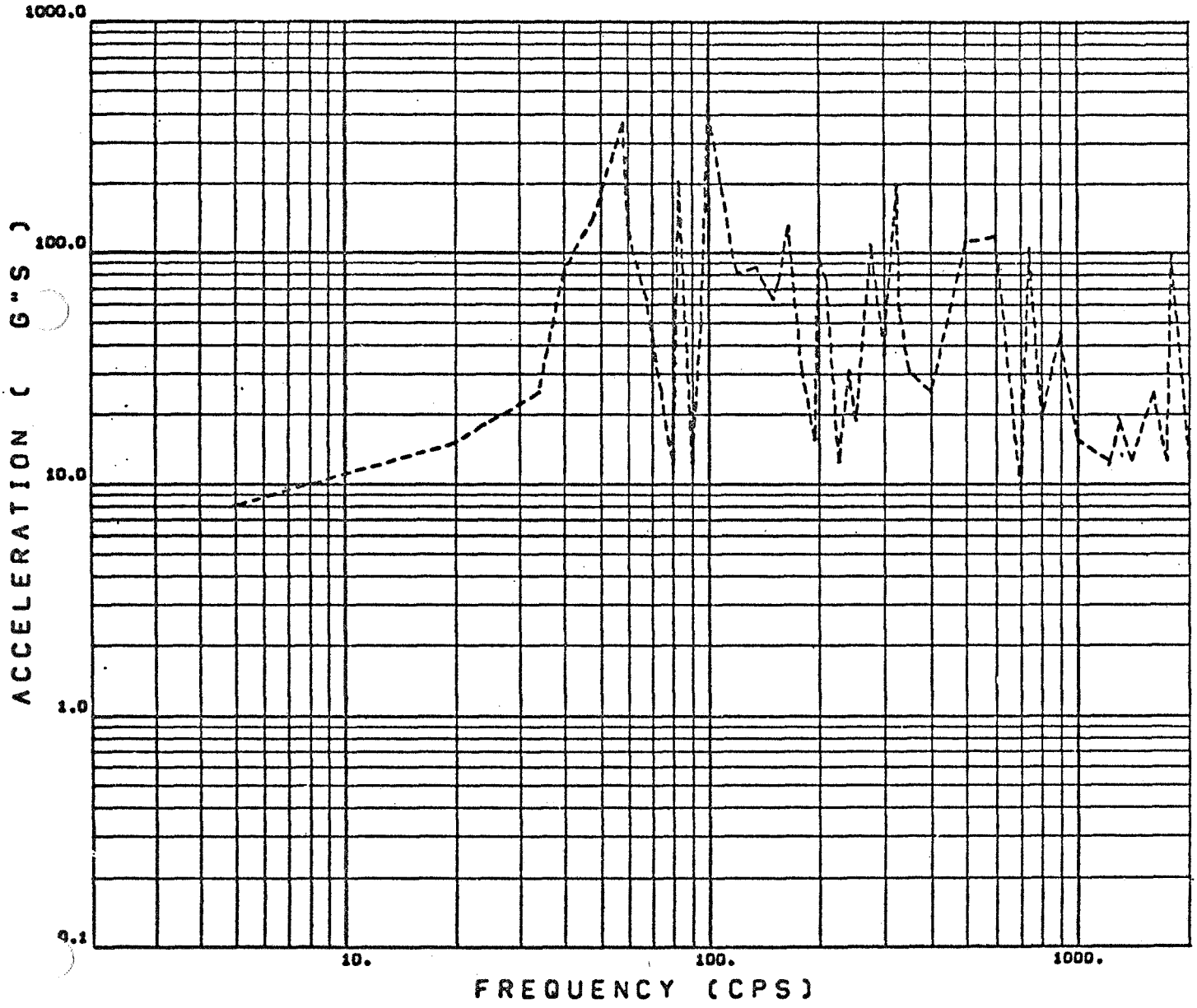
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... X (5 TO 250 TO 5 CPS)
PICK UP NUMBER (6)... 6
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-7

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

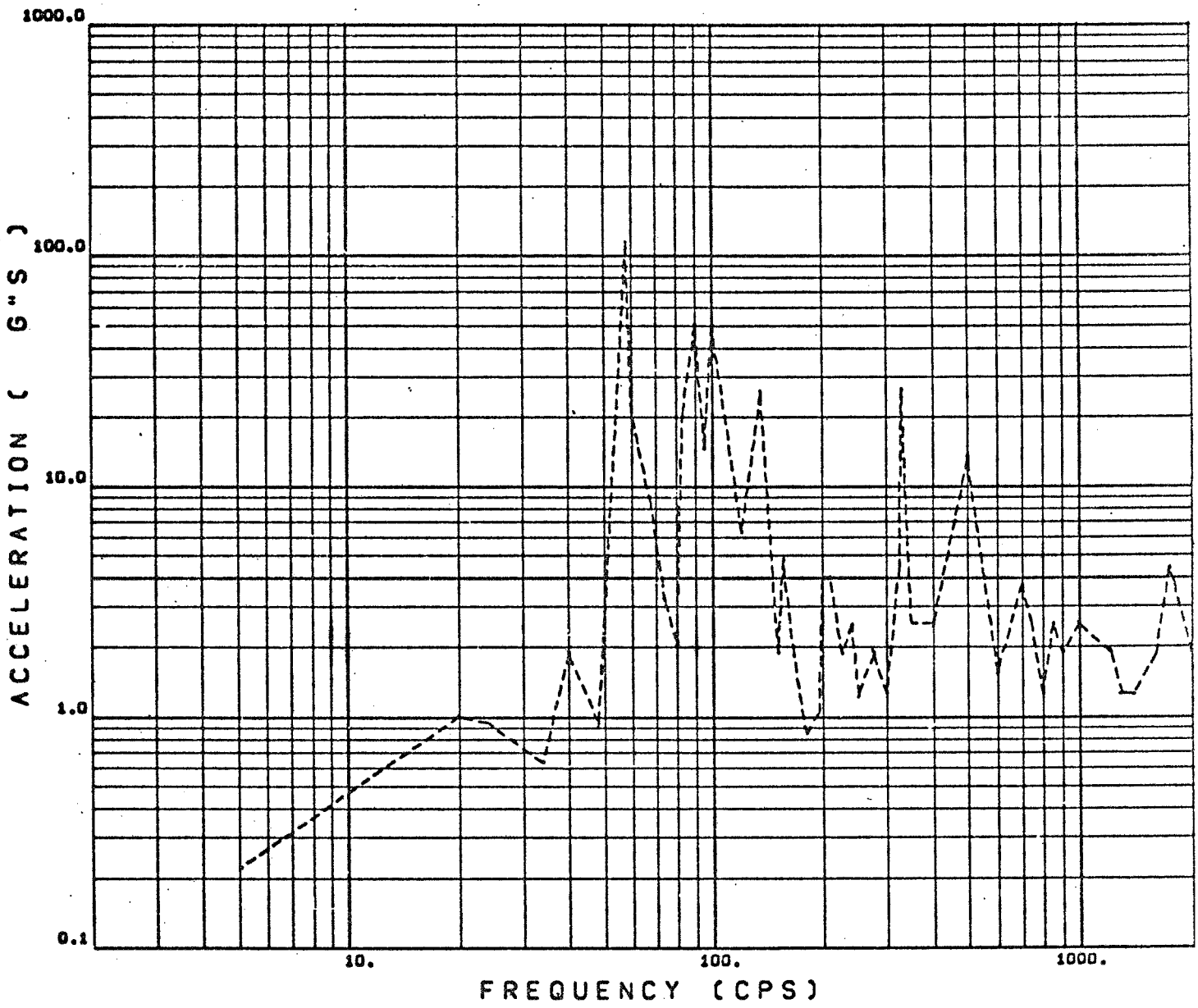
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A (5 TO 250 TO 5 CPS)
PICK UP NUMBER (7)... 7
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-8

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

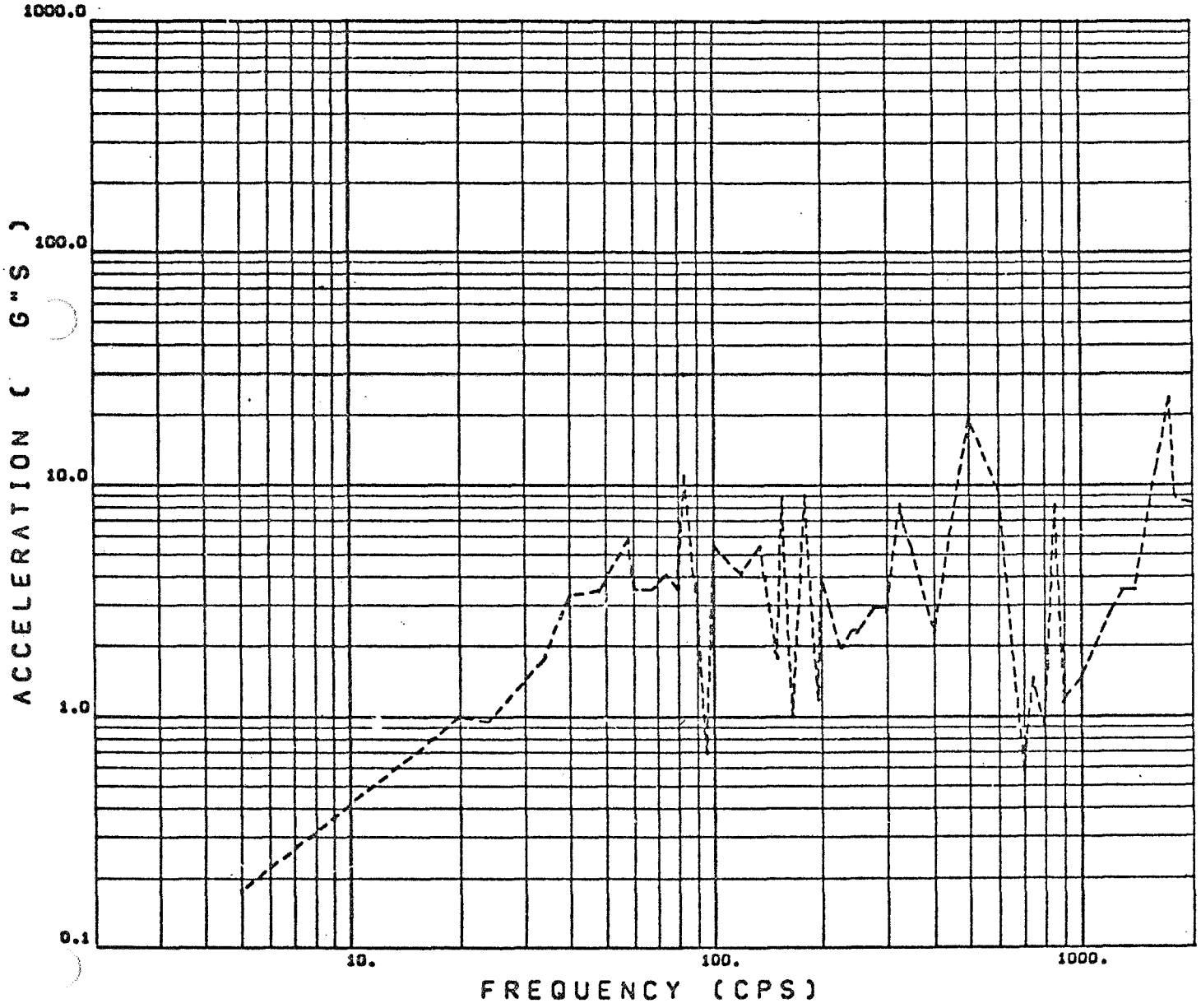
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A (5 TO 250 TO 5 CPS)
PICK UP NUMBER (8)... 8
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



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DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

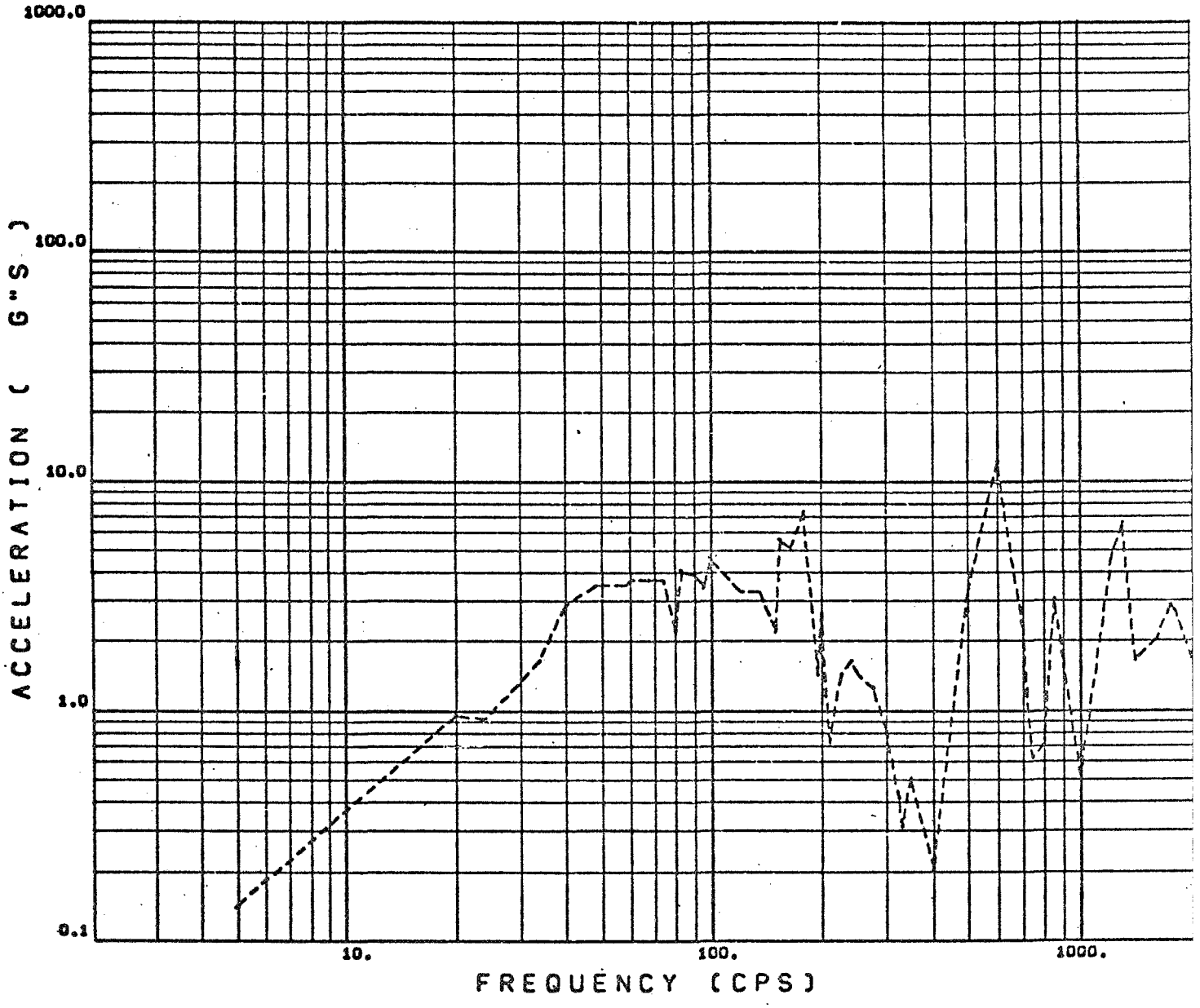
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A (5 TO 250 TO 5 CPS)
PICK UP NUMBER (9)... 9
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-10

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

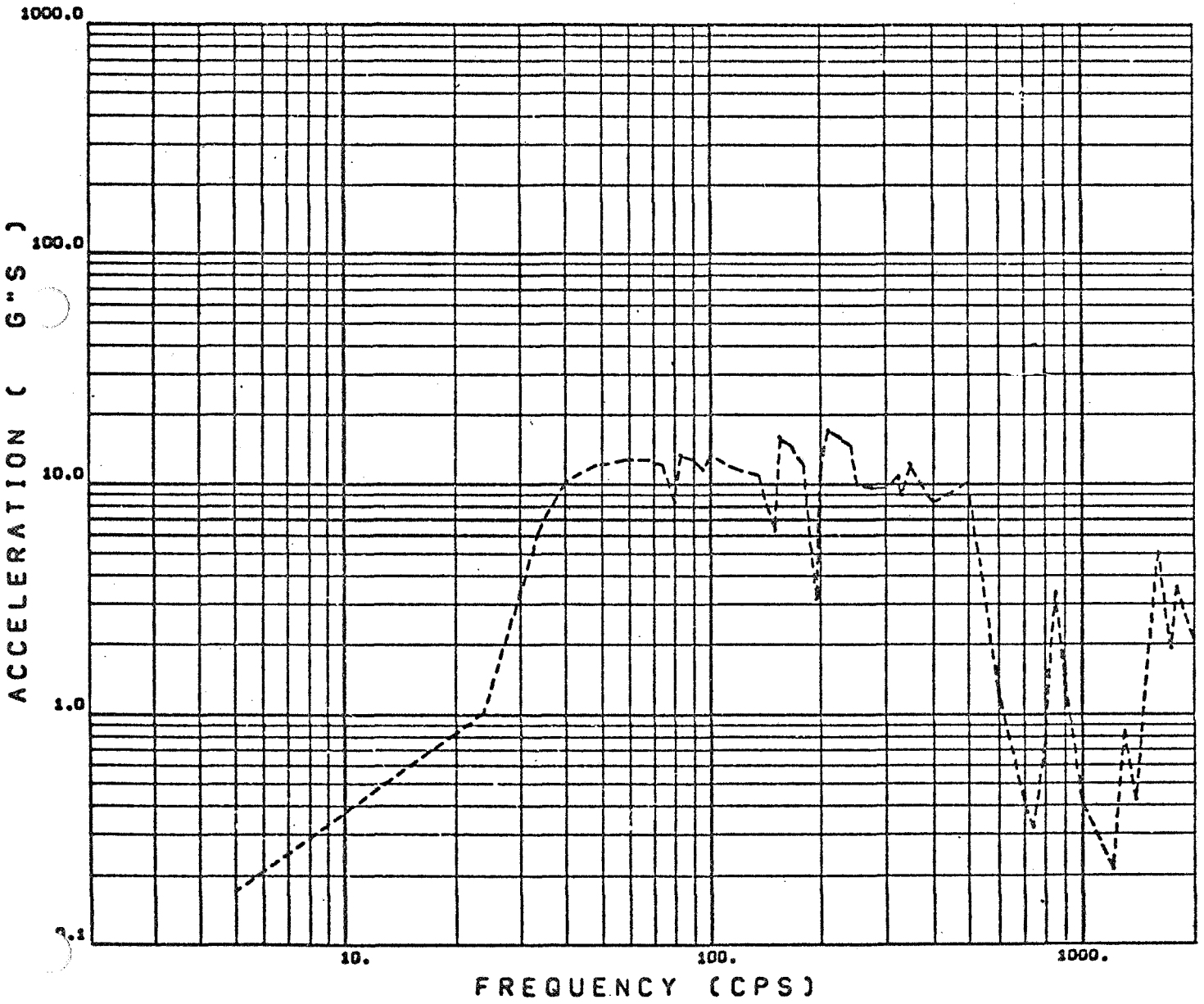
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS...
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A (5 TO 250 TO 5 CPS)
PICK UP NUMBER (10)... 10
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-11

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

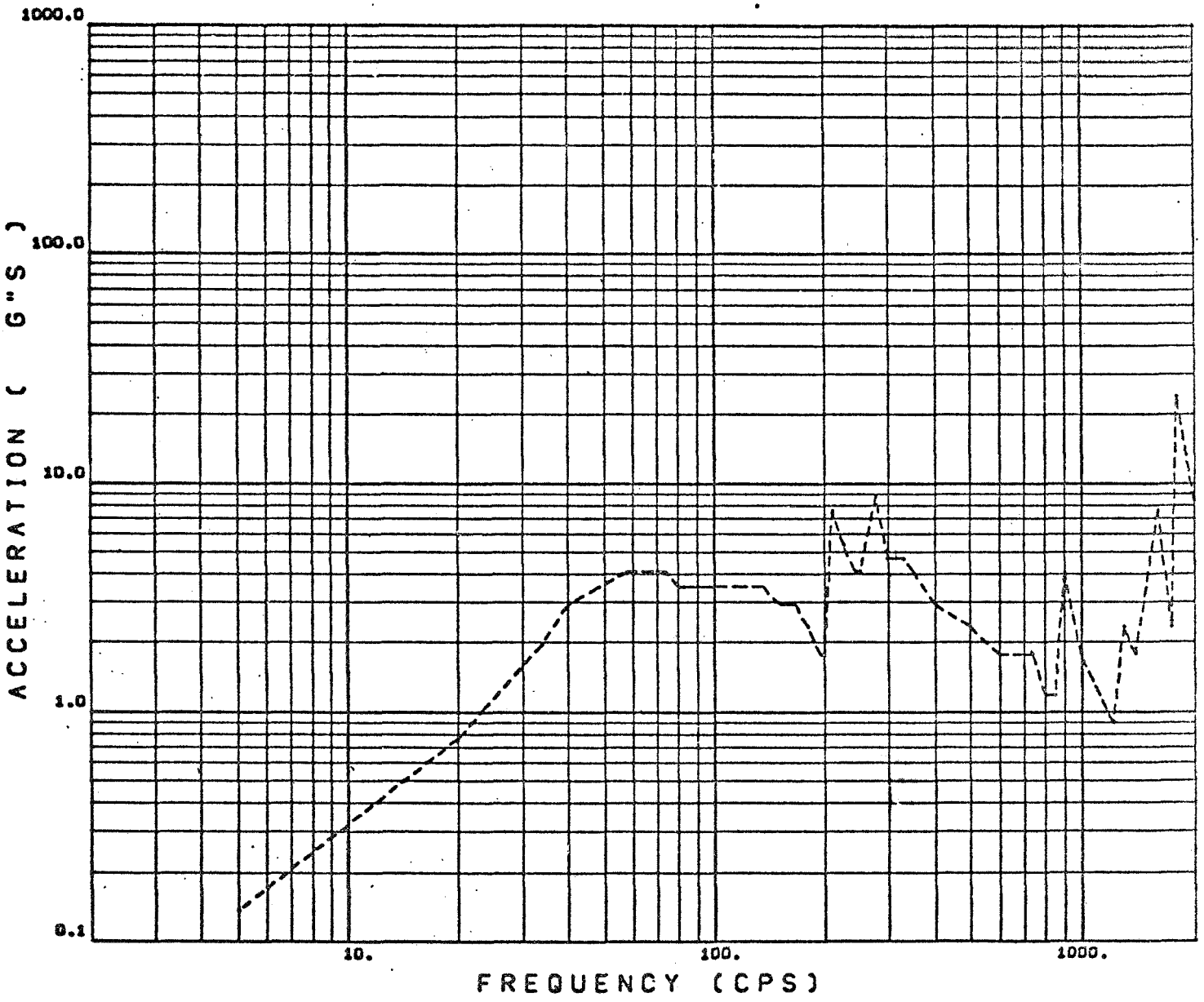
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 3-29-66
AXIS OF EXCITATION.... A (5 TO 250 TO 5 CPS)
PICK UP NUMBER (11)... 11
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-12

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

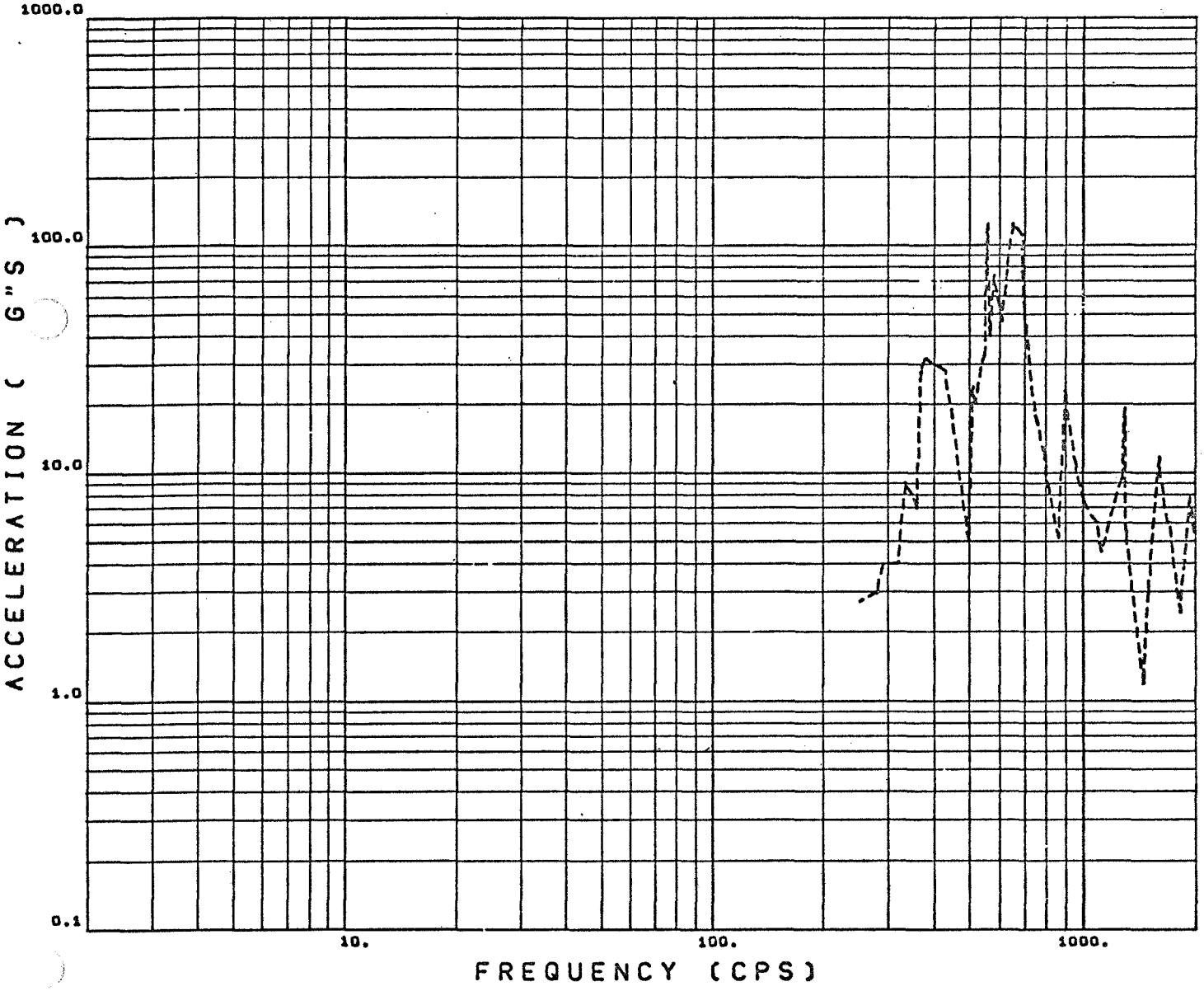
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (1)... 1
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-13

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

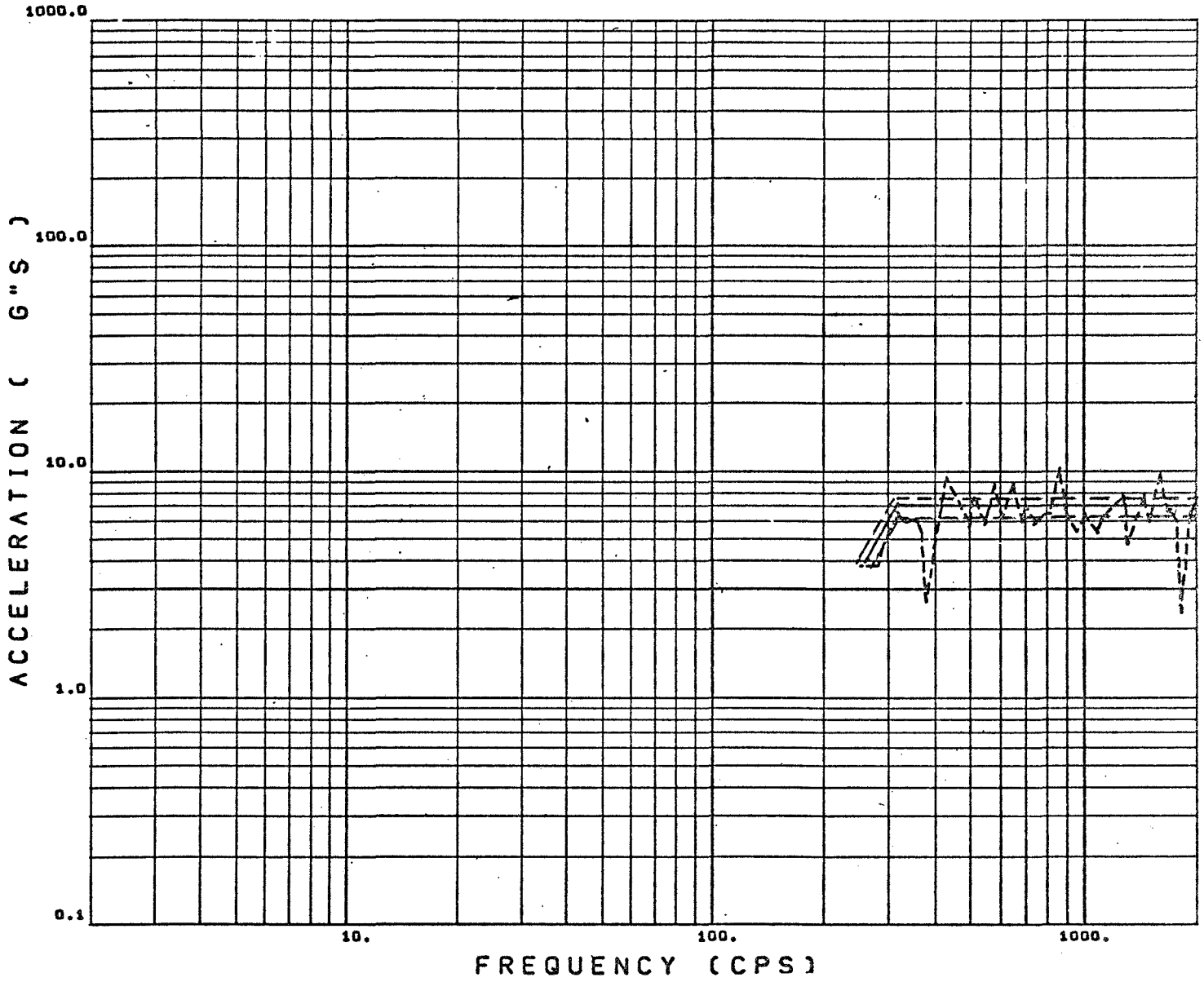
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (2)... 2
PICK UP RESPONSE..... 249 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-14

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

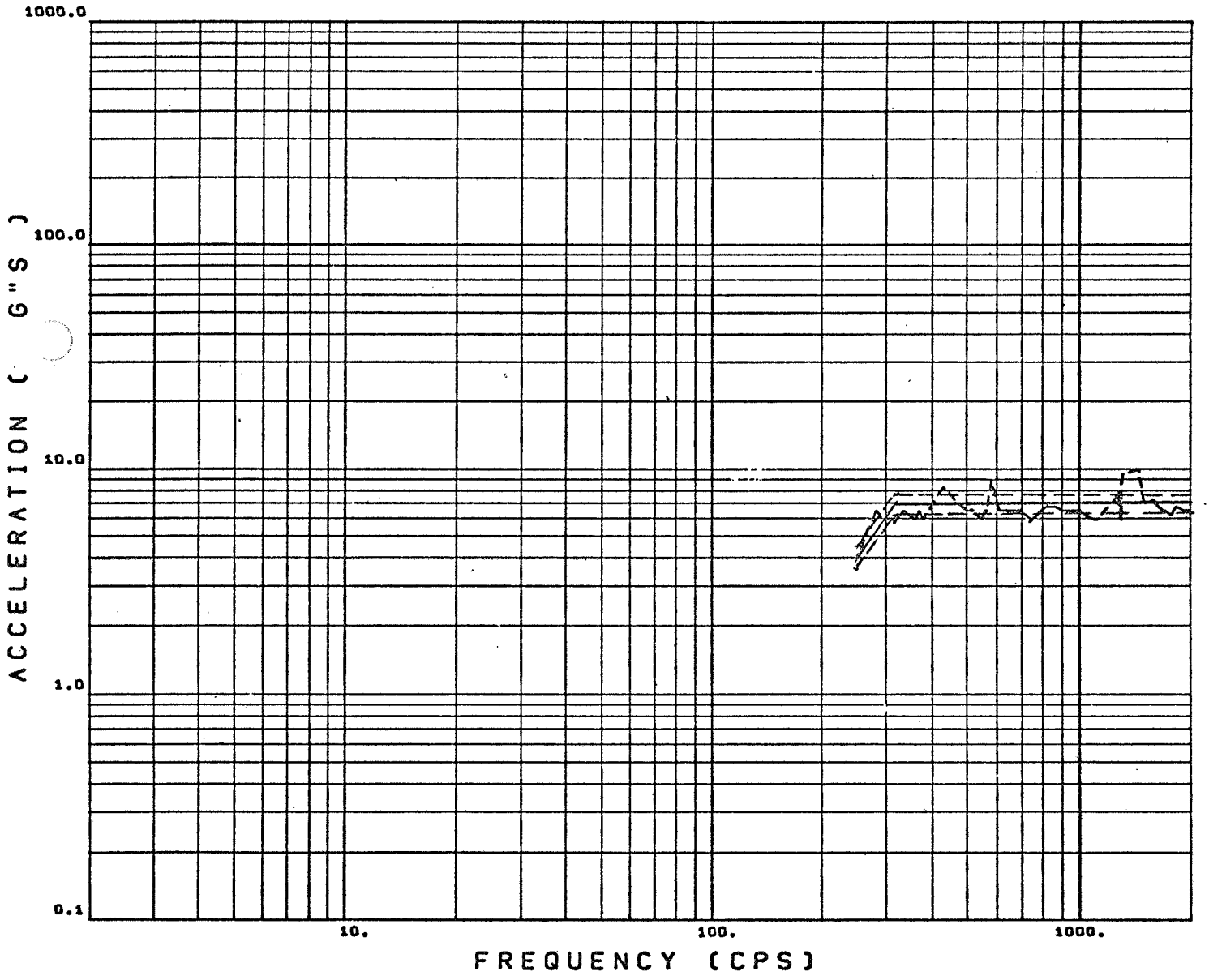
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP - - - - -

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (3)... 3
PICK UP RESPONSE..... 246 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-15

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

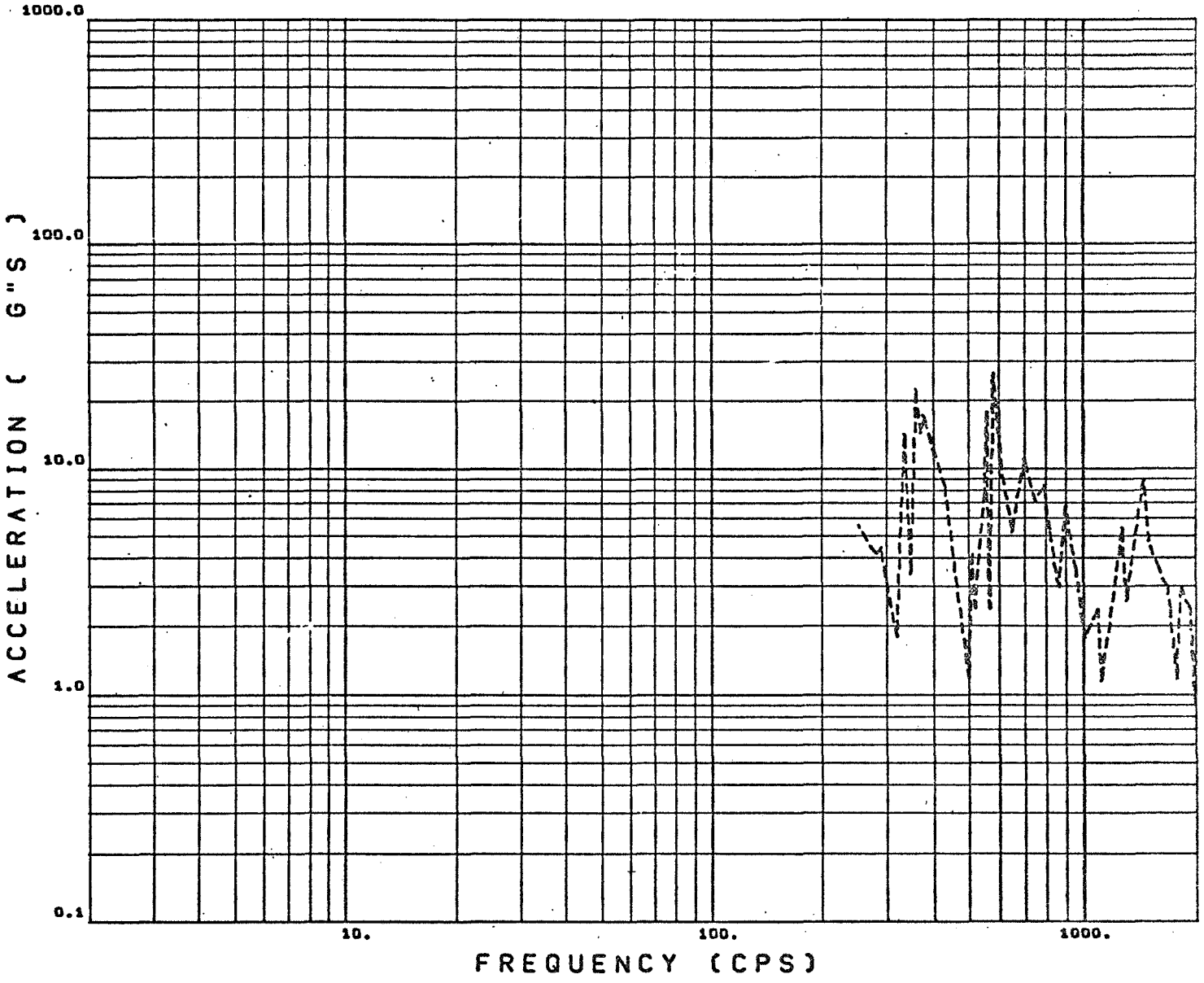
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (4)... 4
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-17

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

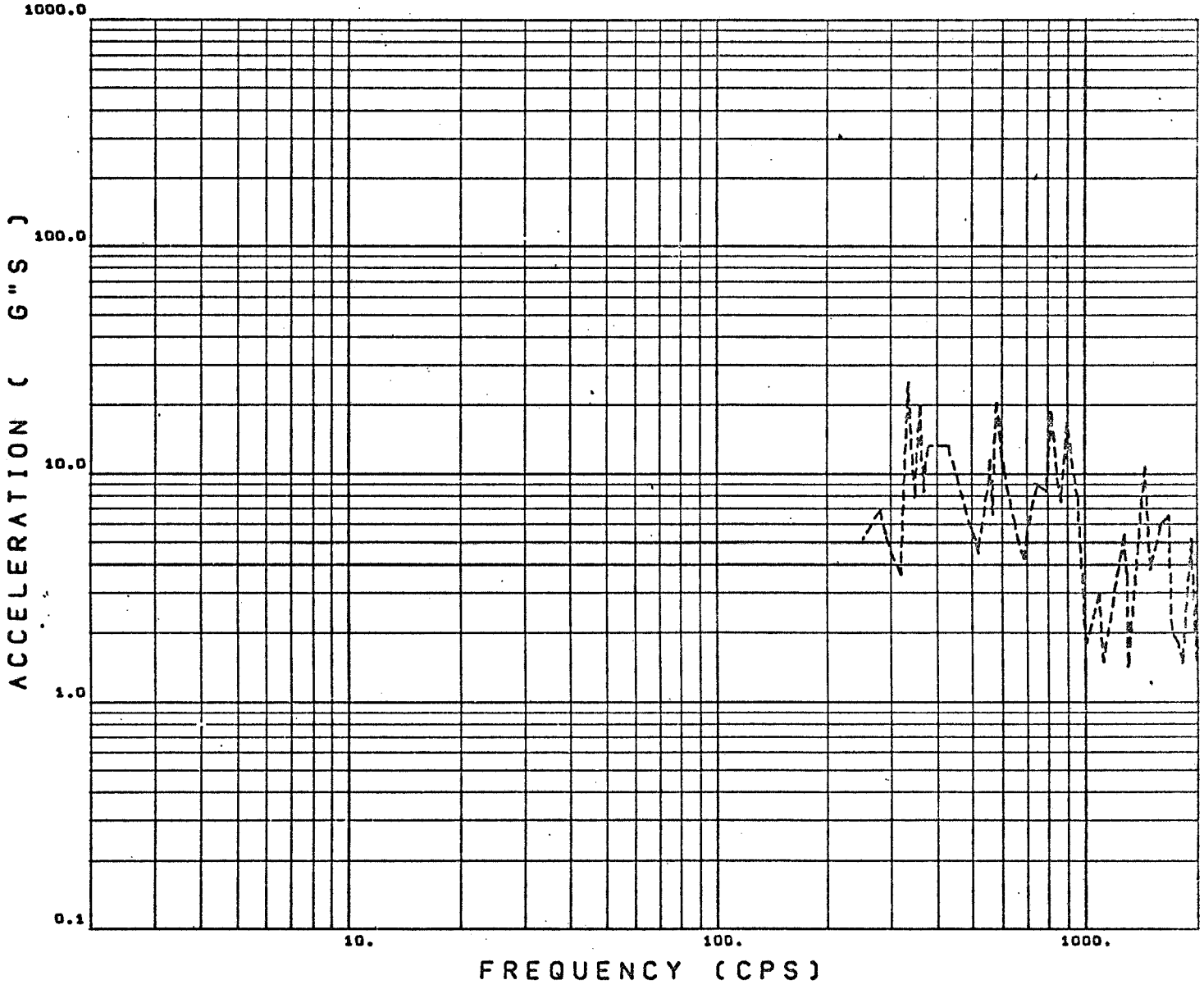
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP - - - - - -

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (6)... 6
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-18

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

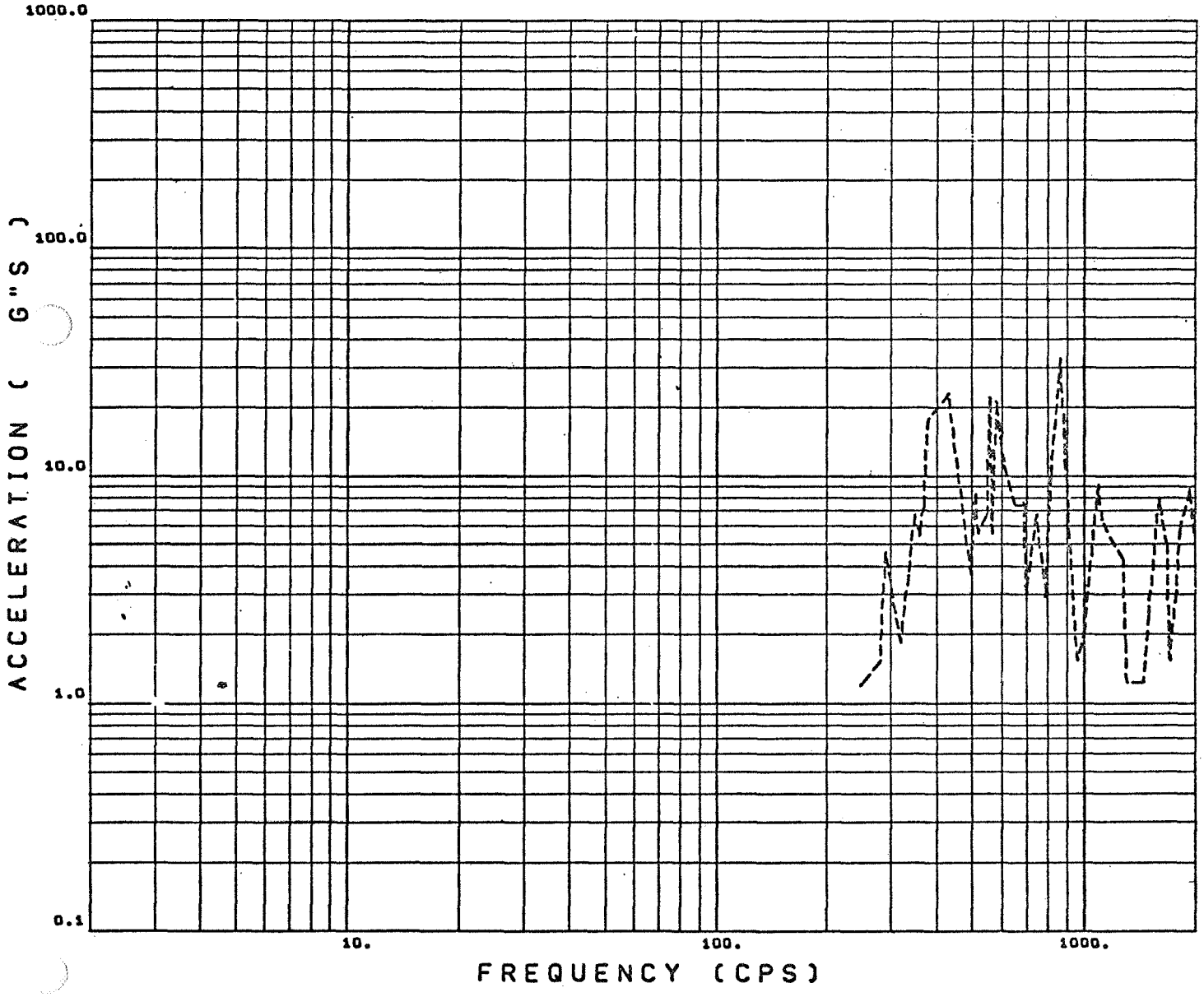
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (7)... 7
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-19

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

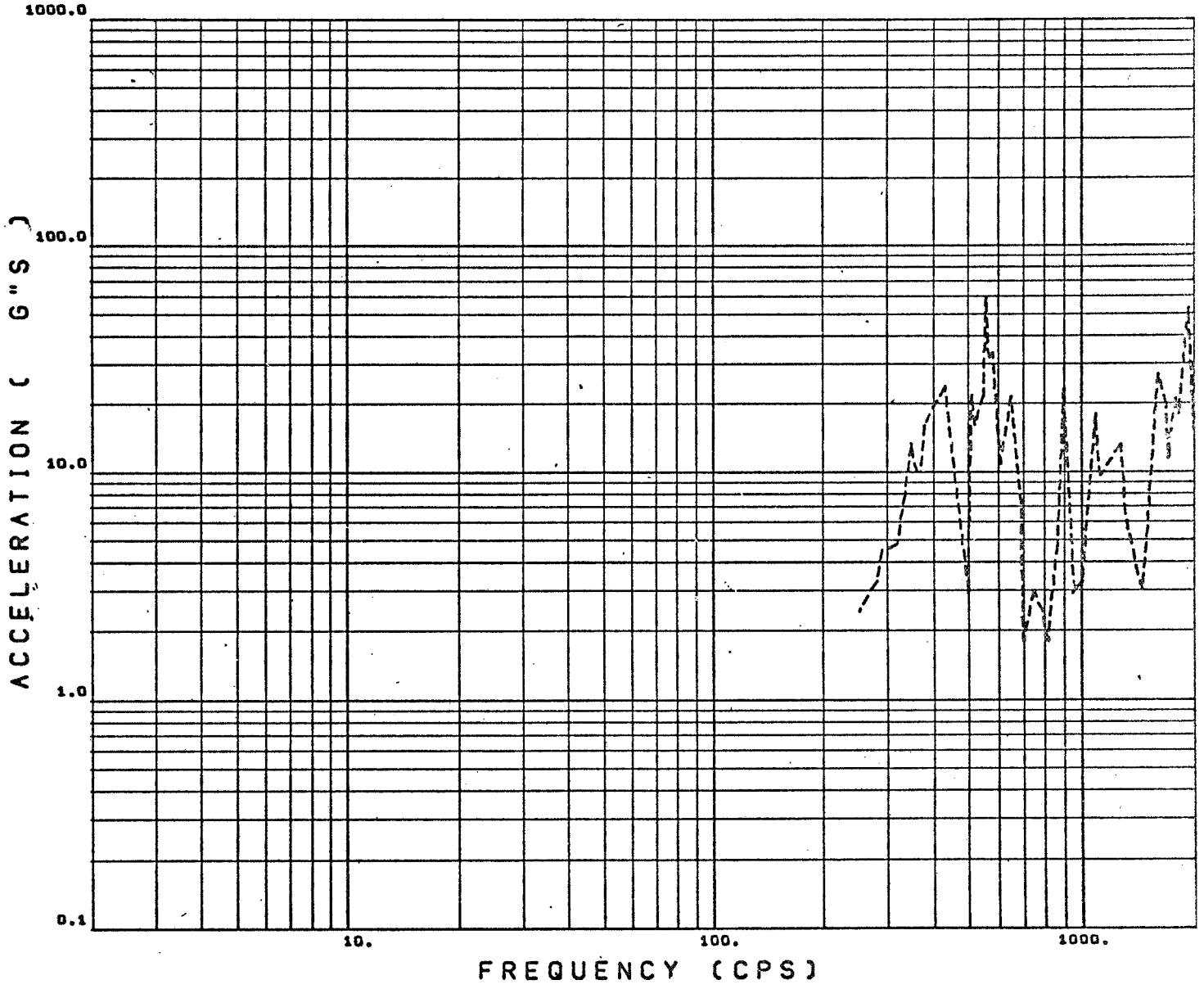
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP - - - - -

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (8)... 8
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-20

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

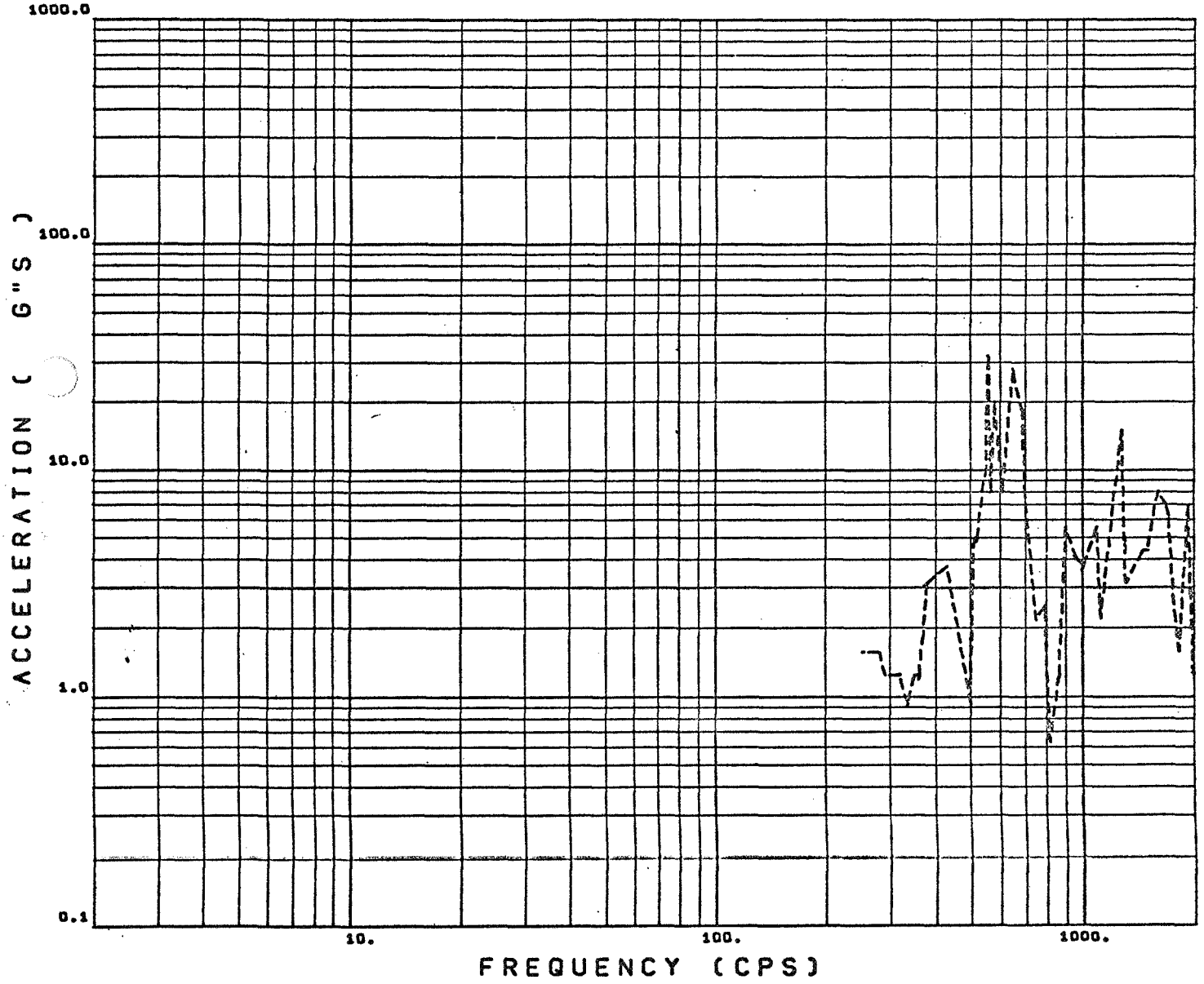
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP - - - - -

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (9)... 9
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-21

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

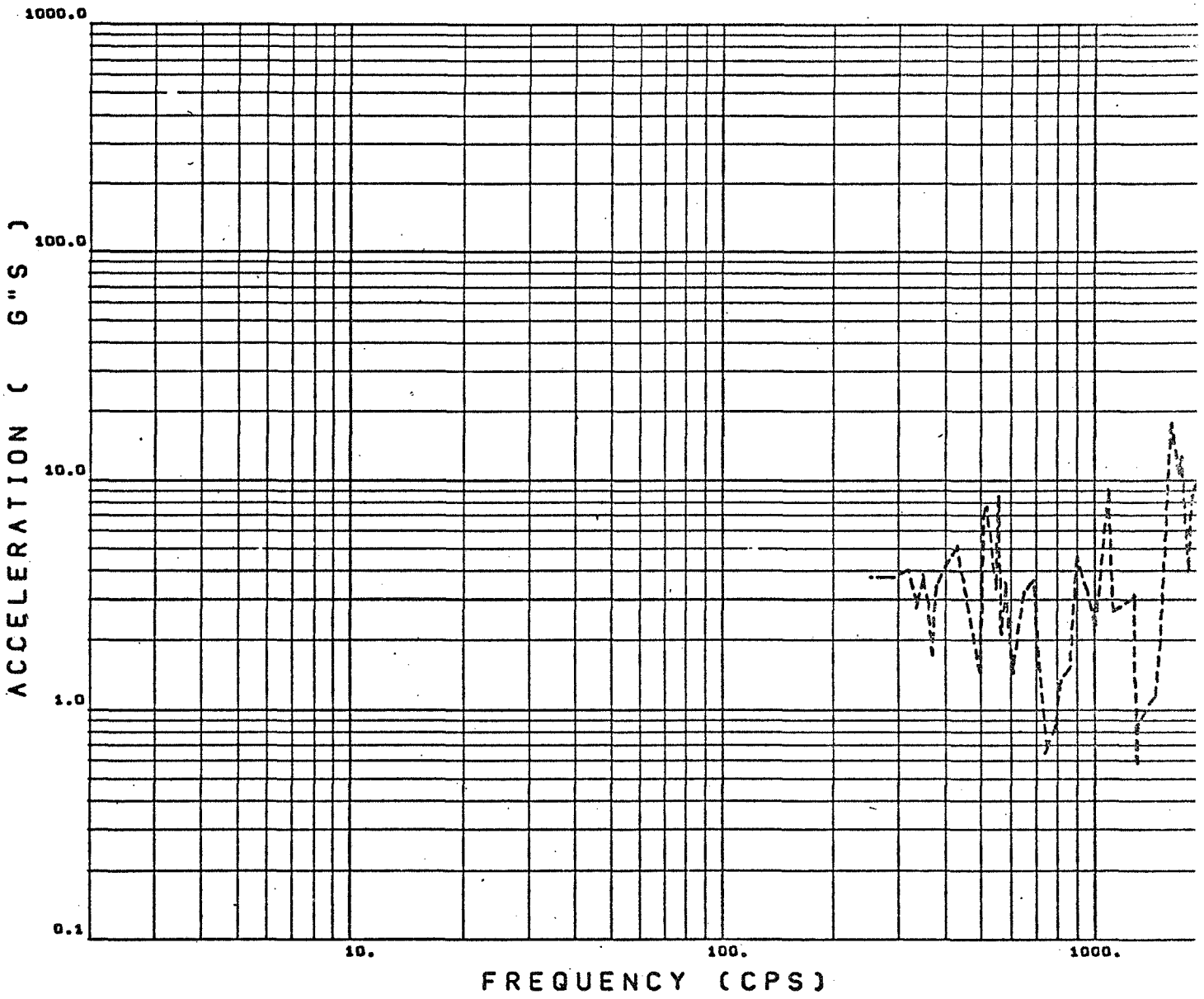
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CP
PICK UP NUMBER (10)... 10
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET II-22

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

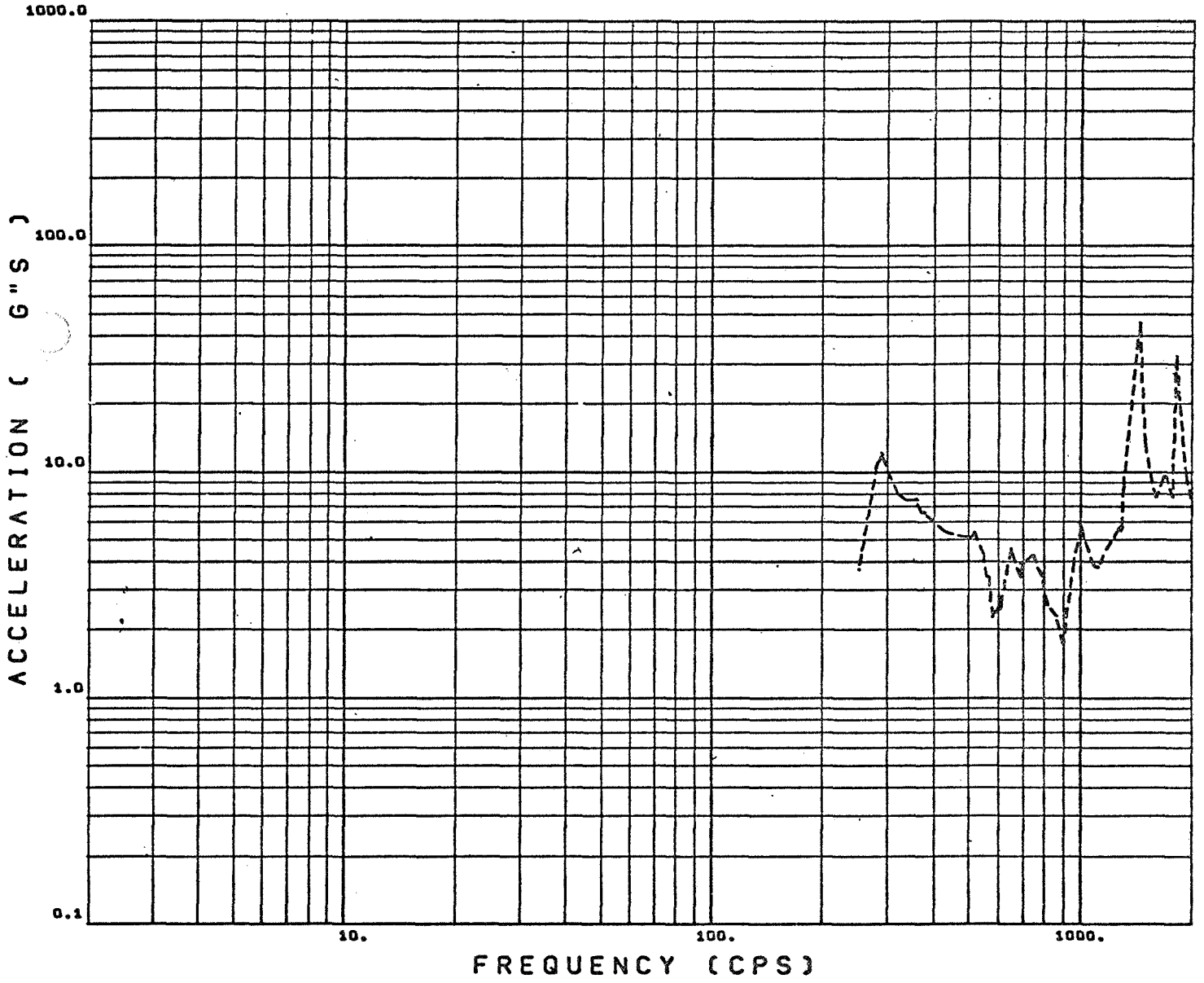
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION --- REVISED 7-23-66
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-06-66
AXIS OF EXCITATION.... A (250 TO 2000 TO 250 CPS)
PICK UP NUMBER (11)... 11
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



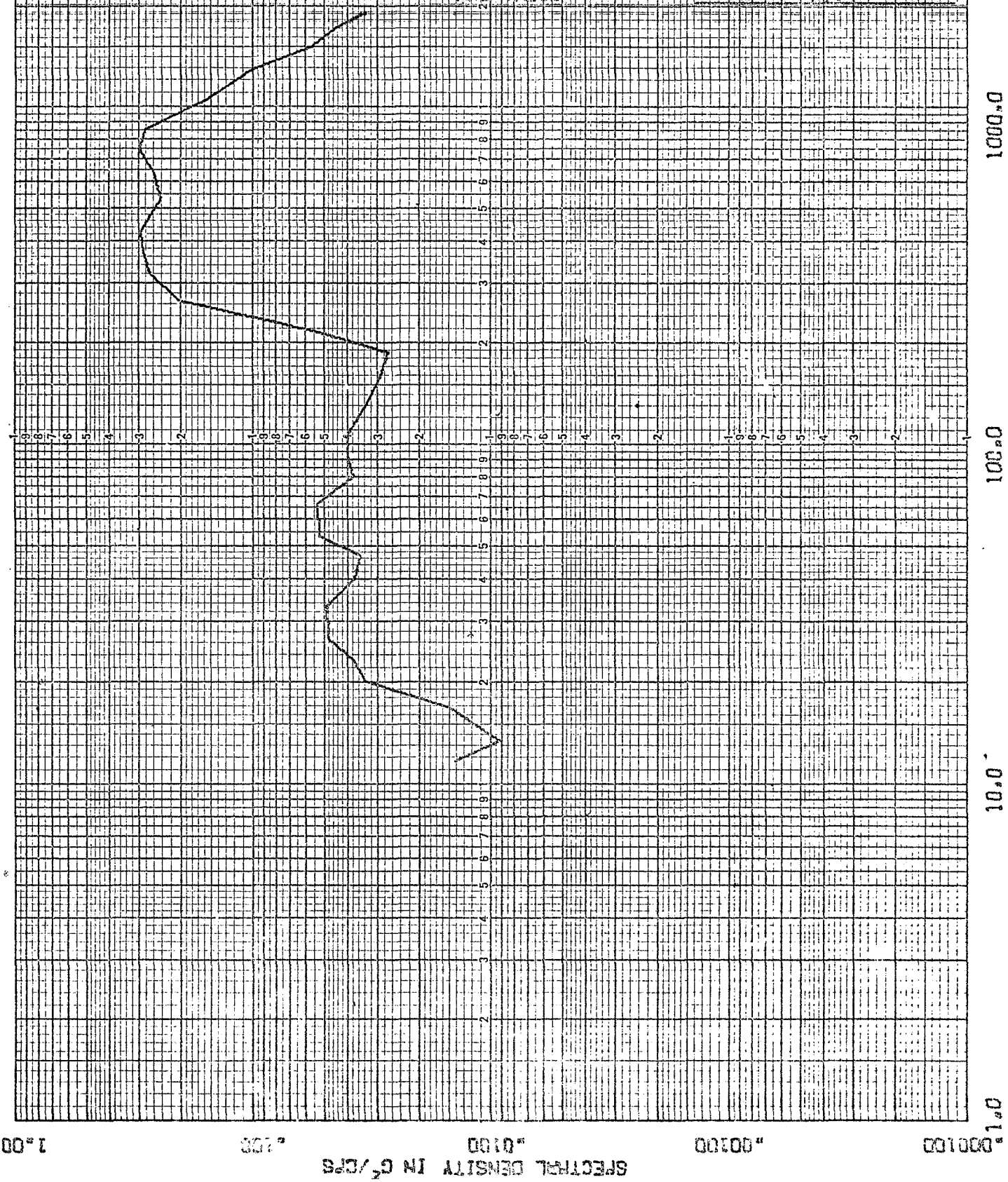
DSV-4B RANDOM VIBRATION TEST

PROPULSIVE FUEL VENT BELLOWS FDM-17 HI LEVEL

CONFIGURATION
P/N 1A87LS2-1

NOTE
SEE PAGE _____ FOR
PICK-UP LOCATION

TEST CONDITIONS
TEST DATE 4/27/66
AXIS OF EXCITATION Z
PICK-UP NUMBER 2
PICK-UP RESPONSE
INPUT ACCELERATION PER PAGE
RMS VALUE 17.7



DOUGLAS AIRCRAFT COMPANY, INC.

PAGE NO.
REPORT NO.

DATA SHEET II-24

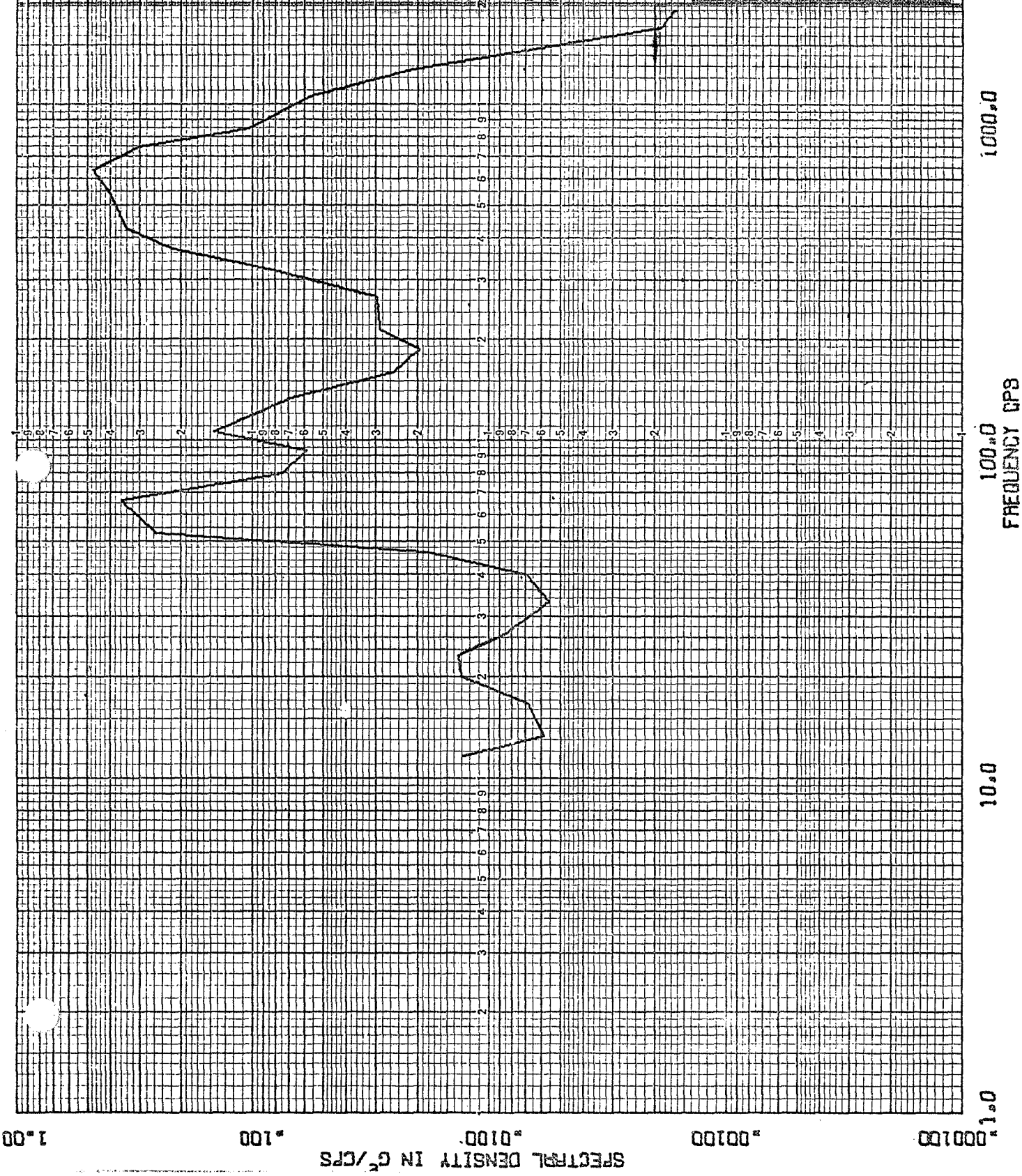
DSV-4B RANDOM VIBRATION TEST

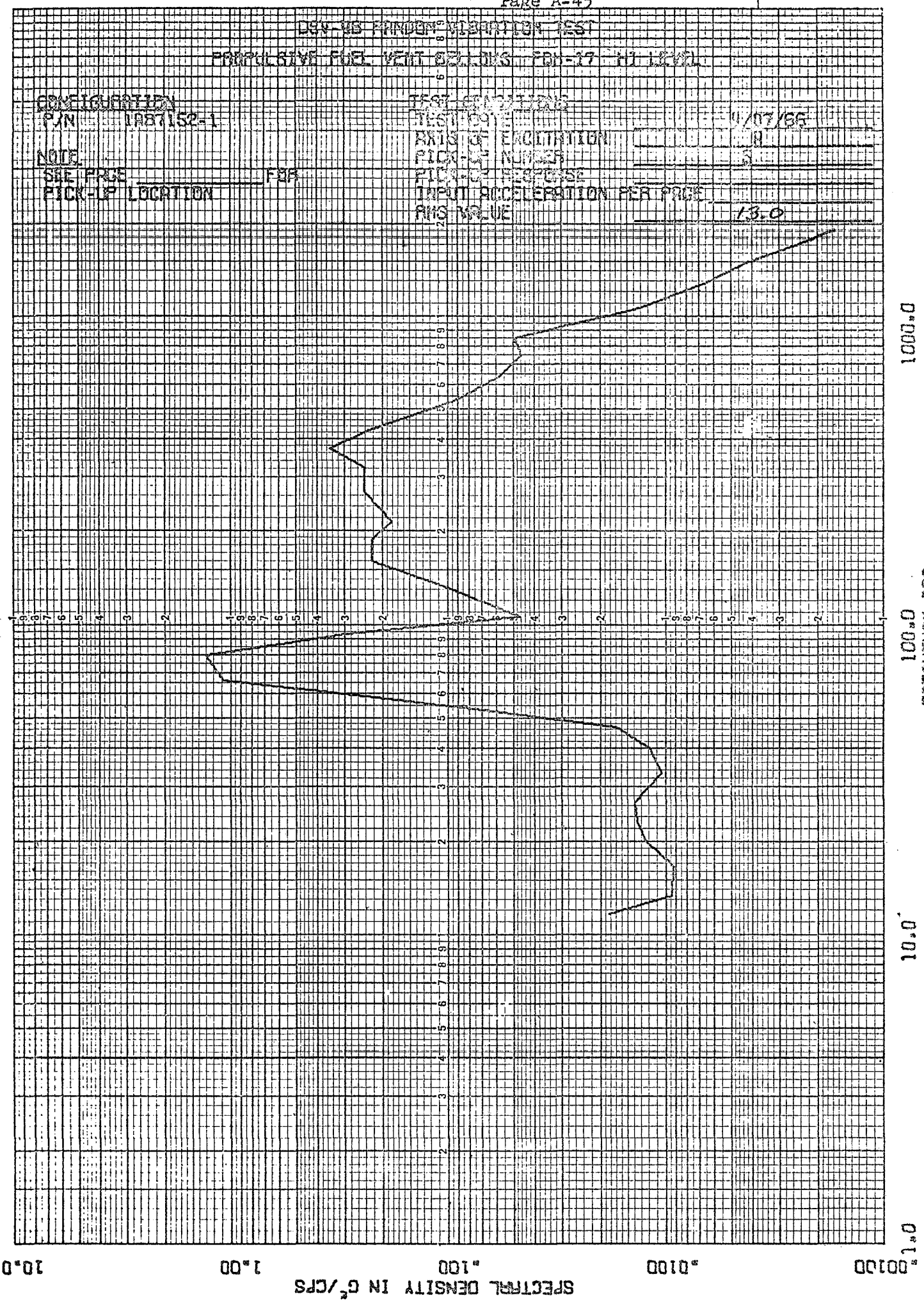
PROPULSIVE FUEL VENT BELLOWS FDH-17 HI LEVEL

CONFIGURATION
P/N 1A87152-1

NOTE
SEE PAGE _____ FOR
PICK-UP LOCATION

TEST CONDITIONS
TEST DATE 11/07/66
AXIS OF EXCITATION B
PICK-UP NUMBER 4
PICK-UP RESPONSE
INPUT ACCELERATION PER PAGE
RMS VALUE 15.4

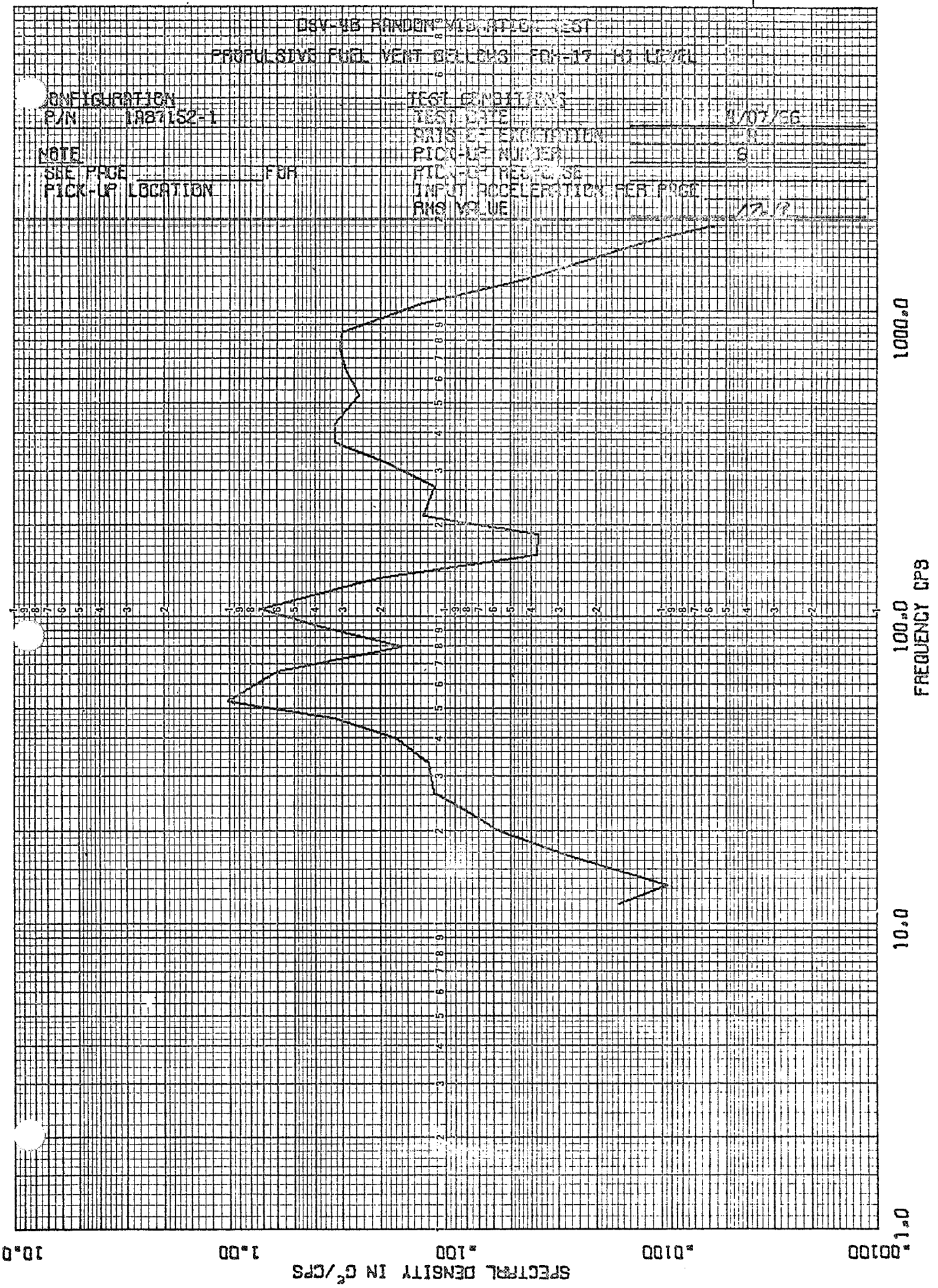


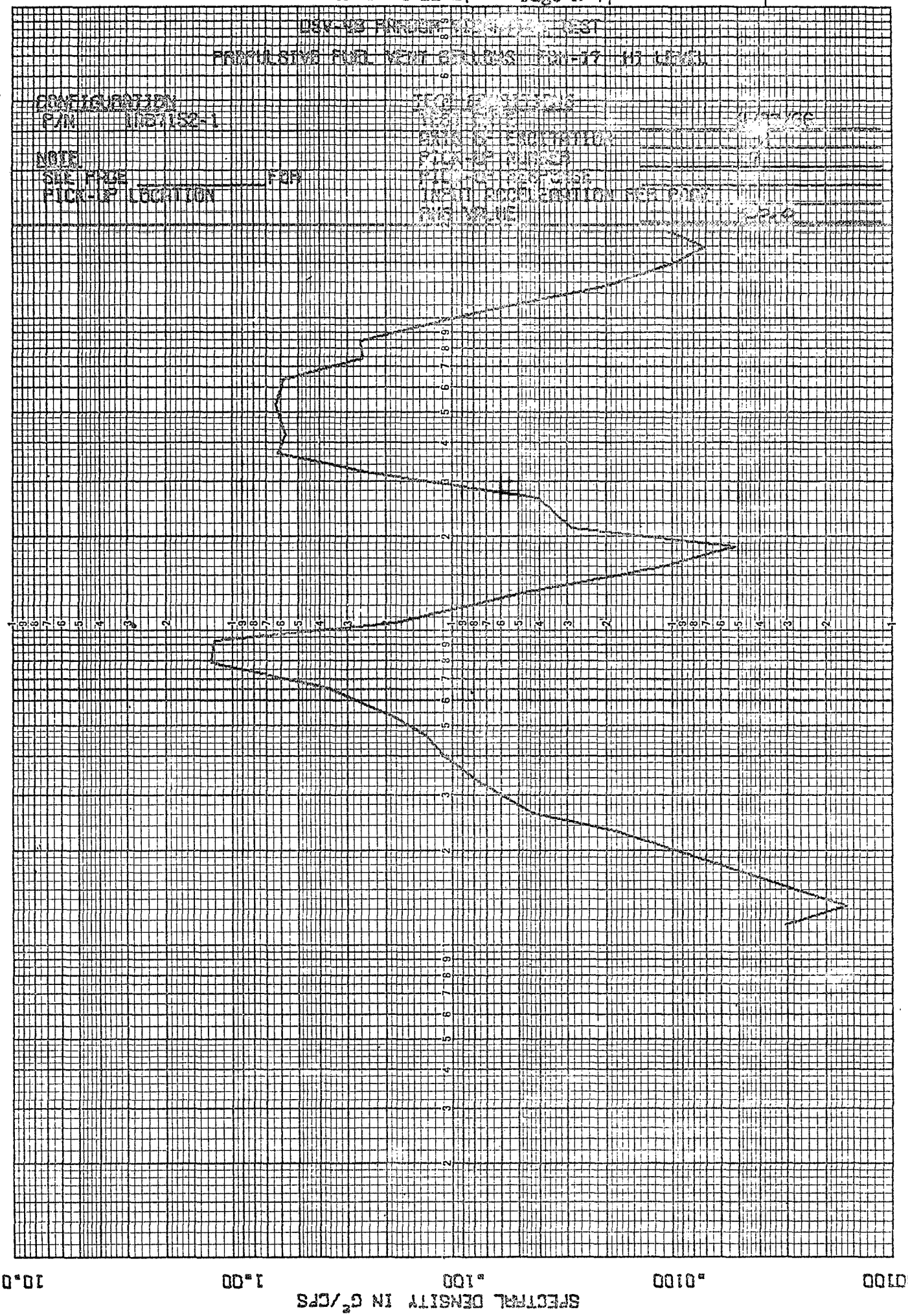

DSV-4B RANDOM VIBRATION TEST
PROPULSIVE FUEL VENT BELLOWS FDH-17 HI LEVEL
CONFIGURATION
P/N 1A87152-1
NOTE
SEE PAGE _____ FOR
PICK-UP LOCATION
TEST CONDITIONS
TEST DATE 4/07/66
AXIS OF EXCITATION A
PICK-UP NUMBER 3
PICK-UP RESPONSE
INPUT ACCELERATION PER PAGE
RMS VALUE 13.0
1000.0
100.0
10.0
1.0
FREQUENCY CPS
10.0
1.00
.100
.0100
.00100
SPECTRAL DENSITY IN G²/CPS

DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET II-26

PAGE NO
REPORT NO

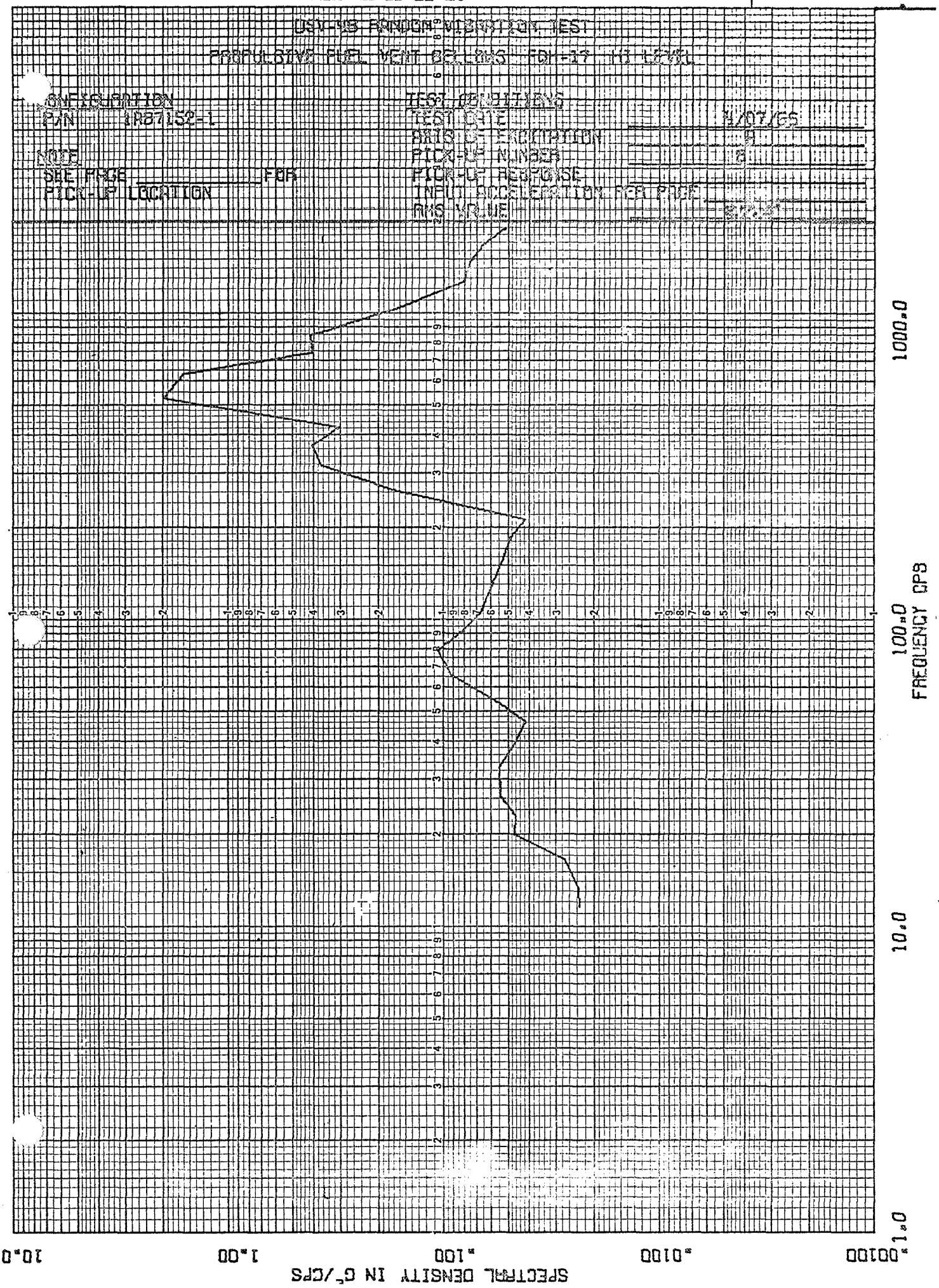


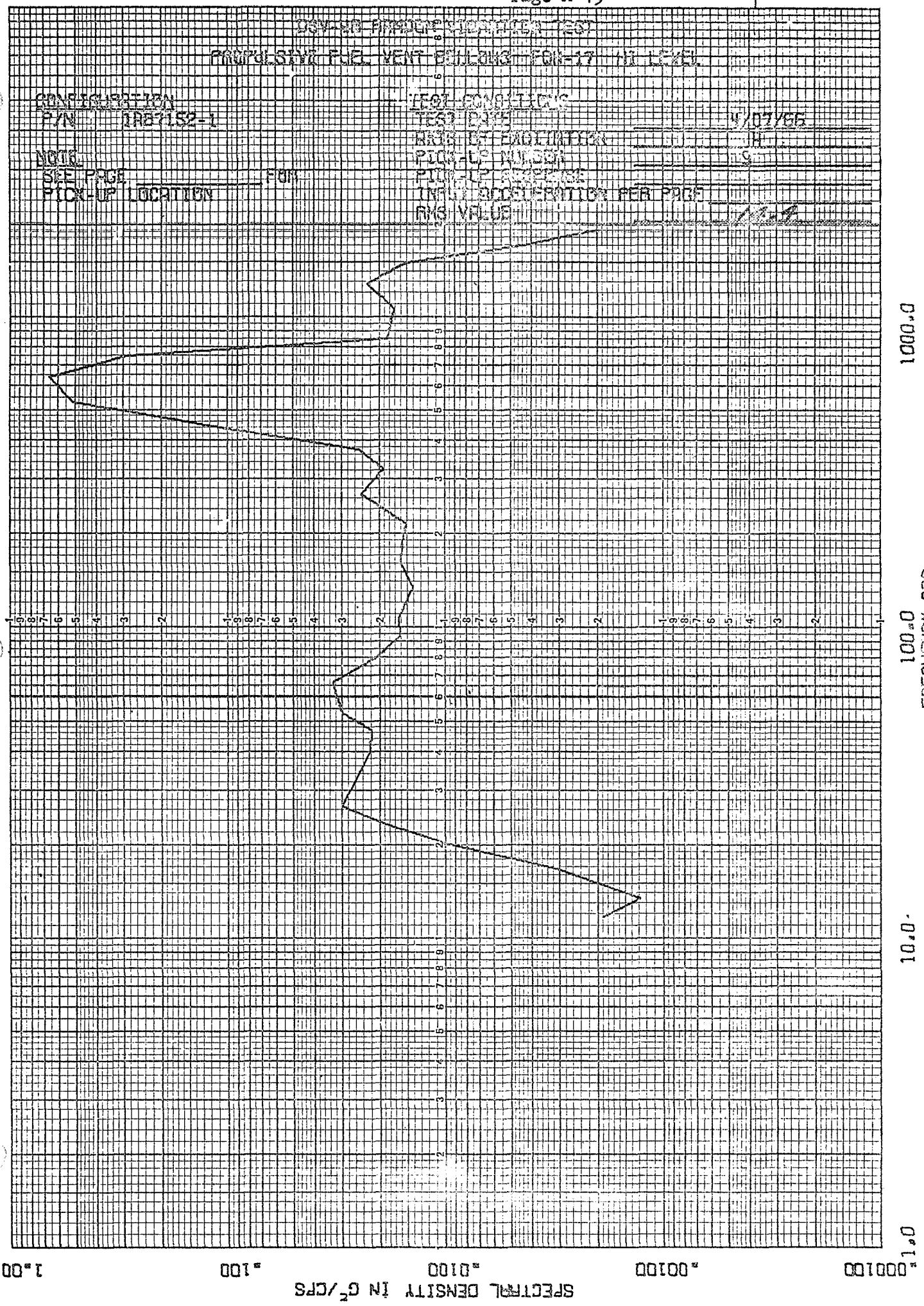

DSV-4B
PROPULSIVE FUEL VENT
CONFIGURATION
P/N
NOTE
SEE PAGE
PICK-UP LOCATION
TOP
1000.0
100.0
10.0
1.0
FREQUENCY CPS
.0100
.100
1.00
10.0
SPECTRAL DENSITY IN G²/CPS

DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET II-28

PAGE NO.
REPORT NO.

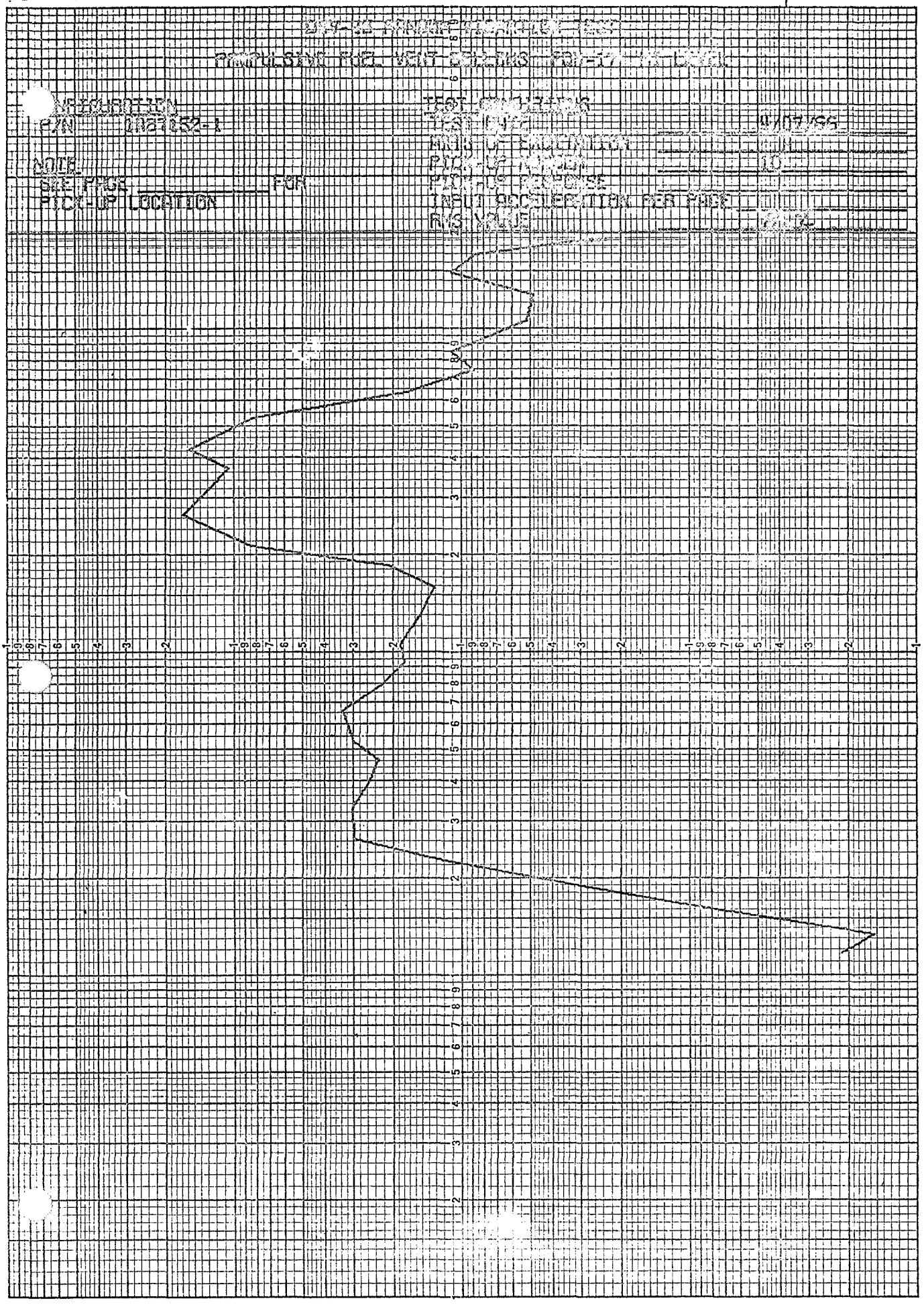


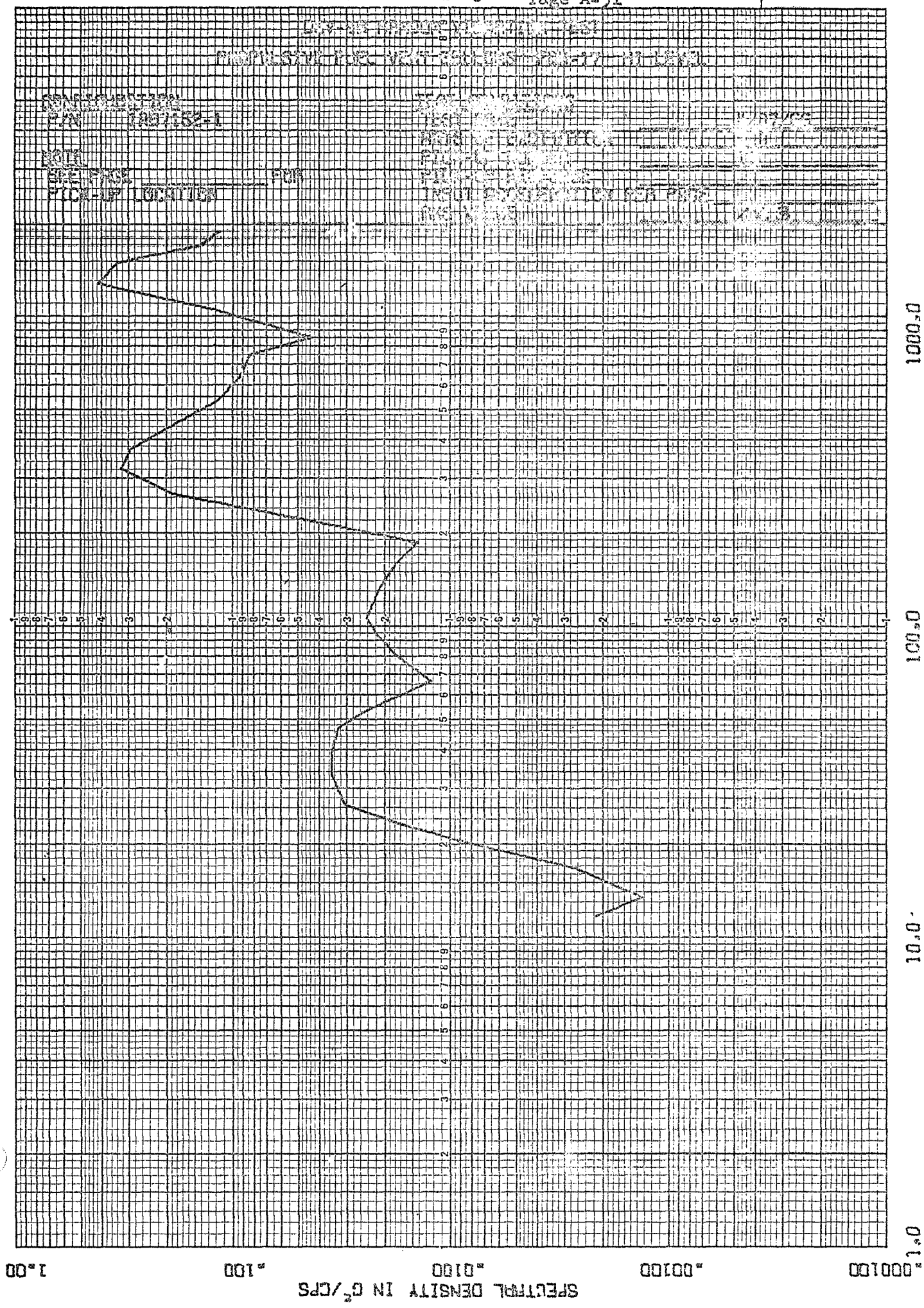

DSV-4B AIRBORNE VIBRATION TEST
PROPULSION FUEL VENT BUILDING FOR-17 HI LEVEL
CONFIGURATION
P/N 1R87152-1
NOTE
SEE PAGE FOR
PICK-UP LOCATION
TEST CONDITIONS
TEST DATE 4/07/66
AXIS OF EXCITATION H
PICK-UP NUMBER 9
PICK-UP SENSITIVITY
INPUT ACCELERATION PER PAGE
RMS VALUE 14.1
1000.0
100.0
10.0
1.0
FREQUENCY CPS
.00100
.0100
.100
1.00
SPECTRAL DENSITY IN G²/CPS

DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET II-30

PAGE NO.
REPORT NO.



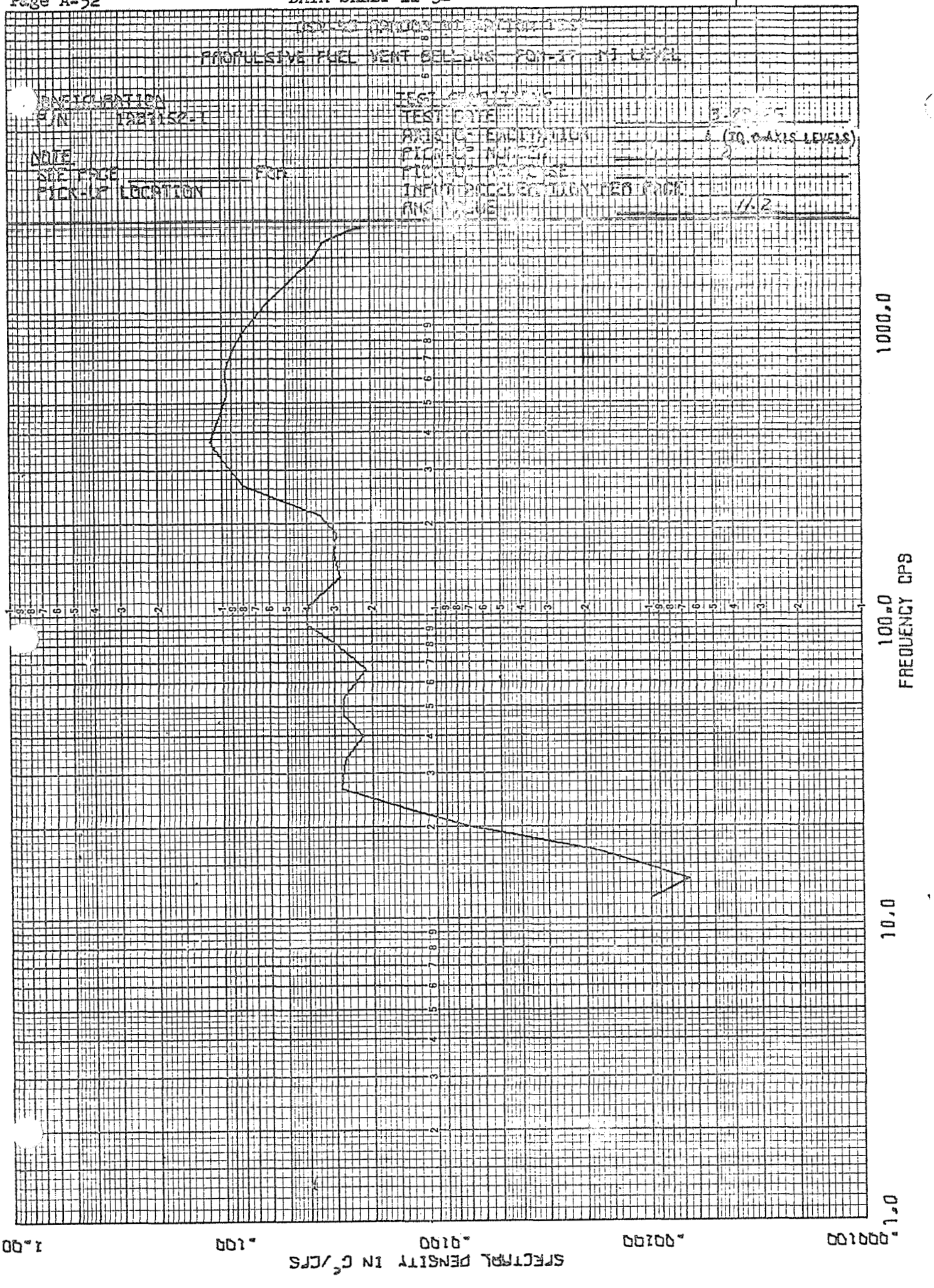


1000.0
100.0
10.0
1.0
FREQUENCY CPS
.00010
.0010
.010
.100
1.00
SPECTRAL DENSITY IN G²/CPS

DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET II-32

PAGE NO. _____
REPORT NO. _____



DATA SHEET II-33

REPORT NO

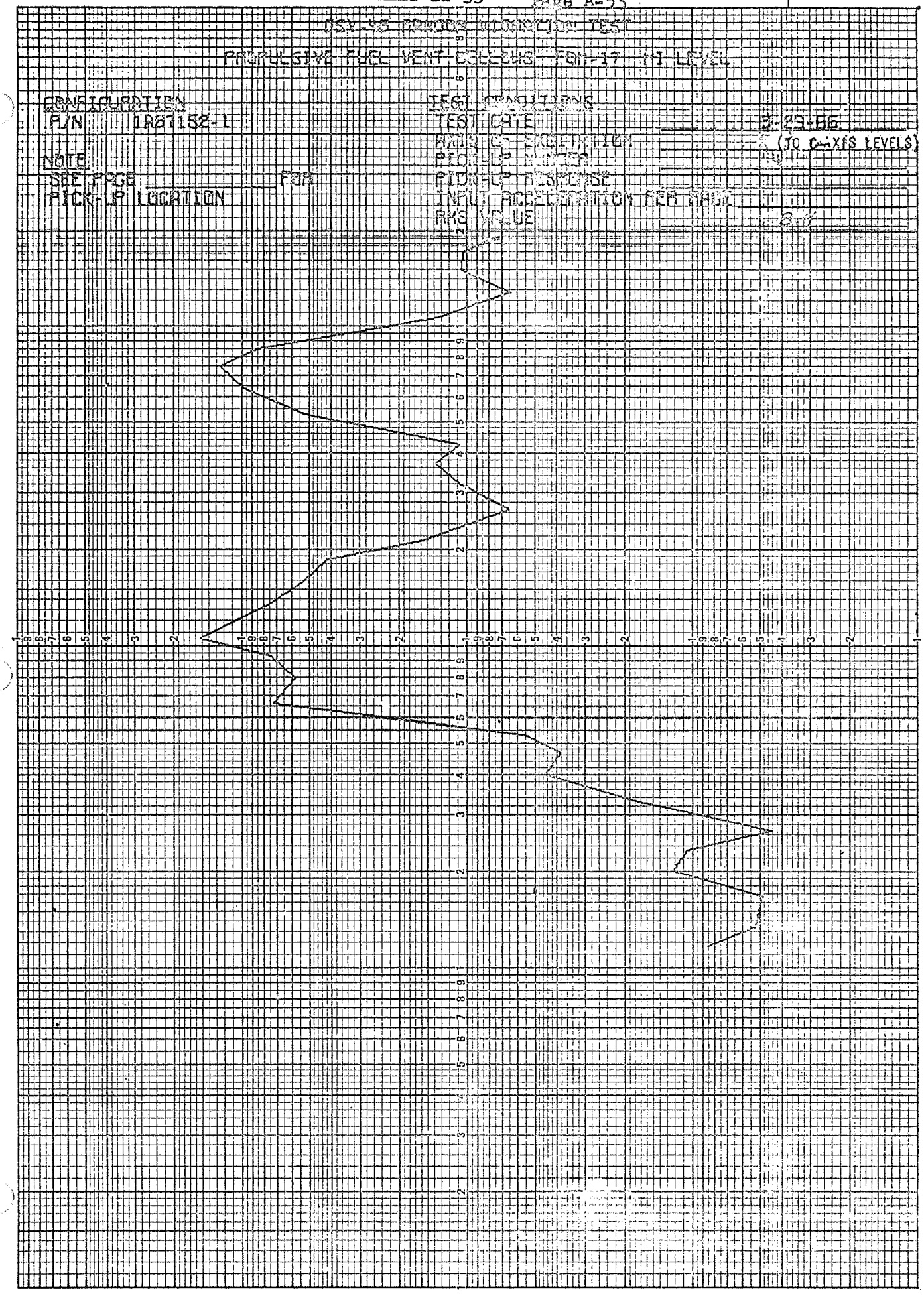
DSV-4B RANDOM VIBRATION TEST

PROPULSIVE FUEL VENT COLLECTOR FOR-17 HI LEVEL

CONFIGURATION
P/N 1R87152-1

NOTE
SEE PAGE ____ FOR
PICK-UP LOCATION

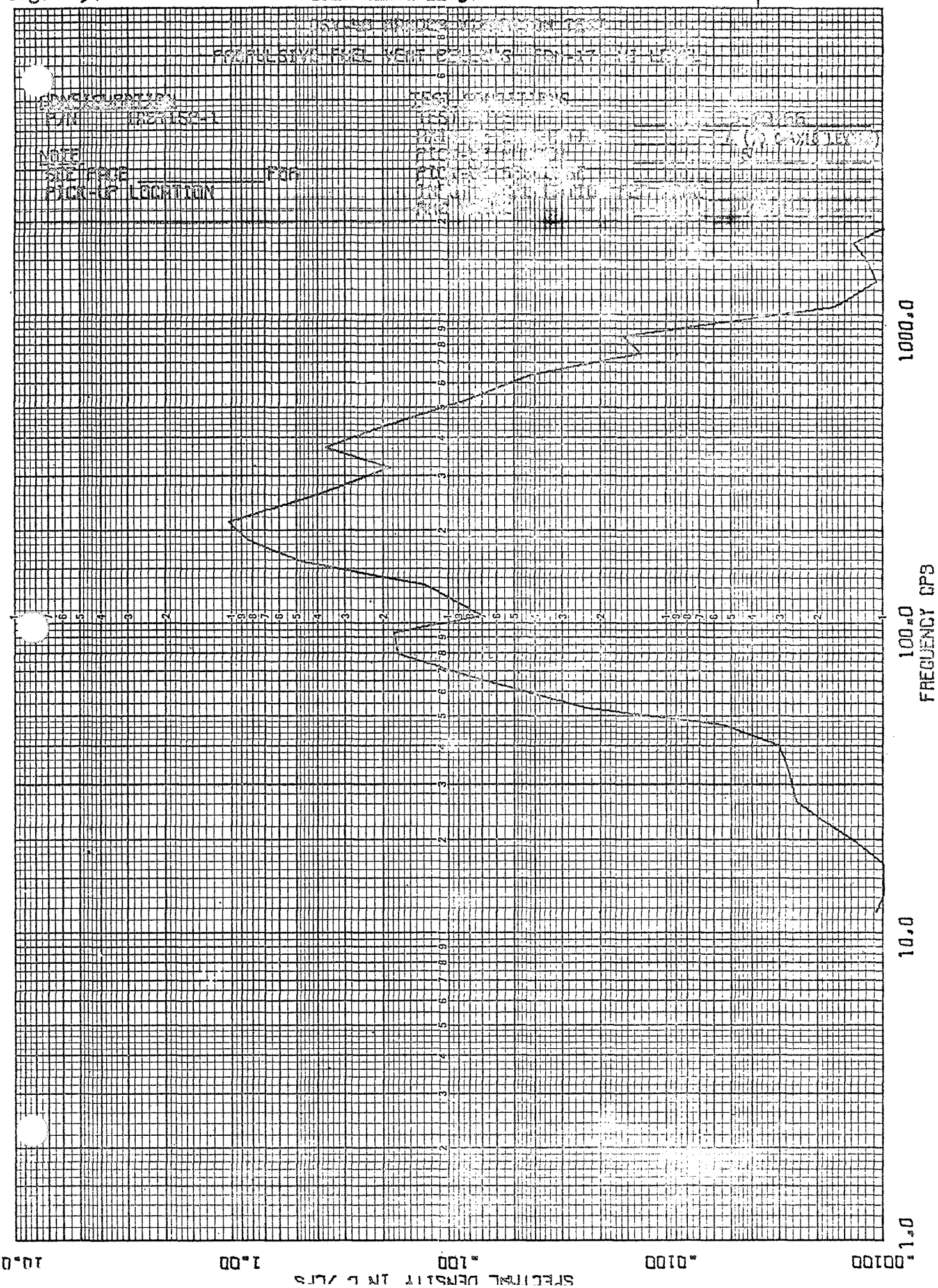
TEST CONDITIONS
TEST DATE 3-29-66
AXIS OF ROTATION (TO CAMIXIS LEVELS)
PICK-UP NUMBER
PICK-UP DISPLACEMENT
INPUT ACCELERATION PER PAGE
RMS VALUE 8.7

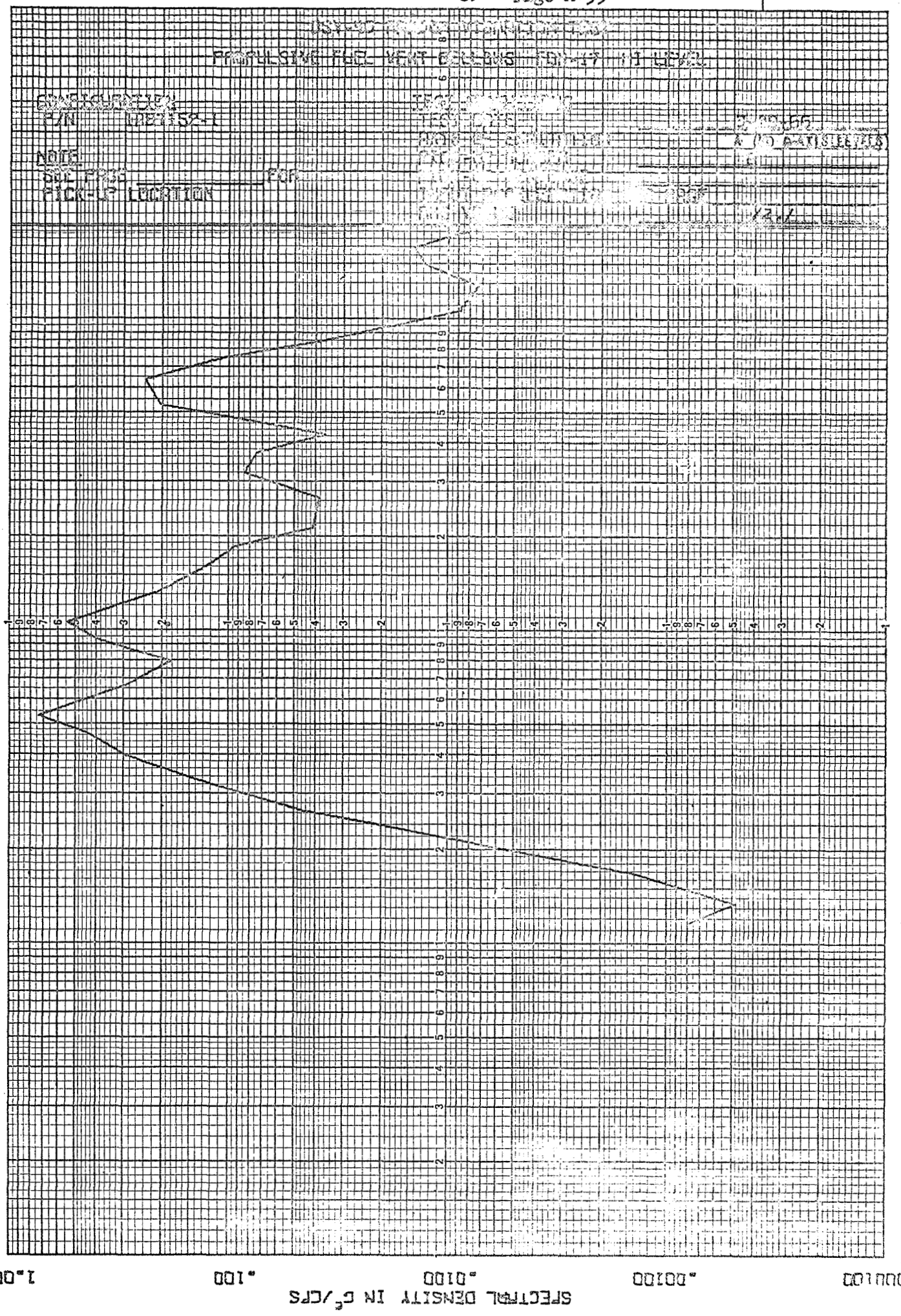


DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET II-34

PAGE NO.
REPORT NO.

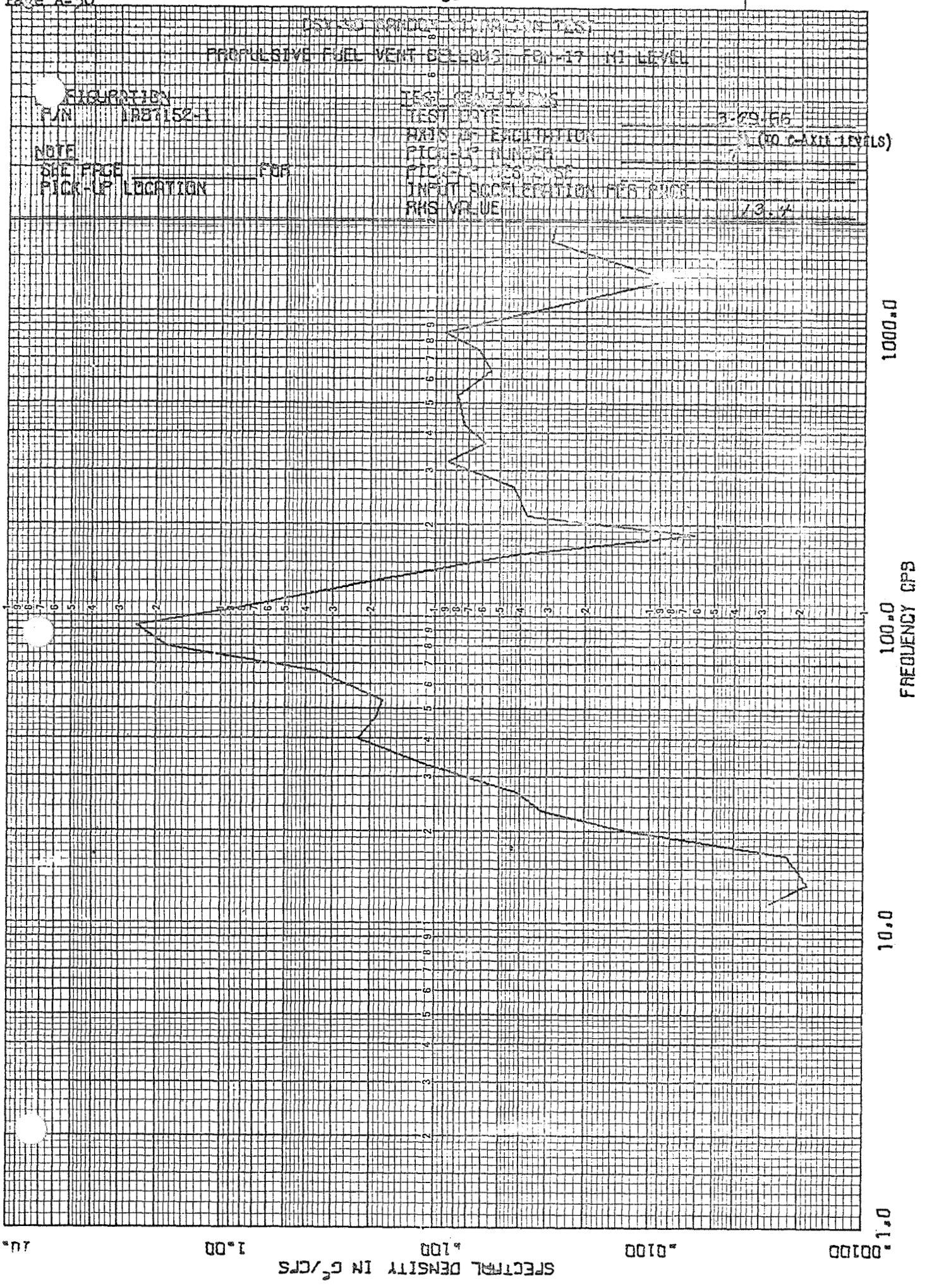


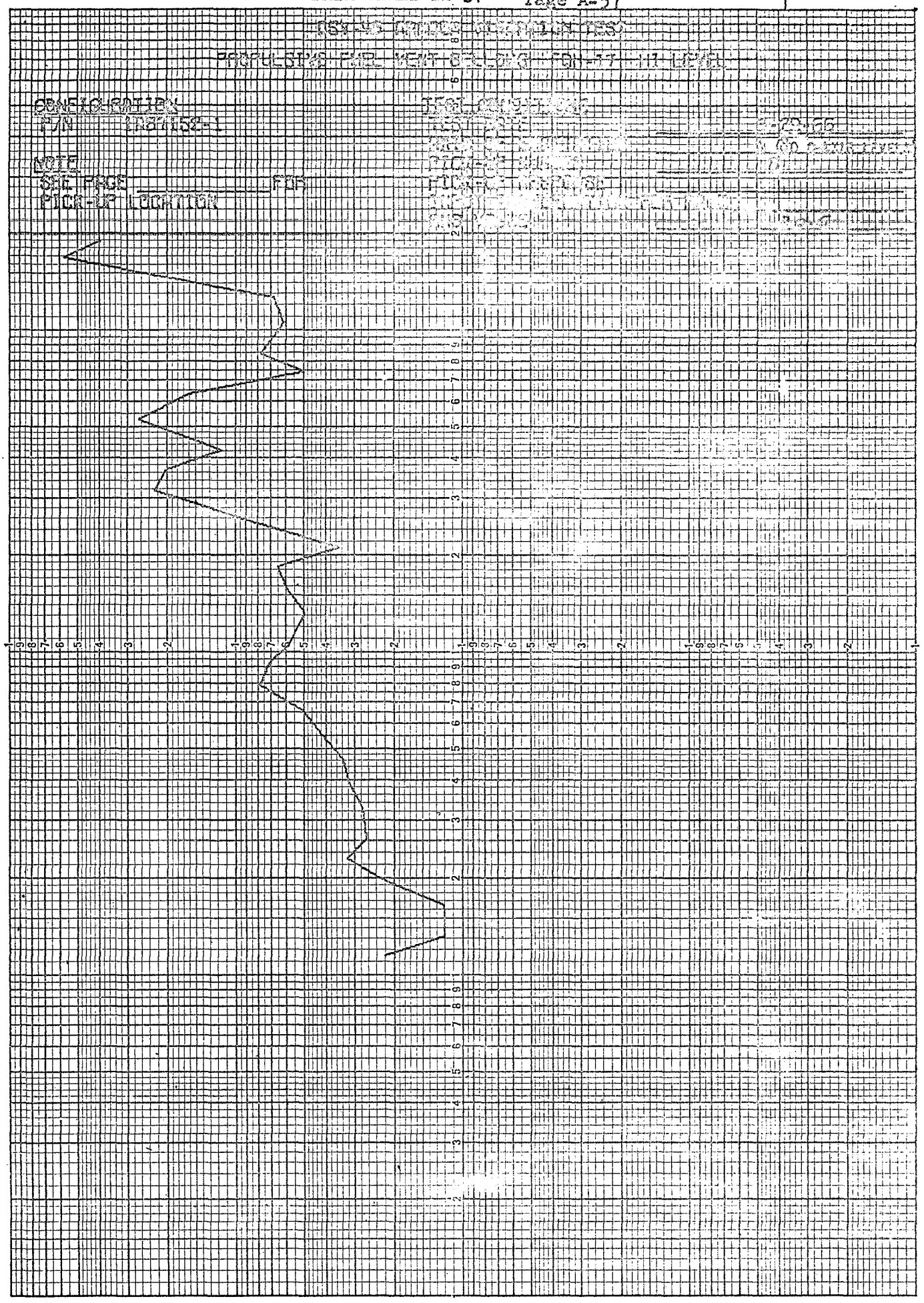

PROPULSIVE FUEL VENT
CONFIGURATION
P/N
NOTE
PICK-UP LOCATION
FOR
1000.0
100.0
10.0
1.0
FREQUENCY CPS
.00100
.0100
.0100
.100
1.00
SPECTRAL DENSITY IN G²/CPS

DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET II-36

PAGE NO. _____
REPORT NO _____

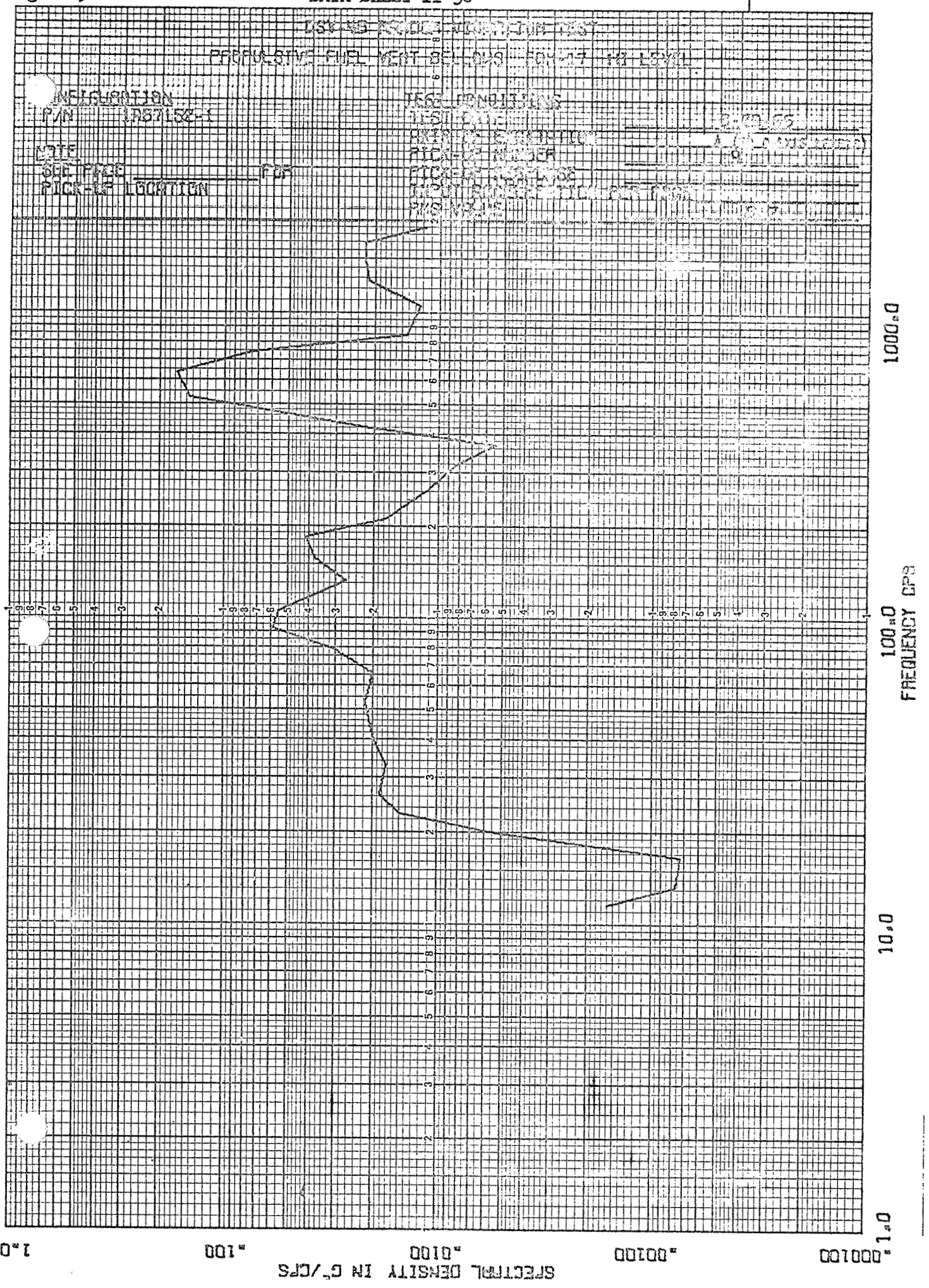


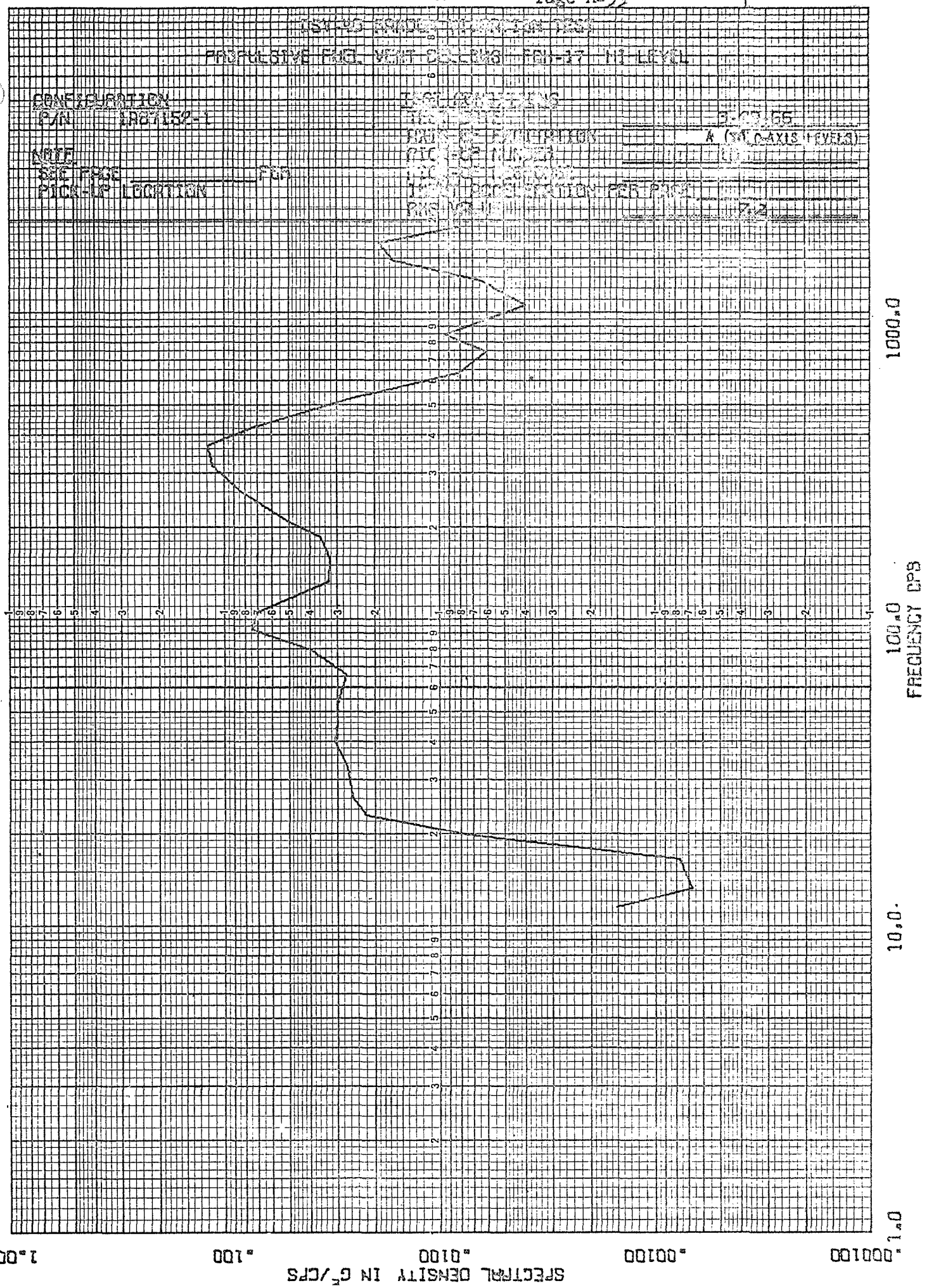

CONFIGURATION
P/N
NOTE
SEE PAGE
FOR
PICK-UP LOCATION
1000.0
100.0
10.0
1.0
FREQUENCY CPS
.00100
.0100
.0100
.100
1.00
SPECTRAL DENSITY IN G²/CPS

DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET II-38

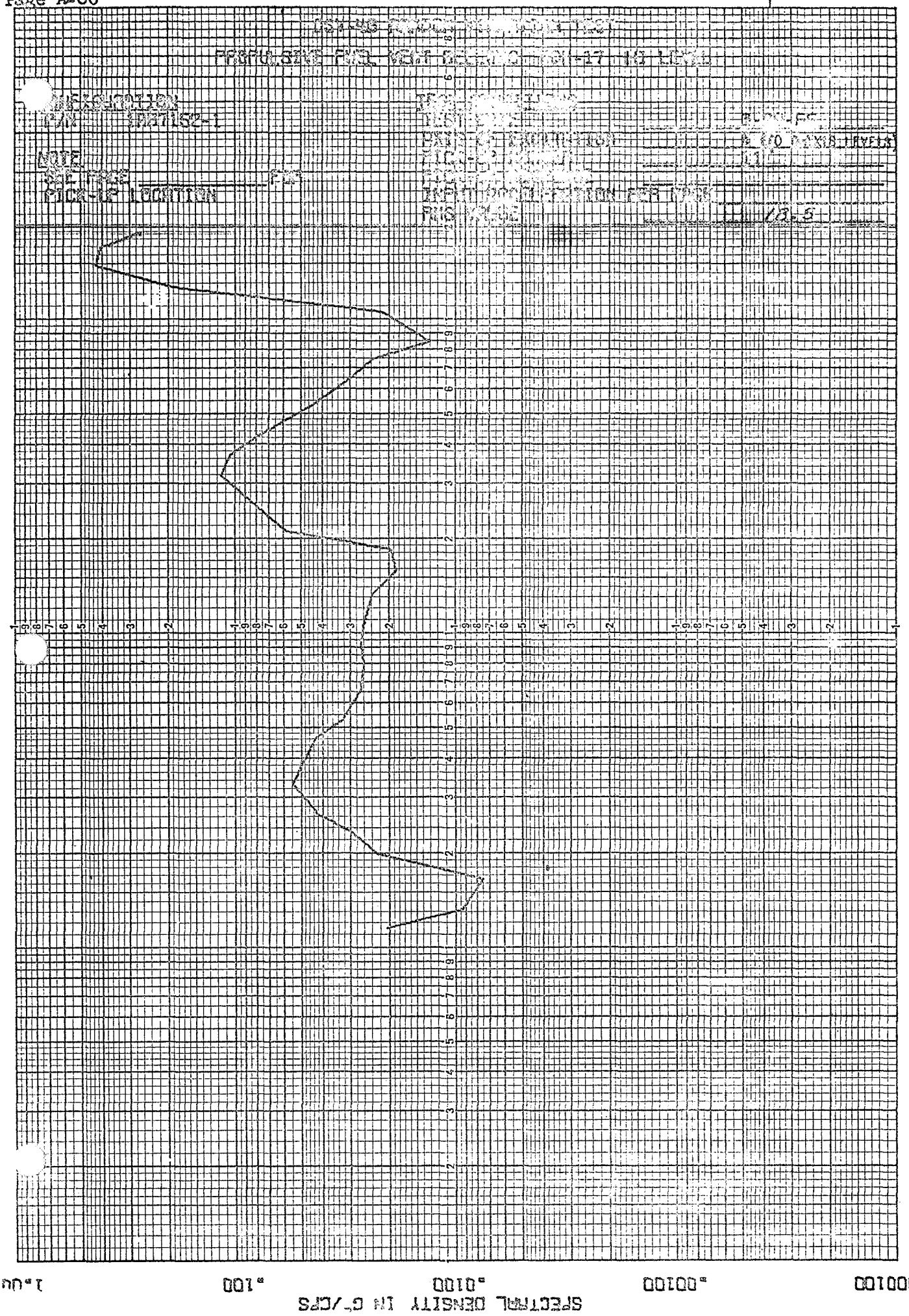
PAGE NO.
REPORT NO.




PROPULSIVE FUEL VENT
CONFIGURATION
P/N 1A87152-1
NOTE
SEE PAGE
PICK-UP LOCATION
A (TO 0-AXIS LEVELS)
1000.0
100.0
10.0
1.0
FREQUENCY CPS
1.00
.100
.0100
.00100
.000100
SPECTRAL DENSITY IN G²/CPS

DOUGLAS AIRCRAFT COMPANY, INC.
DATA SHEET II-40

PAGE NO
REPORT NO



DATA SHEET III-1

DOUGLAS AIRCRAFT COMPANY , INC.

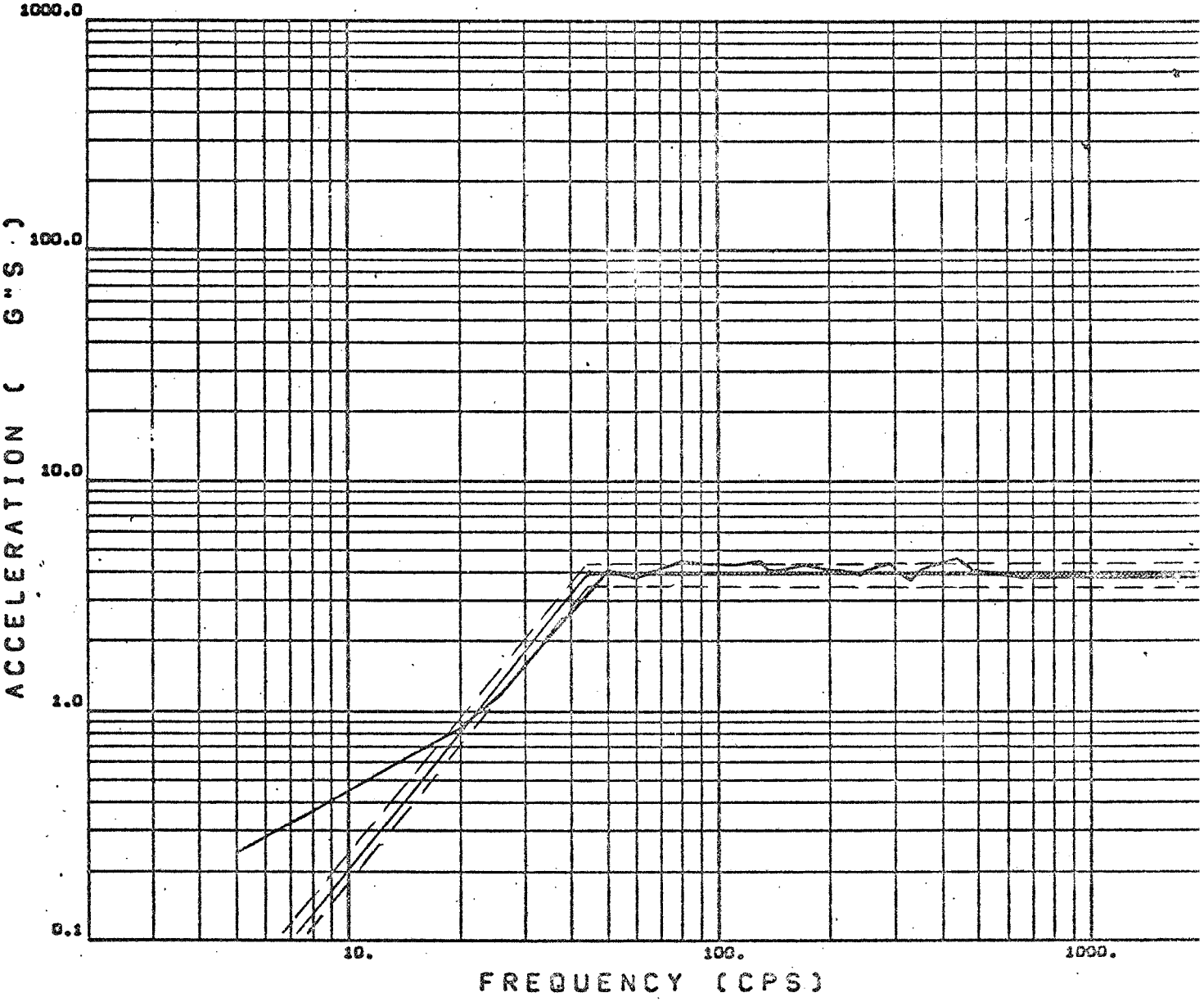
PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP
SIV-B PROPULSIVE FUEL VENT BELLOWS
(H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
PICK UP NUMBER (1)... 1
PICK UP RESPONSE..... 246 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET III-2

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

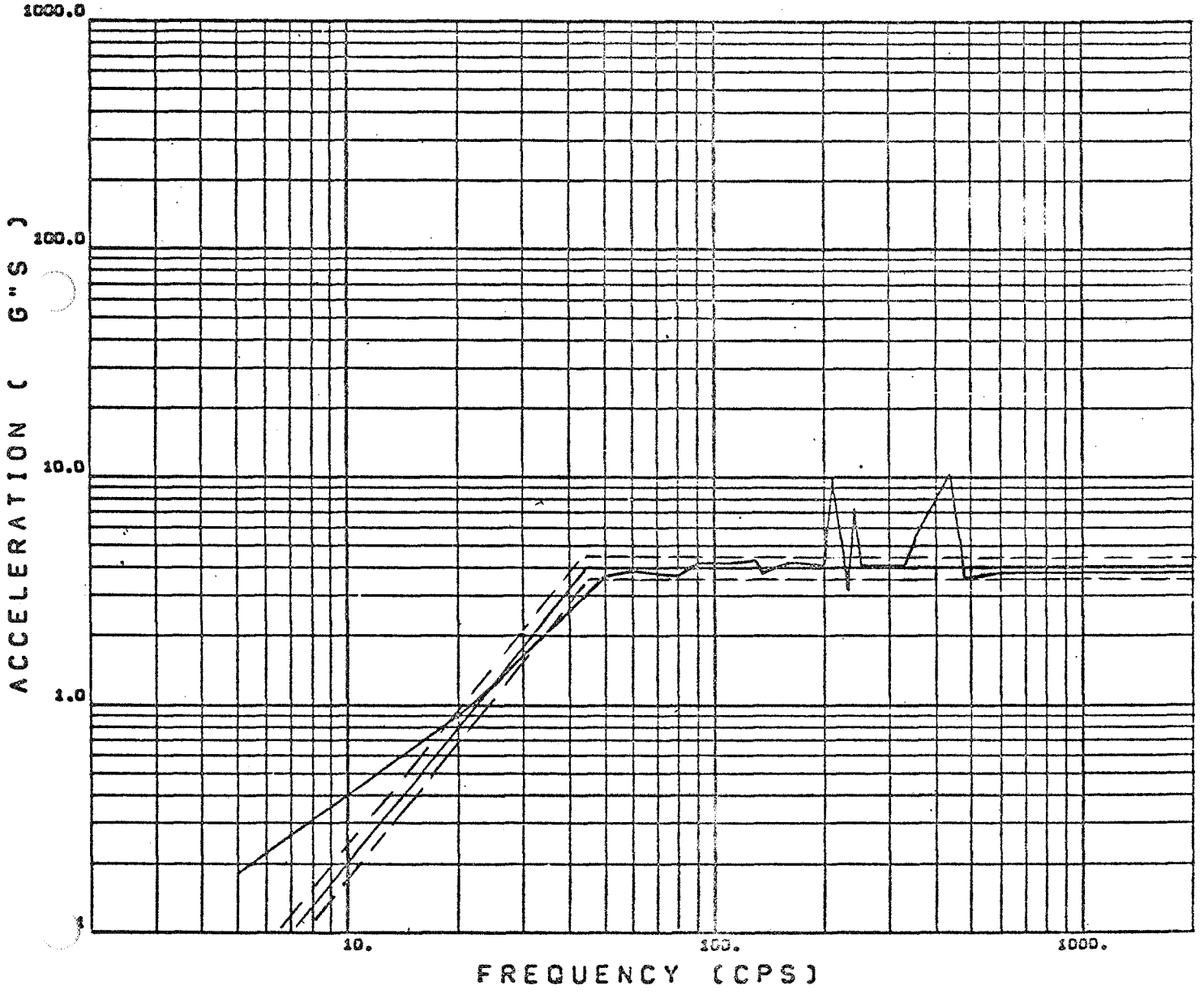
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
PICK UP NUMBER (2)... 2
PICK UP RESPONSE..... 335 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET III-3

DOUGLAS AIRCRAFT COMPANY , INC.

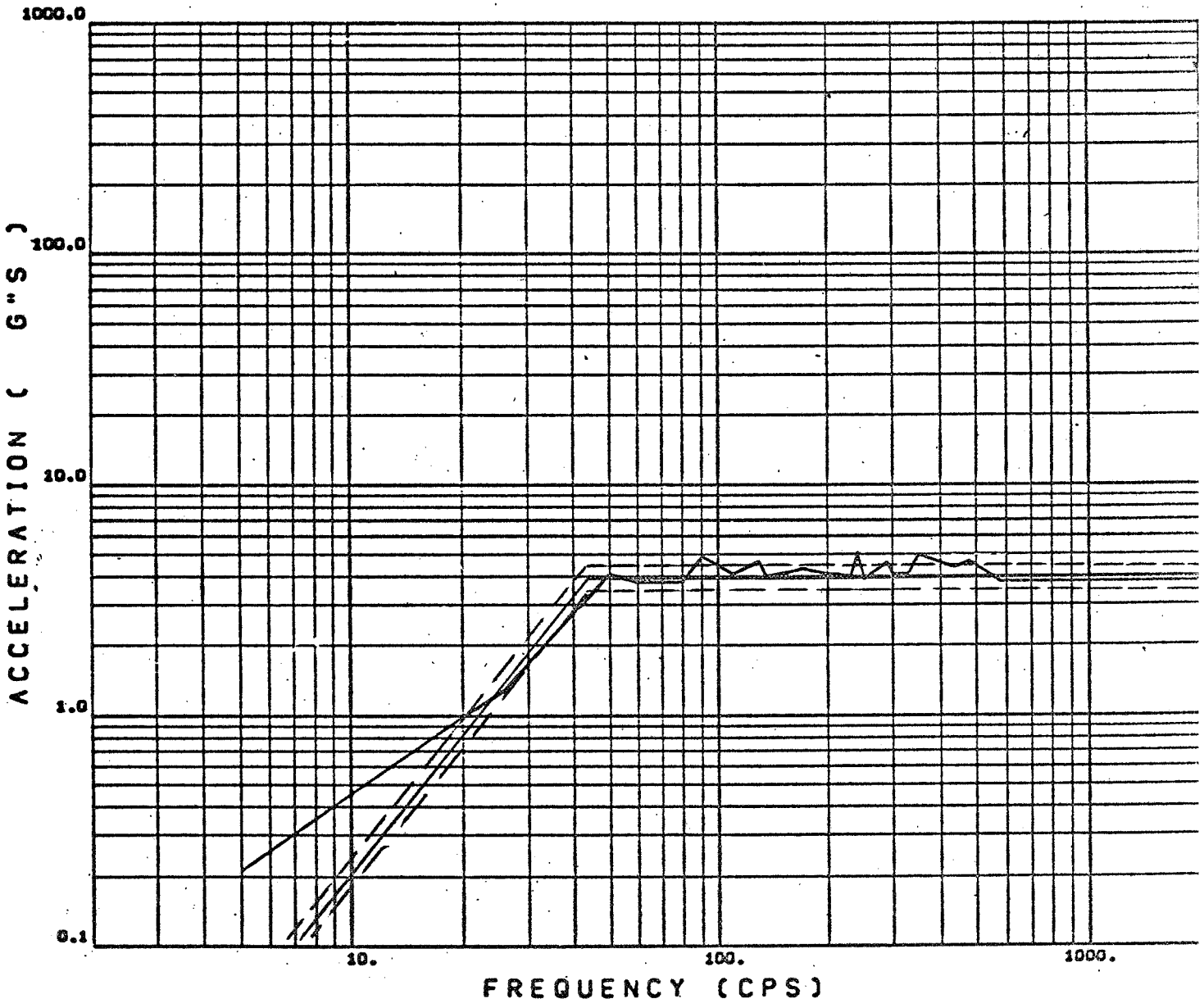
PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP
SIV-B PROPULSIVE FUEL VENT BELLOWS
(H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
PICK UP NUMBER (3)... 3
PICK UP RESPONSE..... 300 EXCITER CONTROL
INPUT ACCEL.PER PAGE.. _____



DATA SHEET III-4

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

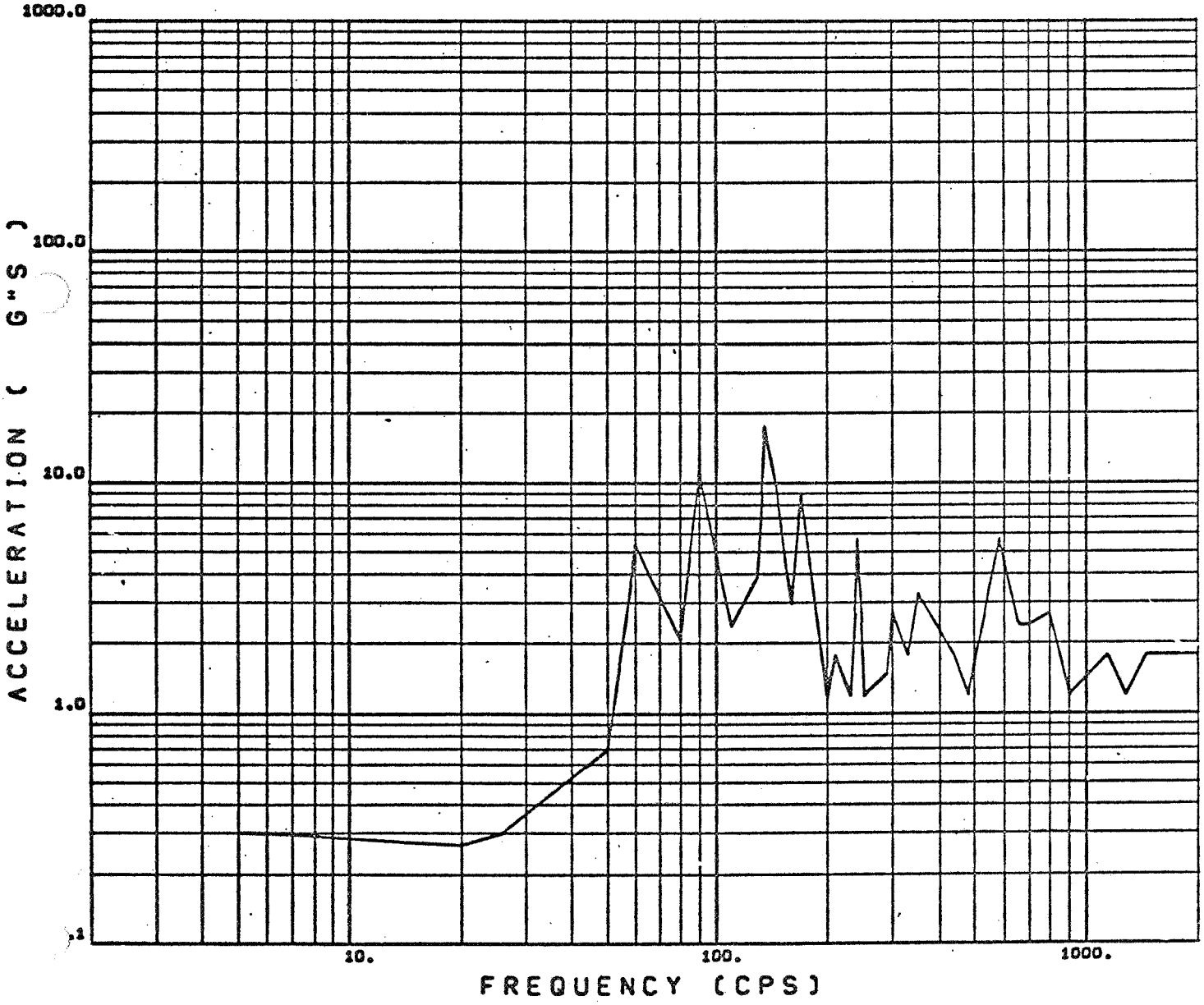
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
PICK UP NUMBER (4)... 4
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET III-5

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

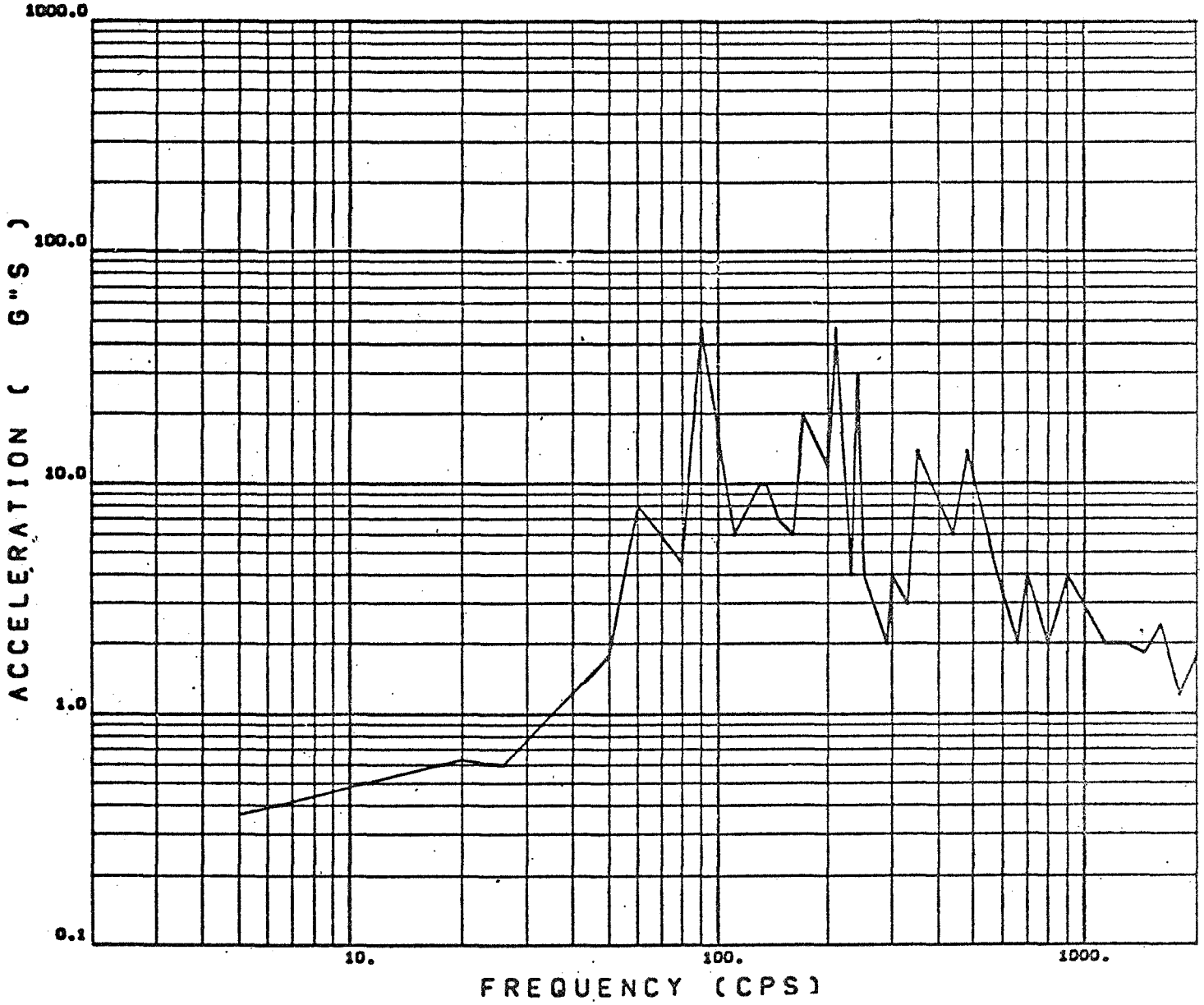
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
PICK UP NUMBER (5)... 5
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET III-6

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

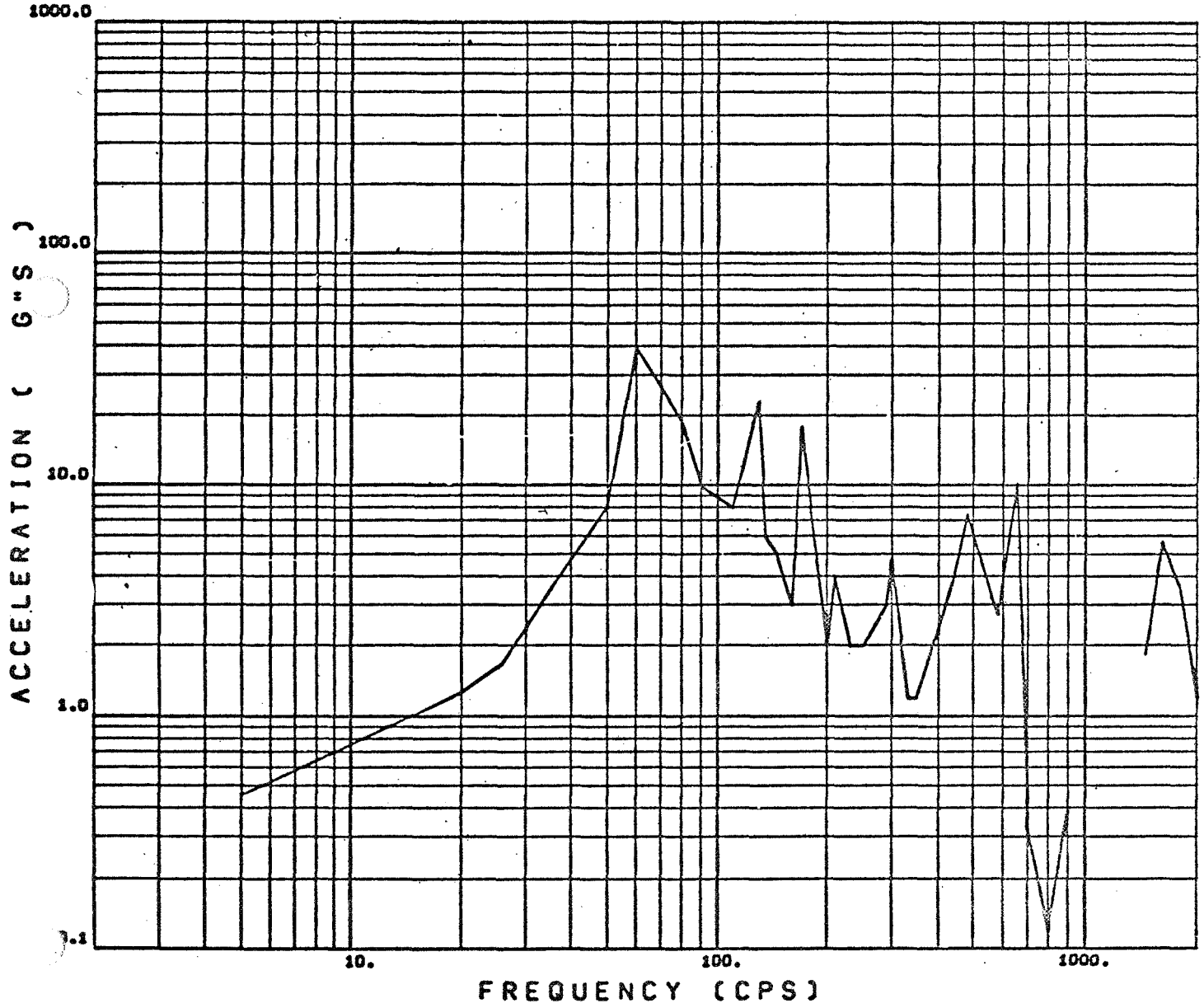
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
PICK UP NUMBER (6)... 6
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET III-7

DOUGLAS AIRCRAFT COMPANY , INC.

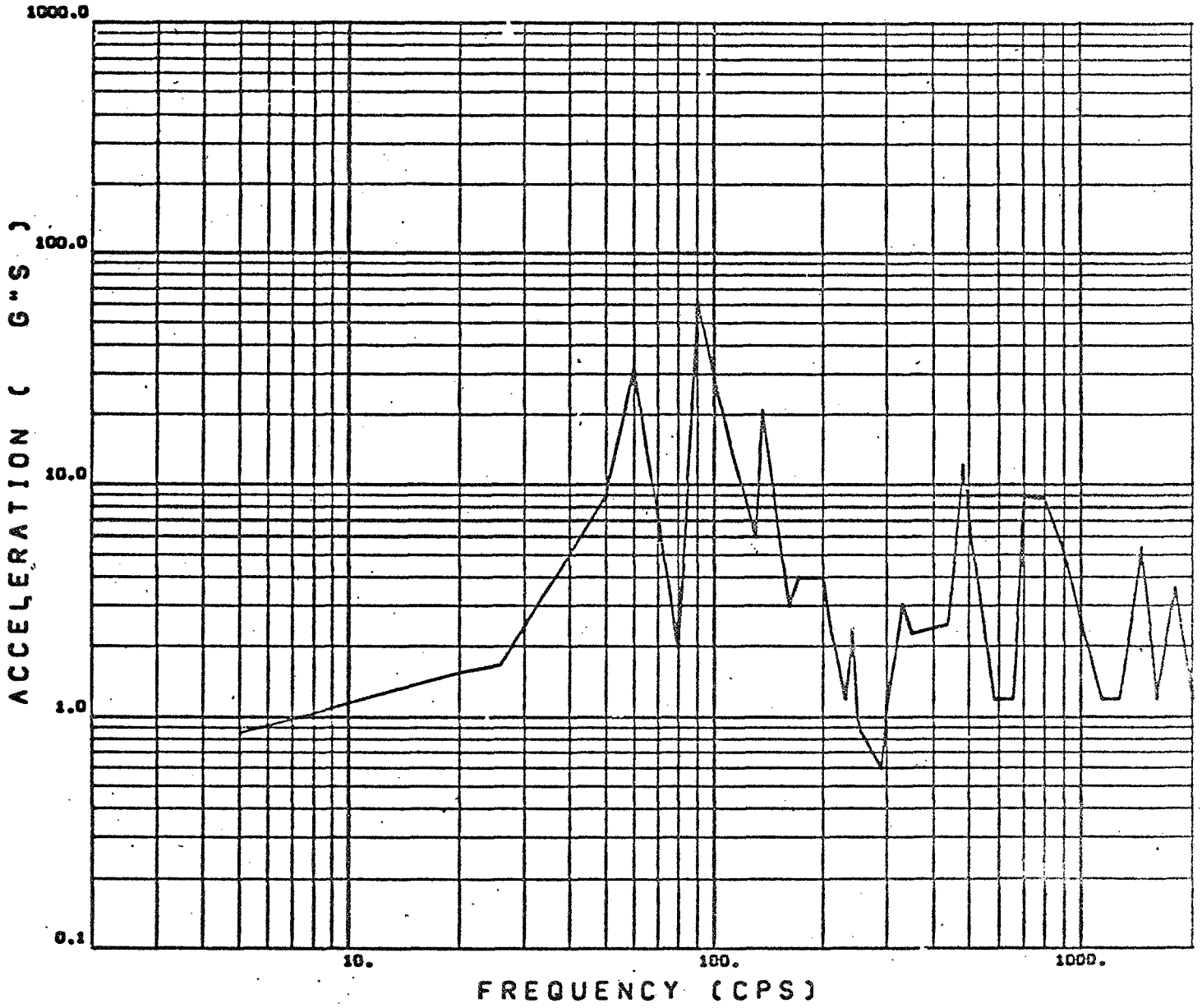
PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP
SIV-B PROPULSIVE FUEL VENT BELLOWS
(H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE: _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP _____
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
PICK UP NUMBER (7)... 7
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET III-8

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

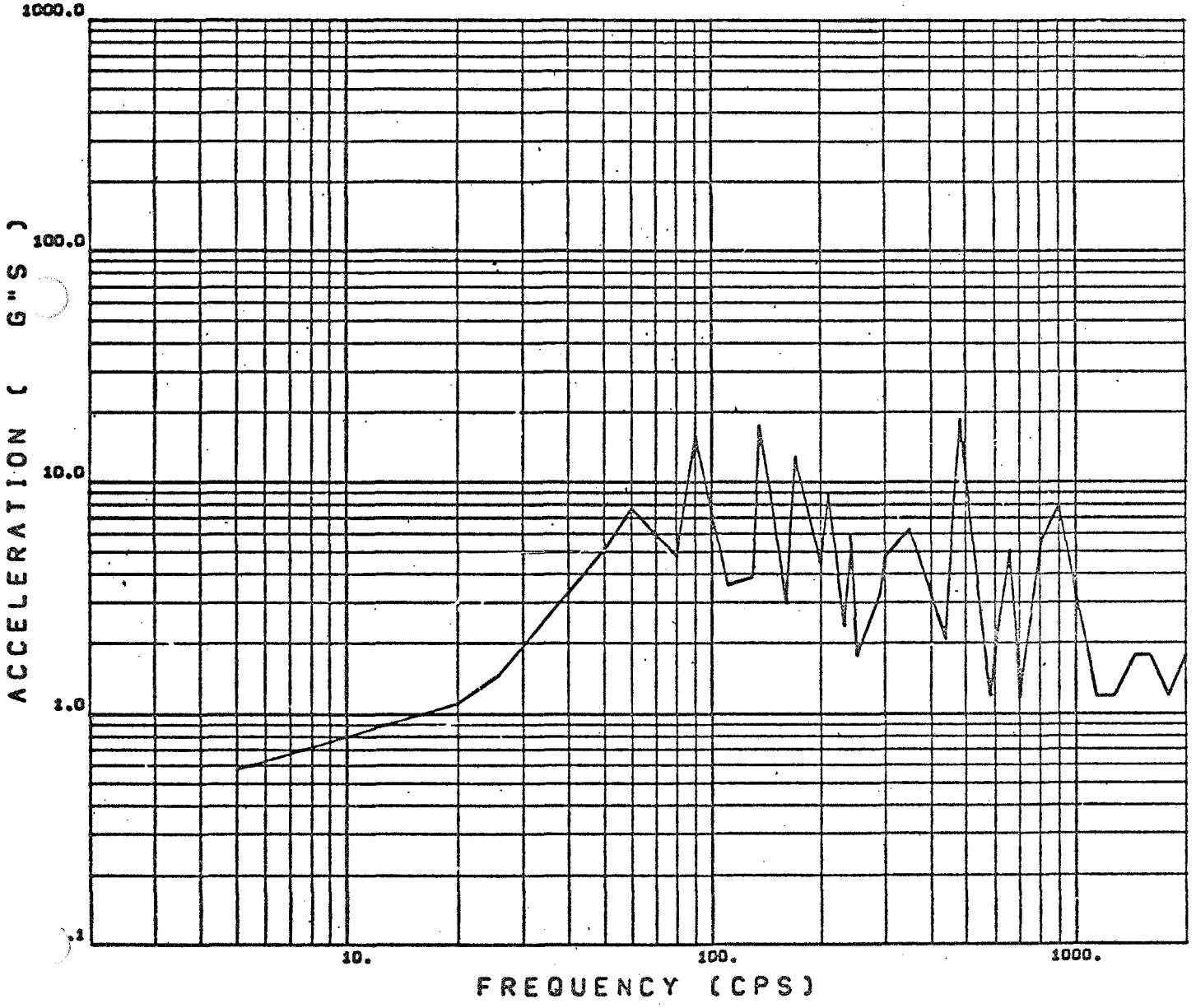
SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
PICK UP NUMBER (8)... 8
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



DATA SHEET III-9

DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
FOR PICK UP LOCATION

LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
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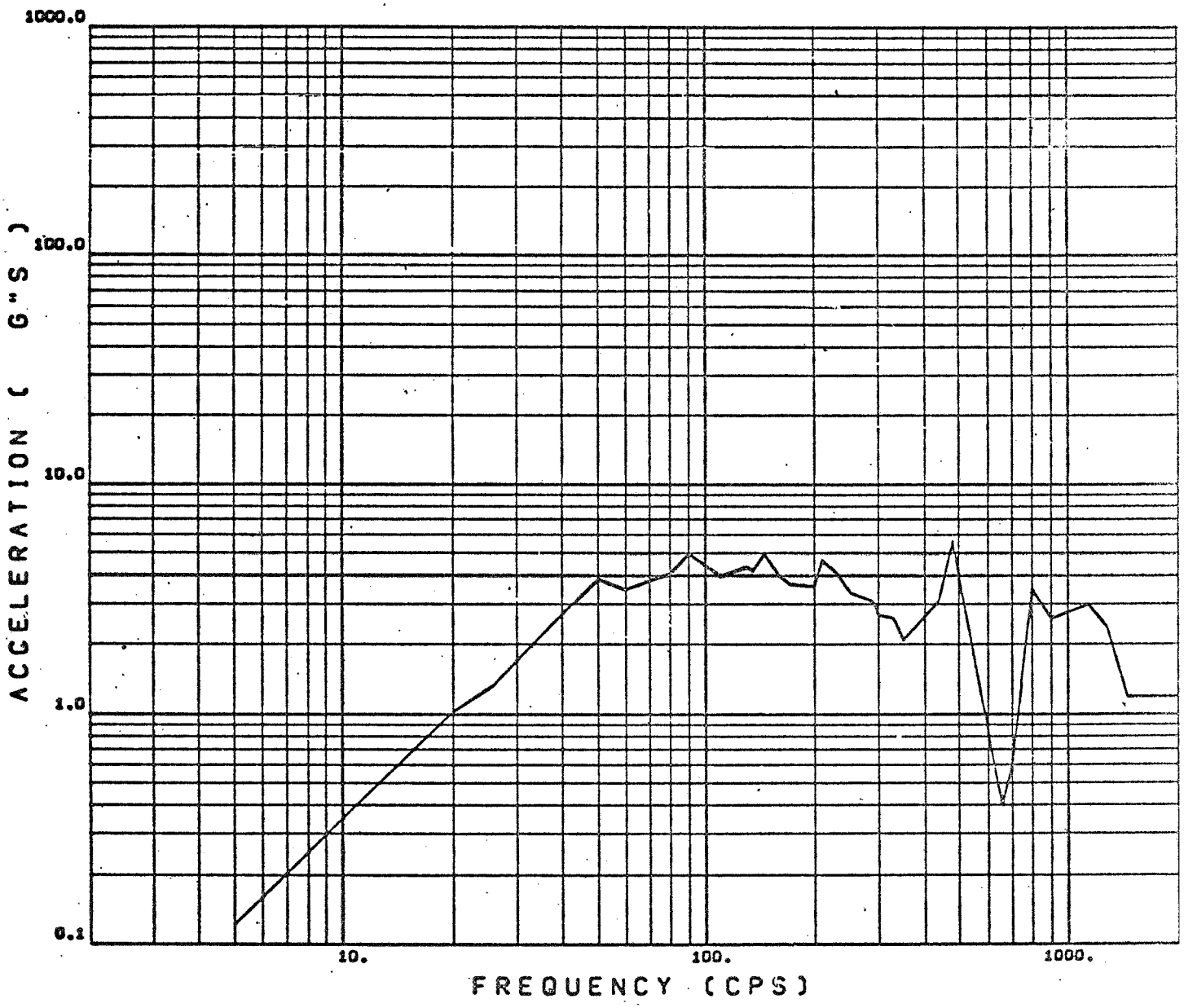
PICK UP RESPONSE.....
INPUT ACCEL.PER PAGE.. _____



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DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. _____
REPORT NO. _____

SINUSOIDAL FREQUENCY SWEEP
SIV-B PROPULSIVE FUEL VENT BELLOWS
(H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
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LEGEND...
UPSWEEP _____
DOWNSWEEP ------

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TEST DATE..... 4-04-66
AXIS OF EXCITATION.... C
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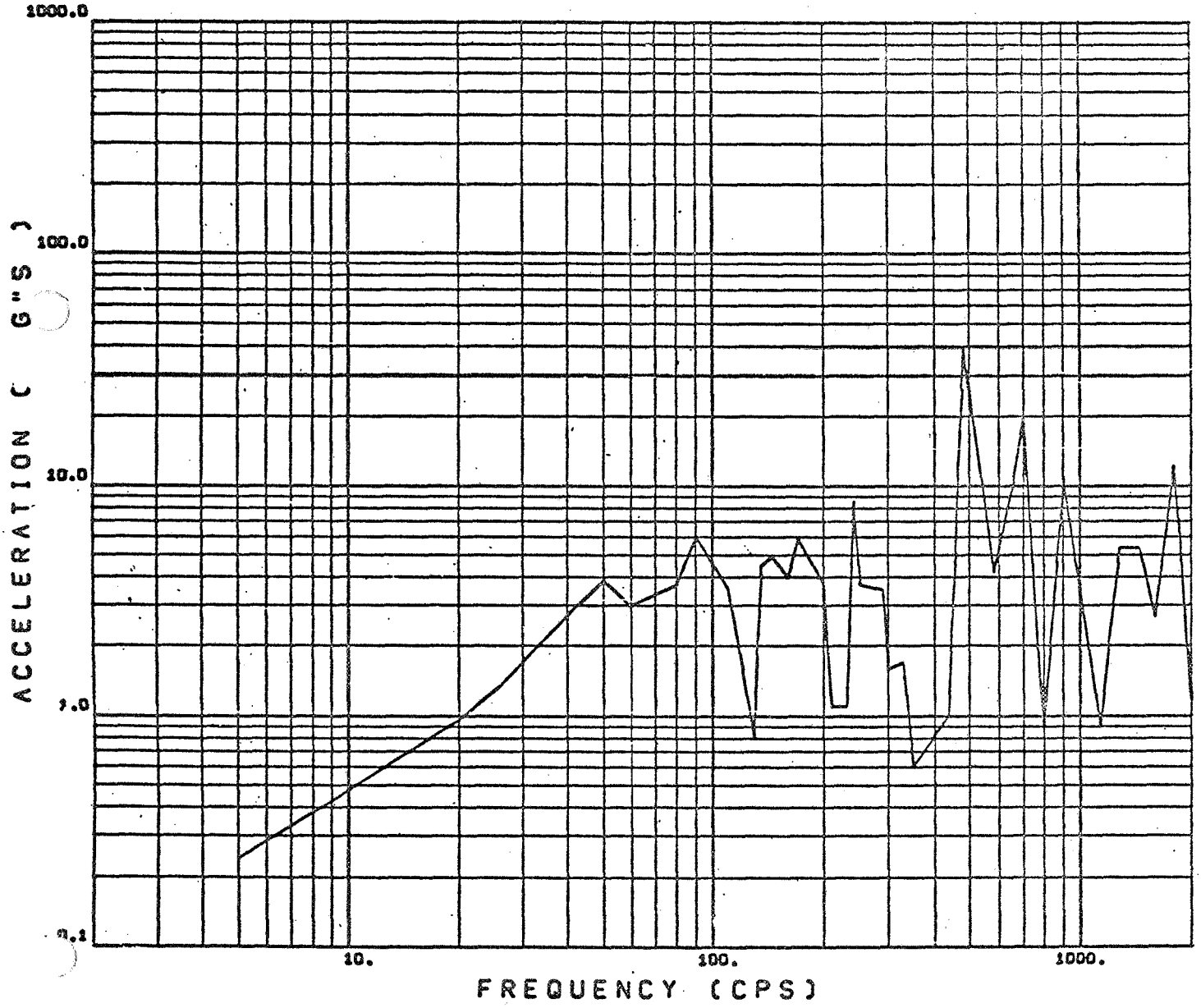

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DOUGLAS AIRCRAFT COMPANY , INC.

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SINUSOIDAL FREQUENCY SWEEP

SIV-B PROPULSIVE FUEL VENT BELLOWS (H-17 FQ)

CONFIGURATION ---
NOTE... SEE PAGE _____
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LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
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AXIS OF EXCITATION.... C
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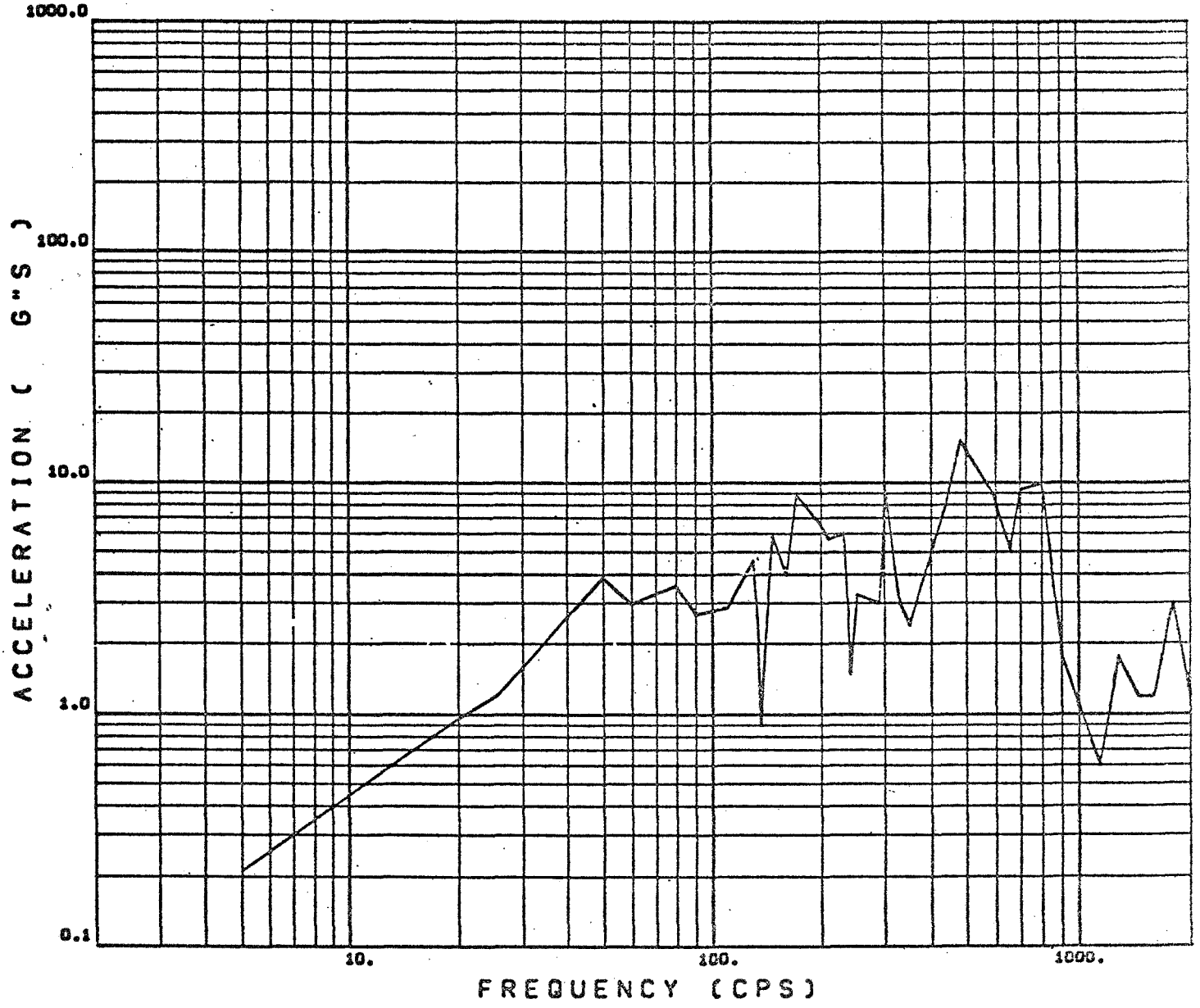

DOUGLAS AIRCRAFT COMPANY, INC.

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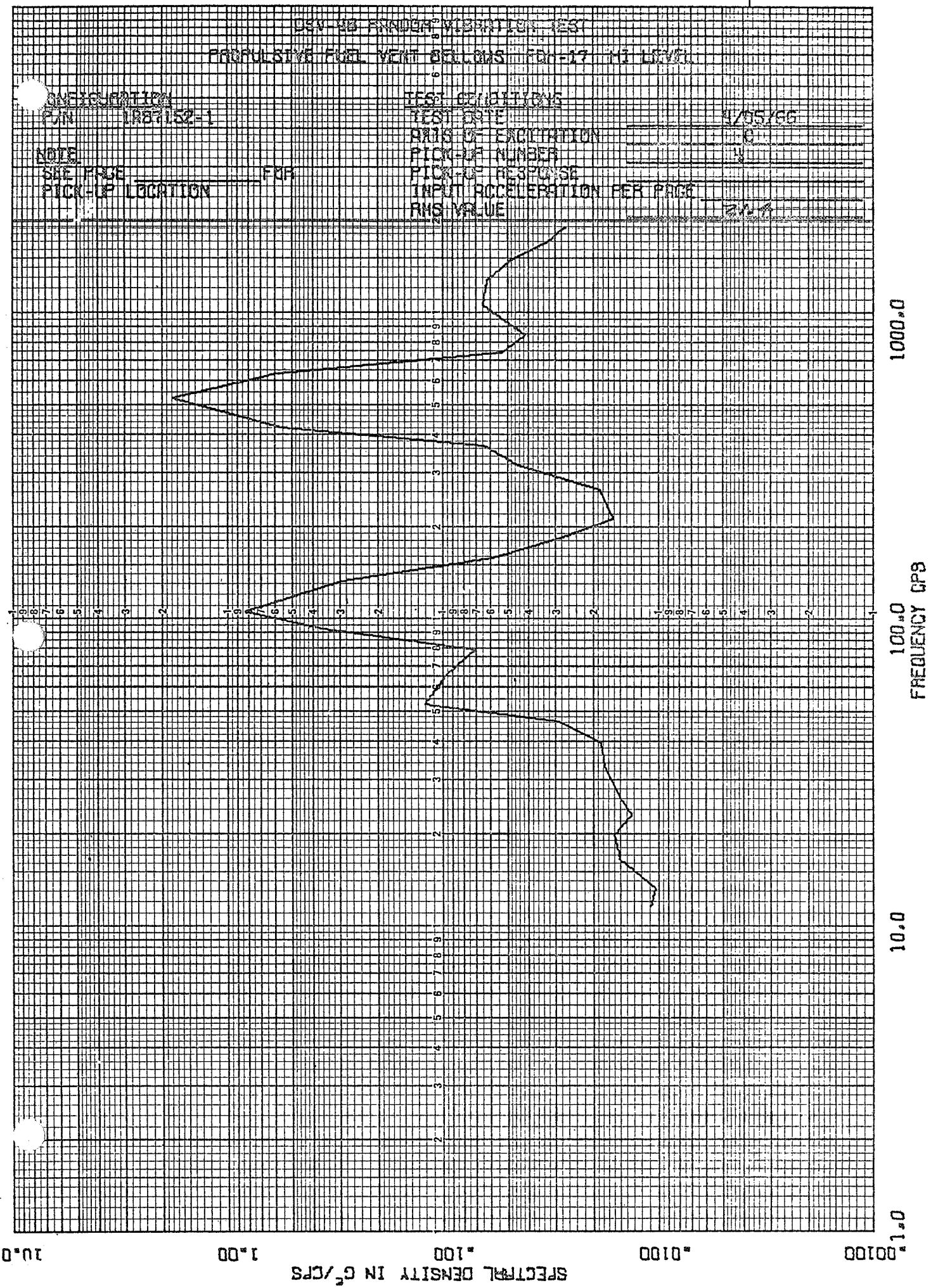

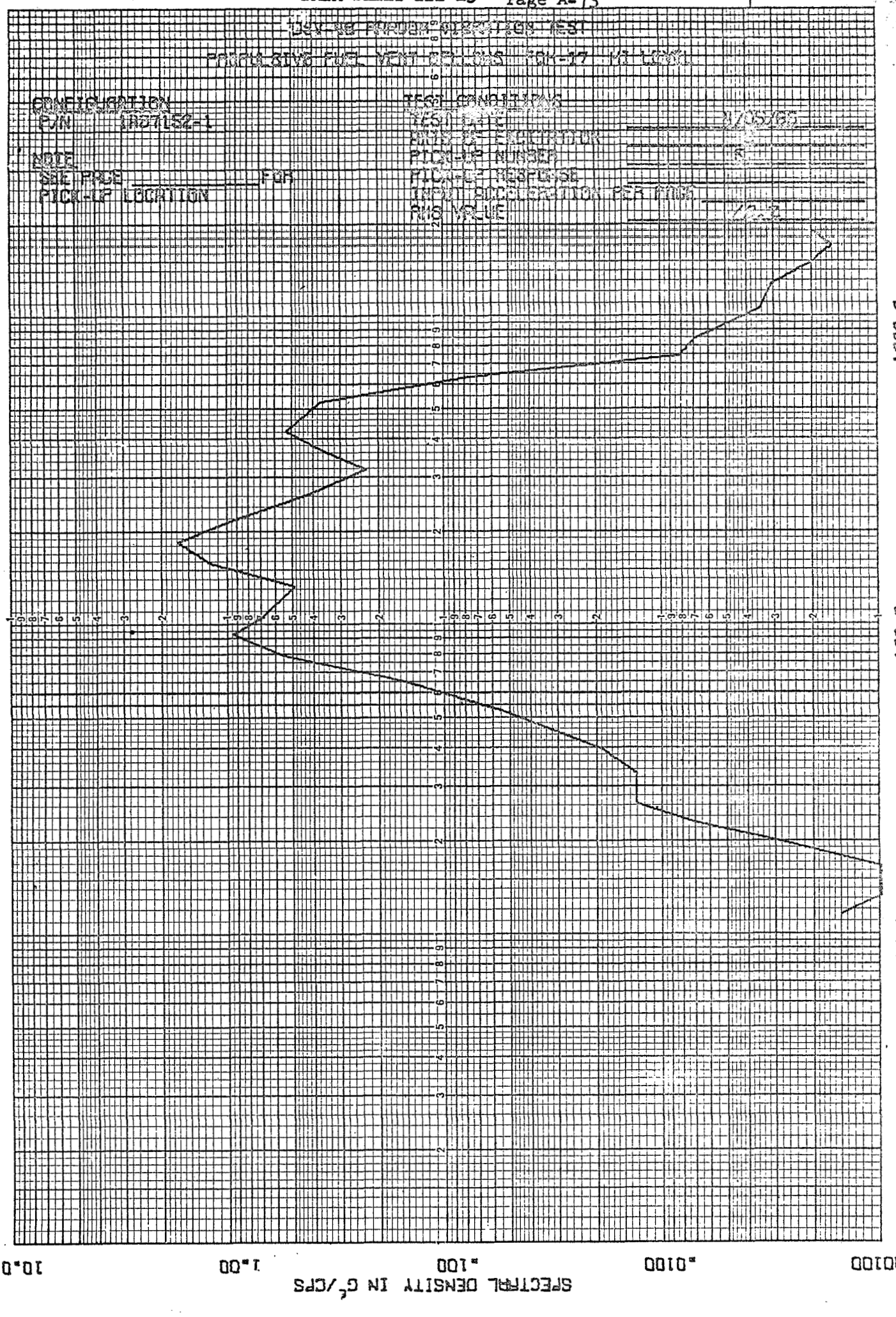
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P/N 1R07152-1
NOTE
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TEST CONDITIONS
TEST DATE
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PICK-UP RESPONSE
INPUT ACCELERATION PER PAGE
RMS VALUE
1000.0
100.0
10.0
1.0
FREQUENCY CPS
10.0
1.00
.100
.0100
.00100
SPECTRAL DENSITY IN G²/CPS

DOUGLAS AIRCRAFT COMPANY, INC.

DATA SHEET III-14

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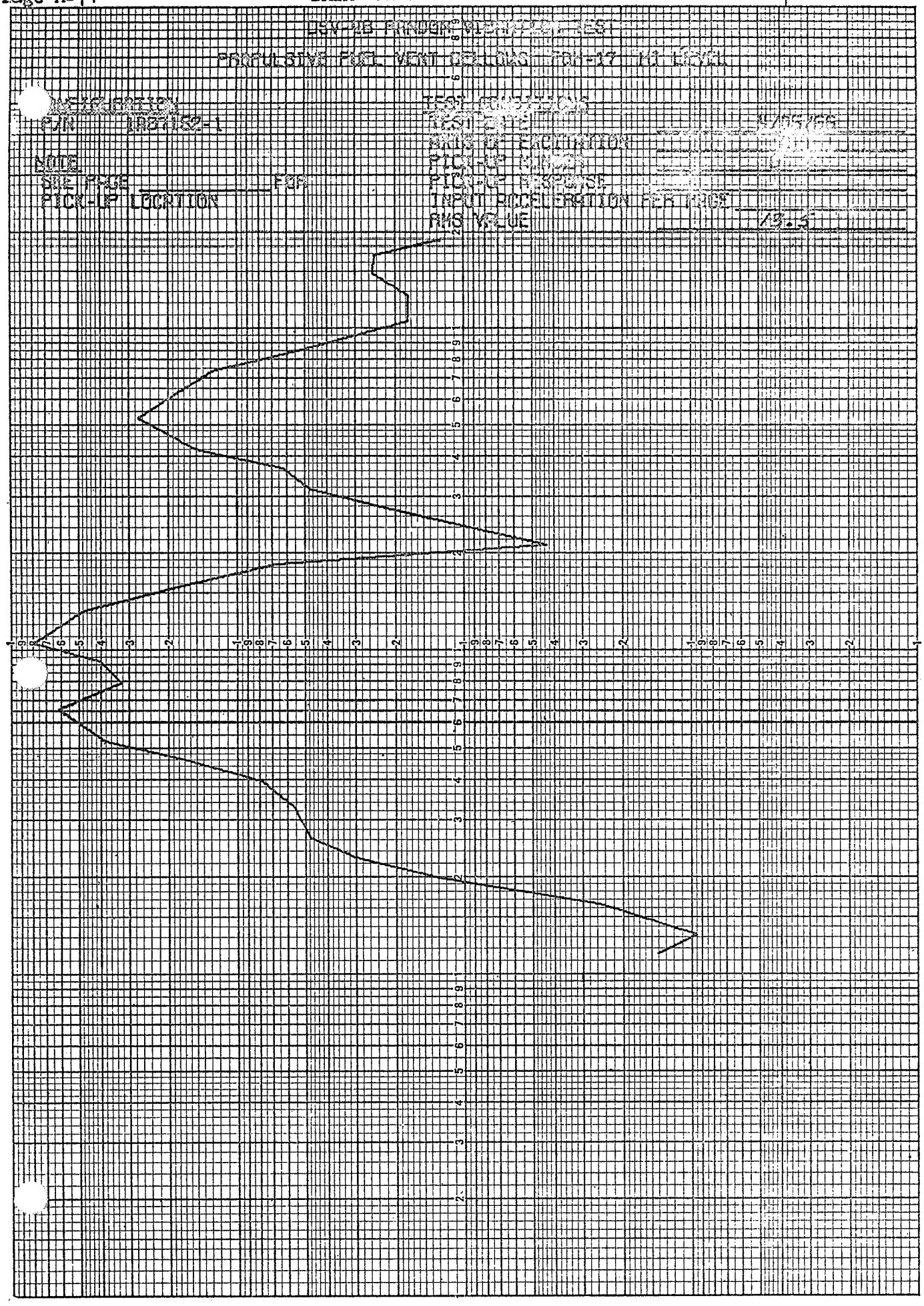
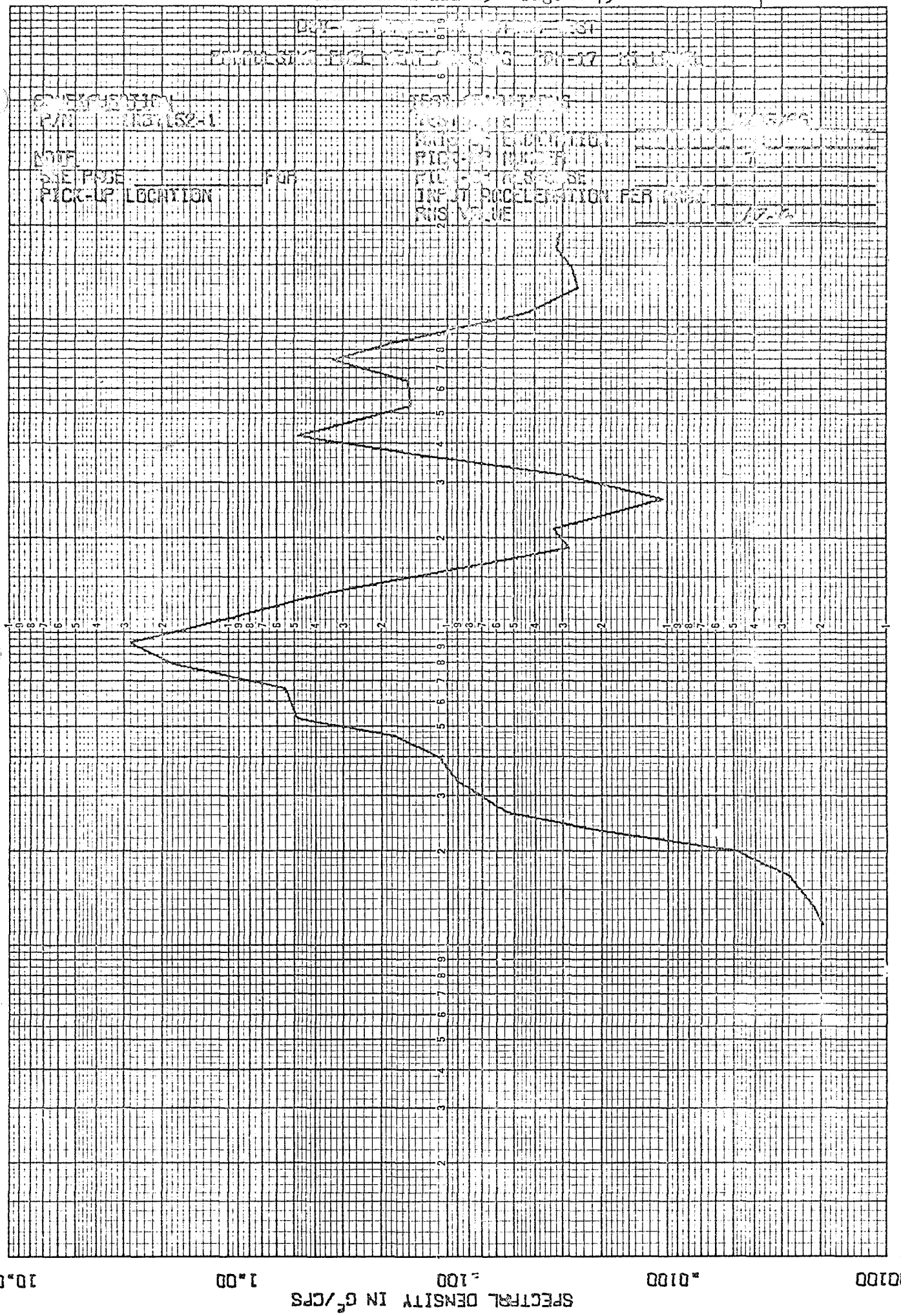
REPORT NO.

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FOR
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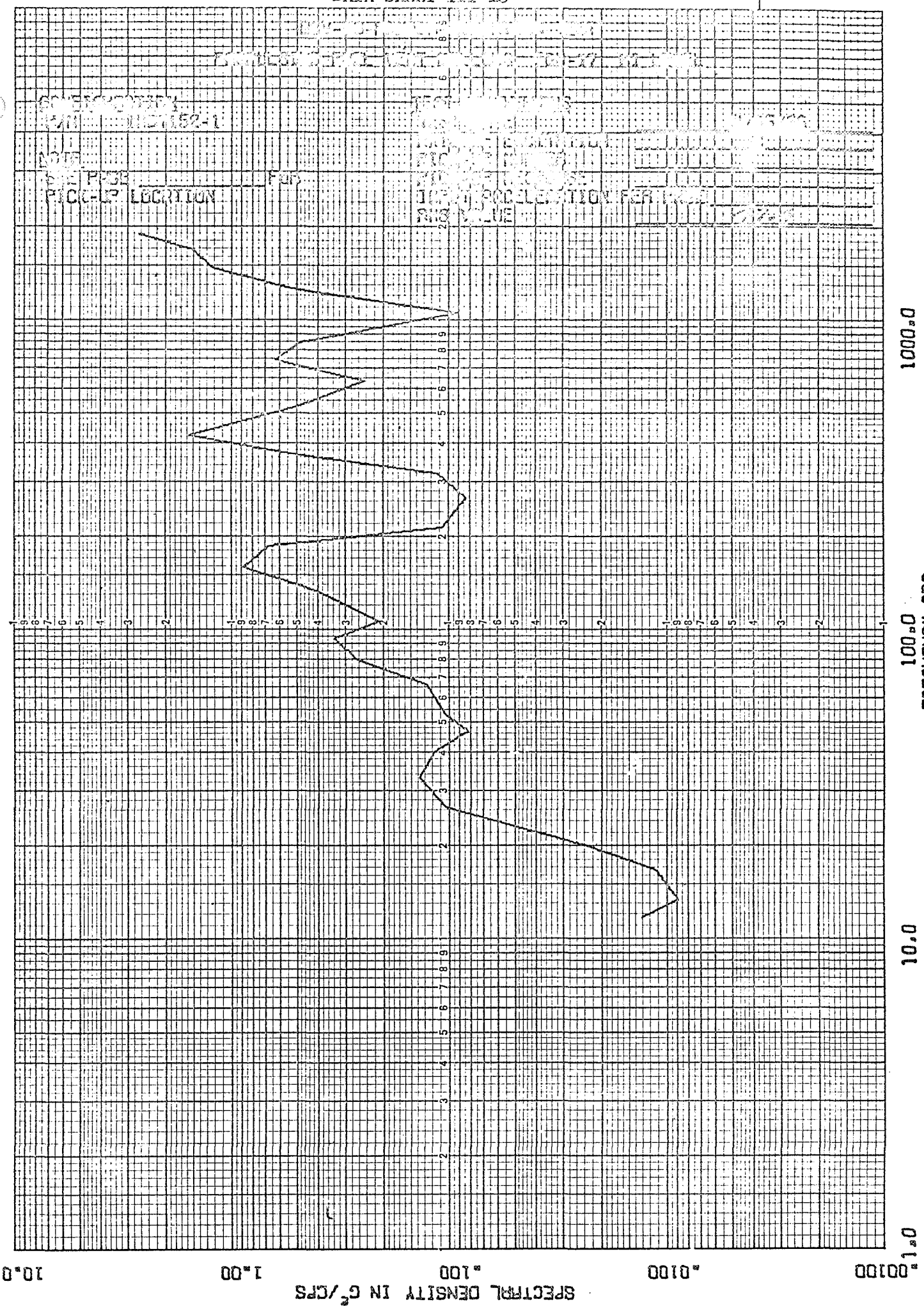
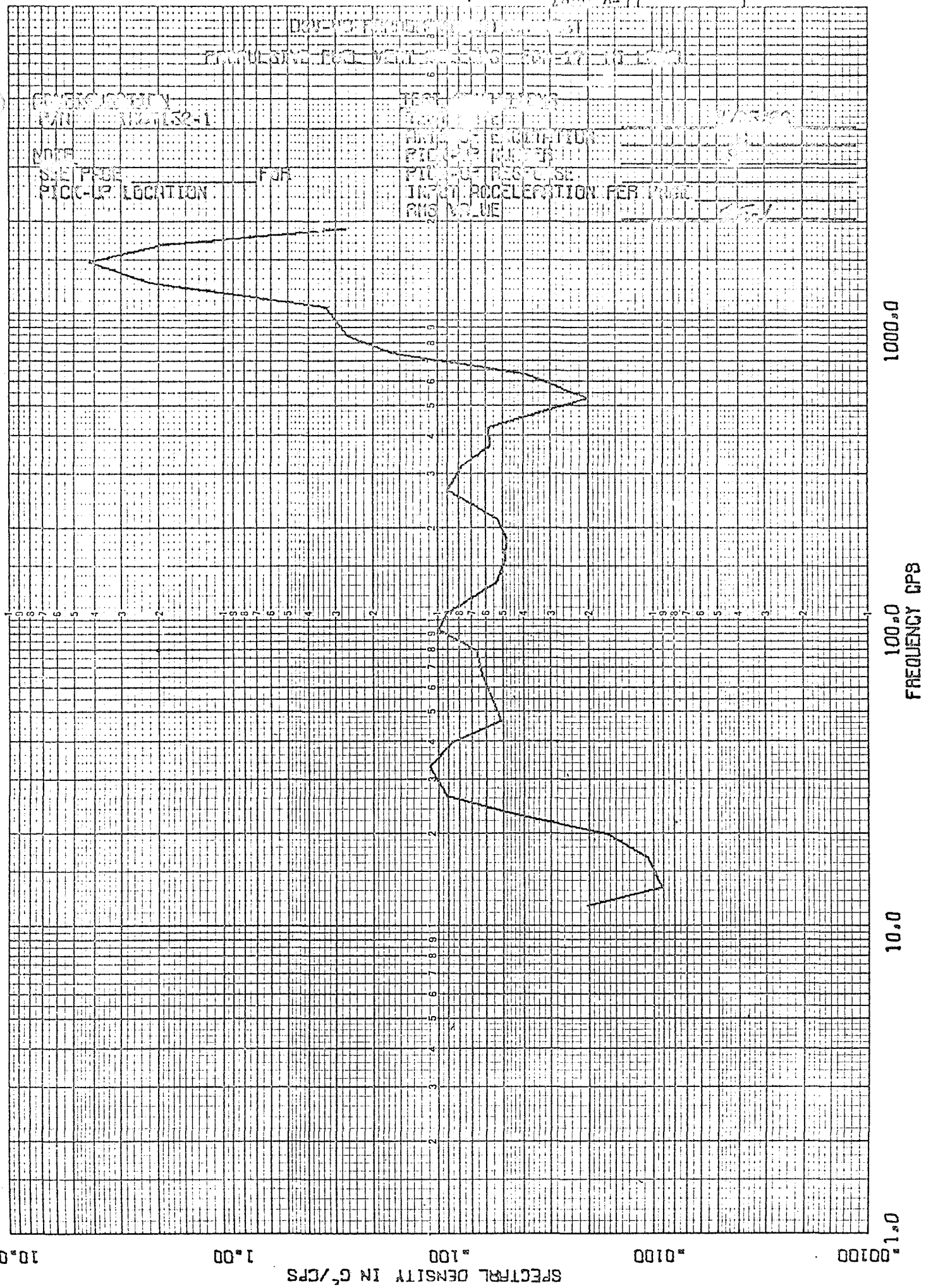
SPECTRAL DENSITY IN G²/CPS

DATA SHEET III-16

REPORT NO

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SEE PAGE FOR
PICK-UP LOCATION
INPUT ACCELERATION PER PAGE
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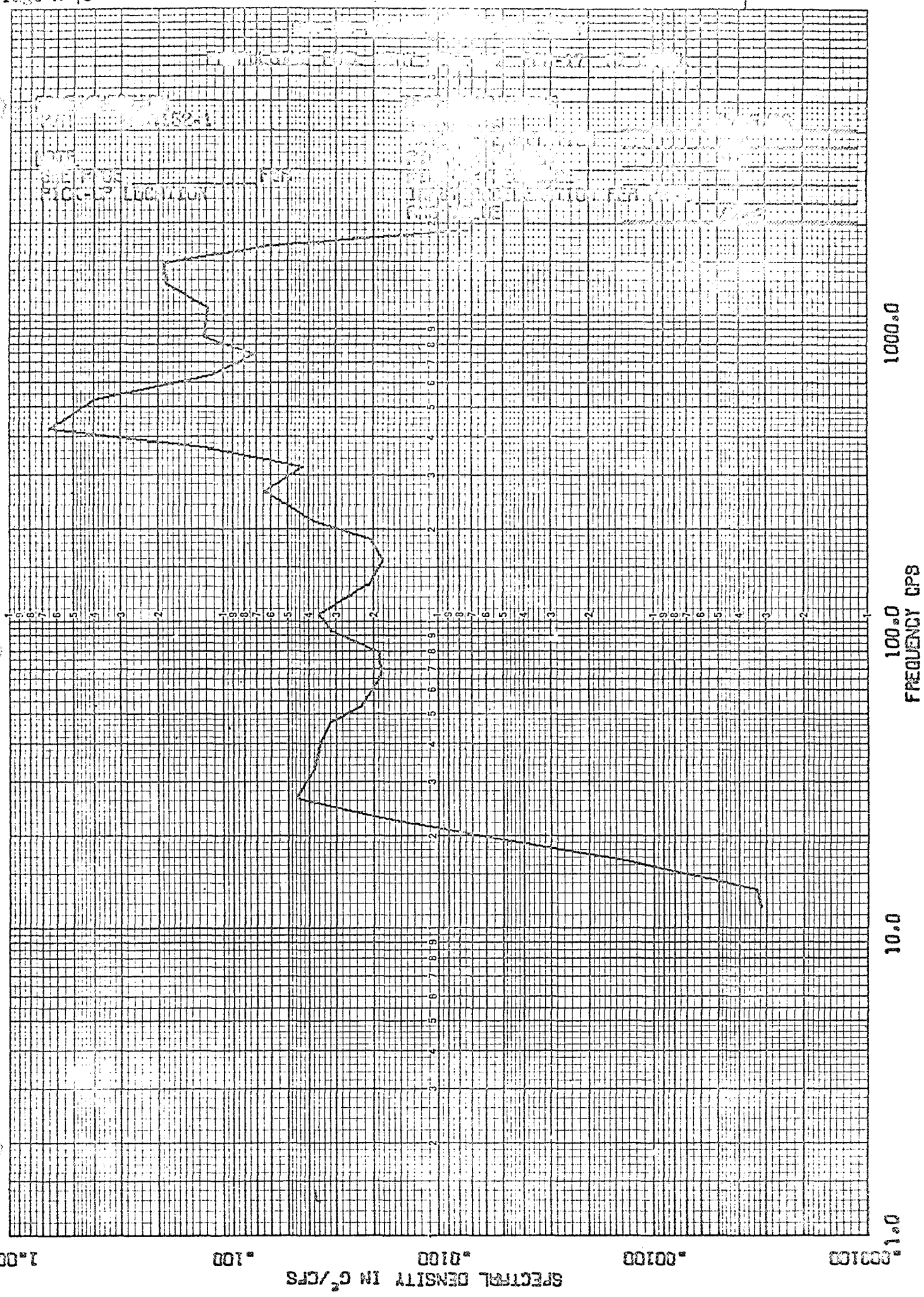
SPECTRAL DENSITY IN G²/CPS

DATA SHEET III-18

REPORT NO.



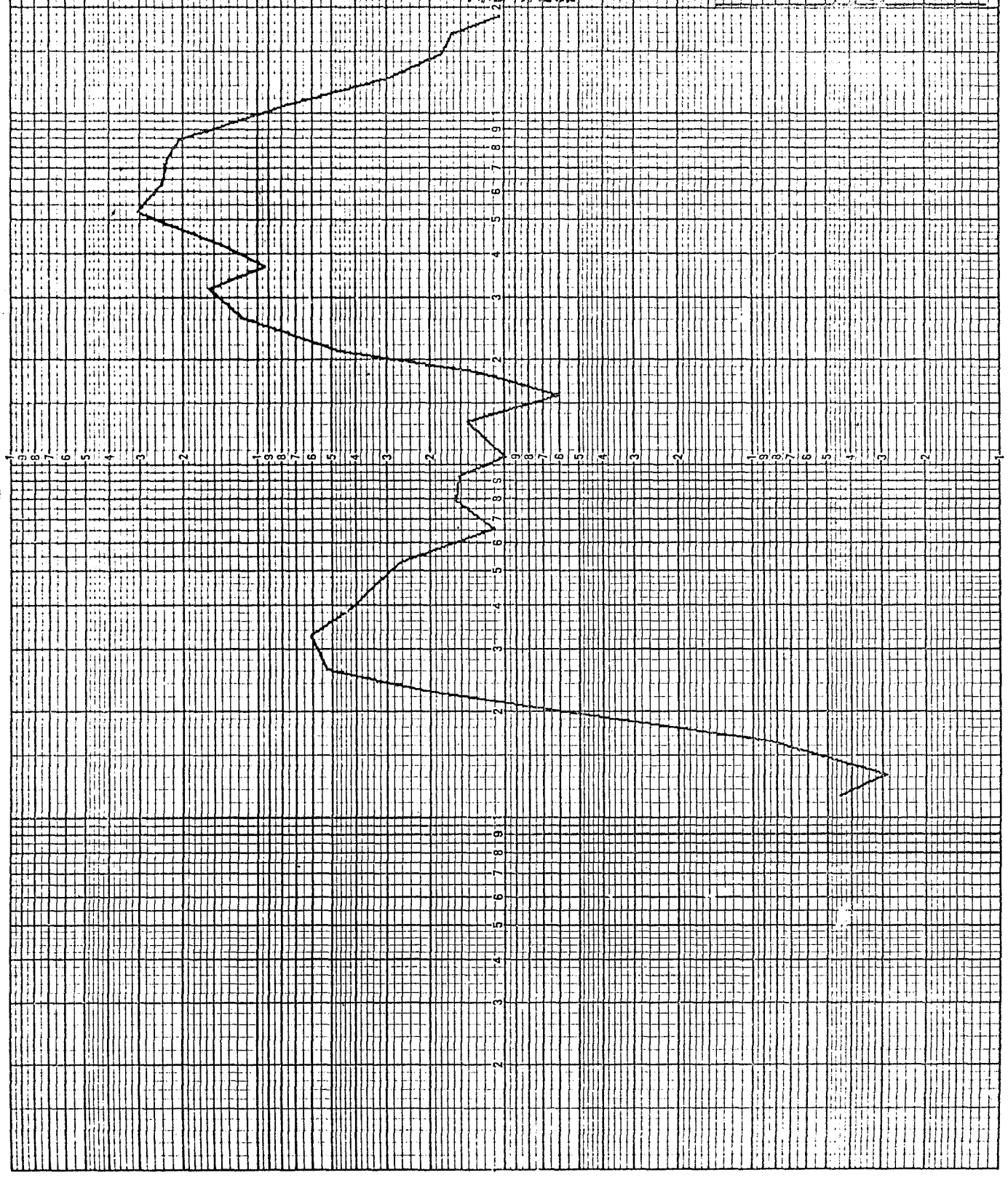
DSV-4B RANDOM VIBRATION TEST

PROPULSIVE FUEL VENT COLUMNS FOR-17 TO LOCK

IDENTIFICATION
P/N 1AB71S2-1

NOTE
SEE PAGE _____ FOR
PICK-UP LOCATION

TEST CONDITIONS
TEST DATE 11/25/69
AXIS OF EXCITATION
PICK-UP NUMBER
PICK-UP RESPONSE
INPUT ACCELERATION PER PAGE
RMS VALUE



FORM 25-9-1 (REV. 8-53)

PREPARED BY: W. SLACK
CHECKED BY:
DATE: 3-26-66
TITLE: BELLOWS PROPULSIVE VENT

DOUGLAS AIRCRAFT COMPANY, INC.
MISSILE & SPACE SYSTEMS DIVISION
(FQ-H-17)

PAGE:
MODEL: DSV-4B
REPORT NO.:

SHOCK PULSE

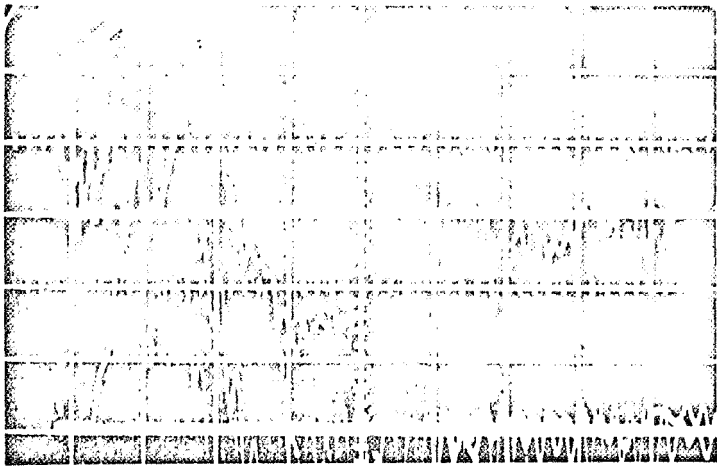
B AXIS

5769-6404
27554
1T02861

NO. 1

5 G's/DIVISION

5 MSEC/DIVISION



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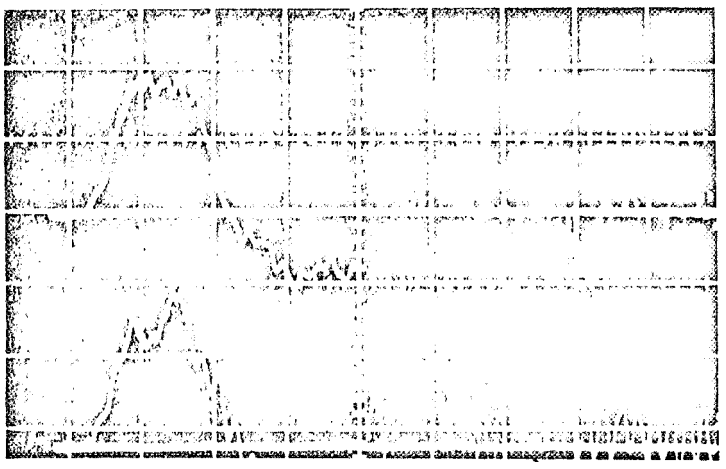
249

NO. 2

10 G's/DIVISION

5 MSEC/DIVISION



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10 G's/DIVISION

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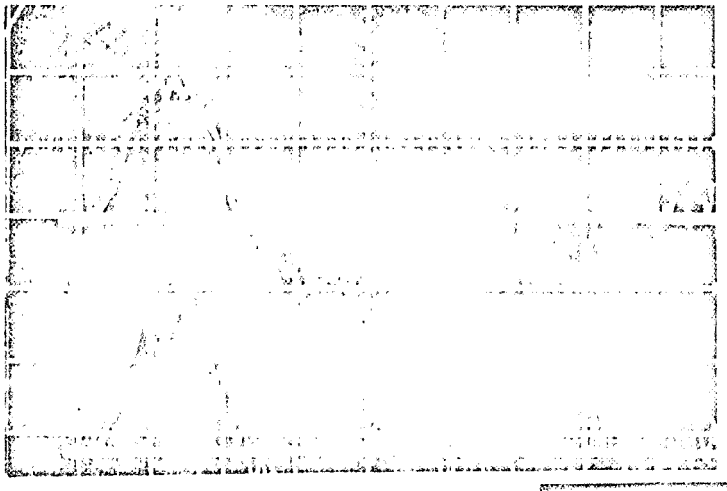

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249

FORM 29-6-1 (REV 6-53)

PREPARED BY: W. SLACK
CHECKED BY:
DATE: 3-30-66
TITLE: BELLOWS PROPULSIVE VENT

DOUGLAS AIRCRAFT COMPANY, INC.
MISSILE & SPACE SYSTEMS DIVISION
(FQ-H-17)

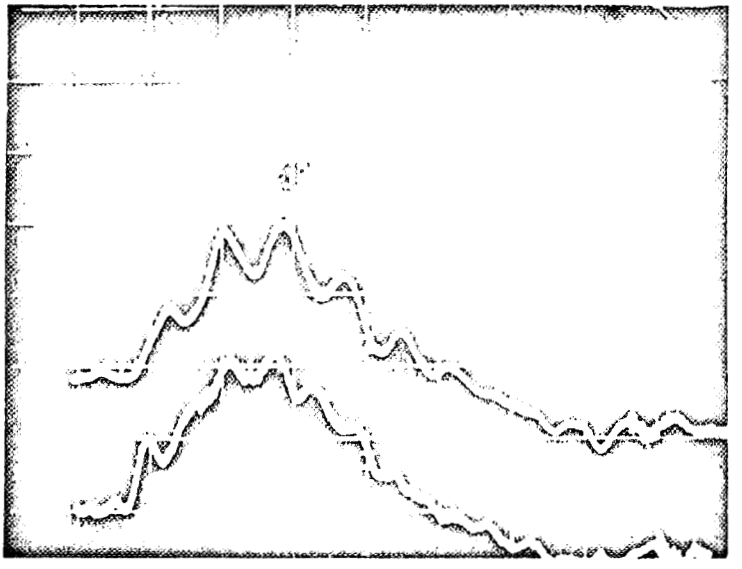
PAGE:
MODEL: DSV-4B
REPORT NO.:

SHOCK PULSE
A AXIS - RADIAL

5769-6404
27554
1T02861

NO. 1

10 G's/DIVISION



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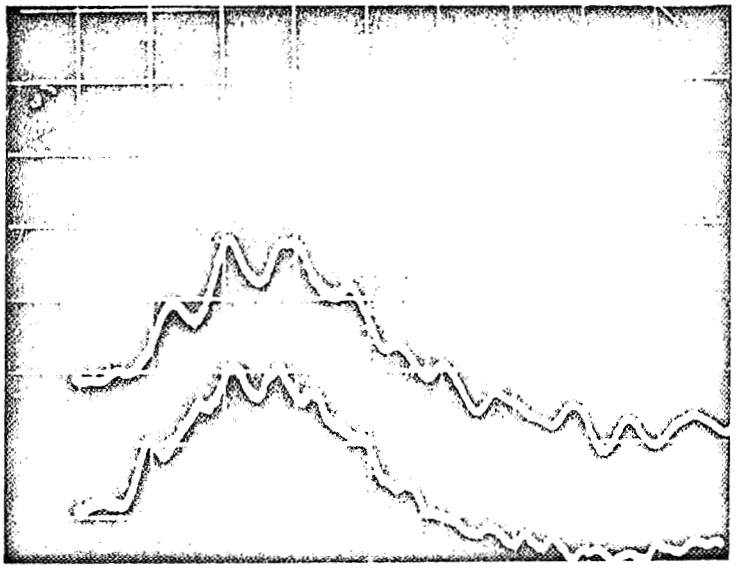
2 MSEC/DIVISION

NO. 2

10 G's/DIVISION



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2 MSEC/DIVISION

FORM 25-6-1 (REV. 8 53)

PREPARED BY: W. SLACK
CHECKED BY:
DATE: 3-30-66
TITLE: BELLOWS PROPULSIVE VENT (FQ-H-17)

DOUGLAS AIRCRAFT COMPANY, INC.

DIVISION

PAGE:
MODEL: DSV-4B
REPORT NO.:

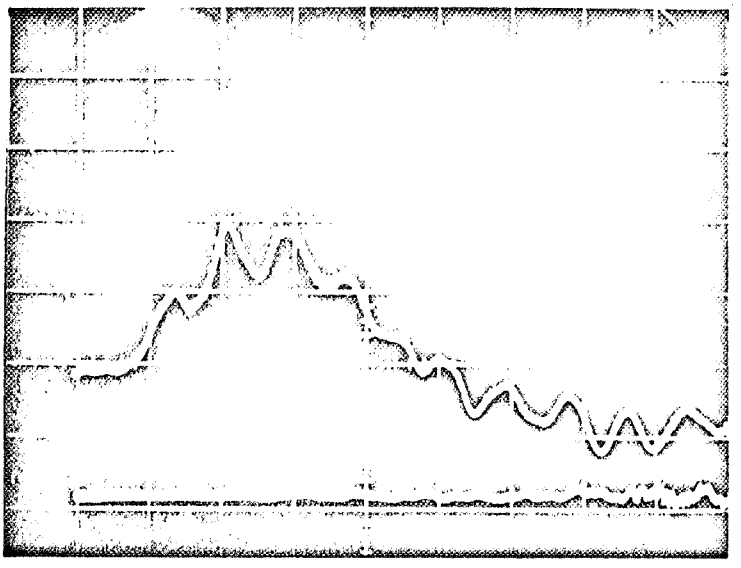
SHOCK PULSE

A AXIS - RADIAL

5769-6404
27554
1T02861

NO. 3

10 G's/DIVISION



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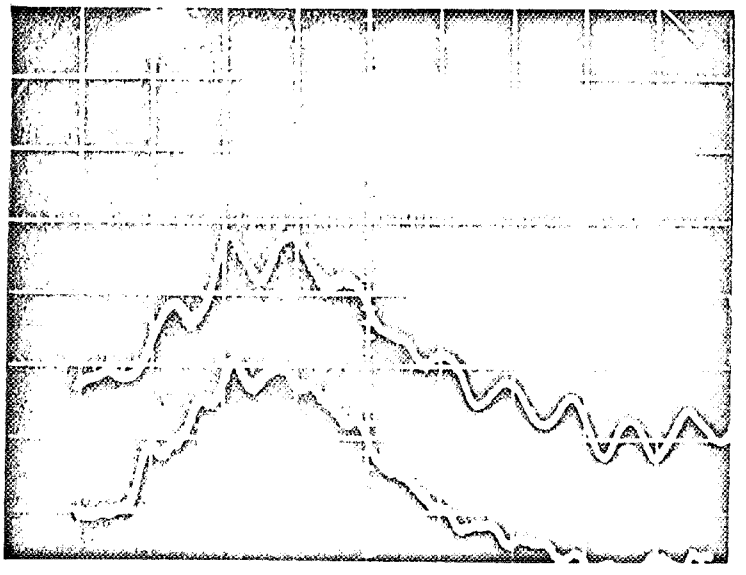
2 MSEC/DIVISION

NO. 4

10 G's/DIVISION



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2 MSEC/DIVISION

FORM 25-8-1 (REV 8-53)

PREPARED BY: W. SLACK
CHECKED BY:
DATE: 4-5-66
TITLE: BELLOWS PROPULSIVE VENT

DOUGLAS AIRCRAFT COMPANY, INC.
MISSILE & SPACE SYSTEMS DIVISION
(FQ-H-17)

PAGE:
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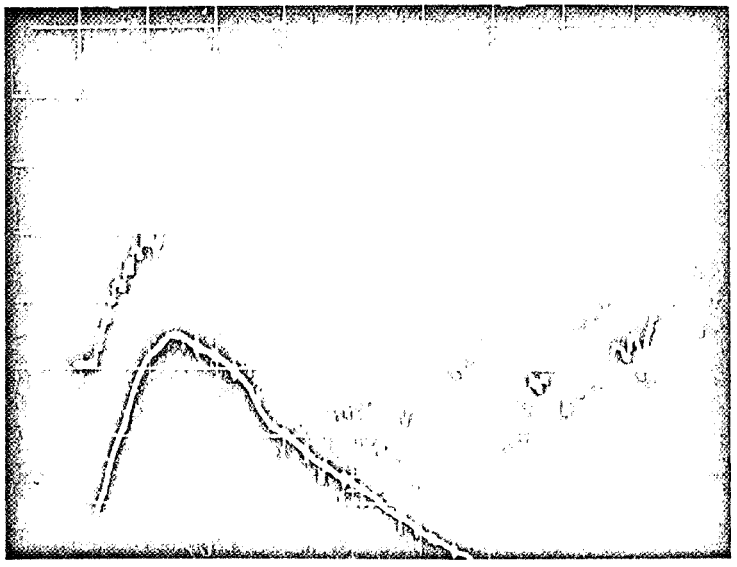
1T02861

SHOCK PULSE NO. 1

THRUST AXIS

10 G's/DIVISION



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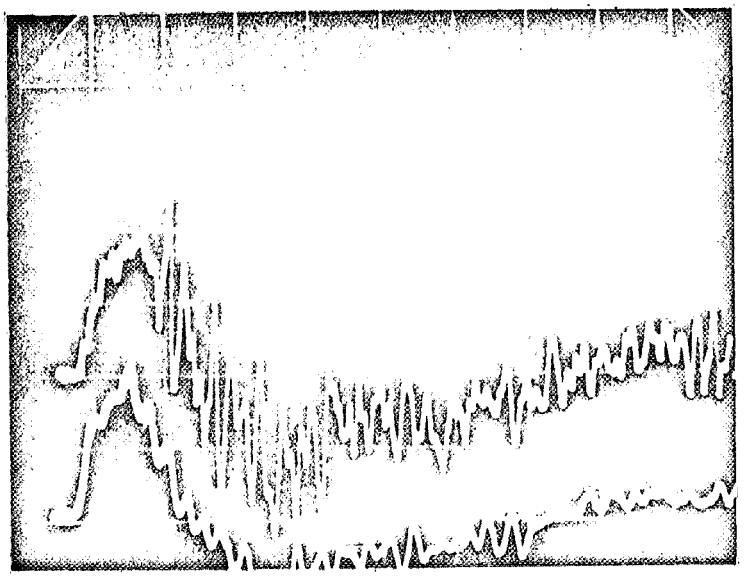
WAVE SYNTHESIZER OUTPUT

5 MSEC/DIVISION

10 G's/DIVISION



300

335

5 MSEC/DIVISION

PREPARED BY W. SLACK
CHECKED BY:
DATE: 4-5-66
TITLE: BELLOWS PROPULSIVE VENT

DOUGLAS AIRCRAFT COMPANY, INC.
MISSILE & SPACE SYSTEMS DIVISION
(FQ-H-17)

PAGE
MODEL DSV-4B
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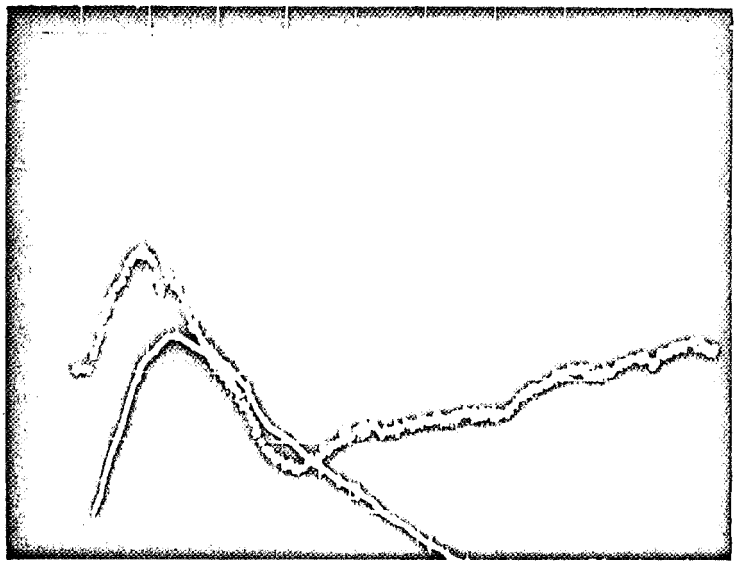
5769-6404
27554
1T02861

SIKORSKY GAGE NO. 2

THRUST AXIS

10 G's/DIVISION



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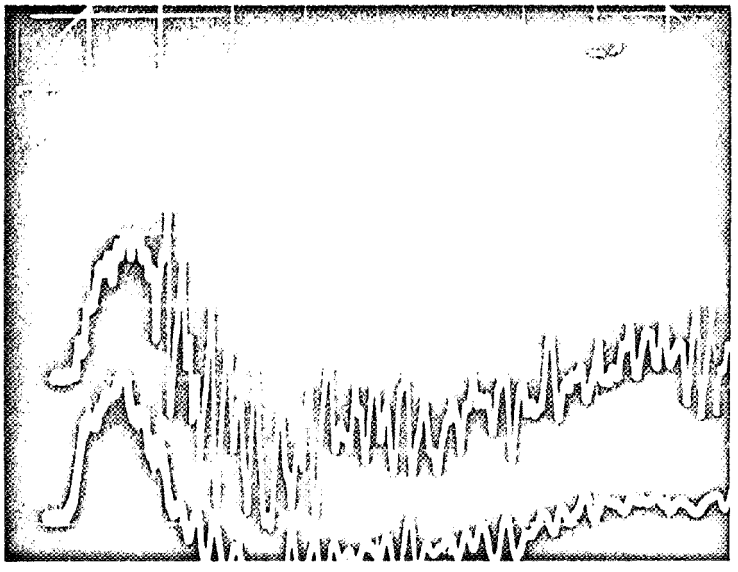
SYNCHRONIZER OUTPUT

5 MSEC/DIVISION

10 G's/DIVISION



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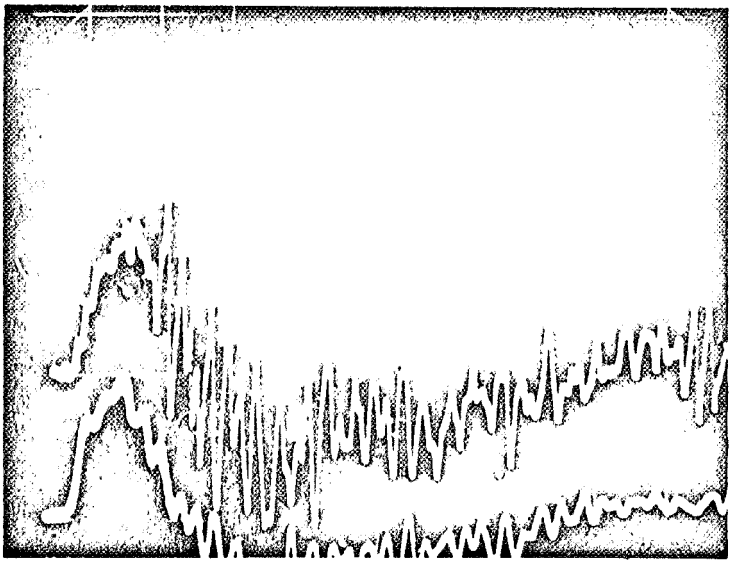
5 MSEC/DIVISION

5769-6404
27554
1T02861

SHOCK PULSE NO. 3

THRUST AXIS

10 G's/DIVISION



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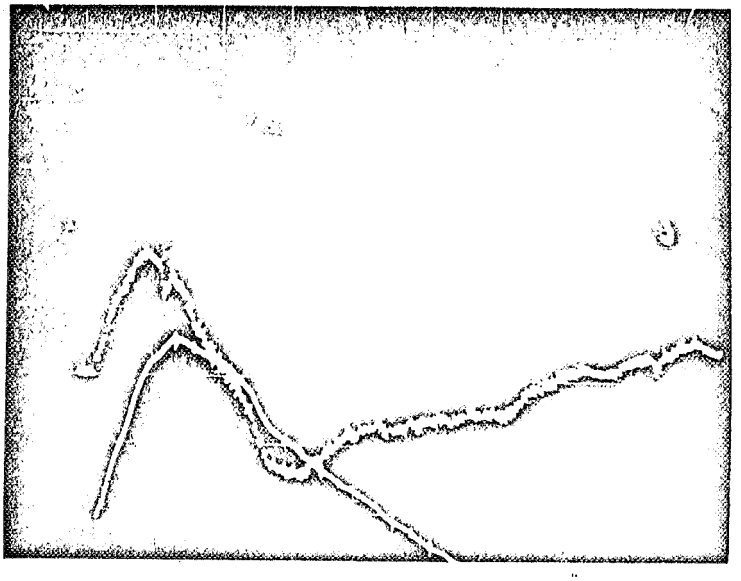
5 MSEC/DIVISION

10 G's/DIVISION



246

5 MSEC/DIVISION

FORMAL QUALIFICATION TEST DATA SHEET V

Item Name: Bellows, Propulsive Fuel Vent

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861-B Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: Wyle Location: El Segundo

Douglas Test Representative: John R. Schulz Date: 4/15/66

Test Witness: J. Olson 4/15/66 _____
Douglas Q.C. Customer Q.C.

Post Test Inspection per Paragraph: 5.16

Test Specimen No: 1

Test Start (Date, Time): 4/11/66

Test Completed (Date, Time): 4/15/66

Specimen Weight: *2.7 lbs 1194.3 gm (S/N 033, Assy 41204-1F, 1A87152-1B)

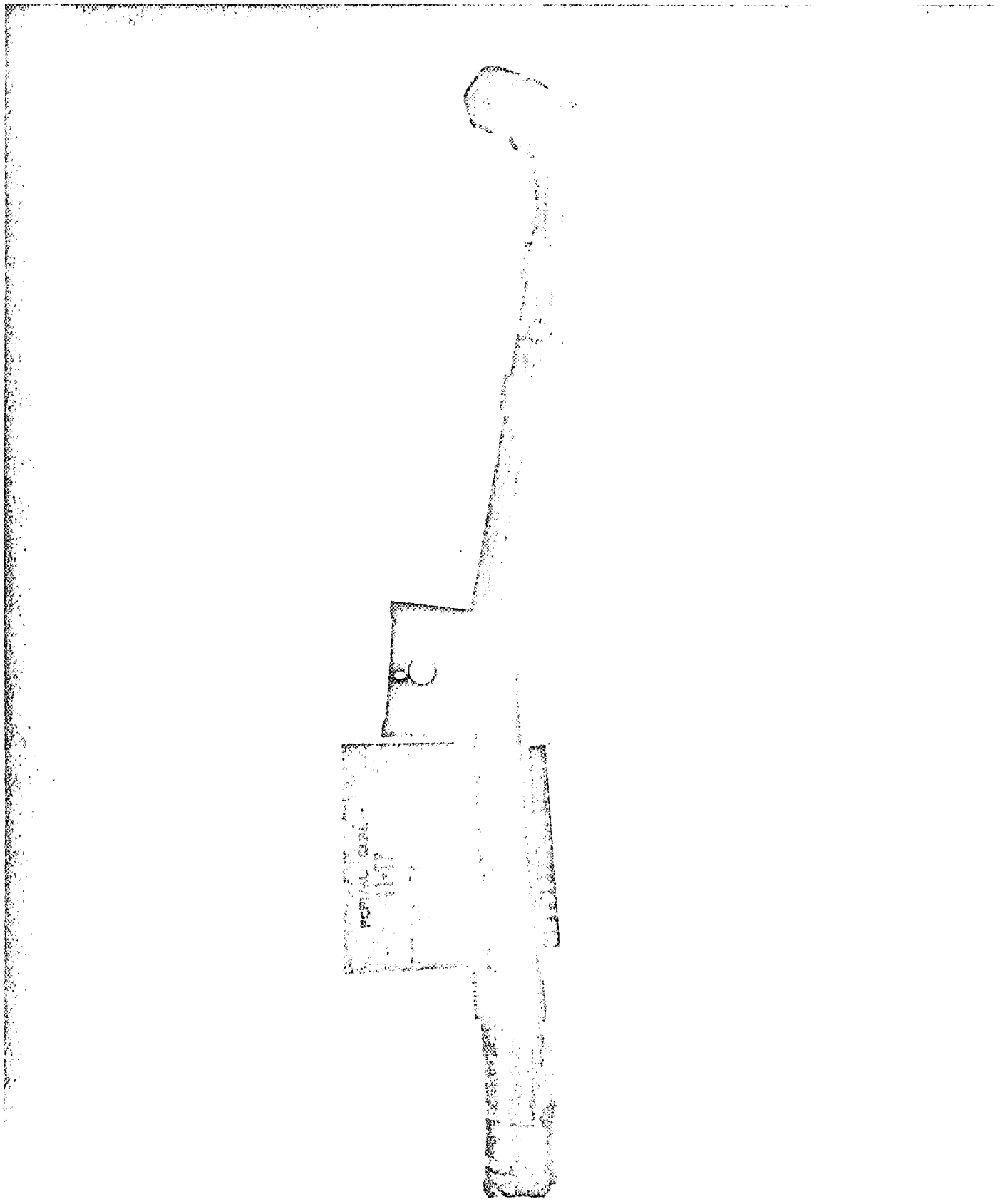
Comments: Test specimen extruded laterally, six inches from c/l of vent duct-convoluted section fully extended. Ruptures at both ends of specimen at outer radius of bend.

*Duplicate Specimen - Balance: DAC Fairbanks Morse S/N 6146921 cert 601 Due 6/28

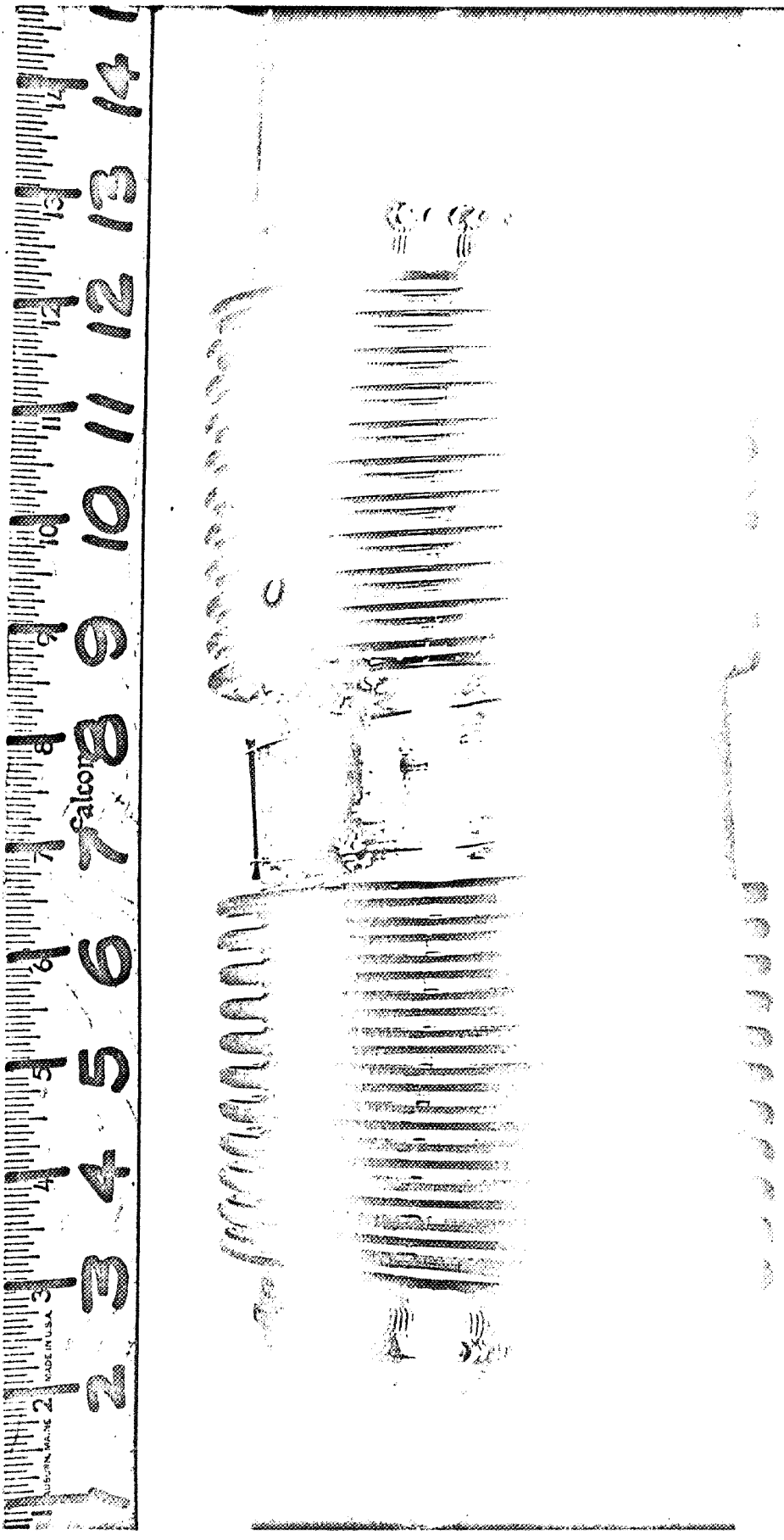
Complete assembly wt. = 19.4 lbs.

Balance DAC 642368 Due 6/17

ADDENDUM B
PHOTOGRAPHS



Test Specimen Configuration



Permanent Deformation of Specimen During Post Deflection Cycle Test

ADDENDUM C
SCHEMATIC DIAGRAMS

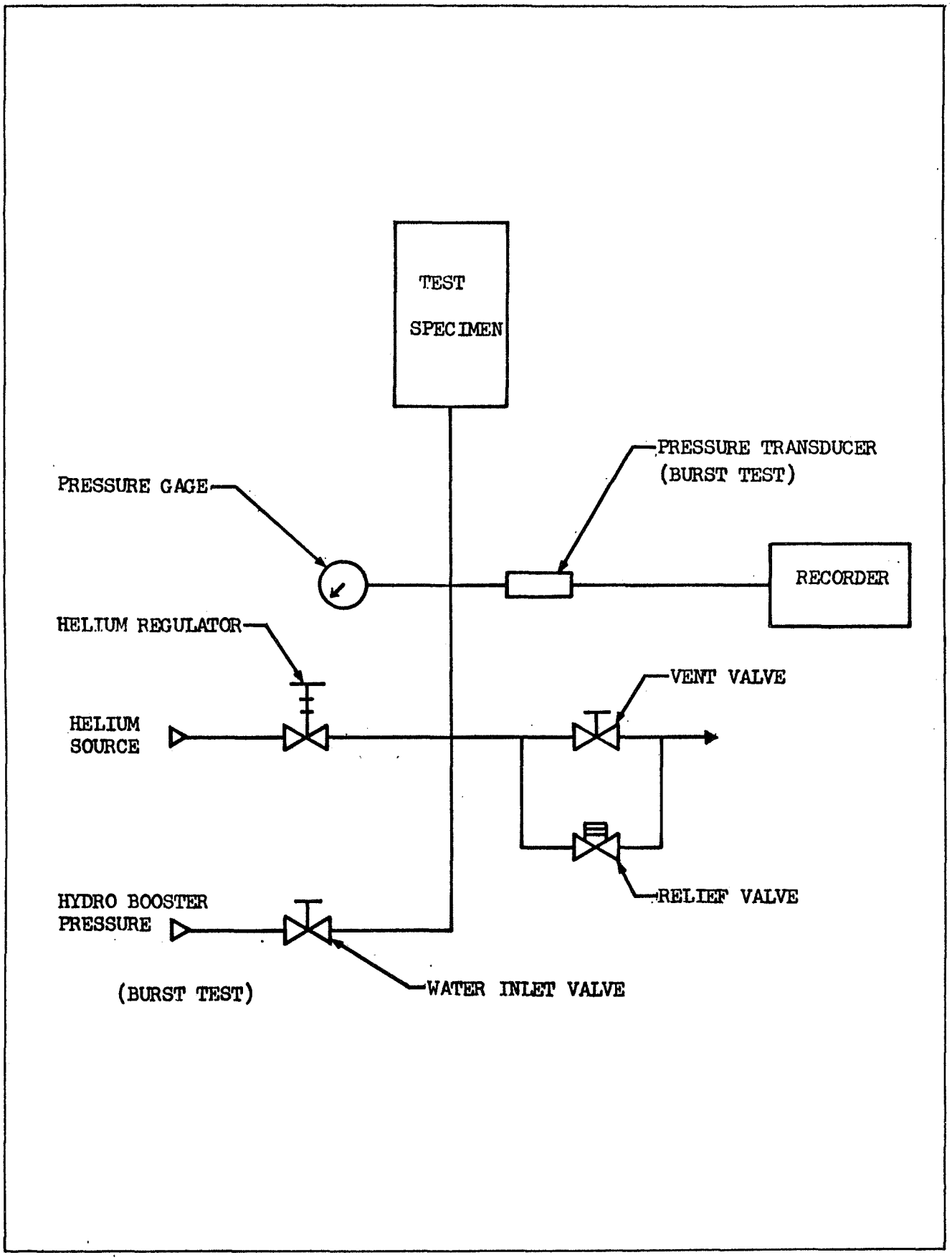


Figure 1. Leakage, Proof, and Burst Test, Schematic Diagram

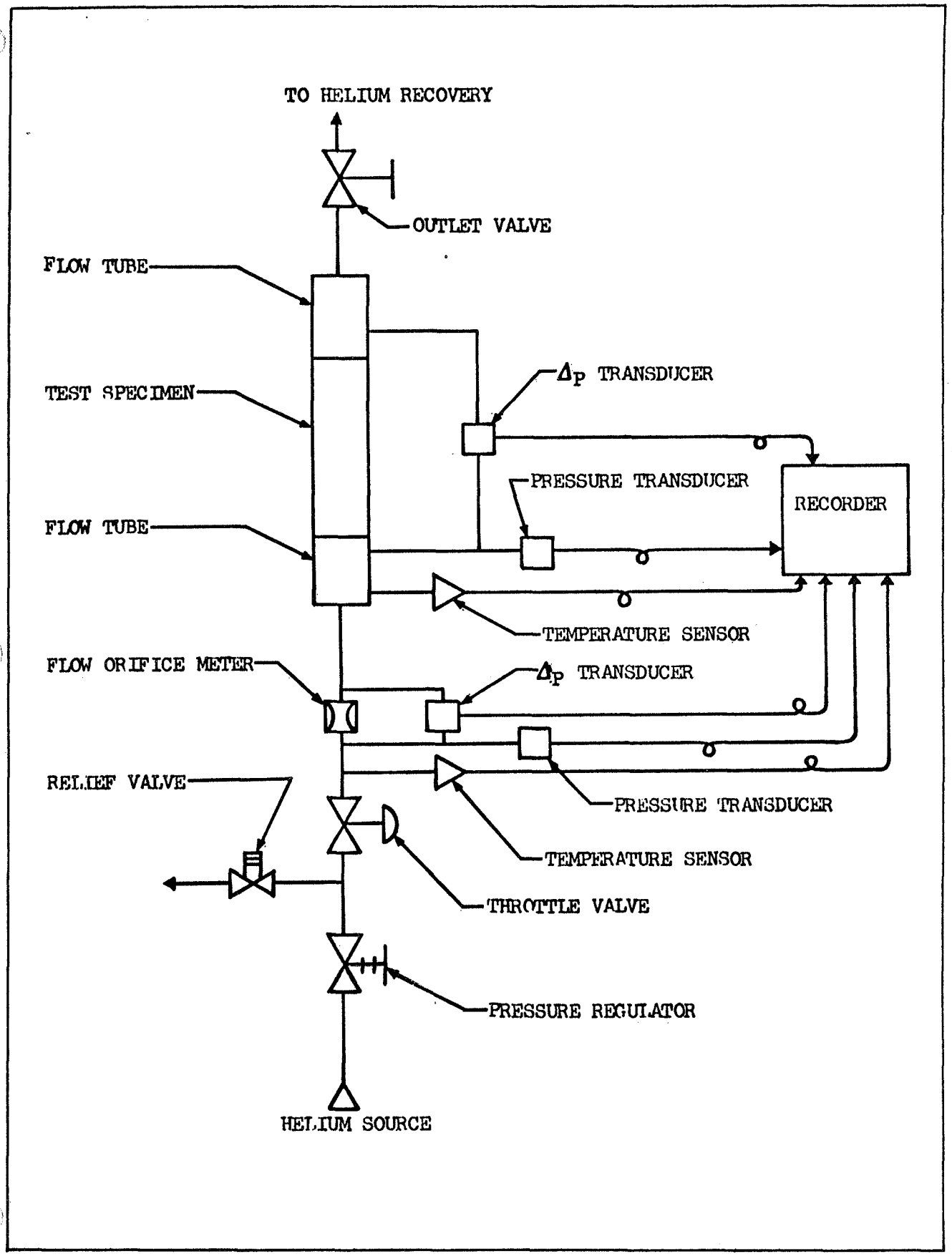


Figure 2. Flow Test, Schematic Diagram

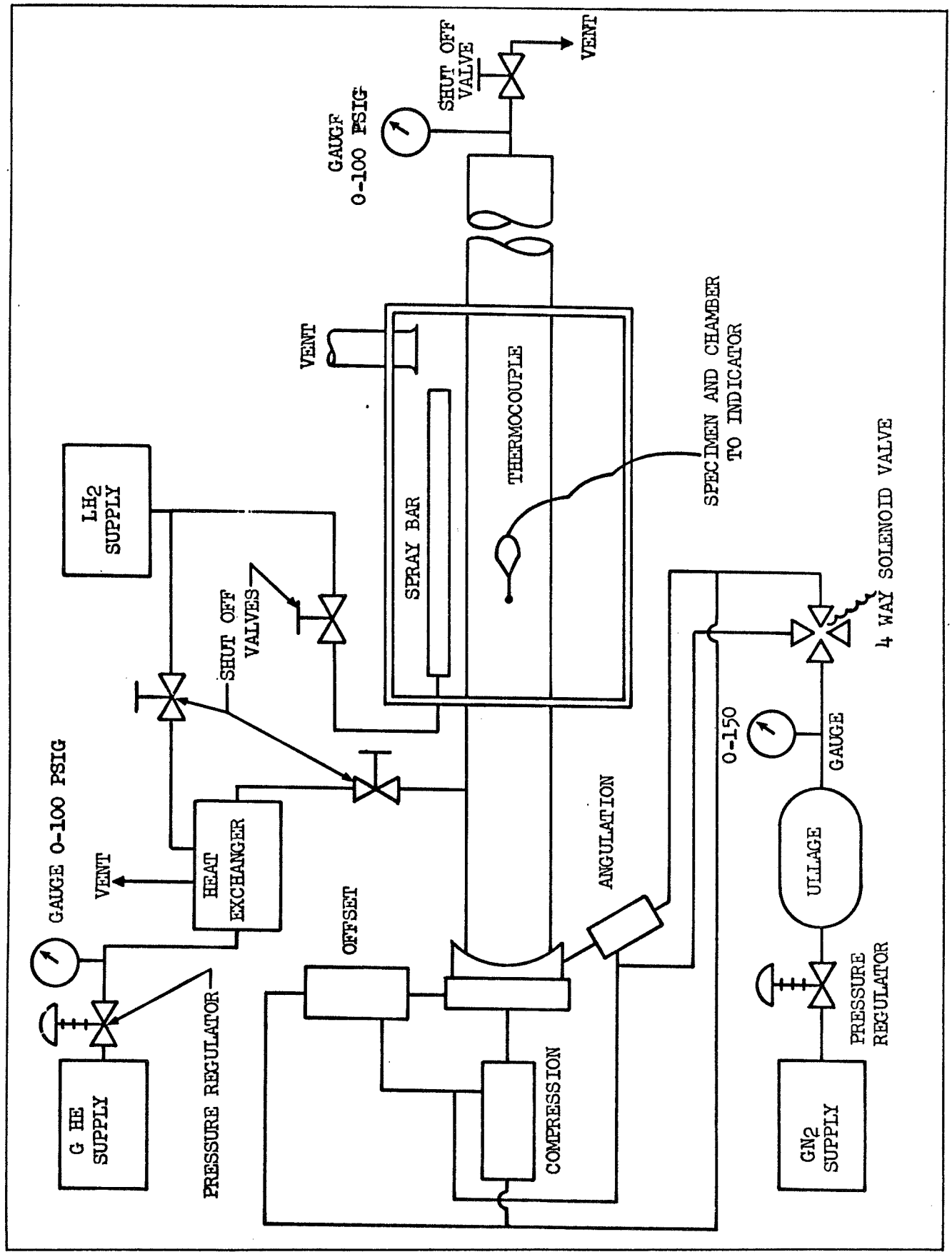
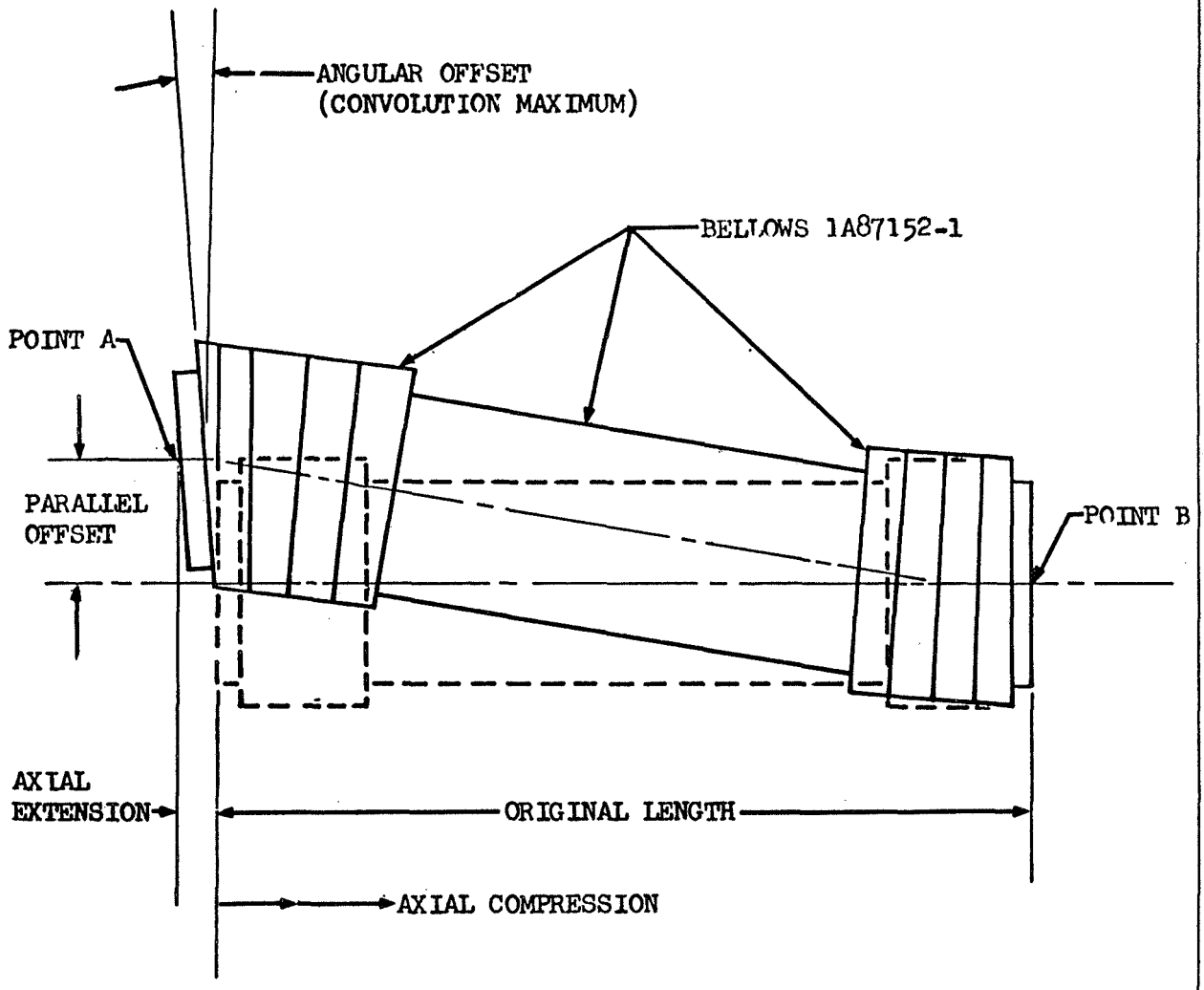


Figure 3. Pressure and Deflection Cycle Diagram



NOTE: WITH POINT B FIXED, DEFLECTIONS AND LOADS SHALL BE APPLIED AT POINT A TESTING THE BELLOWS ASSEMBLY ONLY. RESTRAINT SHALL BE APPLIED AT POINTS A AND B FOR STRUCTURAL TESTS. THE BELLOWS SHALL REMAIN A PART OF THE TEST SPECIMEN ASSEMBLY.

Figure 4. Bellows Deflection Definition

ADDENDUM D

FORMAL QUALIFICATION TEST PROCEDURE DRAWING 1T02861, REVISION C

PML

FORM X60-999 (REV. 4-64)

REVISIONS

SYM	DESCRIPTION	DATE	APPROVED
A	SEE E.O.	9-30-65	JHB
B	SEE E.O	12-6-5	JHB
C	SEE E.O.	7/1/6	JHB

11466
ED
1/8/64
DKW

SATURN SYSTEMS
S-IV B
ACOUSTICS AND
STRUCTURAL DYNAMICS
E. J. Cobb

RLO'Massey

Acoustic and Structural Dynamics Section
Installation Design Section
Reliability Analysis Section Don Cottle 10-8-64
Subsystems Test Section R. I. Wilkins 10-8-64

PREPARED FOR NASA - MSFC

PART OR IDENTIFYING NO.	
1T02861-1	SM 41412 ITEM FQ-H-17 EWO 27554 SM 46532

DASH NUMBERS OF THIS DRAWING ODD DASH NUMBERS SHOWN EVEN DASH NUMBERS OPPOSITE	MATERIAL	
UNLESS OTHERWISE SPECIFIED		
DIMENSIONS ARE IN INCHES TOLERANCES FRACTIONS ± DECIMALS ± ANGLES ±	FINISH	SEE ENGINEERING RECORDS FOR USAGE DATA ORIG SECT. / REL CODE / FIRST REL OF PRINTS / ORIG DATE OF DWG 2 SEP '64

MATL		
WT CHK		
STR CHK		
CHECK		
PR ENGR	E. A. Williams	12-9-4
DES ENGR	[illegible]	10-8-4
GR ENGR	[illegible]	10/8/64
PREP BY	A Paolantonio	10/1/64

DOUGLAS AIRCRAFT COMPANY, INC — SANTA MONICA, CALIFORNIA

FORMAL QUALIFICATION TEST PROCEDURE
BELLOWS, PROPULSIVE FUEL VENT,
PART NUMBER 1A87152-1

TD — TEST PROCEDURE DRAWING

CODE IDENT NO.	SIZE	
18355	A	1T02861
SCALE		SHEET 1 OF 31

DESIGN ACTIVITY APPROVAL
Lyle J. Kelsey MSFC/DK
CUSTOMER APPROVAL

60-999-1

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SYM B

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FIGURE INDEX		A																
INTRODUCTION	5	A	B															
APPLICABLE DOCUMENTS																		
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	7																	
	8	A																
COMPONENT DESCRIPTION	9	A																
TEST PROCEDURE	10	A																
	11	A																
	12	A	B															
	13	A																
	14																	
	15	A	B															
	16	A	B															
	17	A																
	18	A	B															
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DOUGLAS AIRCRAFT COMPANY, INC	CODE IDENT NO. 18355	SIZE A	1T02861
			SHEET 2.0

FORM X60-999-1 (10-62)

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DOUGLAS AIRCRAFT COMPANY, INC

CODE IDENT NO.	SIZE	
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SHEET 2.1

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FORM X60-999-3 (10-62)

SYM B

1.0 INTRODUCTION

1.1 Objective

The purpose of the Formal Qualification Test is to formally demonstrate to the National Aeronautics and Space Administration, Marshall Space Flight Center, the ability of the Propulsive Fuel Vent Bellows, Douglas part number 1A87152-1, to meet the requirements listed in Douglas drawing 1T02860, Revision E. The tests will be conducted in accordance with the requirements of the Formal Qualification Test Plan, SM-46532, Item FQ-H-17.

1.2 Scope

This document establishes and delineates the specific laboratory procedure to be followed in conducting the formal qualification tests on the Propulsive Fuel Vent Bellows, P/N 1A87152-1. The bellows will be mounted on its next assembly, drawing number 1A87436, for these tests. It is used in the fuel tank vent line in the propulsion system of the S-IVB stage of the Saturn IB/V space flight vehicle.

2.0 APPLICABLE DOCUMENTS

2.1 General

The following documents form a part of this drawing to the extent specified herein.

2.2 Douglas Documents

SM-46532	Formal Qualification Test Program
SM-41412	General Test Plan Saturn S-IVB
1A87152	Bellows, Propulsive Fuel Vent
1T02860-E	Formal Qualification Test Requirements
1A87436	Duct, Exit, Propulsive Fuel Vent
1A39322	Installation Drawing
1T00176	Qualification, Test Requirements

2.3 Government Documents

MSFC-SPEC-164 (4/16/62)	Gleaning of components for use in oxygen, fuel and pneumatic systems, specifications for
MIL-P-27401a	Propellant Nitrogen, Pressurizing
Bureau of Mines	Helium, Grade A

2.4 Vendor Documents

41204	Bellows Assy. (Fairchild Precision Metal Products)

3.0 TEST REQUIREMENTS

3.1 Tolerances

3.1.1 Environmental Tolerances

The maximum allowable deviations from the applicable environmental requirements shall be as follows unless otherwise specified.

a.	Altitude	±5%
b.	Temperature (Below -100° F)	±10° F
c.	Temperature (-100 to +250° F)	±5° F
d.	Humidity	+5% minus 0% RH
e.	Vibration	±5% frequency; ±10% amplitude for sinusoidal vibration.
f.	Acoustic	+4 db minus 0 db amplitude from 100 cps to 2000 cps
g.	Acceleration	±2%G
h.	Impact Shock (Mechanical)	±15% pulse amplitude; ±20% pulse duration
i.	Pressure	±3% psig static; ±5% psig dynamic
j.	Angularity	±0.5 degree
k.	Linearity	±1% stroke

3.1.1 (Cont)

l.	Flow	±2% pounds per second
m.	Strain	±4% micro-inches per inch
n.	Load	±5%

3.1.2 Instrumentation Tolerances

The maximum allowable error for measurement equipment used in the test program shall be as follows unless otherwise specified.

a.	Temperature (Below -100°F)	±5°F
b.	Temperature (-100 to +250°F)	±2°F
c.	Vibration	±2.5% frequency; ±8% amplitude
d.	Acceleration	±1%G
e.	Pressure	±1.5% psig static; ±3% psig dynamic
f.	Angularity	±0.25 degrees
g.	Linearity	±0.5% stroke
h.	Flow	±1% pounds per second
i.	Strain	±2.5% micro-inches per inch
j.	Load	±2.5%
k.	Voltage	±1%
l.	Current	±1%
m.	Shock (Mechanical)	±8% pulse amplitude and pulse duration

3.2 Ambient Conditions

Unless otherwise specified, all tests shall be conducted at ambient conditions. Ambient conditions are defined as follows:

3.2 (Cont)

Temperature	70° ± 25°F
Relative Humidity	50% or less
Pressure	30 ± 2 inches Hg

Where tests are made with the temperature different from the above values, proper allowance shall be made in the test results for the difference in system condition. In all cases, atmospheric conditions shall be recorded.

3.3 Failure Definition

Failure is defined as any physical impairment which limits or alters the operational characteristics of the test specimen such that it fails to meet the qualification criteria established by the test requirements, drawing 1T02860. (For convenience, the qualification criteria is included in the applicable paragraphs under the test procedure section of this document.)

In case of failure, Engineering Laboratories and Services will notify Saturn Sub-system Test Section, who will inform MSFC Engineering through the NASA/MSFC Resident Management Office.

A complete analysis of the failure and corrective action taken will be given in the final report.

3.4 Deviations

Changes may be made in the requirements specified in this test procedure document when mutually agreed upon in writing by the Douglas Aircraft Company, Inc., (Saturn Sub-system Test Section) and a NASA/MSFC Contracting Officer's Technical Representative for Testing.

No changes shall be made that will subject the test specimens to new test environments, or levels of environment not previously covered in drawing 1T00176.

3.5 Final Report

The final, Formal Qualification Test Report shall contain, but not be limited to, the following:

a. Part name and number

b. Purpose of the Test

c. Test data and calculations recorded in chronological order

d. Results and conclusions

e. An approved copy of the Formal Qualification Test Procedure in the appendix

f. Black and white photographs of each test setup; and,

g. Color photographs of any damaged specimen, or any specimen which fails during a test

h. A complete analysis of the failure and corrective action taken will be given in the final report.

4.0 COMPONENT DESCRIPTION

4.1 Configuration

The propulsive Fuel Vent Bellows, Douglas part number 1A87152-1, is shown in figure 1. It is a length of articulated, stainless steel tubing which will permit expansion and contraction of a fuel vent line without introducing excessive stresses in either the vent line or the support structure in the stage. The internal construction of the bellows is shown in the cutaway view, figure 2.

4.2 Intended Use

The bellows will be used in the fuel tank vent line in the vehicle propulsion system.

4.3 Location

The bellows will be installed in Douglas station 615.7 between stringers 36 and 49 of the DSV-IVB stage of the Saturn IB/V space-flight rocket vehicle. It is a welded portion of the propulsive fuel vent exit duct, drawing number 1A87436; and the exit duct is shown in zones 41 through 44 of the main fuel tank components installation drawing 1A39322.

SYM A

4.4 Operating Medium

The actual, operating medium used in the Propulsive Fuel Vent Bellows, 1A87152, shall be gaseous hydrogen at a pressure of 31 psig and a temperature range of from -423°F to +160°F.

5.0 TEST PROCEDURE

5.1 General

The test specimen shall be tested as indicated on component test plan H-17 (MSFC Form 1839) in accordance with the test sequence specified by letters. This component test plan is reproduced in this drawing as table 1.

5.2 Number of Test Specimens

One vendor manufactured production specimen will be tested. The specimen shall be subjected to the sequence of tests indicated in table 1.

5.3 Specimen Selection

The test specimen selected for formal qualification testing shall have been manufactured by production methods and tooling. The test specimen shall be serialized production part.

5.4 Test Specimen Identification

In addition to the identification and markings specified in the specification control drawing, 1A87152, the test specimen shall be permanently identified and marked: TEST.

5.5 Cleanliness

The test specimen shall be cleaned before testing unless they were previously cleaned and packaged in accordance with MSFC-SPEC-164.

5.6 Test Sequence

The test specimen will be subjected to the following tests in the sequence shown below. (Refer to table 1 and paragraph 7.6)

a. Pre-test Inspection

b. Proof Pressure

c. Leakage

d. Spring Rate

e. Flow (ΔP)

f. Repeat Cycle (Pressure and Deflection)

g. Vibration

h. Shock (Mechanical)

i. Burst

j. Post-test Inspection

5.7 Pre-test Inspection

The test specimen shall be inspected for conformance with the applicable supplier drawings and the Douglas specification control drawing, 1A87152. The complete identification of the part shall be recorded, including vendor name, vendor part number, complete specification control number, change letter, and manufacturer's serial number. All results of this inspection and the weight of the test specimen shall be included in the test report.

SYM B

5.8 Proof Pressure Test

(See figure 3.)

Mount the test specimen in the test fixture, part number 1T12844-501, to prevent axial movement and plug one end of the bellows. Connect test apparatus as shown in figure 3. With the assembly at ambient temperature, apply helium gas at ambient temperature and a pressure of 46 ± 2 psig to the opposite end of the bellows. Maintain this pressure for 5 minutes. Verify that the bellows suffers no structural failure or permanent distortion.

5.9 Leakage Test

(See figure 3.)

Mount the test specimen in the test fixture, part number 1T12844-501, to prevent axial movement and plug one end of the bellows. Connect test apparatus as shown in figure 3. Submerge the entire test specimen in water. Apply helium gas at ambient temperature and a pressure of 31 ± 2 psig to the opposite end of the bellows. Maintain this pressure for 3 minutes while the test specimen is completely submerged in water. Verify that no leakage occurs. Upon completion of this test, the test specimen shall be cleaned immediately with clean, dry gas.

5.10 Flow (ΔP) Test

(See figure 4.)

Mount the test specimen to the test fixture, P/N 1T12844-501, and attach a flow tube on each end of the test assembly. Connect the test apparatus as shown in figure 4. With the specimen and test medium at ambient room temperature, simultaneously record pressure drop and flow with a minimum of three varied specimen inlet flow pressures up to and including 31 ± 2 psig utilizing gaseous helium. Plot the curves of flow versus ΔP. The minimum flow rate and maximum pressure drop across the entire test specimen assembly shall be 1.5 lb/sec and 1.5 psi respectively. All data shall be continuously recorded.

Prior to the commencement of the flow test, a tare pressure drop test shall be run to determine the pressure drop of the adjoining ducts.

5.11 Vibration Test

(See figures 5 and 6.)

5.11.1 General

Fabricate the vibration test assembly as shown in figure 5. Mount the test assembly in the test fixture, part number 1T07801-C. Connect test apparatus as shown in figure 6. The sinusoidal sweep test and then the random test shall be performed in each axis prior to changing the axis of vibration. A plot of the vibration amplitude versus frequency for the vibration sweep test shall be included in the test report. A plot of G^2/cps for random vibration test shall be included in the test report.

The excitation shall be applied to the specimen simultaneously by three vibration exciters. Each vibration exciter shall be operated with its own console and power amplifier.

5.11.2 Check of Phase and Equalizing Control Systems

Tests shall be conducted on the vibration test fixture to check the capabilities of the phase and equalizing control systems. During these phase and equalizing control checks, the specimen shall not be installed on the fixture; however, a dummy specimen shall be used.

5.11.2.1 Phase Control Check

The fixtures and the dummy specimen shall be subjected to the vibration test levels given in 5.11.4, Sinusoidal Sweep Test, to obtain data on the phase control system during sinusoidal sweep tests. Sinusoidal sweeps from 5 to 2000 to 5 cps shall be made in each of the three mutually perpendicular axes. The phase control system shall be supplied by the cognizant test facility. The phase control system shall use one accelerometer on each of the three shakers. The locations of the control accelerometers are shown in figure 5. The signals from the three (3) control accelerometers shall be recorded on magnetic tape and recording oscillographs during the test. The cognizant test facility shall playback the magnetic tapes to establish the phase angle relationships of the three (3) control accelerometers. These phase angle relationships shall be established by sufficient playbacks using tracking filters (Spectral Dynamics Model SD-1012 or equivalent), a phase meter (Ad-Yu Model 405H or equivalent), and a X-Y recorder. The output from the phase meter shall be recorded continuously on a X-Y recorder.

5.11.2.2 Equalizing Control Check

The equalizing control check shall be conducted using two (2) Ling ASDE-80 Automatic Equalizers and a "programmed" magnetic tape. The programmed magnetic tape shall be made with an ASDE-80 controlling the vibration exciter which is near the middle of the specimen, and with an ASDE-80 controlling the vibration exciter which supports the 1A87860-1 flange. These two exciter systems shall be equalized, and the signal from the latter equalizer shall be recorded on magnetic tape. Two such "programmed" magnetic tapes shall be made for each axis: one for the 120 second test level (Paragraph 5.11.5) and one for the 600 second test level (Paragraph 5.11.5). These "programmed" magnetic tapes shall be recorded for a time period longer than the specified test duration. After the "programmed" magnetic tapes have been prepared, the two (2) ASDE-80 Automatic Equalizers shall be used to equalize the vibration exciters which support stringers 35, 36, 41, and 42. Simultaineously, a "programmed" magnetic tape shall be used to control the exciter system which supports the 1A87860-1 flange. With this test setup, the fixtures and the dummy specimen shall be subjected to the random vibration test levels given in 5.11.5 to obtain data on the equlaizing control systems. During these equalizing control checks, the signals from the three (3) control accelerometers shall be recorded on magnetic tape and recording oscillographs. The oscillograph records shall be examined for signal fidelity, and the magnetic tapes shall be played back into power spectral density analyzers at the cognizant test facility. The data from the three (3) control accelerometers shall be presented in graphical form showing g^2/cps versus frequency. The qualification vibration test of the Propulsive Fuel Vent Bellows, Part Number 1A87152-1, shall be conducted only after the data from the tests of 5.11.2 have been analyzed by the Acoustics & Structural Dynamics Section, K441, to establish phase and equalizing control system requirements.

5.11.3 Vibration Test Axes

Direction A - perpendicular to the forward skirt

Direction B - tangent to the forward skirt

Direction C - parallel to the forward skirt and perpendicular to directions A and B.

5.11.4 Sinusoidal Sweep Test

Apply sinusoidal vibration to the test assembly at a logarithmic sweep rate of 1 octave per minute, starting from the low frequency to the high frequency and back to the low frequency in each of three mutually perpendicular axes. The vibration input levels shall be as follows:

Direction A

5 to 44 cps at 0.04-inch double amplitude displacement

44 to 250 cps at 4.0 g's peak

250 to 320 cps at 0.0013-inch double amplitude displacement

320 to 2000 cps at 7.0 g's peak

Directions B and C

5 to 44 cps at 0.04-inch double amplitude displacement

44 to 2000 cps at 4.0 g's peak

5.11.5 Random Vibration Test

The random vibration shall have an approximate Gaussian amplitude distribution and a peak-to-rms ratio of 3. Equalization of the random input spectrum shall be accomplished by using a random vibration level which is not more than 1/4 of the actual test level. The equalized spectrum shall be monitored and readjusted during the test as necessary by:

a. Using individual meters on each channel of the spectral density equalizer-analyzer or,

b. Using graphical displays on spectral density analyzers. The acceleration power spectral density applied to the test specimen shall be within $^{+100\%}_{-50\%}$ when measured with a filter having a bandwidth of 50 cps or less. Apply random vibration over the frequency interval of 20 to 2000 cps at the spectral density shown below.

Record all accelerometer outputs on magnetic tape. The control accelerometer signal shall be analyzed and presented as g^2/cps versus frequency.

5.11.5 (Continued)

Direction A	120 Seconds	600 Seconds
20 to 200	cps at .03 g^2/cps	.012 g^2/cps
200 to 280	cps at 22 db/octave	22 db/octave
280 to 800	cps at .36 g^2/cps	.14 g^2/cps
800 to 1500	cps at -12 db/octave	-12 db/octave
1500 to 2000	cps at .03 g^2/cps	.012 g^2/cps

Directions B and C	120 Seconds	600 Seconds
20 to 200	cps at .03 g^2/cps	.012 g^2/cps
200 to 280	cps at 10 db/octave	10 db/octave
280 to 800	cps at .090 g^2/cps	.036 g^2/cps
800 to 1500	cps at -5.5 db/octave	-5.5 db/octave
1500 to 2000	cps at .03 g^2/cps	.012 g^2/cps

5.11.6 Post Tests

Upon completion of the sinusoidal and random vibration tests, perform a proof test, paragraph 5.8 and a leakage test, paragraph 5.9.

5.12 Shock Test

(See figure 3.)

5.12.1 General

Mount the test assembly in the test fixture, part number 1T07801-C. Connect test apparatus as shown in figure 3. The test specimen shall be subjected to three shocks in one direction along each of three mutually perpendicular axes (a total of nine shocks).

The shock tests may be performed in conjunction with the vibration testing. However, if the shock test cannot be performed on the vibration exciter, the sine and random vibration tests may be completed in all axes prior to performing the shock test.

5.12.2 Shock Test Axes

Direction A - perpendicular to forward skirt

Direction B - tangent to the forward skirt

Direction C - parallel to the forward skirt and perpendicular to directions A and B

5.12.3 Shock Test Levels

Apply shocks at the following amplitudes:

Directions A, B, and C

20 g's peak (half sine pulse) for a duration of 10 ±2 milliseconds

5.12.4 Post Tests

Upon completion of the shock and vibration tests, perform a proof test per paragraph 5.8, a leakage test per paragraph 5.9, and a spring rate test per paragraph 5.14.

5.13 Burst Test

(See figure 3.)

Mount the test specimen in the test fixture, part number 1T12844-501, to prevent axial movement. Connect test apparatus as shown in figure 3. Apply increasing hydrostatic pressure until the test specimen ruptures (pressurization rate shall not exceed 500 psi per minute). Verify that the bellows does not fail until an internal pressure of 78 psig has been exceeded. Record the burst pressure.

5.14 Spring Rate Test

(See figure 7.)

Mount the test specimen in the test fixture, part number 1T12844-501. Connect test apparatus as shown in figure 7. With the test specimen at ambient temperature, compress the bellows 1/2 inch along its longitudinal axis. Record the force required to compress the bellows 1/2 inch. Verify that the compression force required does not exceed 100 pounds.

SYM β

5.15 Repeat Cycle Test - Service Life

(See figures 7 and 8.)

5.15.1 General

Mount the test specimen in the test fixture, part number 1T12844-501. Connect test apparatus as shown in figure 7.

5.15.2 Pressure Cycle Test

Set up the bellows with an angular deflection of 4 (+1, -0) degrees from the centerline, axial compression of 1-1/8 inches, and parallel offset of 1-5/16 inches. Apply the angular deflection so the total angular motion of each convoluted section is maximum. Chill the assembly with cold helium gas to a temperature of $-400° \pm^{21}_{0}$°F. Pressurize the test specimen to 31 ±1 psig with the helium gas at $-400° \pm^{21}_{0}$°F; then reduce the pressure to 0 psig. Repeat this cycle 200 times. Verify that no failure or degradation of performance occurs.

5.15.3 Post Tests - Pressure Cycle

Upon completion of the pressure cycle test, perform a proof test, paragraph 5.8, and a leakage test, paragraph 5.9.

5.15.4 Deflection Cycle Test

Deflect the bellows from its neutral position for an axial extension of 15/16 inch, an offset of 1-5/16 inches, and an angulation of 4 degrees; then allow the bellows to return to its neutral position. Repeat this deflection cycle 50 times. With the bellows deflected as described above, chill the test specimen with cold helium gas to a temperature of $-400° \pm^{21}_{0}$°F and a pressure of 31 ±1 psig. Deflect the bellows an additional 3/16 inch in axial extension, then remove the 3/16-inch extension. Repeat this cycle 150 times while maintaining the low temperature. Verify that no failure or degradation of performance occurs.

5.15.5 Post Tests - Deflection Cycle

Upon completion of the deflection cycle test, perform a proof test, paragraph 5.8, and a leakage test, paragraph 5.9.

5.16 Post-test Inspection

After completion of all tests, the test specimen shall be inspected for damage or excessive wear and the condition recorded in the test report.

6.0 TEST EQUIPMENT

6.1 Instrumentation List

The following is a list of instrumentation and equipment used to monitor, record, set up, calibrate, and perform the testing as specified herein. Any additional, associated, or replacement equipment will be listed in the test report. All of the equipment listed below will not necessarily be used for every test. At subcontractor locations where listed items are not available, equivalent equipments, or those with greater accuracy, may be substituted.

No.	Description	Mfg. and Model No.	Range	Accuracy
1.	Vibration exciter	TBD		
2.	Power amplifier	TBD		
3.	Recording oscillograph	CEC Mod. 5-123		
4.	a. Pressure gages	U.S. Mod. 1818	0 to 100 psig	±1%
	b. Pressure gages	U.S. Mod. 1835	0 to 3,000 psig	±1%
5.	Transducers	Endevco Mod. 2218	0 to 1,000 g linearity	±1%
6.	Flowmeter	TBD	14,000 pph	±1/2%
7.	Valves	Annin Mod. 1610		
8.	Temperature indicators	Thermo-Electric Mod. 70206	-400° to +100°F	±5%
9.	Differential Pressure Gage	Barton Mod. 214	0 to 40 in. H_2O	±1/2%

SYM A

6.1 (Continued)

No.	Description	Mfg. and Model No.	Range	Accuracy
10.	Douglas Shock Console	Douglas		
	a. Wave Form synthesizer	Exact, Model 200 type F	50 Increments	±3%
	b. Memoscope	Hughes Model 104	125,000 in/sec.	3 db down at 700 KC
	c. Shock Monitor	Endevco Model 2708M2	0 to 50,000 g's	±5%
11.	Vibration Test Fixture	Douglas 1T07801-C		
12.	Load Test Fixture	Douglas 1T12844-501		
13.	Flow Tube (Test)	Douglas 1T12991		

6.2 Instrumentation Replacement

When it becomes necessary to make an instrumentation change during a test, the following minimum information shall be recorded:

Instrument replaced:

Reason for replacement:

New instrument:

Name:

Model No:

Tag No:

Serial No:

Tolerance:

Date of replacement:

Test paragraph No:

7.0 NOTES

7.1 Specimen Markings

The specimen must be identified and serialized in accordance with paragraphs 5.3 and 5.4.

7.2 Disposition of Specimens

At the end of the test program, instructions for disposition of the specimen and related hardware will be furnished by the Douglas representative at the test location.

7.3 Contingencies

If major difficulties arise at any time during the test program, Engineering Laboratories and Services will notify Saturn Sub-system Test Section, who will inform MSFC Engineering through the NASA/MSFC Resident Managment Office. Failures or deviations will be handled in accordance with paragraphs 3.3 and 3.4.

7.4 Data and Reports

The Douglas Aircraft Company, Inc., shall be responsible for the final test report which will conform with paragraph 3.5.

If the test is subcontracted, the subcontractor shall furnish Douglas a complete record of all testing. Submittal shall include one reproducible and eight printed copies of all records.

7.5 Approvals

Approval of procedures, tests, and reports shall be in accordance with the contract NAS 7-101, change order 480.

7.6 Test Sequence Modification

Where tests are not of the test-to-failure type, the order of tests shall be scheduled to conserve time and expedite the completion of the test program unless otherwise stated.

7.7 Photographs

A photograph of each test setup shall be made showing axes of direction, gages, an appropriate scale, and any unique points of interest in black and white. Color photographs shall be taken of any damaged or failed specimen. A plaque shall be included in each photograph. This plaque shall show date, location, part number, etc.

7.8 Check-off List and Log

A detail check-off list shall be used for all phases of testing. This may be incorporated as part of the prepared data records or logs.

A daily log of test activity shall be maintained by the Douglas Engineering Laboratories and Services representative conducting or monitoring the test. Log entries shall be on a continual basis while tests are in progress and daily during test down time. All specimen running time shall be logged.

7.9 Safety Procedures

Safety procedures in accordance with applicable rules for the specific testing area shall be observed at all times and without exception.

7.10 Test Witness

Douglas Quality Control shall attest to the specimen configuration and witness the tests.

NASA Quality Control or their authorized representatives shall witness the tests.

7.11 Definitions

cps	cycles per second
db	decibels
F	degrees Fahrenheit
g	acceleration due to gravity
Hg	mercury
pph	pounds per hour
psi	pounds per square inch
psig	pounds per square inch gage
rms	root mean square

TABLE 1. COMPONENT TEST PLAN NUMBER H-17

1. VEHICLE: IB/V STAGE: S-IVB	2. SYSTEM: Propulsion SUBSYSTEM: Fuel Tank Pressurization	3. PROCUREMENT SPEC/DWG NO: 1A87152 *
4. ITEM NAME: Bellows, Propulsive, Fuel Vent	5. SUPPLIER:	
6. PART NO: 1A87152-1	7. SUPPLIER P/N:	8. TEST SPEC/PROCEDURE NO:
9. CRITICALITY: RANKING:	10. TEST REPORT NO (S):	
11. TEST SPECIMEN (LIST SAMPLE NOS. FOR EACH TEST): FORMAL/QUAL: / RELIABILITY:	12. TEST AGENCY: LOCATION:	

13. TEST STATUS	START DATE ESTIMATED	START DATE ACTUAL	% COMPLETE AND DATE	14. RELIABILITY STATUS	GOAL	ACHIEVED	DATE
PFC/QUALIFICATION				RELIABILITY			
RELIABILITY				CONFIDENCE LEVEL %			

15. TYPE OF TEST	APPLICABILITY (BY S/N) FORMAL/QUAL				REL	RESULT (BY S/N) PASSED/FAILED	DATE COMP	REMARKS
(1) PRETEST INSP	A							
(2) PROOF PRESS	B							
(3) LEAKAGE	C							Room temperature per MSFC Approval
(4) FUNCTIONAL								Letter R-PVE-64-M-352 Dated 10/2/64
(5) HIGH TEMP								
(6) LOW TEMP								
(7) TEMP SHOCK								
(8) ALTITUDE								
(9) ACCELERATION								
(10) FLOW (ΔP)	X							
(11) PRESS SURGE								
(12) VOL EXPANSION								
(13) LIFE CYCLE								
(14) VIBRATION	X							
(15) SHOCK (MECH)	X							
(16) HUMIDITY								
(17) SALT SPRAY								
(18) SAND AND DUST								
(19) FUNGUS								
(20) DIELECTRIC STR								
(21) EXP PROOF								
(22) STORAGE								
(23) BURST	X							
(24) SPRING RATE	D							
(25) REPEAT CYC	X							
(26)								
(27)								
(28) POST TEST INSP	X							
SPECIMEN NUMBER	/				NOTE: SEQUENCE INDICATED BY LETTERS			

16. COMMENTS:

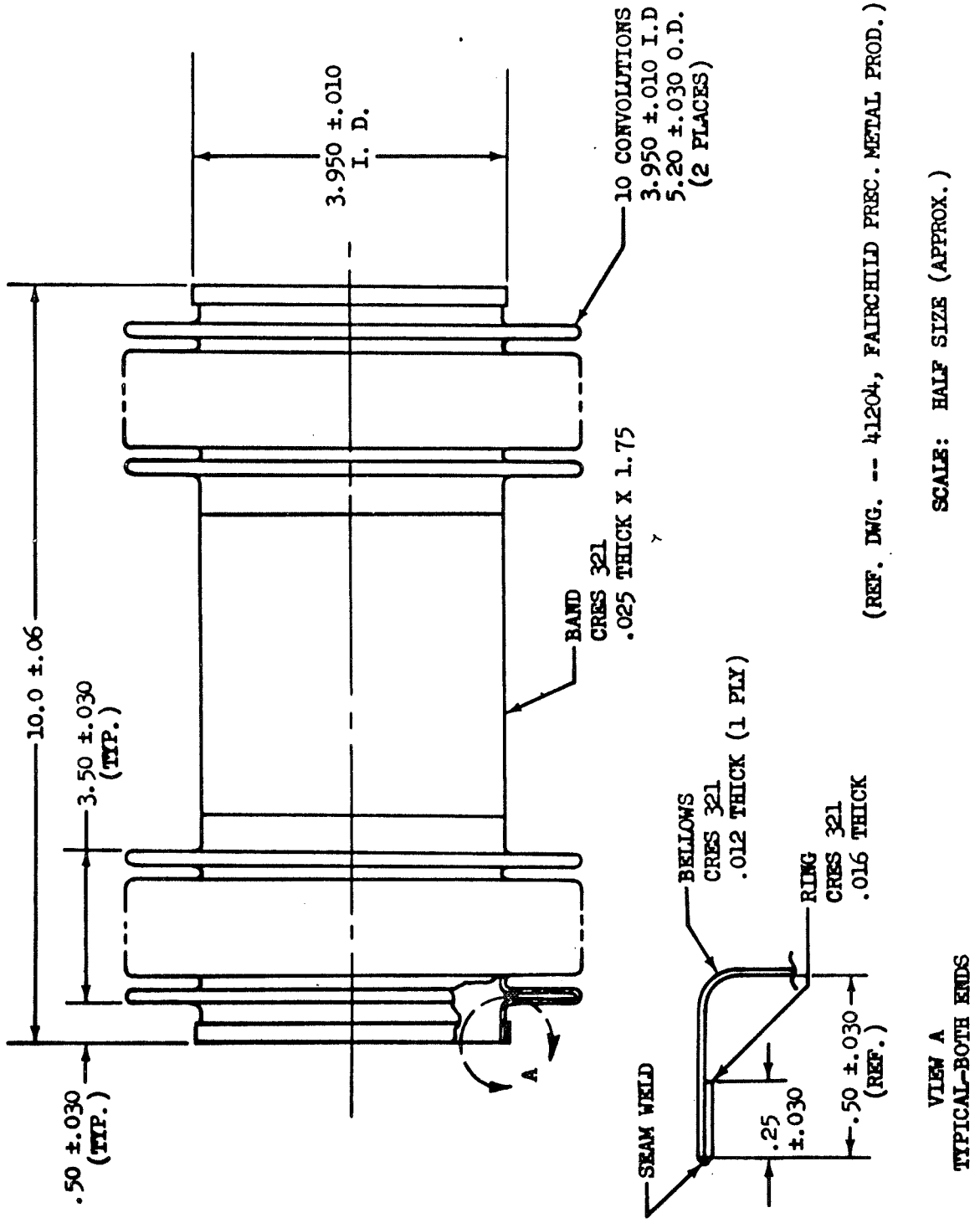
* WILL BE RUN AS AN ASSY. WITH { 1A87436-1, 1A86703-1, 1A89025-501, 1A89026-1 }

ORIGINATOR'S SIGNATURE AND DATE: M. C. Hunt 3/24/64	STAGE CONTRACTOR'S SIGNATURE AND DATE: 1T02861
MSFC TEST PLAN APPROVAL AND DATE: D. L. McCleary 3/20/64	STATUS REPORT APPROVAL AND REPORTING PERIOD: SHEET 23

MSFC - Form 1839 (June 1963) (Supersedes P&VE Form 115 OT) PFC - PRE-FLIGHT CERTIFICATION S/N - SAMPLE NUMBER

FORM X60-999-3 (10-62)

SYM —



(REF. DWG. -- 41204, FAIRCHILD PREC. METAL PROD.)

SCALE: HALF SIZE (APPROX.)

Figure 1. Bellows, Propulsive Fuel Vent

DOUGLAS AIRCRAFT COMPANY, INC	CODE IDENT NO.	SIZE	
	18355	A	1T02861
			SHEET 24

FORM [illegible] (10-62)

SYM —

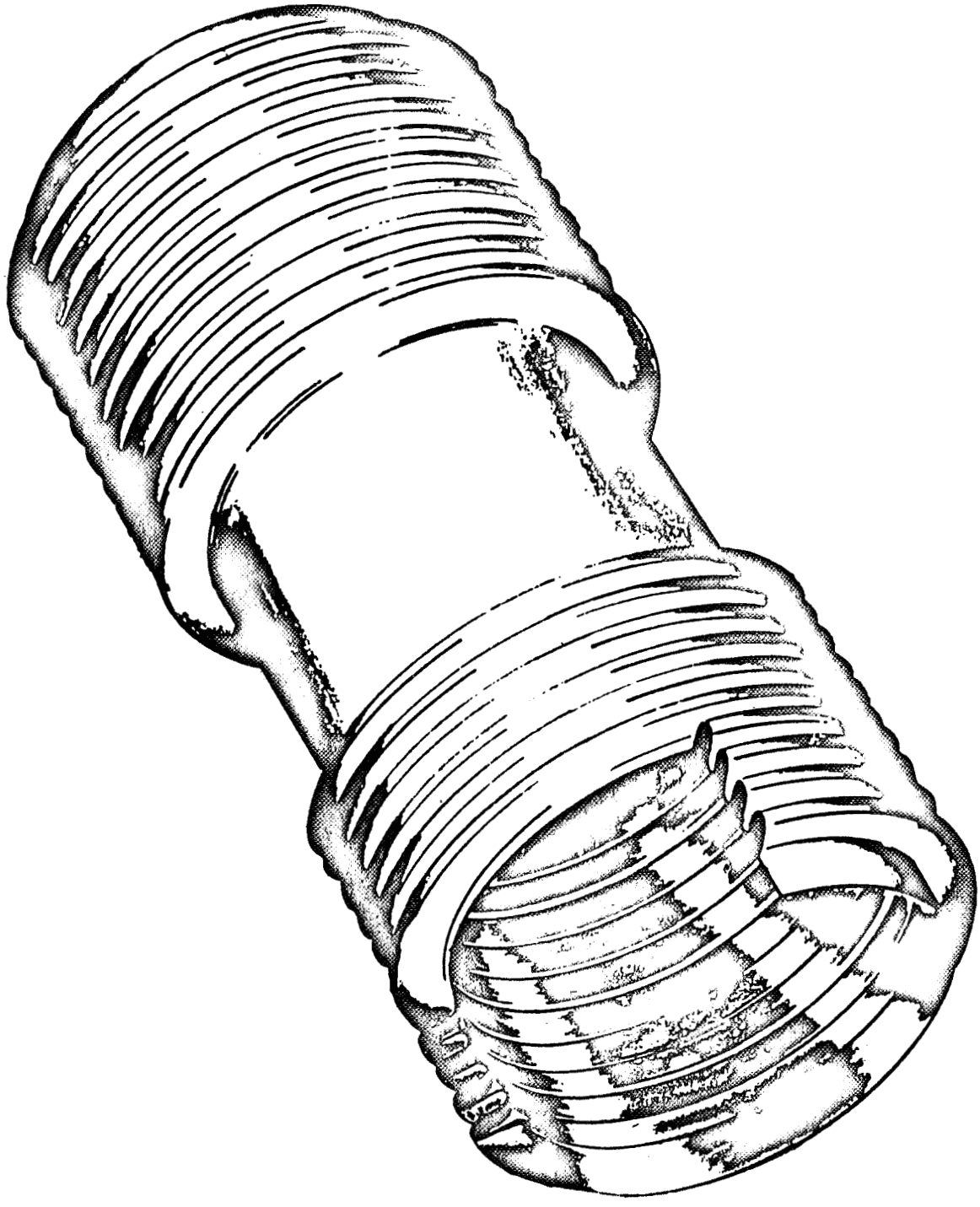
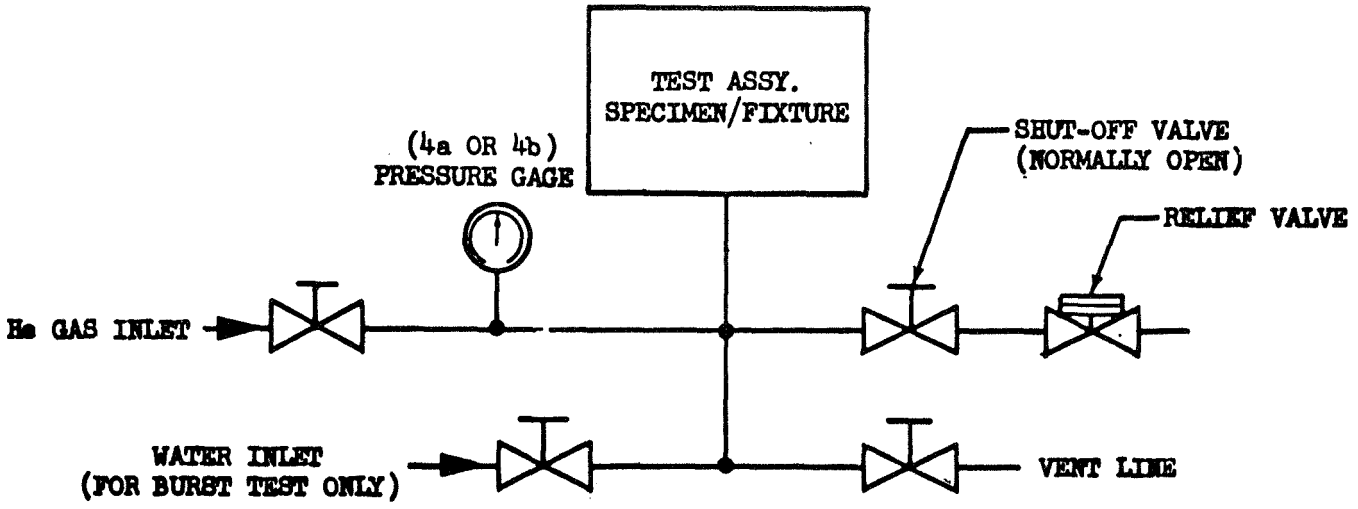


Figure 2. Bellows, Cutaway View

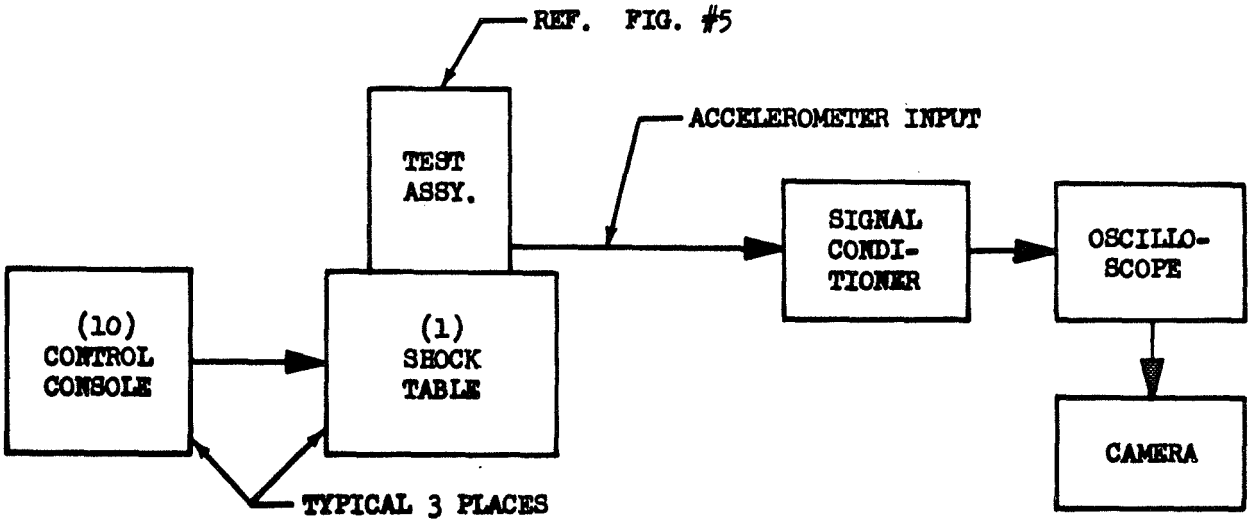
DOUGLAS AIRCRAFT COMPANY, INC	CODE IDENT NO. 18355	SIZE A	1T02861
			SHEET 25

FORM X60-999-3 (10-62)

SYM —



3(a) Proof, Leakage, and Burst Setup



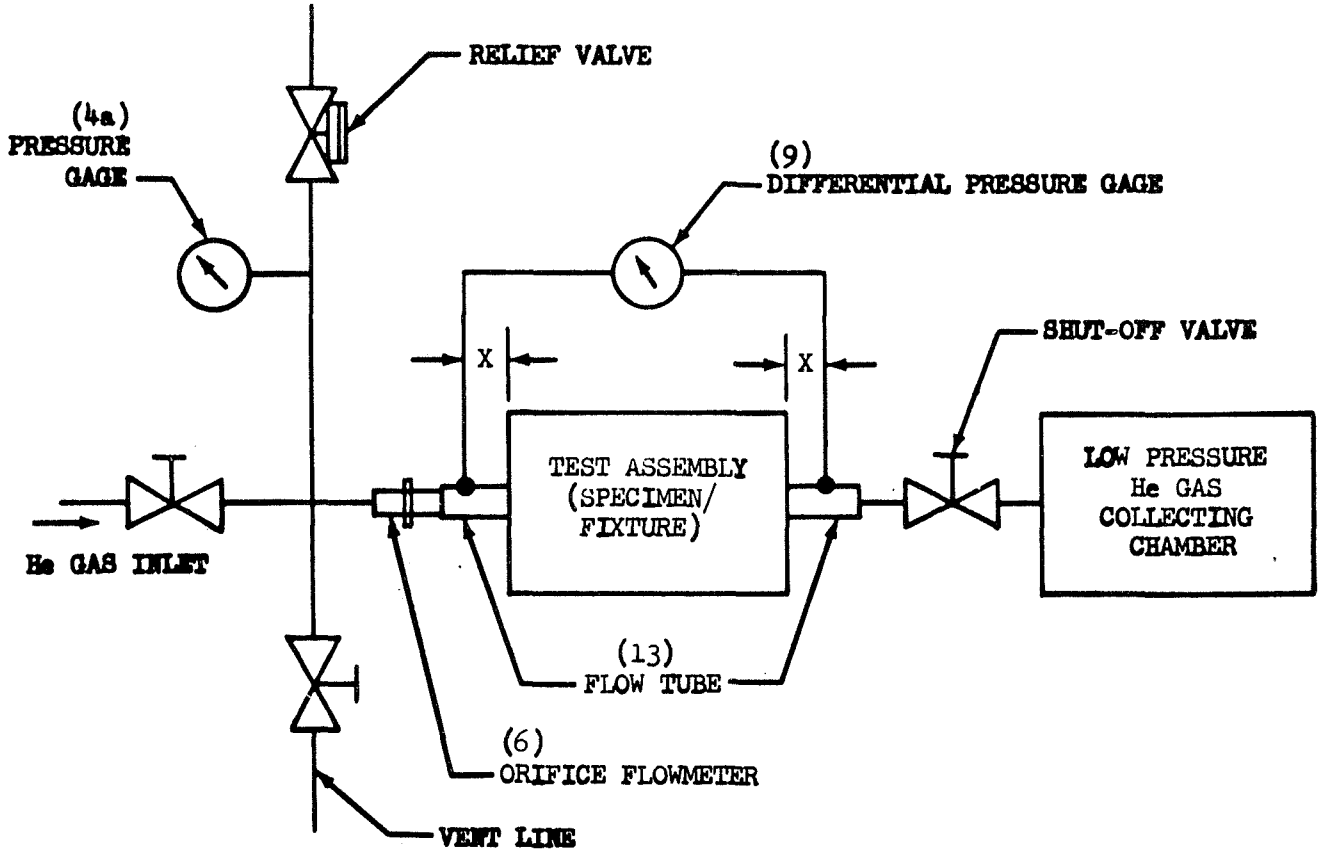
3(b) Shock Test Instrumentation

Figure 3. Proof, Leakage, Shock and Burst Test Diagram

DOUGLAS AIRCRAFT COMPANY, INC	CODE IDENT NO.	SIZE	
	18355	A	1T02861
			SHEET 26

FORM [illegible]

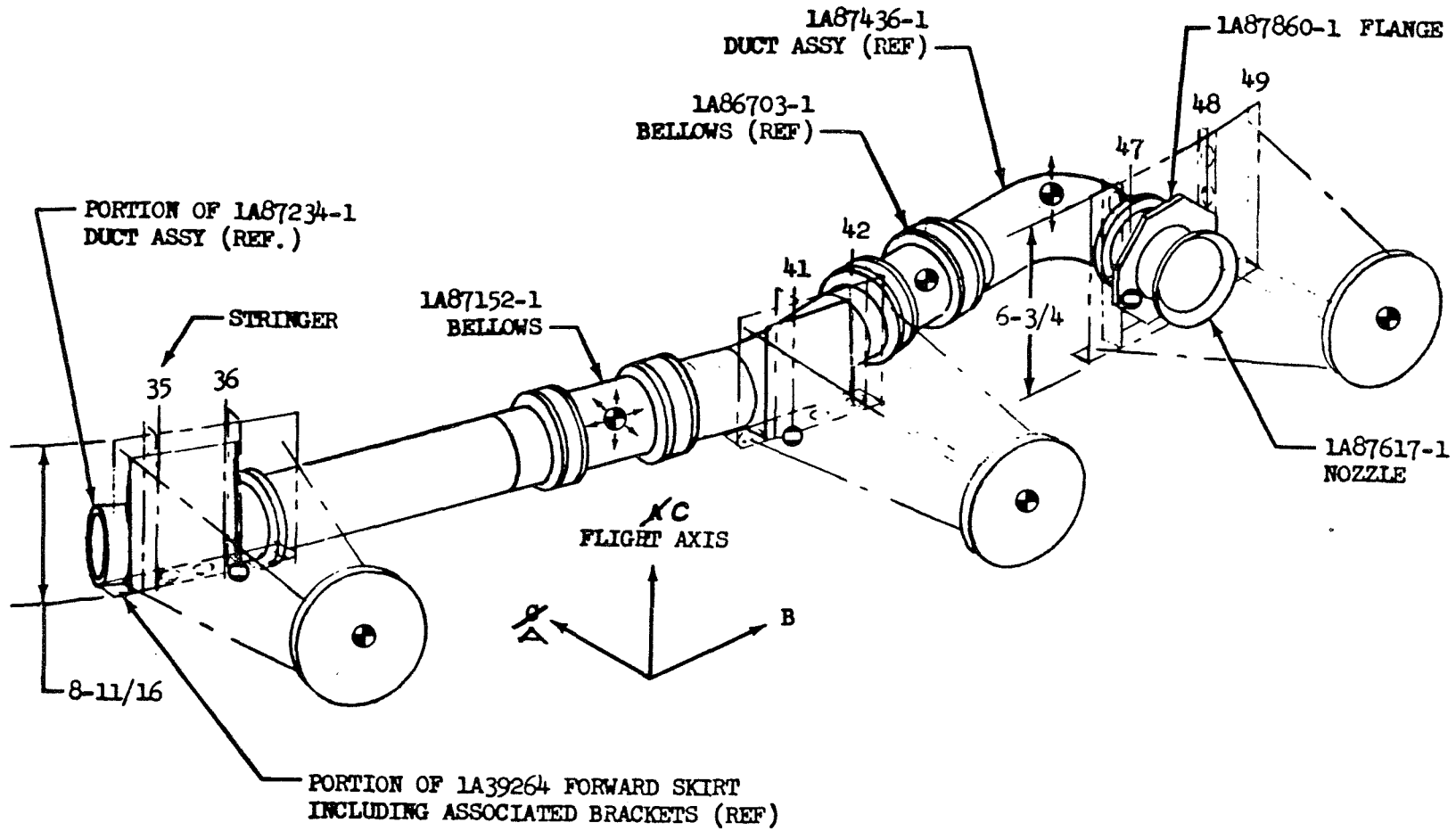
SYM A



X = 10 TO 20 DIAMETERS

Figure 4. Flow (Δ P) Test Diagram

DOUGLAS AIRCRAFT COMPANY, INC	CODE IDENT NO.	SIZE	
	18355	A	1T02861
			SHEET 27



O CONTROL ACCELEROMETER
● RESPONSE ACCELEROMETER
(SUBJECT TO CHANGE BY A & SD ENGINEER)

APPROVALS:

K421 RM Gunn
K414 RCO Massey
K441 R.W. Mustam 12-4-4

Figure 5. Vibration Test Set-Up

DOUGLAS AIRCRAFT COMPANY, INC

CODE IDENT NO. 18355 | SIZE A | 1T02861 | SHEET 28

SYM C

FORM X60-990-3 (10-62)

FORM X60-900-3 (10-62)

SYM —

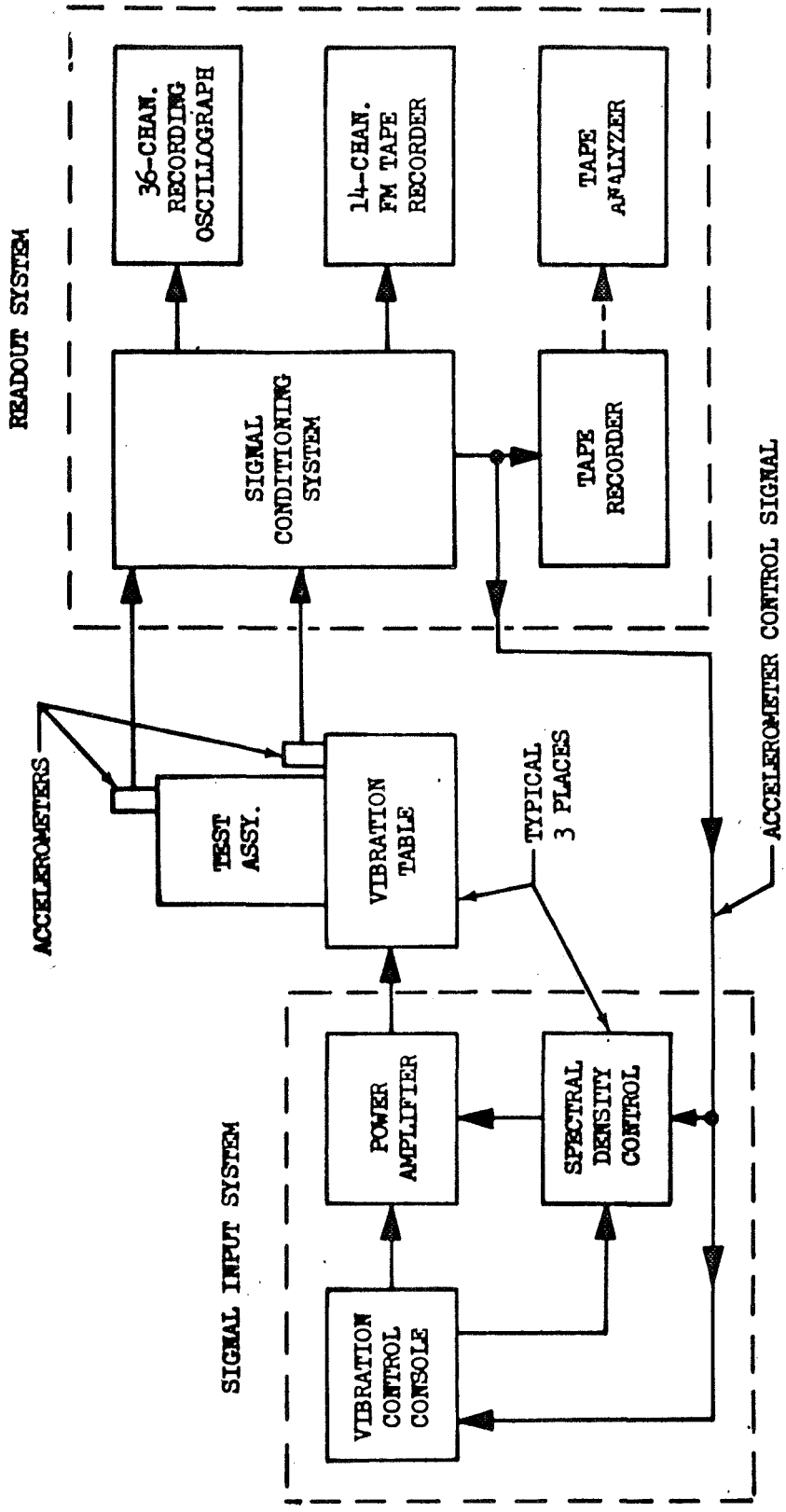
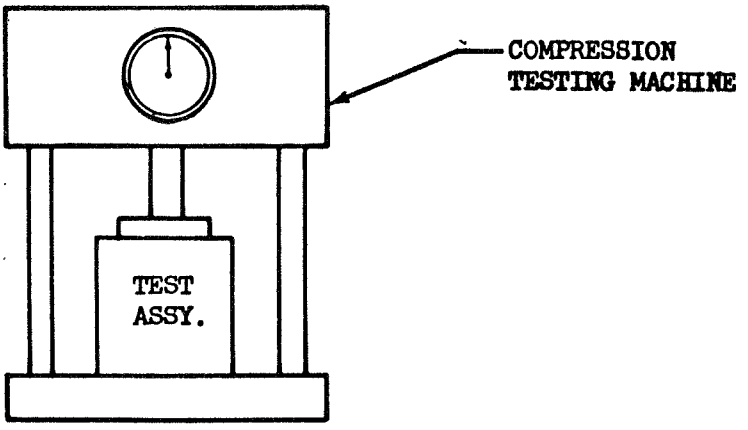


Figure 6. Vibration Test Diagram

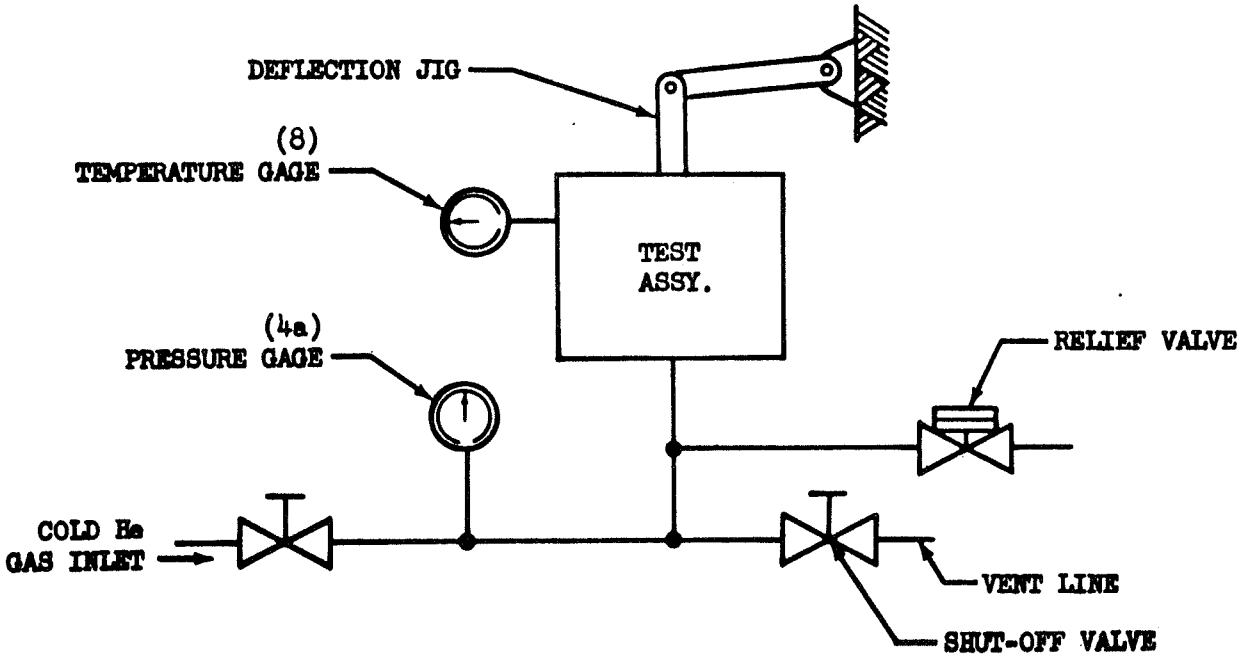
DOUGLAS AIRCRAFT COMPANY, INC	CODE IDENT NO.	SIZE	
	18355	A	1T02861
			SHEET 29

FORM X60-999-3 (10-62)

SYM —



7(a) Spring Rate Test

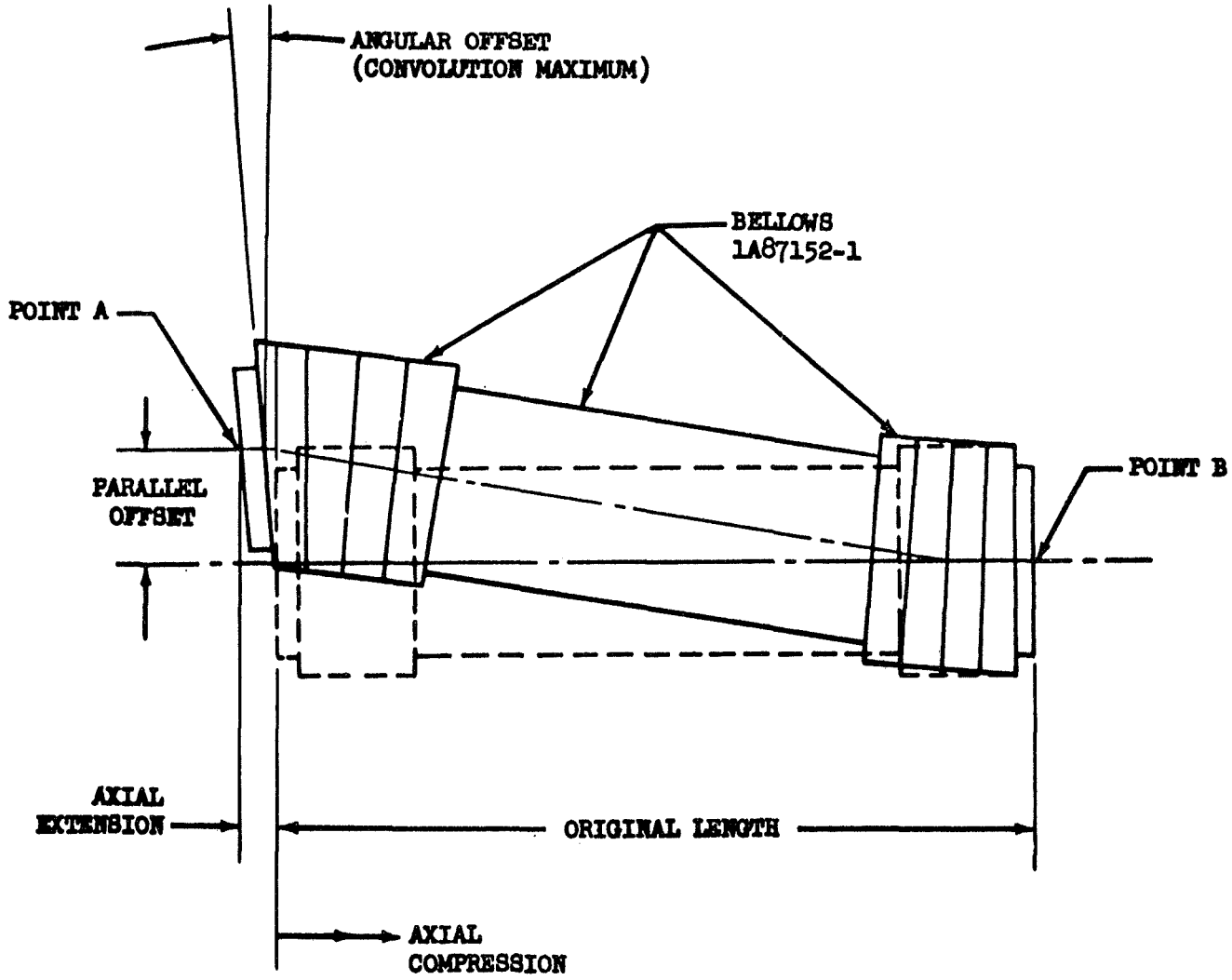


7(b) Repeat Cycle Test

Figure 7. Spring Rate and Repeat Cycle Test Diagram

FORM X80-989-3 (10-62)

SYM A



NOTE:

WITH POINT B FIXED, DEFLECTIONS AND LOADS SHALL BE APPLIED AT POINT A TESTING THE BELLOWS ASSEMBLY ONLY. RESTRAINT SHALL BE APPLIED AT POINTS A AND B FOR STRUCTURAL TESTS. THE BELLOWS SHALL REMAIN A PART OF THE TEST SPECIMEN ASSEMBLY.

Figure 8. Bellows Deflection Definition

ADDENDUM E

WYLE LABORATORIES TEST REPORT NO. 32230, DATED 10 JUNE 1966, REVISION A

TEST REPORT

REPORT NO. 32230

OUR JOB. NO. 32230

YOUR P. O. NO. T&M 0301A

CONTRACT NAS 7-101

TM-DSV4B-ENV-R5776

Page E-1

152-PAGE REPORT

DATE 3 MAY 1966

WYLE LABORATORIES / El Segundo, California • EA 2-1763 • OR 8-4251 • TWX 213-322-5415 • Cable WYLAB

DOUGLAS AIRCRAFT COMPANY
3000 OCEAN PARK BOULEVARD
SANTA MONICA, CALIFORNIA

REVISION A
10 JUNE 1966

FORMAL QUALIFICATION TEST
ON
BELLOWS, PROPULSIVE FUEL VENT
PART NUMBER 1A87152-1
LINE ITEM FQ-H-17
SERIAL NUMBER 042
FOR
DOUGLAS AIRCRAFT COMPANY

STATE OF CALIFORNIA
COUNTY OF LOS ANGELES } ss.

B. BLEAK, being duly sworn, deposes and says: That the information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

SEAL

B. Bleak

SUBSCRIBED and sworn to before me this 10 day of JUNE, 1966

Emily J. Park

Notary Public in and for the County of Los Angeles, State of California.

My Commission expires JANUARY 19, 1970

TEST BY DYNAMICS-INSTRUMENTATION DEPT.

Jack Torchin

DCAS-QAR TEST VERIFICATION:

QUALITY CONTROL APPROVAL

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1.0 PURPOSE

1.1 THE PURPOSE OF THIS REPORT IS TO PRESENT THE TEST PROCEDURES USED AND THE TEST RESULTS OBTAINED DURING THE PERFORMANCE OF A TEST PROGRAM. THE TEST PROGRAM WAS CONDUCTED TO DETERMINE CONFORMANCE OF ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, TO THE REQUIREMENTS SPECIFIED IN REFERENCES 2.1 AND 2.2, IN ACCORDANCE WITH REFERENCE 2.3.

2.0 REFERENCES

2.1 DOUGLAS AIRCRAFT COMPANY TEST PROCEDURE DRAWING 1T02861-B DATED 12 DECEMBER 1965.

TITLED: "FORMAL QUALIFICATION TEST PROCEDURE, BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1"

2.2 DOUGLAS AIRCRAFT COMPANY SATURN SUBCONTRACT TEST CHANGE REPORT DATED 1 APRIL 1966.

TITLED: "ATTACHMENT A TO SPM-EL & S 6456"
REPEAT ONE AXIS OF SINE AND RANDOM VIBRATION

2.3 DOUGLAS AIRCRAFT COMPANY PURCHASE ORDER NUMBER T&M 0301A, WORK ORDER NUMBER A270-EF, LOTS 030 AND 030-1.

3.0 MANUFACTURER

FAIRCHILD PRECISION METAL PRODUCTS
1700 NORTH JACKSON AVENUE
EL CAJON, CALIFORNIA

4.0 SUMMARY

4.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS SUBJECTED TO A FORMAL QUALIFICATION TEST PROGRAM AS DESCRIBED IN DETAIL IN THIS REPORT. THE TEST SPECIMEN CONFORMED TO ALL SPECIFICATION REQUIREMENTS.

5.0 TEST CONDITIONS AND TEST EQUIPMENT

5.1 AMBIENT CONDITIONS

5.1.1 UNLESS OTHERWISE SPECIFIED HEREIN, ALL TESTS REQUIRED BY THE SPECIFICATION WERE PERFORMED AT AN ATMOSPHERIC PRESSURE OF 29.92±0.50 INCHES OF MERCURY ABSOLUTE, A TEMPERATURE OF 70±2°F, AND A RELATIVE HUMIDITY OF APPROXIMATELY 50%.

5.2 TEST MEDIA

5.2.1 HELIUM GAS: AS REQUIRED PER REFERENCE 2.1

5.2.2 LIQUID HYDROGEN: AS DESCRIBED IN NOTICE OF DEVIATION NUMBER 1

5.3 INSTRUMENTATION AND EQUIPMENT

5.3.1 MEASURING AND TEST EQUIPMENT UTILIZED IN THE PERFORMANCE OF THIS CONTRACT HAS BEEN CALIBRATED BY THE WYLE LABORATORIES STANDARDS LABORATORY, OR A COMMERCIAL FACILITY UTILIZING REFERENCE STANDARDS (OR INTERIM STANDARDS) WHOSE CALIBRATION HAS BEEN CERTIFIED AS BEING TRACEABLE TO THE NATIONAL BUREAU OF STANDARDS. ALL REFERENCE STANDARDS UTILIZED IN THE ABOVE CALIBRATION SYSTEM ARE SUPPORTED BY CERTIFICATES, REPORTS, OR DATA SHEETS ATTESTING TO THE DATE, ACCURACY, AND CONDITIONS UNDER WHICH THE RESULTS FURNISHED WERE OBTAINED. ALL SUBORDINATE STANDARDS, AND MEASURING AND TEST EQUIPMENT ARE SUPPORTED BY LIKE DATA WHEN SUCH INFORMATION IS ESSENTIAL TO ACHIEVE THE ACCURACY CONTROL REQUIRED BY THE SUBJECT CONTRACT.

5.3.2 WYLE LABORATORIES ATTESTS THAT THE COMMERCIAL SOURCES PROVIDING CALIBRATION SERVICES ON THE ABOVE REFERENCED EQUIPMENT, OTHER THAN THE NATIONAL BUREAU OF STANDARDS, ARE IN FACT CAPABLE OF PERFORMING THE REQUIRED SERVICES TO THE SATISFACTION OF THE WYLE LABORATORIES QUALITY CONTROL DEPARTMENT. CERTIFICATES AND REPORTS OF ALL CALIBRATIONS PERFORMED ARE RETAINED IN THE WYLE LABORATORIES QUALITY CONTROL FILES AND ARE AVAILABLE FOR INSPECTION UPON REQUEST BY THE CUSTOMER OR GOVERNMENT REPRESENTATIVE.

5.0 TEST CONDITIONS AND TEST EQUIPMENT (CONTINUED)

5.3.3 TEST EQUIPMENT

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	CALIBRATION DATE LAST	CALIBRATION DATE DUE	WYLE O GOV'T. NUMBER
VIBRATION EXCITER	LING MODEL A-249	30,000 FORCE POUNDS SINE	N/A	N/A	5093
VIBRATION EXCITER	LING MODEL 246	7,500 FORCE POUNDS SINE	N/A	N/A	10016
VIBRATION EXCITER	LING MODEL 335	15,000 FORCE	N/A	N/A	91280
POWER AMPLIFIER	LING MODEL PP175/240	175 KVA	N/A	N/A	6375
POWER AMPLIFIER	LING MODEL PP175/240	175 KVA	N/A	N/A	6871
POWER AMPLIFIER	LING MODEL 50/70	50 KVA	N/A	N/A	6374
AUTOMATIC VIBRATION CONTROLLER	B & K MODEL 1039	5 CPS - 10 KC	3/8/66	6/8/66	6613
AUTOMATIC VIBRATION CONTROLLER	B & K MODEL 1038	5 CPS - 10 KC	1/26/66	4/26/66	6226
AUTOMATIC VIBRATION CONTROLLER	B & K MODEL 1038	5 CPS - 10 KC	3/22/66	6/22/66	6271
RANDOM CONSOLE	LING MODEL ASDE-80	85 CHANNEL	PRIOR TO TEST		6534
RANDOM CONSOLE	LING MODEL ASDE-80	85 CHANNEL	PRIOR TO TEST		6812
PHASE CONTROL UNIT	CHADWICK-HELMUTH MODEL 502	AUTOMATIC PHASE CONTROL SYSTEM	PRIOR TO TEST		30581
AM-PM MULTIPLIER	CHADWICK-HELMUTH MODEL 252	AUTOMATIC PHASE CONTROL SYSTEM	PRIOR TO TEST		31010

5.0 TEST CONDITIONS AND TEST EQUIPMENT (CONTINUED)

5.3.3 TEST EQUIPMENT (CONTINUED)

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	CALIBRATION DATE LAST	CALIBRATION DATE DUE	WYLE OR GOV'T. NUMBER
AM-PM MULTIPLIER	CHADWICK-HELMUTH MODEL 252	AUTOMATIC PHASE CONTROL SYSTEM	PRIOR TO TEST		31009
AM-PM MULTIPLIER	CHADWICK-HELMUTH MODEL 512R	AUTOMATIC PHASE CONTROL SYSTEM	PRIOR TO TEST		S/N 10 (RENTAL
VOLTMETER	B & K MODEL 2416	TRUE RMS	3/9/66	6/9/66	6356
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	1/24/66	4/24/66	4530
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	1/24/66	4/24/66	4529
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	1/24/66	4/24/66	4531
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	1/24/66	4/24/66	4532
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	1/24/66	4/24/66	4533
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	1/24/66	4/24/66	4549
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	2/15/66	8/15/66	99960
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	2/15/66	8/15/66	99964
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	2/15/66	8/15/66	99966
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	2/15/66	8/15/66	99967
CHARGE AMPLIFIER	UNHOLTZ-DICKIE MODEL 8PMCV	ACCELEROMETER AMPLIFIER	2/15/66	8/15/66	99962

5.0 TEST CONDITIONS AND TEST EQUIPMENT (CONTINUED)

5.3.3 TEST EQUIPMENT (CONTINUED)

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	CALIBRATION DATE LAST	CALIBRATION DATE DUE	WYLE OR GOV'T. NUMBER
AMPLIFIER	ENDEVCO MODEL 2702B	ACCELEROMETER AMPLIFIER	2/15/66	5/15/66	4668
TAPE RECORDER	PRECISION INST. MODEL PI-214	14 CHANNEL F.M.	PRIOR TO TEST		S/N 509
OSCILLOGRAPH	HONEYWELL MODEL 1012	12" DIRECT WRITING	3/7/66	6/7/66	1085
ACCELEROMETER	ENDEVCO MODEL 2213	0-10,000G	3/9/66	4/9/66	6437
ACCELEROMETER	ENDEVCO MODEL 2213	0-10,000G	3/14/66	4/14/66	6438
ACCELEROMETER	ENDEVCO MODEL 2213	0-10,000G	3/9/66	4/9/66	6887
ACCELEROMETER	ENDEVCO MODEL 2213	0-10,000G	3/23/66	4/23/66	4376
ACCELEROMETER	ENDEVCO MODEL 2213	0-10,000G	3/9/66	4/9/66	6342
*ACCELEROMETER	ENDEVCO MODEL 2213	0-10,000G	4/2/66	5/2/66	6343
ACCELEROMETER	ENDEVCO MODEL 2211	0-10,000G	3/23/66	4/23/66	6791
ACCELEROMETER	ENDEVCO MODEL 2211	0-10,000G	3/23/66	4/23/66	6793
ACCELEROMETER	ENDEVCO MODEL 2211	0-10,000G	3/23/66	4/23/66	6796
ACCELEROMETER	ENDEVCO MODEL 2211	0-10,000G	3/23/66	4/23/66	6794
ACCELEROMETER	ENDEVCO MODEL 2211	0-10,000G	3/23/66	4/23/66	6795
ACCELEROMETER	ENDEVCO MODEL 2211	0-10,000G	3/23/66	4/23/66	6792

*REPLACED ACCELEROMETER ON 4/2/66 - W/N 6438

5.0 TEST CONDITIONS AND TEST EQUIPMENT (CONTINUED)

5.3.3 TEST EQUIPMENT (CONTINUED)

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	CALIBRATION DATE LAST	CALIBRATION DATE DUE	WYLE OR GOV'T. NUMBER
ACCELEROMETER	ENDEVCO MODEL 2213	0-10,000G	3/11/66	4/11/66	8543
ACCELEROMETER	ENDEVCO MODEL 2213C	0-1000G	3/9/66	4/9/66	6574
ACCELEROMETER	ENDEVCO MODEL 2215	0-2000G	3/15/66	4/15/66	6427
VOLTMETER	B & K MODEL 2416	TRUE RMS	3/9/66	6/9/66	6469
VOLTMETER	B & K MODEL 2416	TRUE RMS	3/14/66	6/14/66	6823
VOLTMETER	B & K MODEL 2416	TRUE RMS	3/14/66	6/14/66	6513
VOLTMETER	B & K MODEL 2416	TRUE RMS	3/8/66	6/8/66	5504
VOLTMETER	B & K MODEL 2416	TRUE RMS	2/2/66	5/2/66	5523
VOLTMETER	B & K MODEL 2416	TRUE RMS	3/9/66	6/9/66	6597
OSCILLOSCOPE	HEWLETT-PACKARD MODEL 122AR	DUAL BEAM	2/12/66	5/12/66	6456
OSCILLOSCOPE	HEWLETT-PACKARD MODEL 122AR	DUAL BEAM	2/28/66	5/28/66	6585
OSCILLOSCOPE	HEWLETT-PACKARD MODEL 122AR	DUAL BEAM	1/13/66	4/13/66	6536
AMPLIFIER	ENDEVCO MODEL 2614B	SHOCK ACCELEROMETER AMPLIFIER	2/3/66	8/3/66	6504

5.0 TEST CONDITIONS AND TEST EQUIPMENT (CONTINUED)

5.3.3 TEST EQUIPMENT (CONTINUED)

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	CALIBRATION DATE LAST	CALIBRATION DATE DUE	WYLE OR GOV'T. NUMBER
AMPLIFIER	ENDEVCO MODEL 2614B	SHOCK ACCELEROMETER AMPLIFIER	2/3/66	8/3/66	6472
AMPLIFIER	ENDEVCO MODEL 2614B	SHOCK ACCELEROMETER AMPLIFIER	2/3/66	8/3/66	6467
POWER SUPPLY	LING MODEL PLA-100B	POWER FOR 2614 AMPLIFIER	10/26/65	4/26/66	6511
POWER SUPPLY	LING MODEL PLA-100B	POWER FOR 2614 AMPLIFIER	10/26/65	4/26/66	6492
POWER SUPPLY	LING MODEL PLA-100B	POWER FOR 2614 AMPLIFIER	10/26/65	4/26/66	6493
*WAVE SYNTHESIZER	EXACT ELECTS. MODEL 200	3.3 MICRO-SECONDS TO 1 SECOND INCREMENTS, VARIABLE	3/29/66	9/29/66	6615
**WAVE SYNTHESIZER	EXACT ELECTS. MODEL 200	3.3 MICRO-SECOND INCREMENTS, VARIABLE	3/4/66	9/4/66	30984
OSCILLOSCOPE	TEKTRONIX MODEL 502A	DUAL BEAM	2/12/66	5/12/66	6770
OSCILLOSCOPE	TEKTRONIX MODEL 502	DUAL BEAM	2/8/66	5/8/66	5535
X-Y RECORDER	ELECTRO-INST. SERIES 400	11" X 17"	1/20/66	4/20/66	6175
AMPLIFIER	ELECTRO-INST. MODEL 420	GENERAL PURPOSE X-Y RECORDER	1/20/66	4/20/66	6177
AMPLIFIER	ELECTRO-INST. MODEL 420	GENERAL PURPOSE X-Y RECORDER	1/20/66	4/20/66	3178

*USED FOR RADIAL (A) AND THRUST (C) AXES SHOCK TESTS
**USED FOR TANGENTIAL (B) AXIS SHOCK TEST

5.0 TEST CONDITIONS AND TEST EQUIPMENT (CONTINUED)

5.3.3 TEST EQUIPMENT (CONTINUED)

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	CALIBRATION DATE LAST	CALIBRATION DATE DUE	WYLE OR GOV'T. NUMBER
LOG CONVERTER	MOSELEY MODEL 60B	20 CPS-20 KC	10/30/65	7/15/66	3401
SWEEP OSCILLATOR	SPECTRAL-DYN. MODEL SD-104-5	0.001 CPS-50 KC	1/20/66	4/20/66	1046
PHASE METER	AD-YU MODEL 4052	PHASE METER 0 TO 180F	3/23/66	6/23/66	G1312
FREQUENCY CONVERTER	WAUGH MODEL FR-111	5 CPS-3 KC	11/4/65	5/4/66	4354
ELECTRONIC COUNTER	HEWLETT-PACKARD MODEL 521C	5 DIGIT	2/13/66	5/13/66	5427
WAVE ANALYZER	SPECTRAL-DYN. MODEL SD-101A	2 CPS-25 KC	PRIOR TO TEST		6280
WAVE ANALYZER	SPECTRAL-DYN. MODEL SD-1012	2 CPS-25 KC	PRIOR TO TEST		S/N 183 (RENTAL
STRIP-CHART RECORDER	SANBORN MODEL 156-100CW	6 CHANNEL	11/10/65	2/10/66	4320
MANOMETER	MERIAM MODEL A338-A	0-61 IN. H_2O	12/1/65	6/1/66	3568
PRESSURE GAUGE	ASHCROFT MODEL 1082-A	0-100 PSIG	12/14/65	1/15/66	4257
PORTABLE POTENTIOMETER	RUBICON MODEL 2745	0-75 MV	11/5/65	1/5/66	2221
MANOMETER	MERIAM MODEL A-324	0-30 IN. HG	8/16/65	2/16/66	3574
PRESSURE TRANSDUCER	STATHAM MODEL PG 146	0-100 PSIG	PRIOR TO TEST		S/N 156
PRESSURE TRANSDUCER	STATHAM MODEL PM60	±5 PSID	PRIOR TO TEST		2512

5.0 TEST CONDITIONS AND TEST EQUIPMENT (CONTINUED)

5.3.3 TEST EQUIPMENT (CONTINUED)

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	CALIBRATION DATE LAST	CALIBRATION DATE DUE	WYLE OR GOV'T. NUMBER
PRESSURE TRANSDUCER	STATHAM MODEL PG731	0-100 PSIG	PRIOR TO TEST		S/N 10156
PRESSURE TRANSDUCER	STATHAM MODEL PM60	±5 PSID	PRIOR TO TEST		S/N 354
PRESSURE TRANSDUCER	STATHAM MODEL EMB	0-50 PSIG	PRIOR TO TEST		S/N 499
PRESSURE GAUGE	ASHCROFT MODEL 1279-D	0-5000 PSIG	12/7/65	1/9/66	G1103
PRESSURE GAUGE	ASHCROFT MODEL 1279-A	0-100 PSIG	11/15/65	1/9/66	G1104
PRESSURE GAUGE	ASHCROFT MODEL 1279A	0-60 PSIG	11/15/65	12/16/65	4213
STRIP-CHART RECORDER	SANBORN MODEL 152-100BP	2 CHANNEL	1/5/66	7/5/66	G1051
PRESSURE TRANSDUCER	TELEDYNE MODEL 206-SA	0-500 PSIG	PRIOR TO TEST		5438
PRESSURE TRANSDUCER	STATHAM MODEL PG10TC	0-300 PSIG	PRIOR TO TEST		6675
DEAD WEIGHT TESTER	AMTHOR MODEL 460	0-5000 PSIG	1/8/66	1/8/67	G1187
PRESSURE GAUGE	ASHCROFT MODEL 1082A	0-200 PSIG	4/4/66	5/11/66	G1046
PRESSURE GAUGE	ASHCROFT MODEL 1082A	0-600 PSIG	3/11/66	5/11/66	G1044
DECADE RESISTOR	GENERAL RADIO MODEL 1432P	0-1 MEGOHM	11/30/65	5/30/66	2063
PRESSURE GAUGE	ASHCROFT MODEL 1279A	0-600 PSIG	3/22/66	5/11/66	4183
PRESSURE GAUGE	ASHCROFT MODEL 1279B	0-1000 PSIG	3/30/66	5/11/66	4130

5.0 TEST CONDITIONS AND TEST EQUIPMENT (CONTINUED)

5.3.3 TEST EQUIPMENT (CONTINUED)

APPARATUS	MANUFACTURER AND MODEL	DESCRIPTION	CALIBRATION DATE LAST	CALIBRATION DATE DUE	WYLE OR GOV'T. NUMBER
PRESSURE GAUGE	ASHCROFT MODEL 1082A	0-100 PSIG	2/24/66	4/16/66	G1055
PRESSURE GAUGE	DURAGAGE	0-100 PSIG	12/22/65	1/22/66	G50513
PORTABLE POTENTIOMETER	RUBICON INST. MODEL 2745	0-80.5 MV	12/29/65	2/29/66	30045

6.0 REQUIREMENTS, PROCEDURES AND RESULTS

6.1 PRE-TEST INSPECTION

6.1.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.7

6.1.1.1 THE TEST SPECIMEN SHALL BE VISUALLY AND MANUALLY INSPECTED FOR WORKMANSHIP, IDENTIFICATION, MARKINGS, CLEANLINESS, AND FREEDOM FROM DAMAGE. THE SPECIMEN WEIGHT SHALL BE MEASURED AND NOTED.

6.1.2 TEST PROCEDURE

6.1.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS INSPECTED PRIOR TO TESTING FOR CONFORMANCE WITH THE APPLICABLE DETAIL DRAWING. THE TEST SPECIMEN WAS INSPECTED FOR WORKMANSHIP, IDENTIFICATION, MARKINGS, CLEANLINESS, AND FREEDOM FROM DAMAGE. THE TEST SPECIMEN WAS NOT WEIGHED SINCE A TEST FIXTURE WAS WELDED TO THE SPECIMEN.

6.1.3 TEST RESULTS

6.1.3.1 THE SPECIMEN COMPLIED WITH THE SPECIFICATION REQUIREMENTS. THE PRE-TEST INSPECTION DATA SHEET IS INCLUDED IN APPENDIX A OF THIS REPORT.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.2 PROOF PRESSURE TEST

6.2.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.8

6.2.1.1 THE TEST SPECIMEN SHALL WITHSTAND THE SPECIFIED PROOF PRESSURE FOR A MINIMUM TIME PERIOD OF FIVE MINUTES. THERE SHALL BE NO EVIDENCE OF STRUCTURAL FAILURE OR PERMANENT DISTORTION.

6.2.2 TEST PROCEDURE

6.2.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS SUBJECTED TO THE PROOF PRESSURE TEST OUTLINED BELOW. PROOF PRESSURE TESTS WERE PERFORMED UPON COMPLETION OF THE FOLLOWING TESTS.

1. PRE-TEST INSPECTION
2. VIBRATION AND SHOCK
3. REPEAT CYCLE TEST - PRESSURE CYCLE
4. REPEAT CYCLE TEST - DEFLECTION TEST

6.2.2.2 THE TEST SPECIMEN WAS MOUNTED IN A DOUGLAS AIRCRAFT COMPANY TEST FIXTURE, PART NUMBER 1T12844-501, AND ONE END OF THE BELLOWS WAS CAPPED. THE PROOF PRESSURE TEST SETUP IS SHOWN IN PHOTOGRAPH NUMBER 1. WITH THE ASSEMBLY AT LOCAL AMBIENT TEMPERATURE, THE SPECIMEN WAS INTERNALLY PRESSURIZED WITH HELIUM GAS TO 46±2 PSIG. THE PRESSURE WAS MAINTAINED FOR A PERIOD OF FIVE MINUTES. THE PRESSURE WAS THEN REDUCED TO ZERO PSIG AND THE SPECIMEN WAS INSPECTED FOR EVIDENCE OF FAILURE OR PERMANENT DISTORTION.

6.2.3 TEST RESULTS

6.2.3.1 THERE WAS NO EVIDENCE OF STRUCTURAL FAILURE AS A RESULT OF THE ABOVE TESTS. BELLOWS DEFORMATION WAS NOTED AFTER THE PROOF PRESSURE TEST FOLLOWING THE REPEAT CYCLE DEFLECTION TEST AS SHOWN IN PHOTOGRAPH NUMBER 2. HOWEVER, PER THE DOUGLAS AIRCRAFT COMPANY FAILURE REPORT REFERENCED ON THE APPLICABLE DATA SHEET AND PER DIRECTION OF THE DOUGLAS AIRCRAFT COMPANY TEST REPRESENTATIVE, THE DEFORMATION WAS NOT CONSIDERED AN OUT-OF-TOLERANCE CONDITION. PROOF PRESSURE TEST DATA SHEETS ARE INCLUDED IN APPENDIX A OF THIS REPORT.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.3 LEAKAGE TEST

6.3.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.9

6.3.1.1 THE TEST SPECIMEN SHALL BE SUBMERGED IN WATER WITH THE SPECIFIED LEAKAGE PRESSURE APPLIED FOR A PERIOD OF THREE MINUTES. THERE SHALL BE NO VISUAL INDICATION OF LEAKAGE.

6.3.2 TEST PROCEDURE

6.3.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS SUBJECTED TO THE LEAKAGE TEST OUTLINED BELOW. LEAKAGE TESTS WERE PERFORMED UPON COMPLETION OF THE FOLLOWING TESTS.

1. PRE-TEST INSPECTION
2. VIBRATION AND SHOCK
3. REPEAT CYCLE TEST - PRESSURE CYCLE
4. REPEAT CYCLE TEST - DEFLECTION CYCLE

6.3.2.2 THE TEST SPECIMEN WAS MOUNTED IN A DOUGLAS AIRCRAFT COMPANY TEST FIXTURE, PART NUMBER 1T12844-501, AND ONE END OF THE BELLOWS WAS CAPPED. THE LEAKAGE TEST SETUP IS SHOWN IN PHOTOGRAPHS NUMBERS 3, 4, AND 5. THE BELLOWS WAS SUBMERGED IN WATER OR ENCAPSULATED IN POLYETHYLENE SHEETING WHICH WAS THEN FILLED WITH WATER, AS NOTED IN NOTICE OF DEVIATION NUMBER 6. THE SPECIMEN WAS INTERNALLY PRESSURIZED TO 31±2 PSIG WITH HELIUM GAS AT LOCAL AMBIENT TEMPERATURE. THE PRESSURE WAS MAINTAINED FOR A PERIOD OF THREE MINUTES AND THE SPECIMEN WAS EXAMINED FOR EVIDENCE OF LEAKAGE.

6.3.3 TEST RESULTS

6.3.3.1 THERE WAS NO EVIDENCE OF LEAKAGE AS A RESULT OF THE ABOVE TESTS. LEAKAGE TEST DATA SHEETS ARE INCLUDED IN APPENDIX A OF THIS REPORT.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.4 FLOW (DIFFERENTIAL PRESSURE) TEST

6.4.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.10

6.4.1.1 THE MAXIMUM PRESSURE DROP ACROSS THE ENTIRE TEST SPECIMEN ASSEMBLY SHALL BE 1.5 PSI AT A MINIMUM HELIUM FLOW RATE OF 1.5 POUNDS PER SECOND.

6.4.2 TEST PROCEDURE

6.4.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS SUBJECTED TO A FLOW TEST AS DESCRIBED BELOW.

6.4.2.2 PHOTOGRAPH NUMBER 6 DEPICTS THE TARE PRESSURE DROP TEST SETUP. THE DOUGLAS AIRCRAFT COMPANY UPSTREAM FLOW TUBE, DRAWING NUMBER 1T12991-1, WAS CONNECTED TO THE DOUGLAS AIRCRAFT COMPANY DOWNSTREAM FLOW TUBE, DRAWING NUMBER 1T12991-501. THE FREE PLAIN END OF EACH DUCT WAS EQUIPPED WITH COLLARS BY WYLE LABORATORIES TO FACILITATE CONNECTION TO THE TEST SYSTEM WITH VICTAULIC COUPLINGS.

6.4.2.3 DURING THE TARE PRESSURE DROP TEST THE DIFFERENTIAL PRESSURE WAS MEASURED BETWEEN THE PRESURE TAP IN THE UPSTREAM FLOW TUBE AND THE PRESSURE TAP IN THE DOWNSTREAM FLOW TUBE WHICH WERE LOCATED APPROXIMATELY 80 INCHES APART. THE GAS TEMPERATURE WAS MEASURED BY MEANS OF A COPPER-CONSTANTAN THERMOCOUPLE PROBE INSERTED INTO THE UPSTREAM FLOW TUBE APPROXIMATELY 4 INCHES UPSTREAM OF THE MARMAN CONOSEAL JOINT. THE IDENTICAL PRESSURE AND TEMPERATURE TAP LOCATIONS WERE ALSO USED DURING THE GROSS FLOW TEST.

6.4.2.4 FLOW MEASUREMENTS WERE MADE WITH A 10.027 INCH I.D. ORIFICE FLOW SECTION AND A 6.500 INCH DIAMETER SHARP EDGED ORIFICE. FLANGE TAPS WERE UTILIZED. THE ORIFICE SECTION WAS BUILT IN ACCORDANCE WITH SUPPLEMENT PTC 19.5; 4-1959 OF THE ASME POWER TEST CODE. THE ORIFICE SECTION WAS LOCATED UPSTREAM OF THE FLOW TUBES. THE OUTLET OF THE FLOW TUBE WAS CONNECTED THROUGH A 6 INCH RECOVERY LINE TO A 5000 CUBIC FEET HELIUM RECOVERY VOLUME.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.4.2 TEST PROCEDURE (CONTINUED)

6.4.2.5 PHOTOGRAPHS NUMBERS 7 AND 8 DEPICT THE GROSS FLOW TEST SETUP. THE TEST SETUP WAS IDENTICAL TO THE TARE FLOW TEST SETUP EXCEPT THAT THE TEST SPECIMEN, CONNECTED TO ADJOINING DUCTS AND BELLOWS AS FURNISHED BY DOUGLAS AIRCRAFT COMPANY AND INSTALLED IN THE TEST FIXTURE 1T12844-501, WAS INSTALLED BETWEEN THE UPSTREAM AND DOWNSTREAM FLOW TUBES.

6.4.2.6 HELIUM GAS FROM A HIGH PRESSURE SOURCE (100 CUBIC FEET AT 6000 PSIG) WAS PASSED THROUGH THE TEST SYSTEM AT SYSTEM EFFLUENT TEMPERATURE. DURING A FLOW RUN, THE FLOW RATE WAS CHANGED IN INCREMENTS. THE LINE PRESSURE AT THE TEST SECTION CHANGED GRADUALLY DUE TO THE PRESSURE INCREASE IN THE HELIUM RECOVERY TANK. WHEN THE SPECIMEN INLET PRESSURE REACHED 32 PSIG, THE TEST RUN WAS TERMINATED. SEVERAL TEST RUNS WERE CONDUCTED WITH THE TARE AND GROSS FLOW TEST SETUPS. DURING EACH TEST RUN THE NECESSARY PRESSURE, DIFFERENTIAL PRESSURES, AND TEMPERATURES WERE CONTINUOUSLY RECORDED ON A STRIP CHART RECORDER.

6.4.3 TEST RESULTS

6.4.3.1 SINCE THE PRESSURES AND TEMPERATURES CHANGED CONTINUOUSLY DURING THE TEST, A PLOT OF THE DATA AS OBTAINED DIRECTLY FROM THE STRIP CHART RECORDINGS IS MEANINGLESS. THEREFORE THE DATA WERE REDUCED AND PLOTTED IN THE FORM OF $\frac{\Delta P_s}{P_s}$ VERSUS $\frac{W\sqrt{T_s}}{P_s}$. THE REDUCED TEST DATA ARE PRESENTED IN THE FLOW TEST DATA SHEETS IN APPENDIX A OF THIS REPORT. WHEN THE PRESSURE DROP IS CALCULATED FOR THE SPECIFIED CONDITIONS FROM THE REDUCED PARAMETERS, THE FOLLOWING RESULTS ARE OBTAINED.

SPECIFIED CONDITIONS:	INLET PRESSURE	31 PSIG
	INLET TEMPERATURE	70F
	HELIUM FLOW RATE	1.5 LB./SEC.
PRESSURE DROP:	GROSS	1.21 PSIG
	TARE	0.31 PSID
	NET	0.90 PSID
	ALLOWABLE NET	1.50 PSID

THE TEST SPECIMEN COMPLIED WITH THE SPECIFICATION REQUIREMENTS. FLOW TEST DATA SHEETS ARE INCLUDED IN APPENDIX A.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.5 VIBRATION TEST

6.5.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.11
REFERENCE 2.2

6.5.1.1 THERE SHALL BE NO STRUCTURAL FAILURE OR PERMANENT DEFORMATION AS A RESULT OF THE VIBRATION TEST.

6.5.2 TEST PROCEDURE

6.5.2.1 ONE BELLOWS, PROPULSIVE VENT SYSTEM, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS SUBJECTED TO QUALIFICATION LEVEL SINUSOIDAL AND RANDOM VIBRATION EXCITATION IN THREE ORTHOGONAL AXES. THE TEST SPECIMEN, WITH ASSOCIATED MOUNTING HARDWARE AND DOUGLAS AIRCRAFT COMPANY TEST FIXTURES, WAS VIBRATED USING A LING MODEL A-249 EXCITER AND A LING MODEL 246 EXCITER IN THE RADIAL (A) AND TANGENTIAL (B) AXES, AND ON ONE EACH OF THE LING MODELS 335, 246, AND B-300 EXCITERS IN THE THRUST (C) AXIS. TEST CONDITIONS AND LEVELS WERE MAINTAINED AS SPECIFIED IN REFERENCE 2.1 AND/OR AS DIRECTED BY THE DOUGLAS TEST REPRESENTATIVE, EXCEPT AS NOTED IN THE NOTICES OF DEVIATION INCLUDED IN APPENDIX A OF THIS REPORT.

6.5.2.2 PHOTOGRAPHS NUMBERS 9, 10 AND 11 ILLUSTRATE THE TEST SETUP IN THE RADIAL (A), TANGENTIAL (B), AND THRUST (C) AXES, RESPECTIVELY. FIGURE 1 IS A BLOCK DIAGRAM OF THE VIBRATION TEST CONTROL SYSTEM. ACCELEROMETER LOCATIONS ARE SHOWN IN PHOTOGRAPHS NUMBERS 12 THROUGH 19, 20 THROUGH 23, AND 24 THROUGH 29, FOR THE RADIAL (A), TANGENTIAL (B), AND THRUST (C) AXES RESPECTIVELY. ACCELEROMETER CHANNELS WERE RECORDED ON DIRECT WRITING OSCILLOGRAPH AND MAGNETIC TAPE DURING SINUSOIDAL TESTS AND ON MAGNETIC TAPE DURING RANDOM TESTS.

6.5.2.3 PRIOR TO THE SINUSOIDAL TEST IN EACH AXIS THE VIBRATION EXCITER PHASE WAS CHECKED. THE CONTROL ACCELEROMETERS WERE MOUNTED ON BARE FIXTURES AND A QUALIFICATION LEVEL SINUSOIDAL SWEEP WAS PERFORMED FROM 5 TO 2000 CPS AT ONE OCTAVE PER MINUTE. THE TEST WAS PHASE CONTROLLED USING A CHADWICK-HELMUTH PHASE CONTROL SYSTEM AND CONTROL ACCELEROMETER OUTPUTS WERE RECORDED ON MAGNETIC TAPE AND DIRECT WRITING OSCILLOGRAPH. HIGH SPEED RUNS WERE MADE ON THE OSCILLOGRAPH AT 20, 50, AND 100 CPS IN ORDER TO RESOLVE PHASE. UPON COMPLETION OF THE SWEEP, PHASE PLOTS WERE MADE FROM THE TAPED DATA.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.5.2 TEST PROCEDURE (CONTINUED)

6.5.2.4 PRIOR TO THE RANDOM TEST IN THE THRUST (A) AXIS, A MAGNETIC TAPE RECORDING WAS MADE FOR THE PURPOSE OF PROVIDING THE RANDOM SIGNAL SOURCE FOR THE MODEL 246 VIBRATION EXCITER DURING THE RANDOM QUALIFICATION TEST. THE 246 EXCITER WAS EQUALIZED PER THE TEST SPECIFICATION WITH THE BARE FIXTURE INSTALLED USING A LING ASDE-80 RANDOM CONSOLE, AND THE POWER AMPLIFIER INPUT WAS RECORDED ON MAGNETIC TAPE. TAPE RECORDINGS WERE MADE FOR BOTH THE 120 SECOND AND 600 SECOND PORTIONS OF THE QUALIFICATION LEVEL TEST. THE MAGNETIC TAPES WERE THEN USED TO DRIVE THE 246 EXCITER AT BOTH THE 120 SECOND AND 600 SECOND TEST LEVELS, AND THE CONTROL ACCELEROMETER SIGNAL WAS RECORDED ON MAGNETIC TAPE. POWER SPECTRAL DESNITY PLOTS WERE MADE OF THE CONTROL ACCELEROMETER DATA FOR BOTH TEST LEVELS AND APPROVED BY THE DOUGLAS AIRCRAFT COMPANY TEST REPRESENTATIVE.

6.5.2.5 IMMEDIATELY PRIOR TO THE RANDOM VIBRATION TEST IN EACH AXIS, EQUALIZATION WAS ACCOMPLISHED AT 6 DB BELOW THE 600 SECOND TEST SPECIFICATION LEVEL. EACH LEVEL OF RANDOM TEST IN EACH AXIS WAS INTERRUPTED AFTER THE FIRST 30 SECOND TO ONE MINUTE OF TEST IN ORDER TO MAKE POWER SPECTRAL DENSITY (PSD) PLOTS. IF PLOTS WERE SATISFACTORY, THE RANDOM TEST WAS THEN CONTINUED. IF NOT, THE TEST SPECTRUM WAS ADJUSTED AS REQUIRED AND A SECOND 30 SECOND TO ONE MINUTE PORTION OF THE TEST WAS COMPLETED FOR PLOTTING. THIS PROCEDURE WAS REPEATED AS NECESSARY UNTIL SATISFACTORY PLOTS WERE OBTAINED AND APPROVED BY THE DOUGLAS AIRCRAFT COMPANY TEST REPRESENTATIVE. IN THE THRUST (A) AXIS, IT WAS NECESSARY TO MAKE A SECOND TAPE RECORDING OF THE POWER AMPLIFIER INPUT WITH THE BARE FIXTURE EQUALIZED TO A MODIFIED TEST SPECTRUM PROVIDED BY THE DOUGLAS AIRCRAFT COMPANY TEST REPRESENTATIVE.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.5.2 TEST PROCEDURE (CONTINUED)

6.5.2.6 FOLLOWING VIBRATION TESTING IN THE TANGENTIAL AND RADIAL AXES, THE AXIS DEFINITION DESCRIBED IN FIGURE 5 OF REFERENCE 2.1 WAS FOUND TO BE IN ERROR. IN THE RADIAL AXIS, THE TEST SPECIMEN WAS SUBJECTED TO THE SINUSOIDAL AND RANDOM TEST LEVELS FOR THE C AXIS AS DEFINED BY THE SPECIFICATION. HOWEVER, THE RADIAL AXIS SHOULD HAVE BEEN DEFINED AS DIRECTION A AND THE THRUST AXIS DEFINED AS DIRECTION C. THEREFORE, PER DIRECTION OF THE DOUGLAS AIRCRAFT COMPANY TEST REPRESENTATIVE, THE THRUST AXIS TEST WAS PERFORMED PER DIRECTION C TEST LEVELS AND ADDITIONAL TESTING WAS PERFORMED IN THE RADIAL AXIS PER A MODIFIED DIRECTION A SPECIFICATION. ADDITIONAL CLARIFICATION AND DETAILED TEST LEVELS ARE PROVIDED IN NOTICES OF DEVIATION NUMBERS 4 AND 5, AND IN REFERENCE 2.2.

6.5.3 TEST RESULTS

6.5.3.1 THE TEST SPECIMEN WAS EXAMINED FOR EVIDENCE OF STRUCTURAL FAILURE AND PERMANENT DISTORTION UPON COMPLETION OF EACH VIBRATION TEST. NO DAMAGE OR DISTORTION WAS OBSERVED.

6.5.3.2 VIBRATION TEST DATA SHEETS AND POWER SPECTRAL DENSITY PLOTS ARE INCLUDED IN APPENDIX A OF THIS REPORT.

6.5.3.3 OSCILLOGRAPH RECORDINGS, MAGNETIC TAPES, PHASE PLOTS, AND INSTRUMENTATION DATA SHEETS HAVE BEEN FORWARDED TO DOUGLAS AIRCRAFT COMPANY UNDER SEPARATE COVER.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.6 SHOCK TEST

6.6.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.12

6.6.1.1 THERE SHALL BE NO EVIDENCE OF STRUCTURAL FAILURE OR DEFORMATION AS A RESULT OF THE SHOCK TEST.

6.6.2 TEST PROCEDURE

6.6.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS SUBJECTED TO QUALIFICATION LEVEL SHOCK TESTS IN EACH OF THREE ORTHOGONAL AXES. WITH THE TEST SPECIMEN STILL ATTACHED TO THE VIBRATION TEST FIXTURES AND ELECTRODYNAMIC EXCITERS, THE SHOCK TEST WAS CONDUCTED UPON COMPLETION OF THE VIBRATION TEST IN EACH AXIS.

6.6.2.2 FIGURE 2 IS A BLOCK DIAGRAM OF THE SHOCK TEST CONTROL SYSTEM. SHOCK TEST ACCELEROMETER LOCATIONS ARE SHOWN IN PHOTOGRAPHS NUMBERS 12 AND 13, 20 AND 21, AND 24 THROUGH 26, FOR THE RADIAL (A), TANGENTIAL (B), AND THRUST (C) AXES RESPECTIVELY. OSCILLOSCOPE PHOTOGRAPHS WERE TAKEN OF THE CONTROL ACCELEROMETER SIGNAL WAVEFORMS FOR EACH TEST. MONITOR ACCELEROMETERS WERE MOUNTED AS DESCRIBED IN PARAGRAPH 6.5.2.2 AND RECORDED ON MAGNETIC TAPE AND DIRECT WRITING OSCILLOGRAPH.

6.6.3 TEST RESULTS

6.6.3.1 THE TEST SPECIMEN WAS EXAMINED FOR EVIDENCE OF STRUCTURAL DAMAGE OR PERMANENT DISTORTION UPON COMPLETION OF THE SHOCK TEST IN EACH AXIS. NO DAMAGE WAS APPARENT.

6.6.3.2 SHOCK TEST DATA SHEETS ARE INCLUDED IN APPENDIX A OF THIS REPORT.

6.6.3.3 OSCILLOGRAPH RECORDINGS, MAGNETIC TAPES, SHOCK PULSE OSCILLOSCOPE PHOTOGRAPHS, AND INSTRUMENTATION DATA SHEETS HAVE BEEN FORWARDED TO DOUGLAS AIRCRAFT UNDER SEPARATE COVER.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.7 BURST TEST

6.7.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.13

6.7.1.1 THE TEST SPECIMEN SHALL NOT FAIL UNTIL AN INTERNAL PRESSURE OF 78 PSIG HAS BEEN EXCEEDED.

6.7.2 TEST PROCEDURE

6.7.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS MOUNTED IN A DOUGLAS AIRCRAFT COMPANY TEST FIXTURE, PART NUMBER 1T12844-501, AND ONE END OF THE BELLOWS WAS CAPPED. THE BURST TEST SETUP IS SHOWN IN PHOTOGRAPHS NUMBERS 30 AND 31. WITH THE TEST SPECIMEN AT LOCAL AMBIENT TEMPERATURE, HYDROSTATIC PRESSURE WAS APPLIED AT A RATE OF 200 PSI PER MINUTE. THE PRESSURE AT WHICH INITIAL DEFORMATION OCCURRED AND THE BURST PRESSURE WERE NOTED.

6.7.3 TEST RESULTS

6.7.3.1 THE TEST SPECIMEN CONFORMED TO SPECIFICATION REQUIREMENTS. THE CONDITION OF THE TEST SPECIMEN AFTER THE BURST TEST IS ILLUSTRATED IN PHOTOGRAPHS NUMBERS 32, 33, AND 34. THE BURST TEST DATA SHEET IS INCLUDED IN APPENDIX A OF THIS REPORT.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.8 SPRING RATE TEST

6.8.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.14

6.8.1.1 THE FORCE REQUIRED TO COMPRESS THE BELLOWS ONE-HALF INCH SHALL NOT EXCEED 100 POUNDS.

6.8.2 TEST PROCEDURE

6.8.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS SUBJECTED TO THE SPRING RATE TEST DESCRIBED BELOW. SPRING RATE TESTS WERE PERFORMED UPON COMPLETION OF THE INITIAL PROOF AND LEAKAGE TESTS AND UPON COMPLETION OF THE SHOCK AND VIBRATION TESTS.

6.8.2.2 THE TEST SPECIMEN WAS MOUNTED IN A DOUGLAS AIRCRAFT COMPANY TEST FIXTURE, PART NUMBER 1T12844-501. COMPRESSIVE FORCE WAS MANUALLY APPLIED, THROUGH A FORCE GAUGE, TO THE BELLOWS AS ILLUSTRATED IN PHOTOGRAPH NUMBER 35. THE FORCE GAUGE INDICATION AT 1/2 INCH AXIAL COMPRESSION WAS NOTED.

6.8.3 TEST RESULTS

6.8.3.1 THE TEST SPECIMEN COMPLIED WITH SPECIFICATION REQUIREMENTS. SPRING RATE TEST DATA SHEETS ARE INCLUDED IN APPENDIX A OF THIS REPORT.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.9 REPEAT CYCLE TEST - SERVICE LIFE

6.9.1 PRESSURE CYCLE TEST

6.9.1.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.15.2

THERE SHALL BE NO FAILURE OR DEGRADATION OF PERFORMANCE AS A RESULT OF THE PRESSURE CYCLE TEST.

6.9.1.2 TEST PROCEDURE

ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS INSTALLED IN THE DOUGLAS AIRCRAFT COMPANY TEST FIXTURE, PART NUMBER 1T12844-501, AS SHOWN IN PHOTOGRAPH NUMBER 36. USING THE PNEUMATIC DEFLECTION SYSTEM ATTACHED TO THE FIXTURE, THE SPECIMEN WAS DEFLECTED 4^{+1}_{-0} DEGREES FROM THE CENTERLINE, WITH AXIAL COMPRESSION OF 1-1/8 INCHES, AND PARALLEL OFFSET OF 1-5/16 INCHES. THE ANGULAR DEFLECTION WAS APPLIED SO THAT THE TOTAL ANGULAR MOTION OF EACH CONVOLUTED SECTION WAS MAXIMUM. THE SPECIMEN WAS EXTERNALLY COOLED TO -400^{+21}_{-0} F BY SPRAYING WITH LIQUID HYDROGEN. WHEN THE REQUIRED TEMPERATURE WAS REACHED, THE SPECIMEN WAS INTERNALLY PRESSURIZED TO 31±1 PSIG WITH COLD HELIUM GAS THAT HAD PASSED THROUGH A LIQUID HYDROGEN HEAT EXCHANGER. THE PRESSURE WAS THEN REDUCED TO ZERO PSIG. THIS CYCLE WAS REPEATED 200 TIMES. (A)

6.9.1.3 TEST RESULTS

NO FAILURE OR DEGRADATION OF PERFORMANCE OCCURRED AS A RESULT OF THE PRESSURE CYCLE TEST. THE PRESSURE CYCLE TEST DATA SHEET IS INCLUDED IN APPENDIX A OF THIS REPORT.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.9 REPEAT CYCLE TEST - SERVICE LIFE (CONTINUED)

6.9.2 DEFLECTION CYCLE TEST

6.9.2.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.15.4

THERE SHALL BE NO FAILURE OR DEGRADATION OF PERFORMANCE AS A RESULT OF THE DEFLECTION CYCLE TEST.

6.9.2.2 TEST PROCEDURE

6.9.2.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS INSTALLED IN THE DOUGLAS AIRCRAFT COMPANY TEST FIXTURE, PART NUMBER 1T12844-501, AS SHOWN IN PHOTOGRAPH NUMBER 37. USING THE PNEUMATIC ACTUATION SYSTEM CONNECTED TO THE TEST FIXTURE, AS SHOWN IN PHOTOGRAPH NUMBER 38, THE BELLOWS WAS DEFLECTED FROM ITS NEUTRAL POSITION FOR AN AXIAL EXTENSION OF 15/16 INCH, AN OFFSET OF 1-5/16 INCHES, AND AN ANGULATION OF 4 DEGREES. THE BELLOWS WAS THEN RETURNED TO ITS NEUTRAL POSITION, THUS COMPLETING ONE CYCLE. WITH THE TEST SPECIMEN AT LOCAL AMBIENT TEMPERATURE AND UNPRESSURIZED, A TOTAL OF 50 DEFLECTION CYCLES WERE PERFORMED.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.9.2.2 TEST PROCEDURE (CONTINUED)

6.9.2.2.2 THE SPECIMEN WAS THEN PRESSURIZED TO 31±1 PSIG WITH COLD HELIUM GAS AND SPRAYED WITH LIQUID HYDROGEN UNTIL THE BELLOWS TEMPERATURE REACHED -400, +21, -0 F. USING THE DEFLECTION POSITION, AS DESCRIBED ABOVE AS THE BASIC POSITION, THE BELLOWS WAS DEFLECTED AN ADDITIONAL 3/16 INCH IN AXIAL EXTENSION. THE ADDITIONAL 3/16 INCH AXIAL EXTENSION WAS REMOVED, THUS COMPLETING ONE CYCLE. THIS CYCLE WAS PERFORMED A TOTAL OF 150 TIMES WITH THE SPECIMEN AT A TEMPERATURE OF -400, +21, -0 F, AND A PRESSURE OF 31±1 PSIG.

6.9.2.3 TEST RESULTS

NO FAILURE OR DEGRADATION OF PERFORMANCE OCCURRED. THE DEFLECTION CYCLE DATA SHEET IS INCLUDED IN APPENDIX A OF THIS REPORT.

6.0 REQUIREMENTS, PROCEDURES AND RESULTS (CONTINUED)

6.10 POST TEST INSPECTION

6.10.1 PERFORMANCE CRITERIA REQUIREMENTS

REFERENCE 2.1, PARAGRAPH 5.16

6.10.1.1 AFTER COMPLETION OF THE TEST PROGRAM, THE TEST SPECIMEN SHALL BE INSPECTED FOR DAMAGE OR EXCESSIVE WEAR AND ANY SUCH CONDITIONS NOTED.

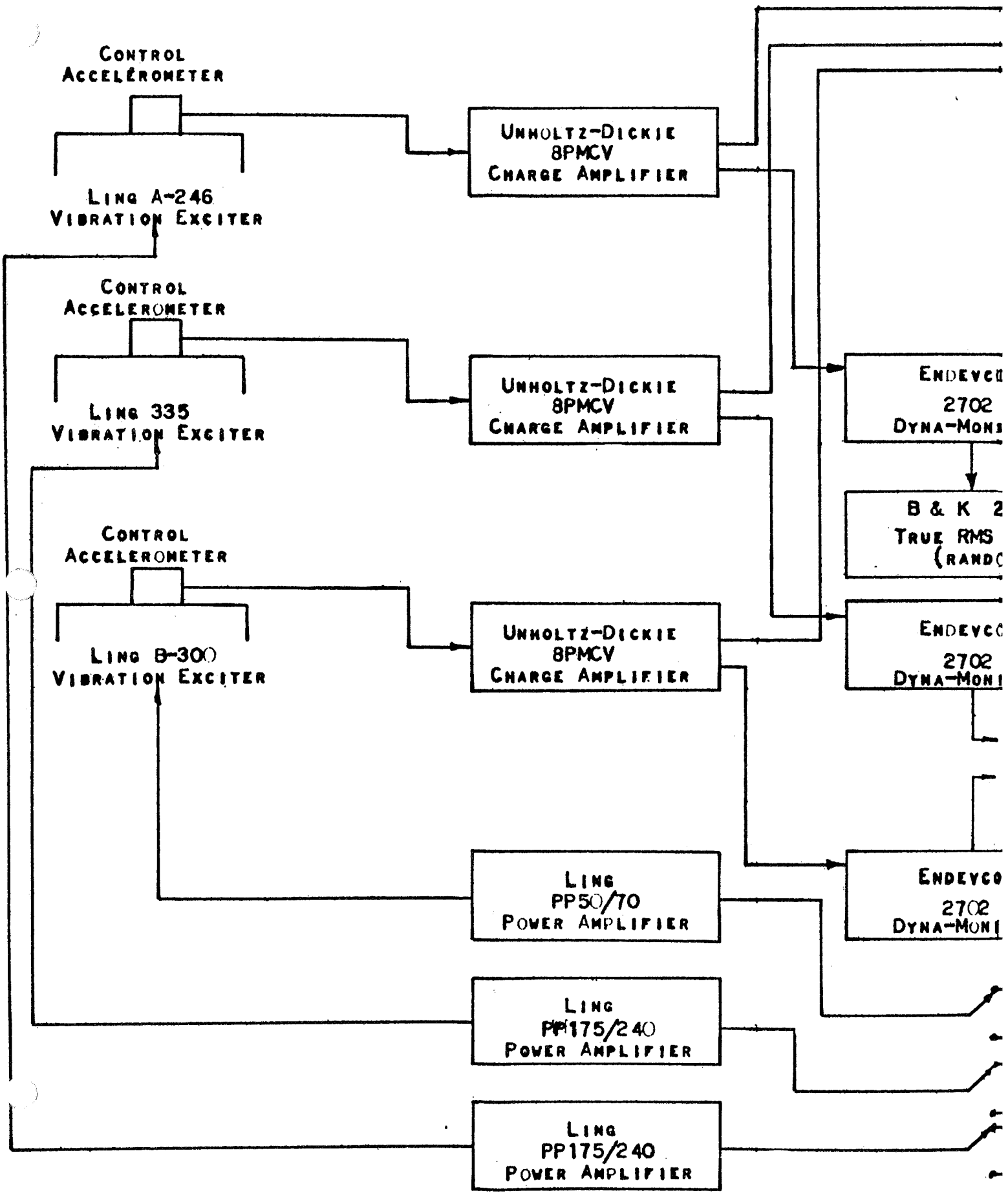
6.10.2 TEST PROCEDURE

6.10.2.1 ONE BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQ-H-17, SERIAL NUMBER 042, WAS VISUALLY INSPECTED FOR DAMAGE OR EXCESSIVE WEAR UPON COMPLETION OF THE TEST PROGRAM.

6.10.3 TEST RESULTS

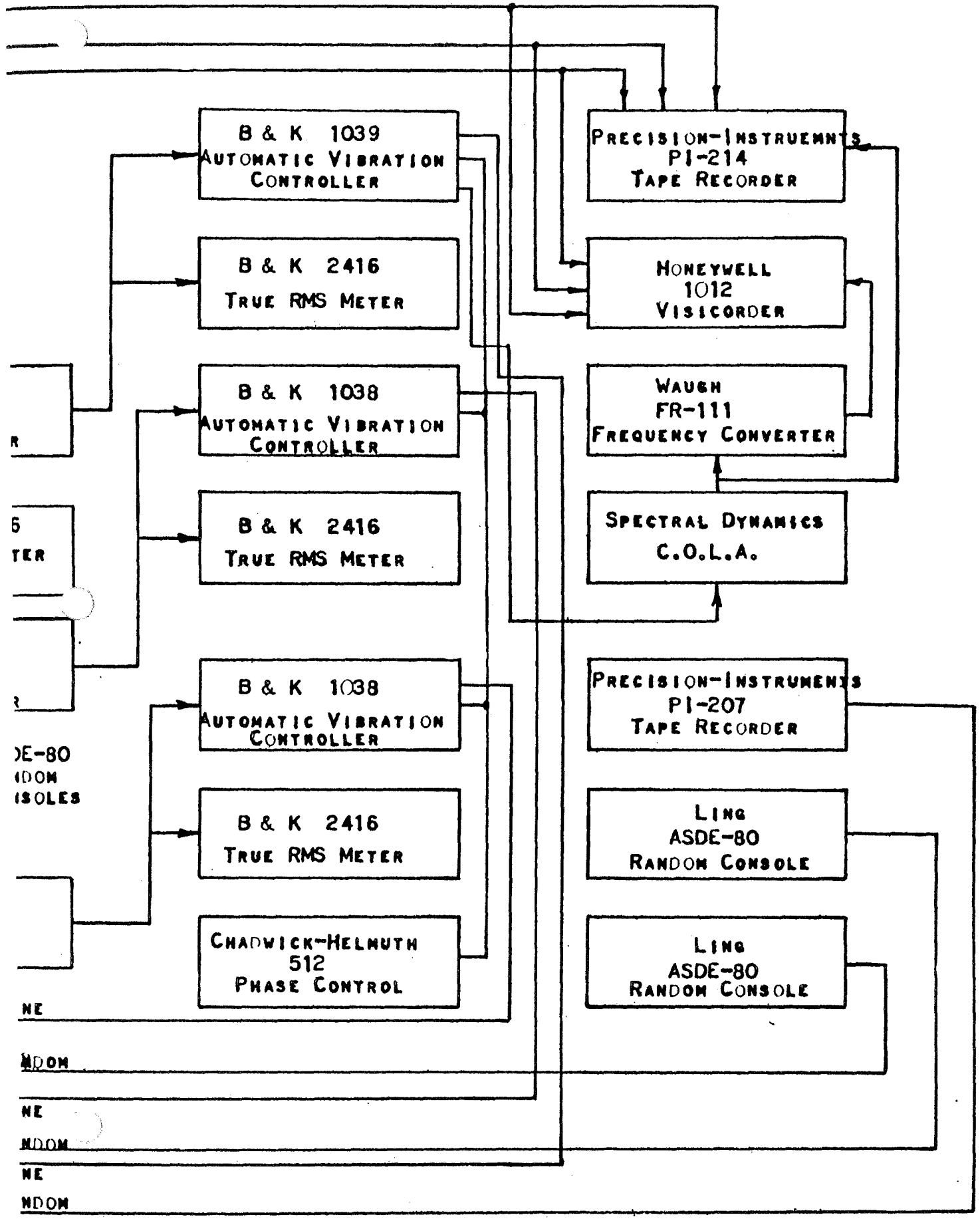
6.10.3.1 THE ONLY DAMAGE NOTED WAS INCURRED AS A RESULT OF THE BURST TEST AS DESCRIBED IN PARAGRAPH 6.7.3. THE POST TEST INSPECTION DATA SHEET IS INCLUDED IN APPENDIX A OF THIS REPORT.

BLOCK DIAGRAM - VI



GURE 1

ATION TEST CONTROL SYSTEM



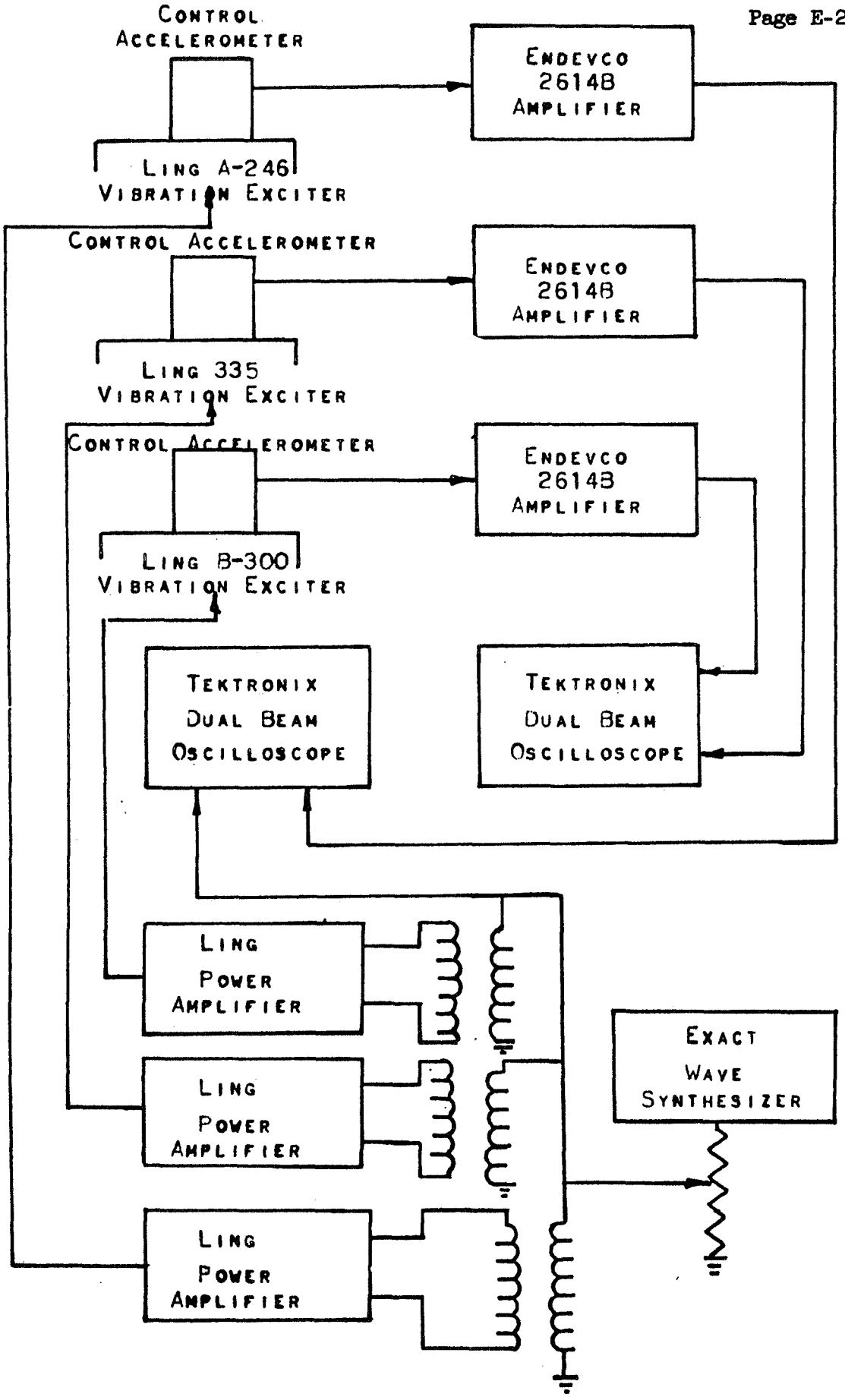
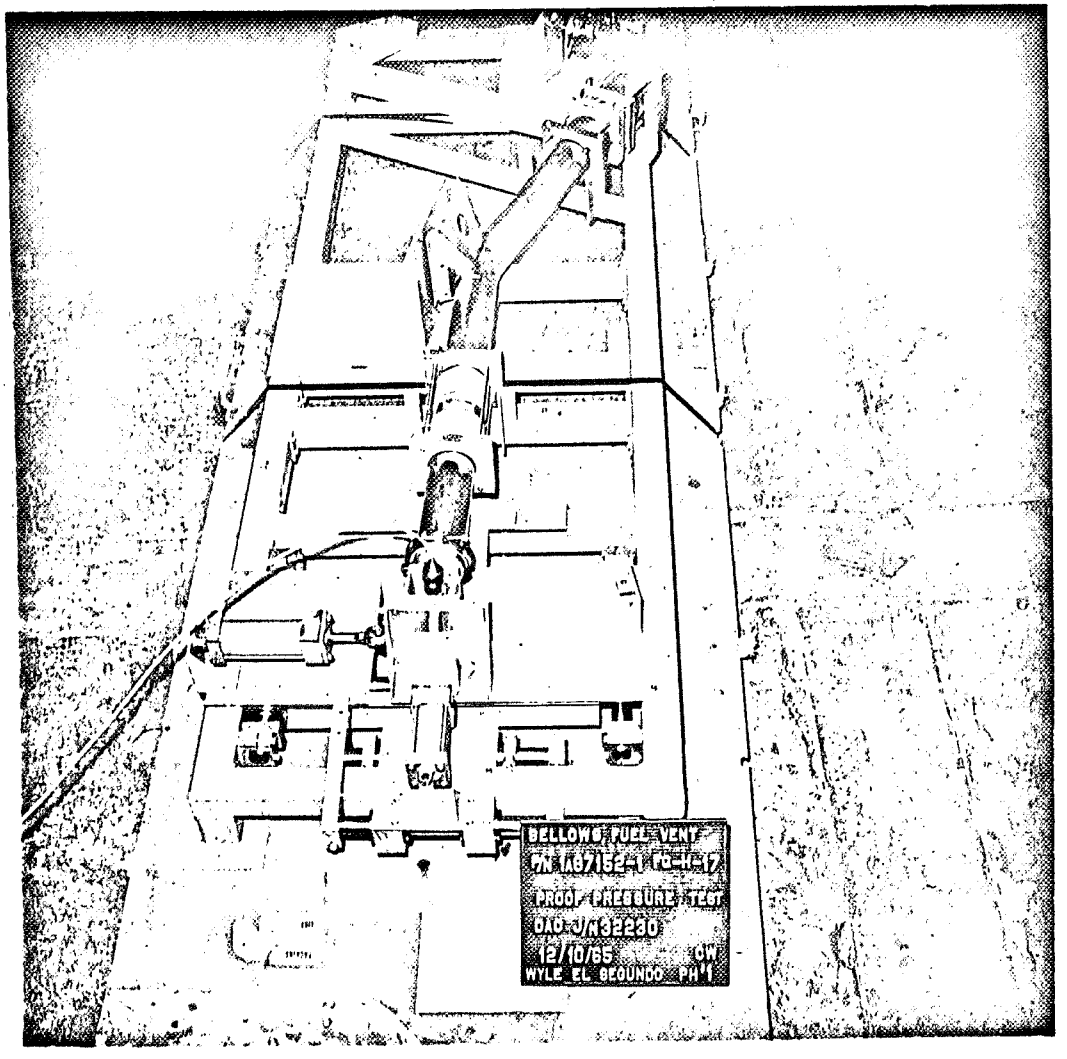
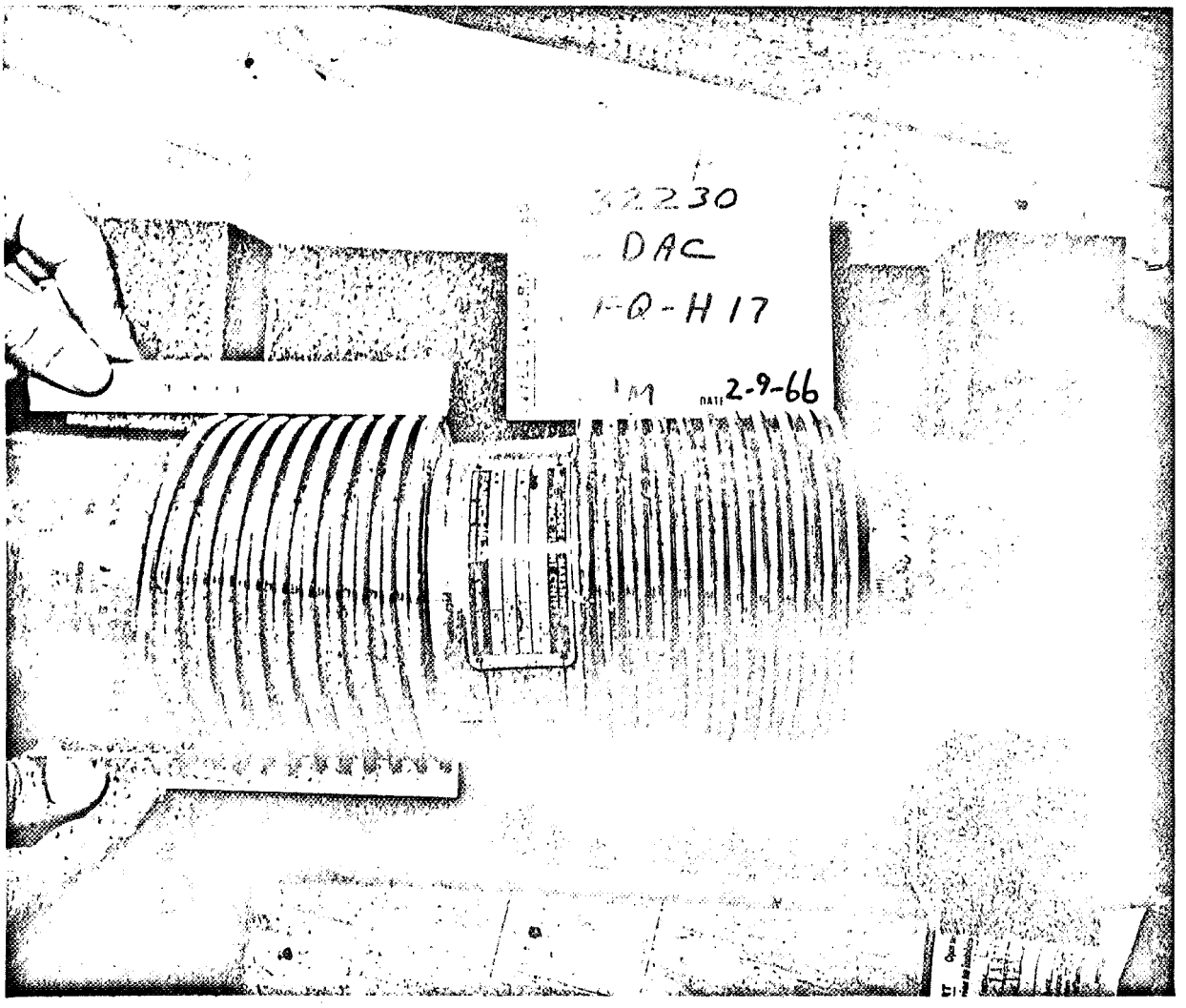


FIGURE 2
BLOCK DIAGRAM - SHOCK TEST



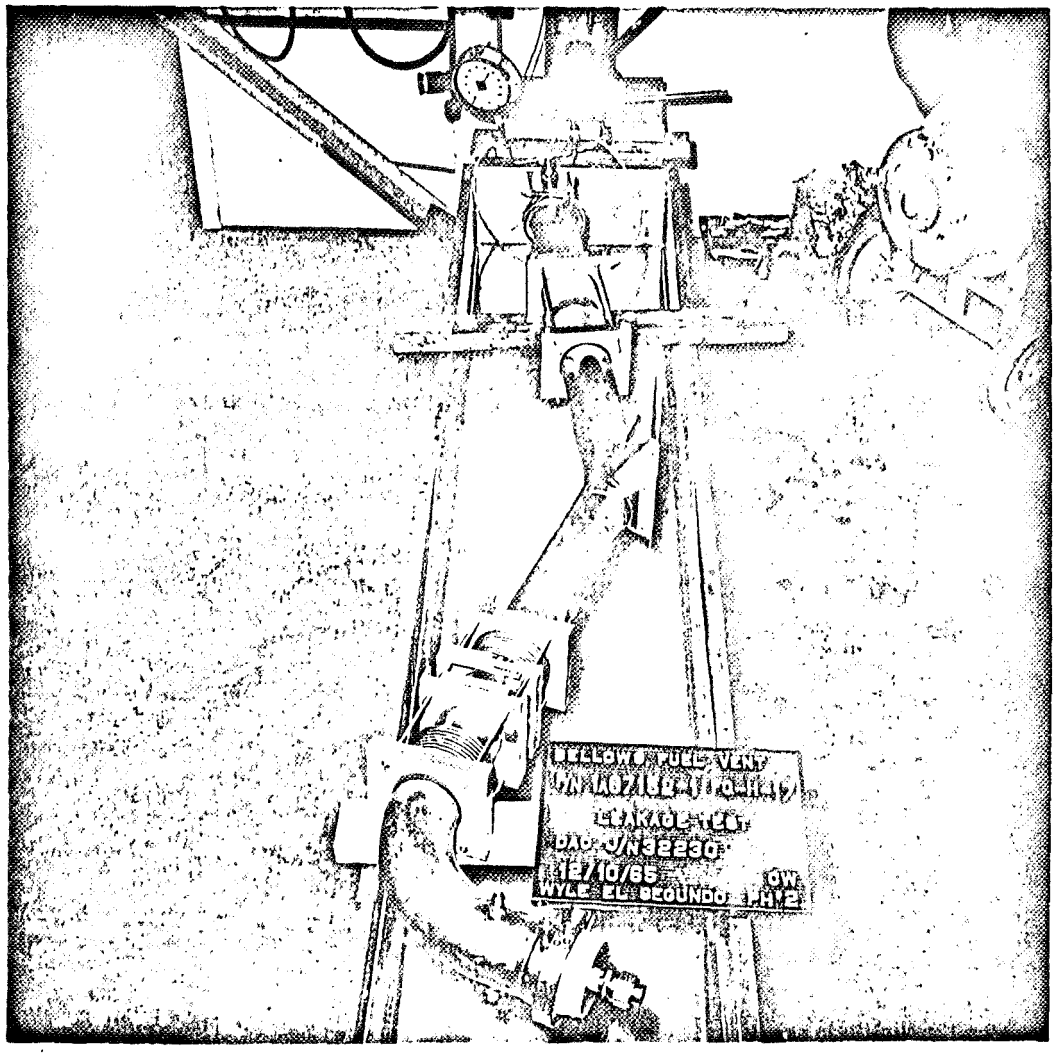
PHOTOGRAPH NUMBER 1

PROOF PRESSURE TEST SETUP



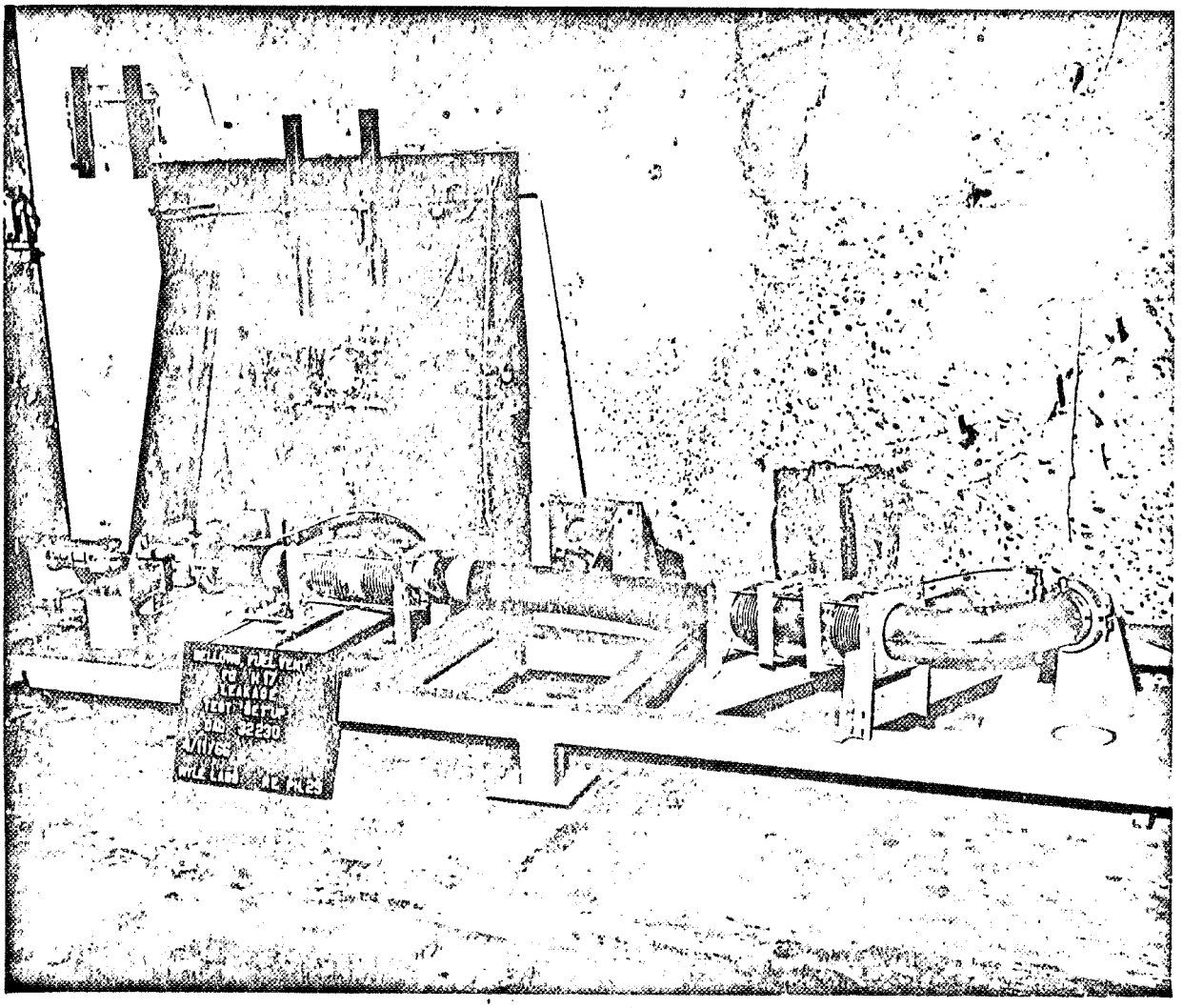
PHOTOGRAPH NUMBER 2

DEFORMATION FOLLOWING REPEAT CYCLE
PROOF AND LEAKAGE



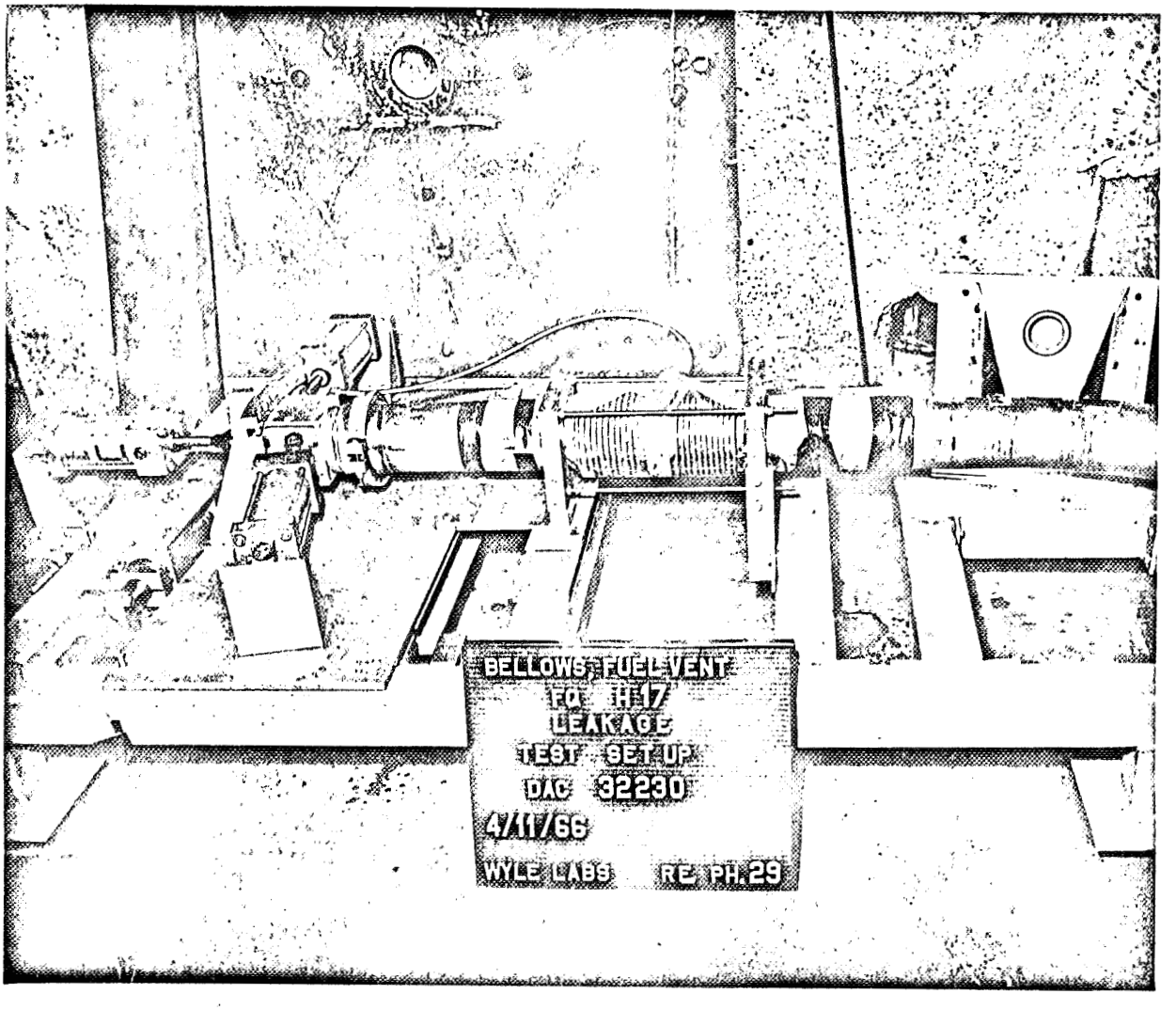
PHOTOGRAPH NUMBER 3

LEAKAGE TEST SETUP



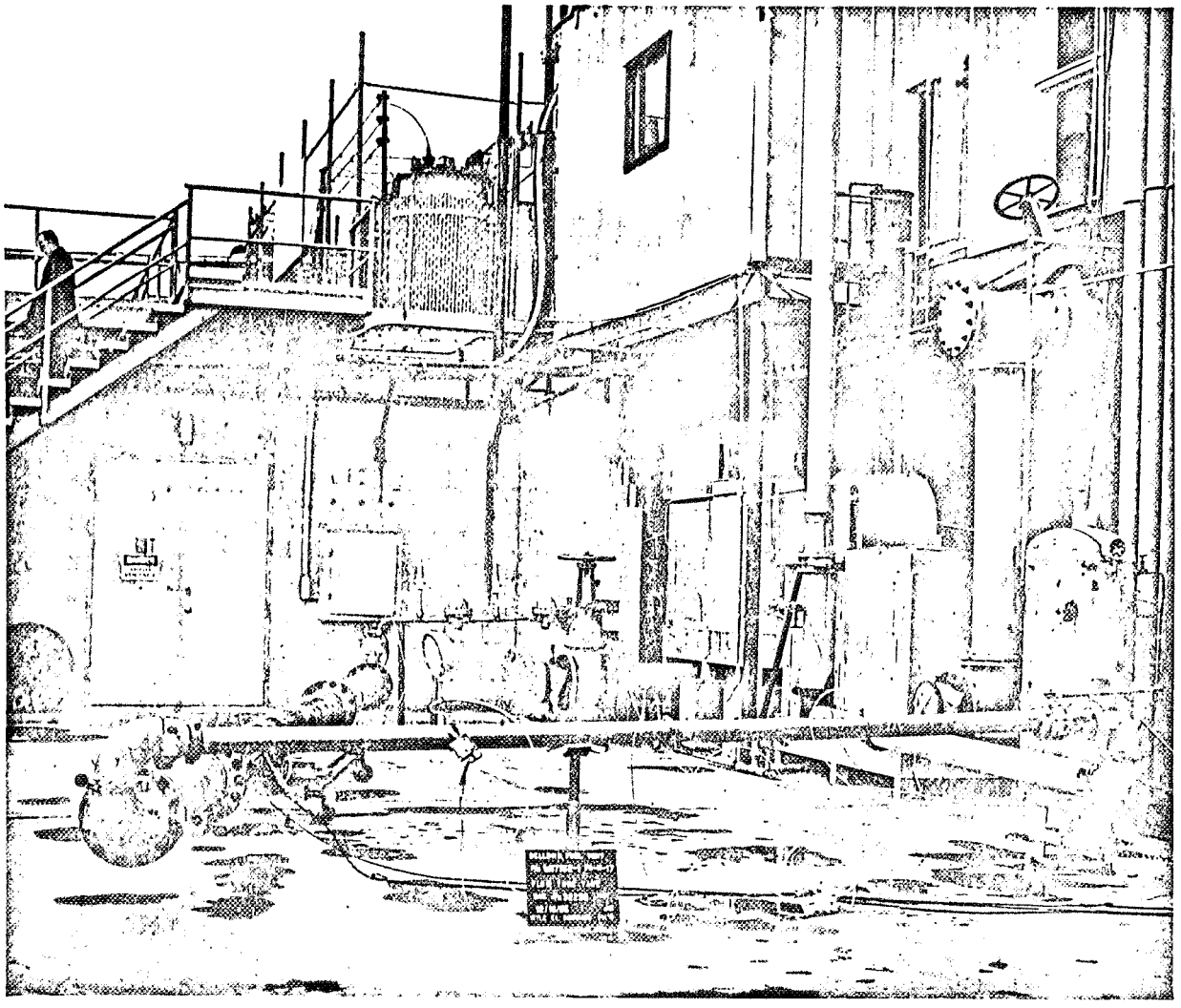
PHOTOGRAPH NUMBER 4

LEAKAGE TEST SETUP



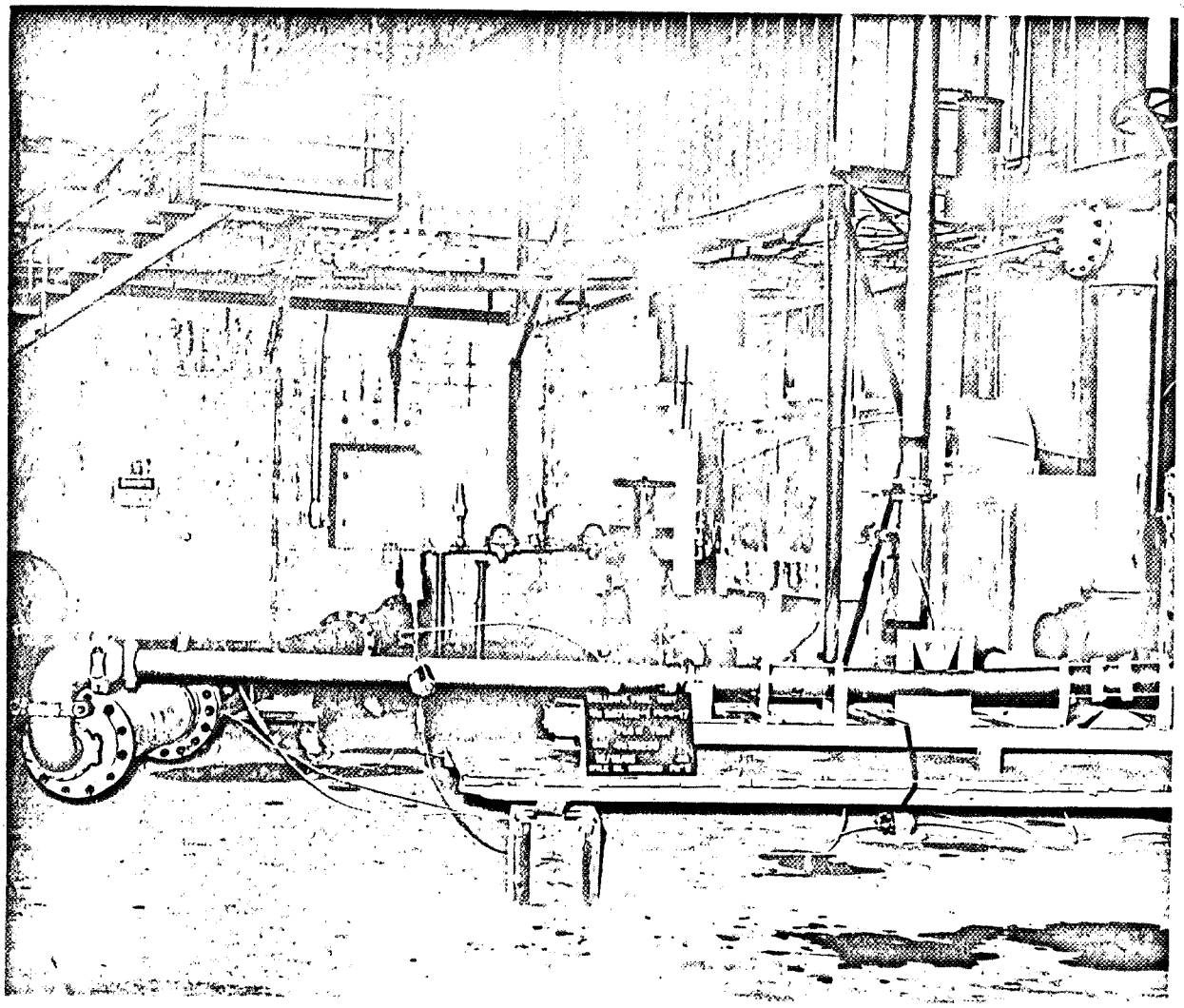
PHOTOGRAPH NUMBER 5

LEAKAGE TEST SETUP



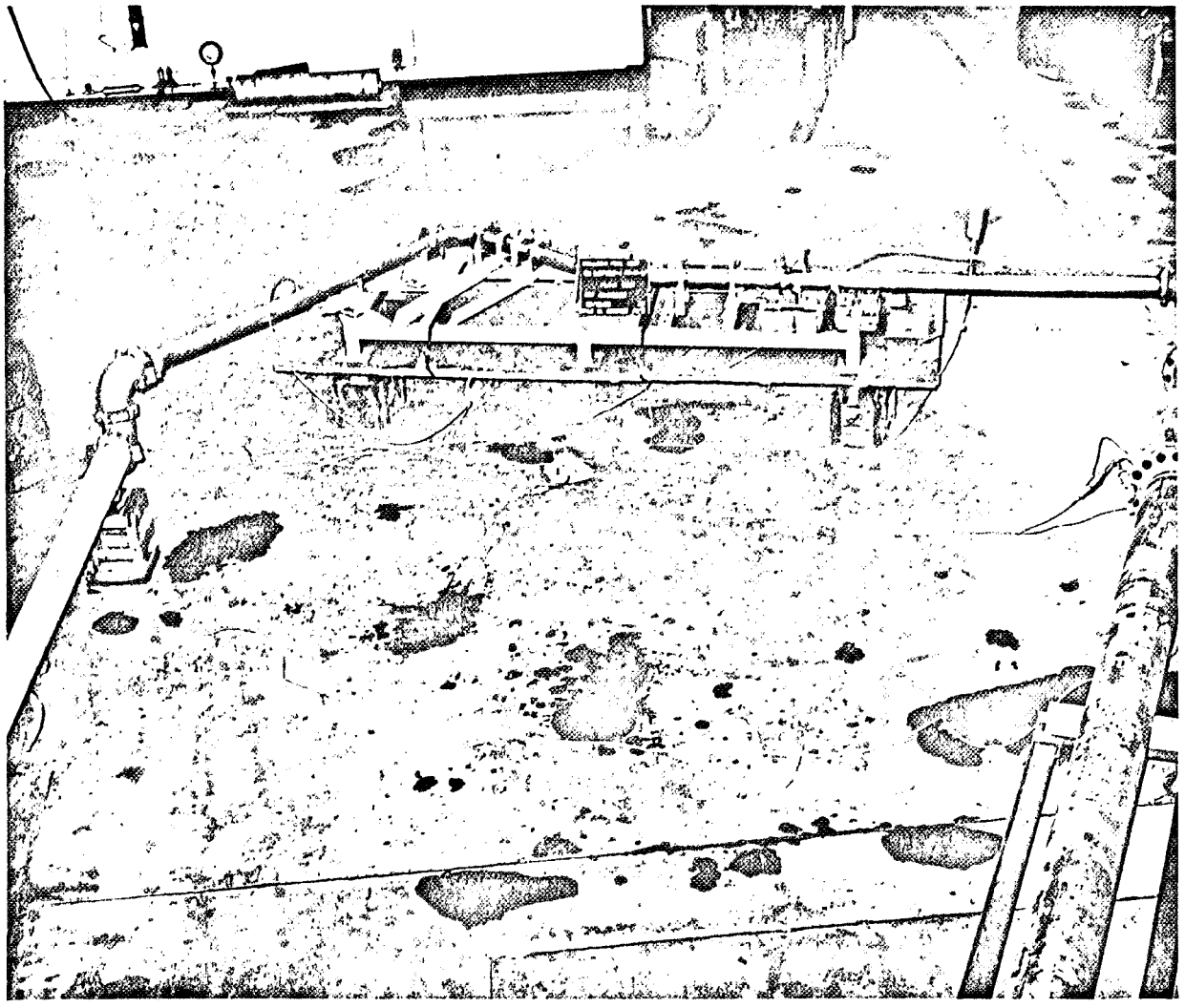
PHOTOGRAPH NUMBER 6

TARE FLOW TEST SETUP
FLOW TUBES 1T1299-1 & -501 ONLY



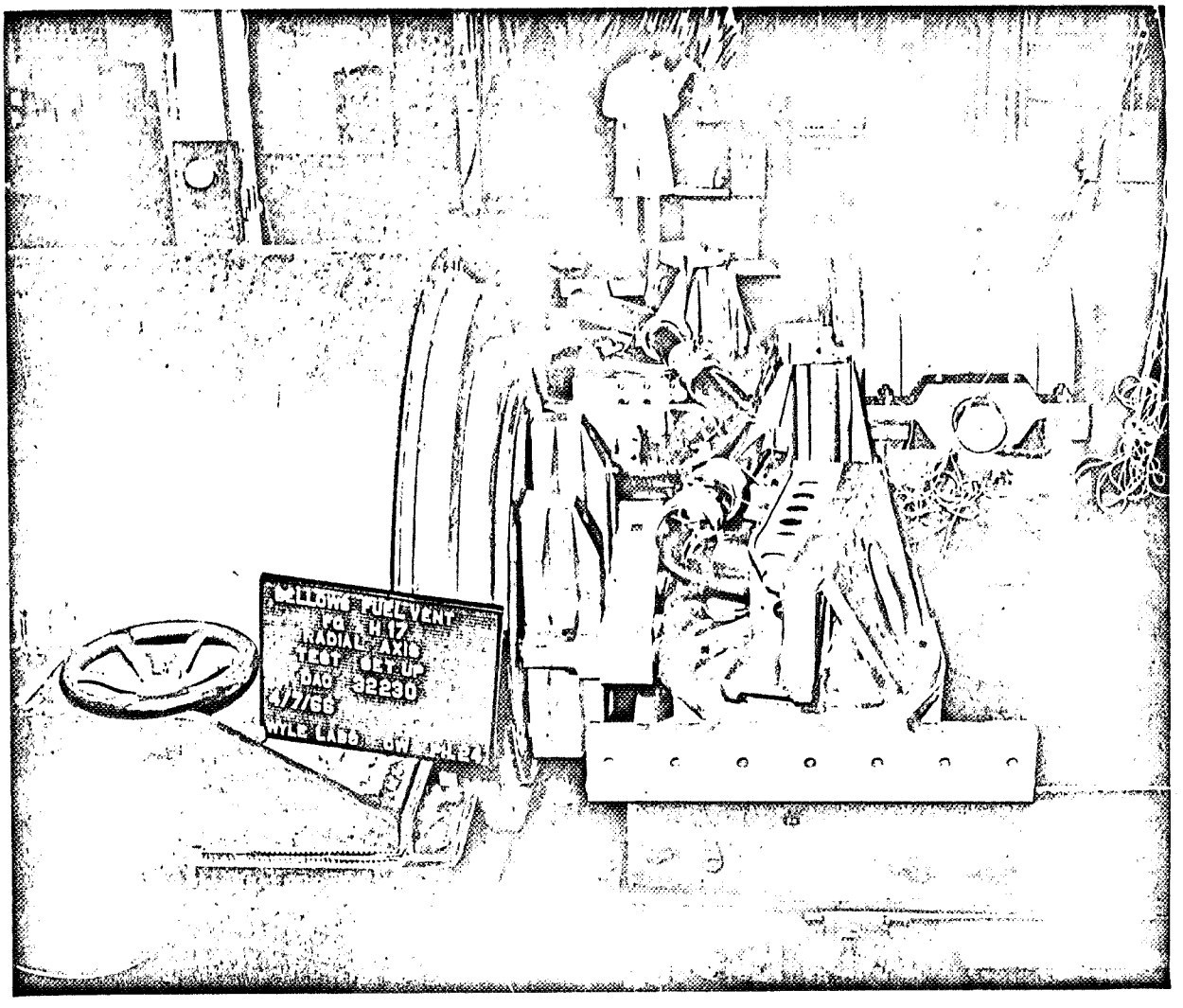
PHOTOGRAPH NUMBER 7

CROSS FLOW TEST SETUP
FLOWTUBES AND TEST SPECIMEN



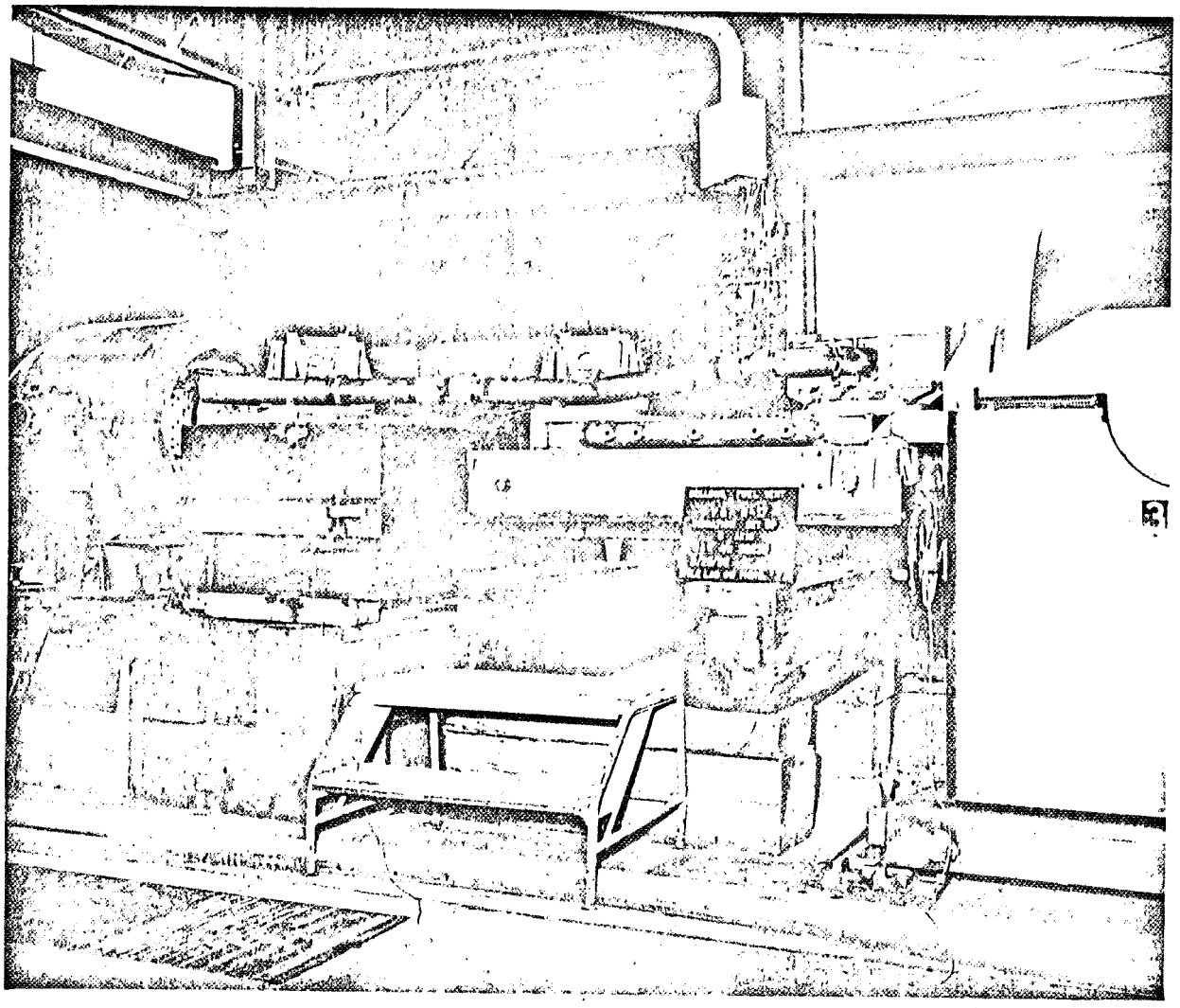
PHOTOGRAPH NUMBER 8

GROSS FLOW TEST SETUP
VIEWED FROM OPPOSITE SIDE SHOWN IN PHOTOGRAPH



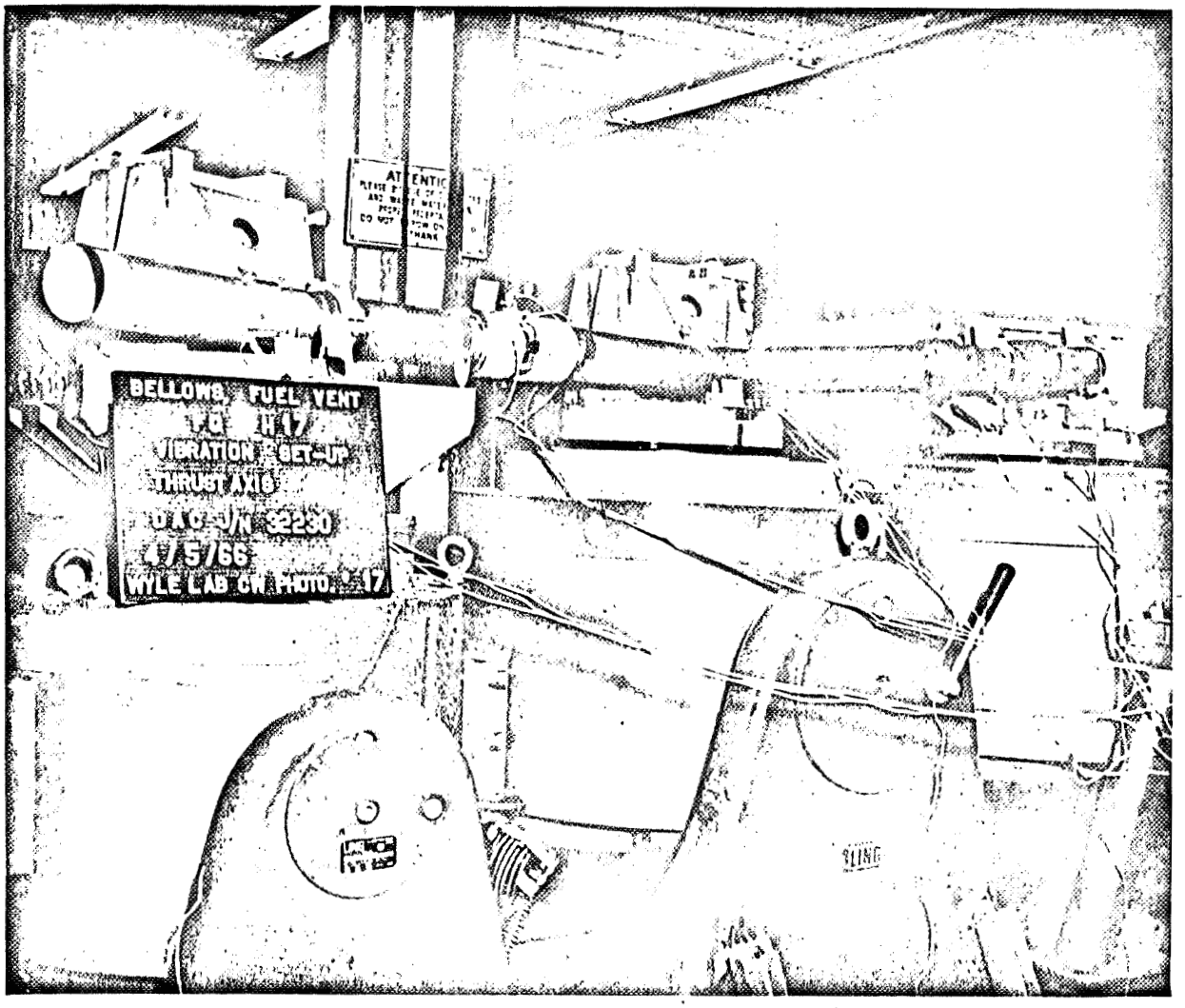
PHOTOGRAPH NUMBER 9

VIBRATION TEST SETUP
RADIAL AXIS



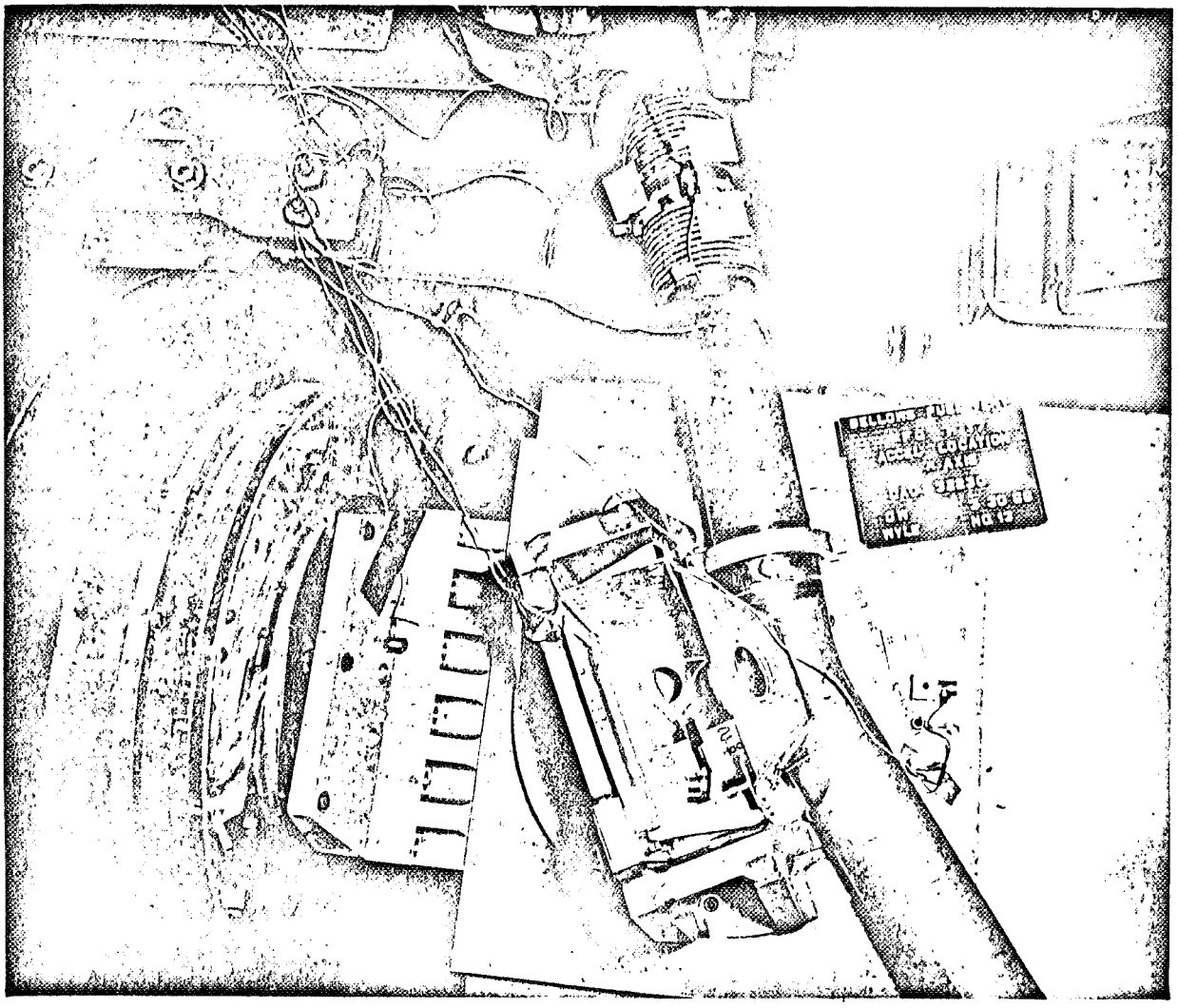
PHOTOGRAPH NUMBER 10

VIBRATION TEST SETUP
TANGENTIAL AXIS



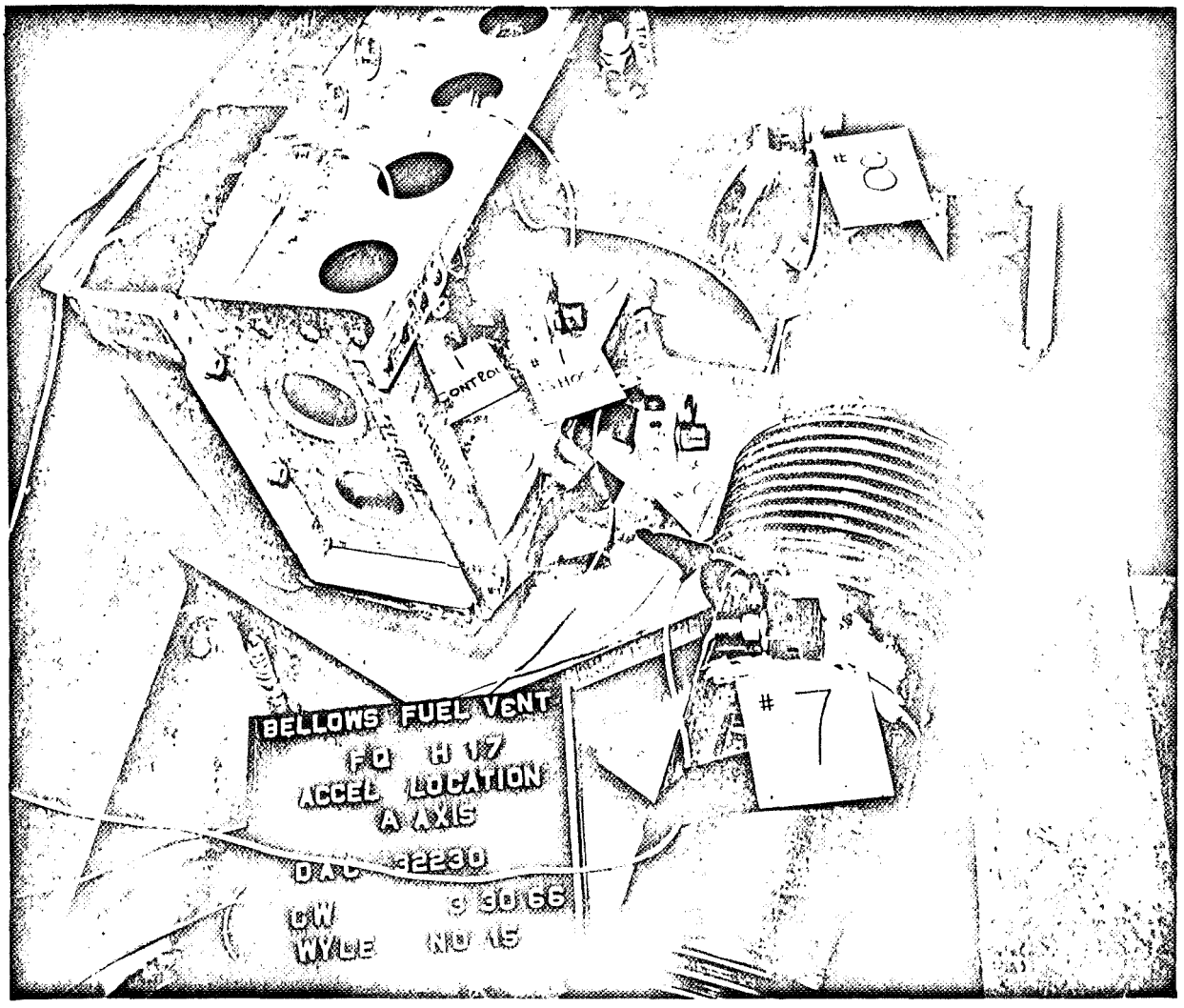
PHOTOGRAPH NUMBER 11

VIBRATION TEST SETUP
THRUST AXIS



PHOTOGRAPH NUMBER 12

RADIAL (A) AXIS
ACCELEROMETER LOCATIONS

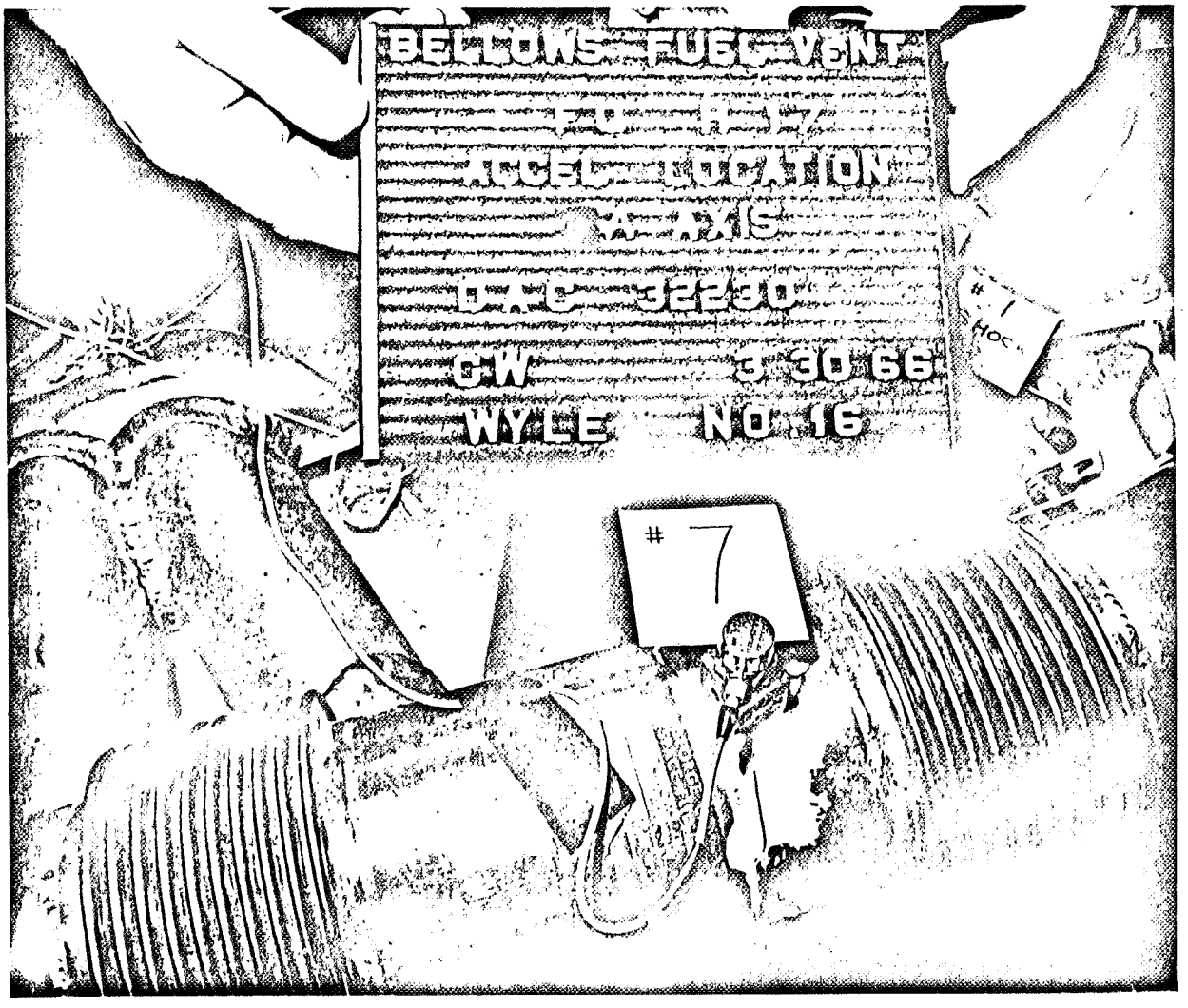


PHOTOGRAPH NUMBER 13

RADIAL (A) AXIS
ACCELEROMETER LOCATIONS

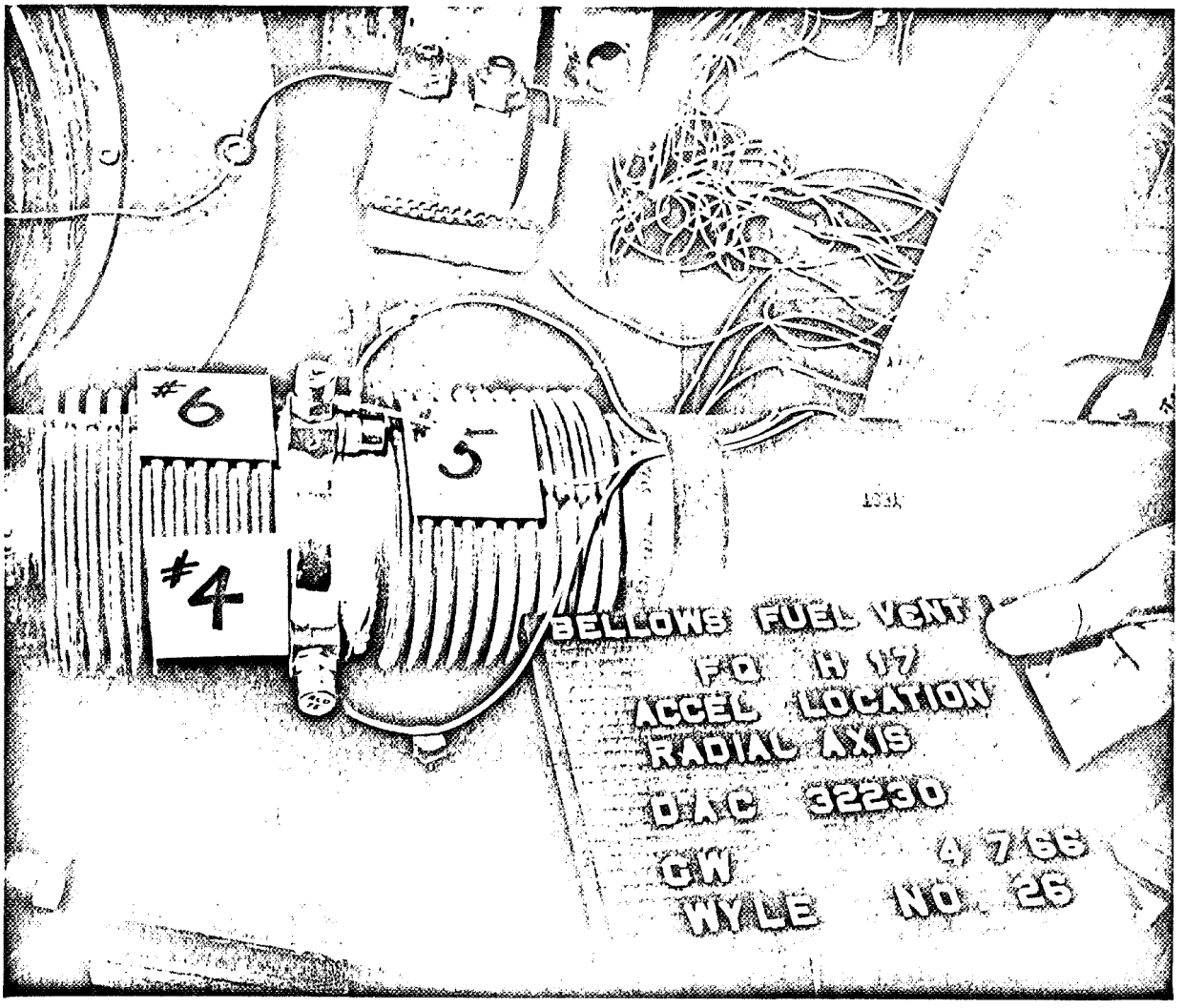
PHOTOGRAPH NUMBER 14

RADIAL (A) AXIS ACCELEROMETER LOCATIONS



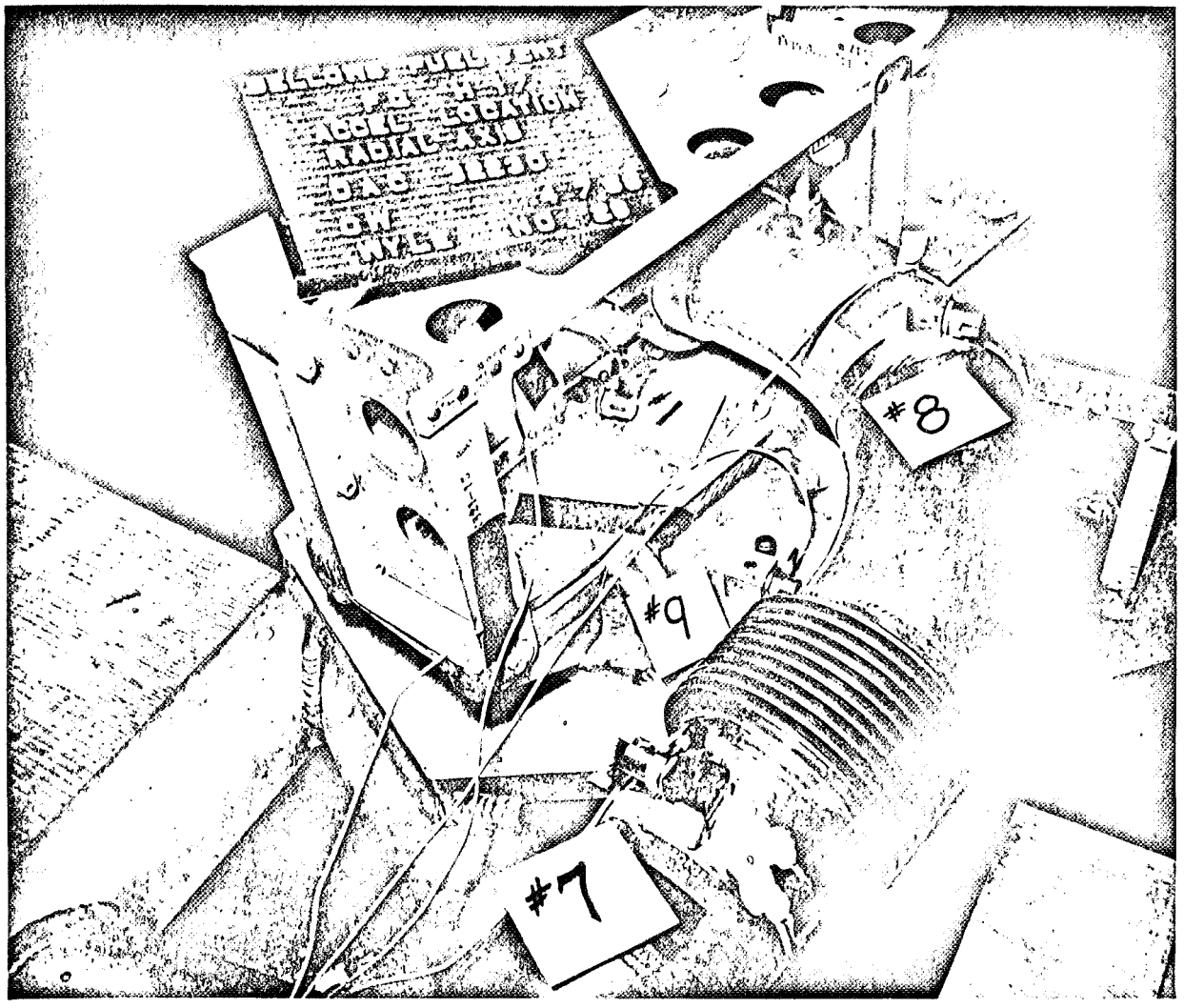
PHOTOGRAPH NUMBER 15

RADIAL (A) AXIS
ACCELEROMETER LOCATIONS



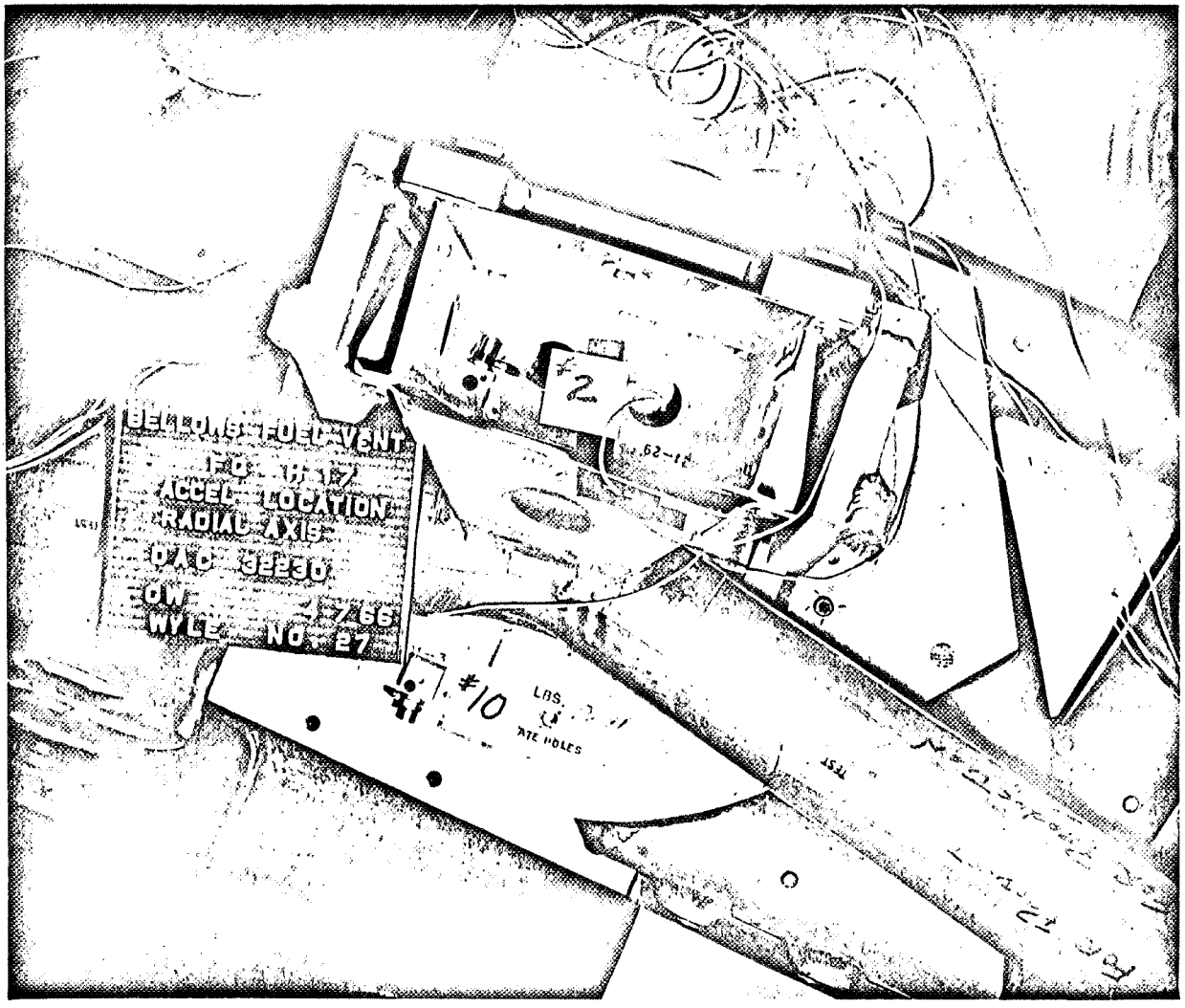
PHOTOGRAPH NUMBER 16

RADIAL (A) AXIS
ACCELEROMETER LOCATIONS
(RE-RUN)



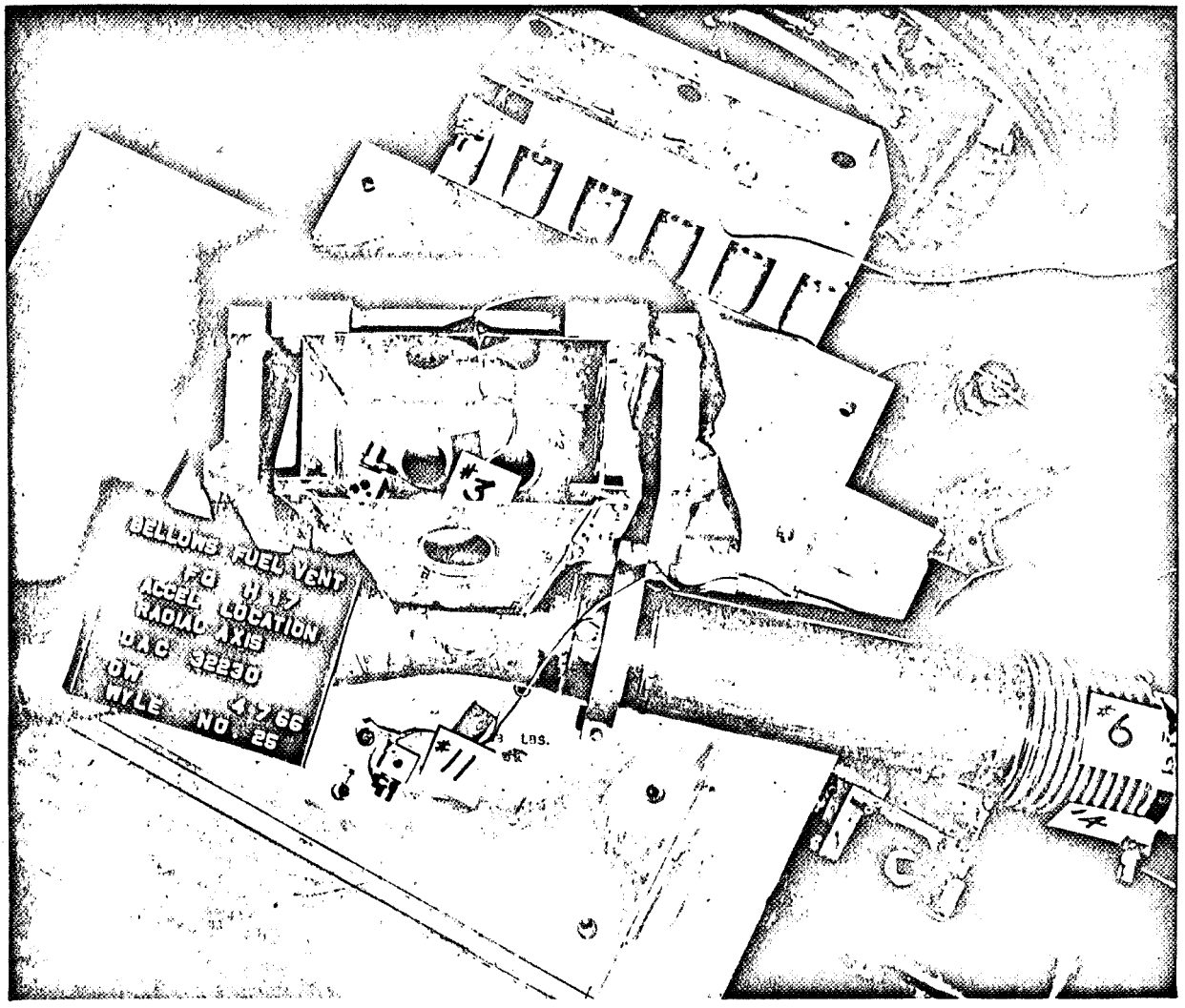
PHOTOGRAPH NUMBER 17

RADIAL (A) AXIS
ACCELEROMETER LOCATIONS
(RE-RUN)



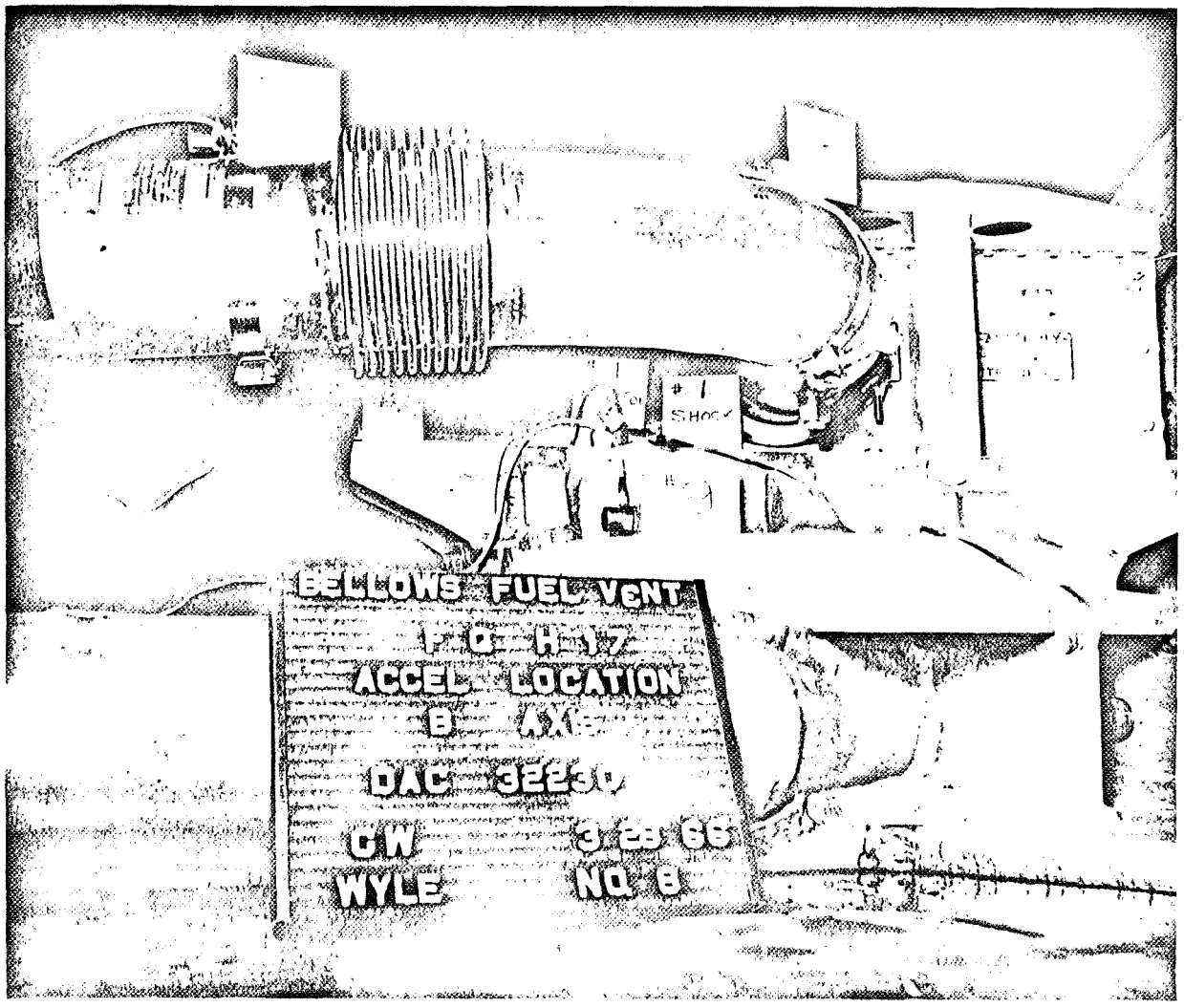
PHOTOGRAPH NUMBER 18

RADIAL (A) AXIS
ACCELEROMETER LOCATIONS
(RE-RUN)



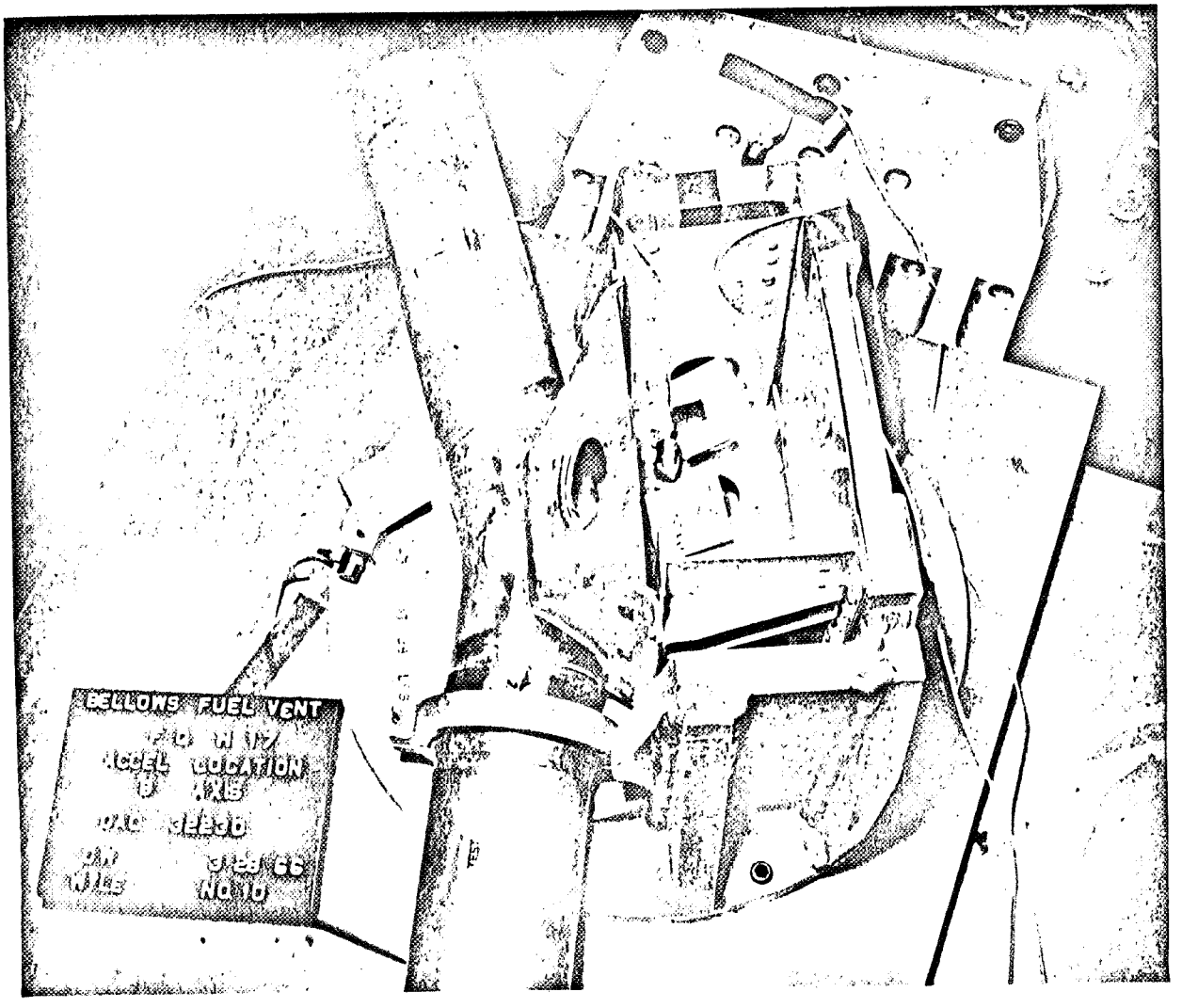
PHOTOGRAPH NUMBER 19

RADIAL (A) AXIS
ACCELEROMETER LOCATIONS
(RE-RUN)



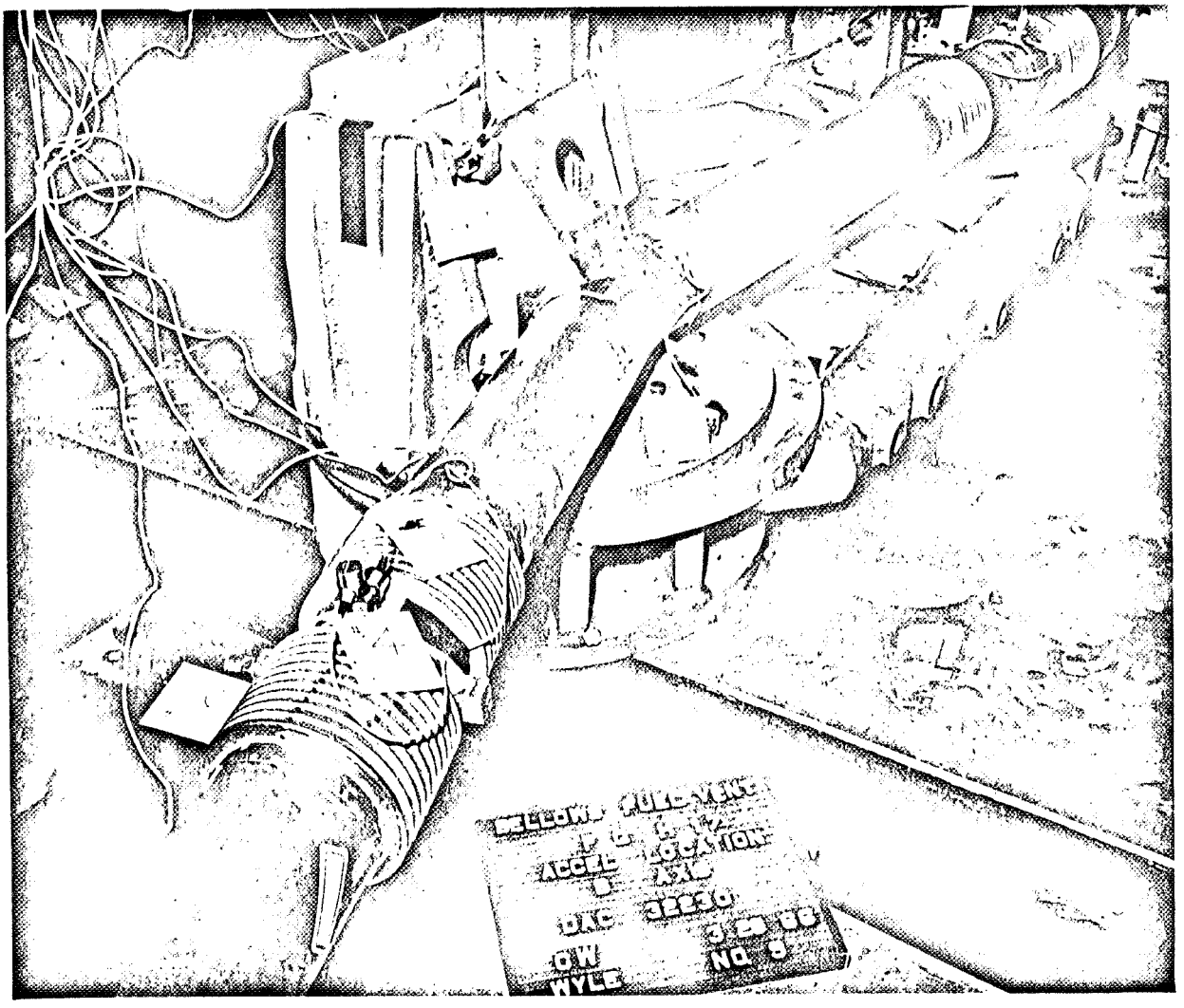
PHOTOGRAPH NUMBER 20

TANGENTIAL (B) AXIS
ACCELEROMETER LOCATIONS



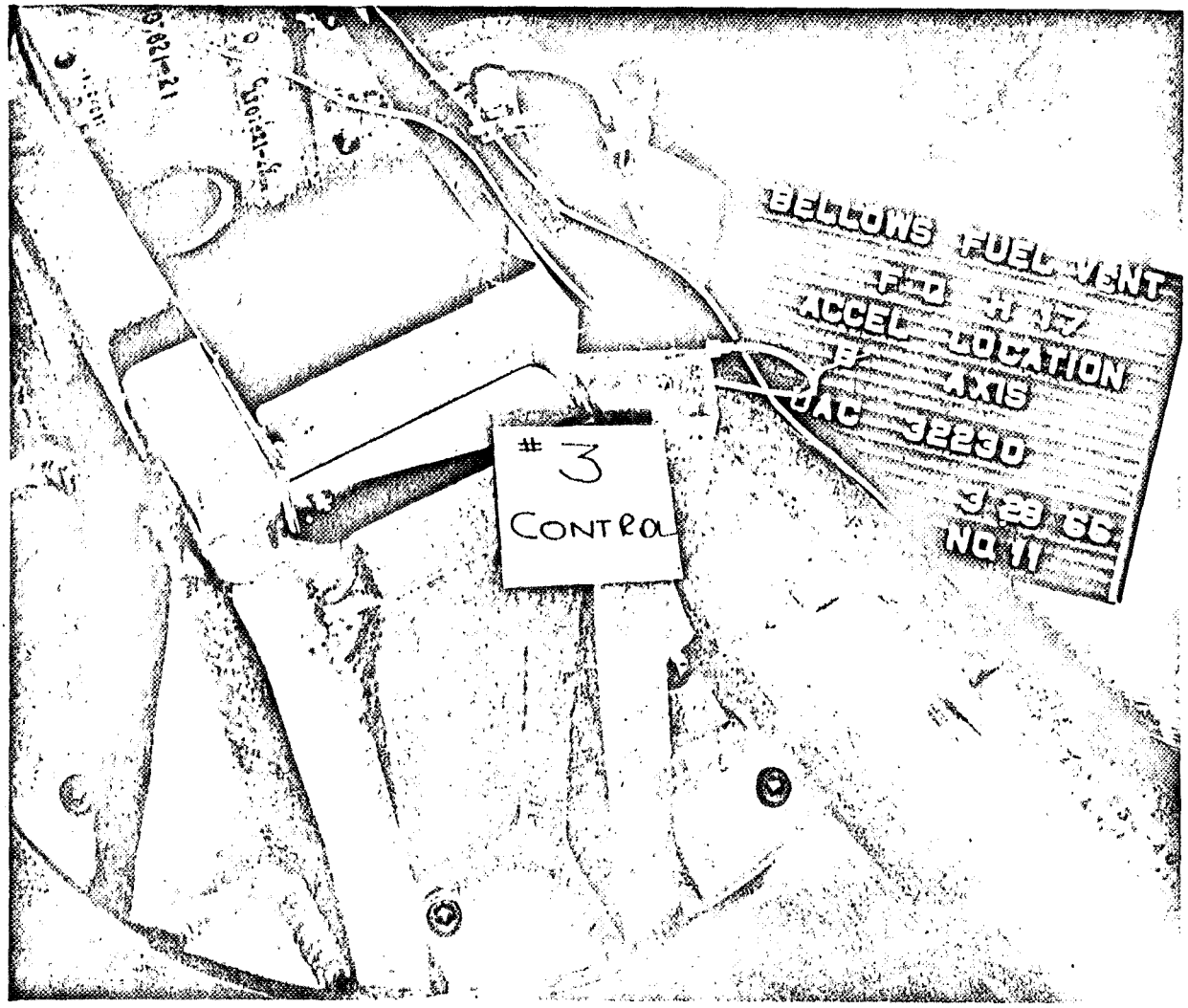
PHOTOGRAPH NUMBER 21

TANGENTIAL (B) AXIS
ACCELEROMETER LOCATIONS



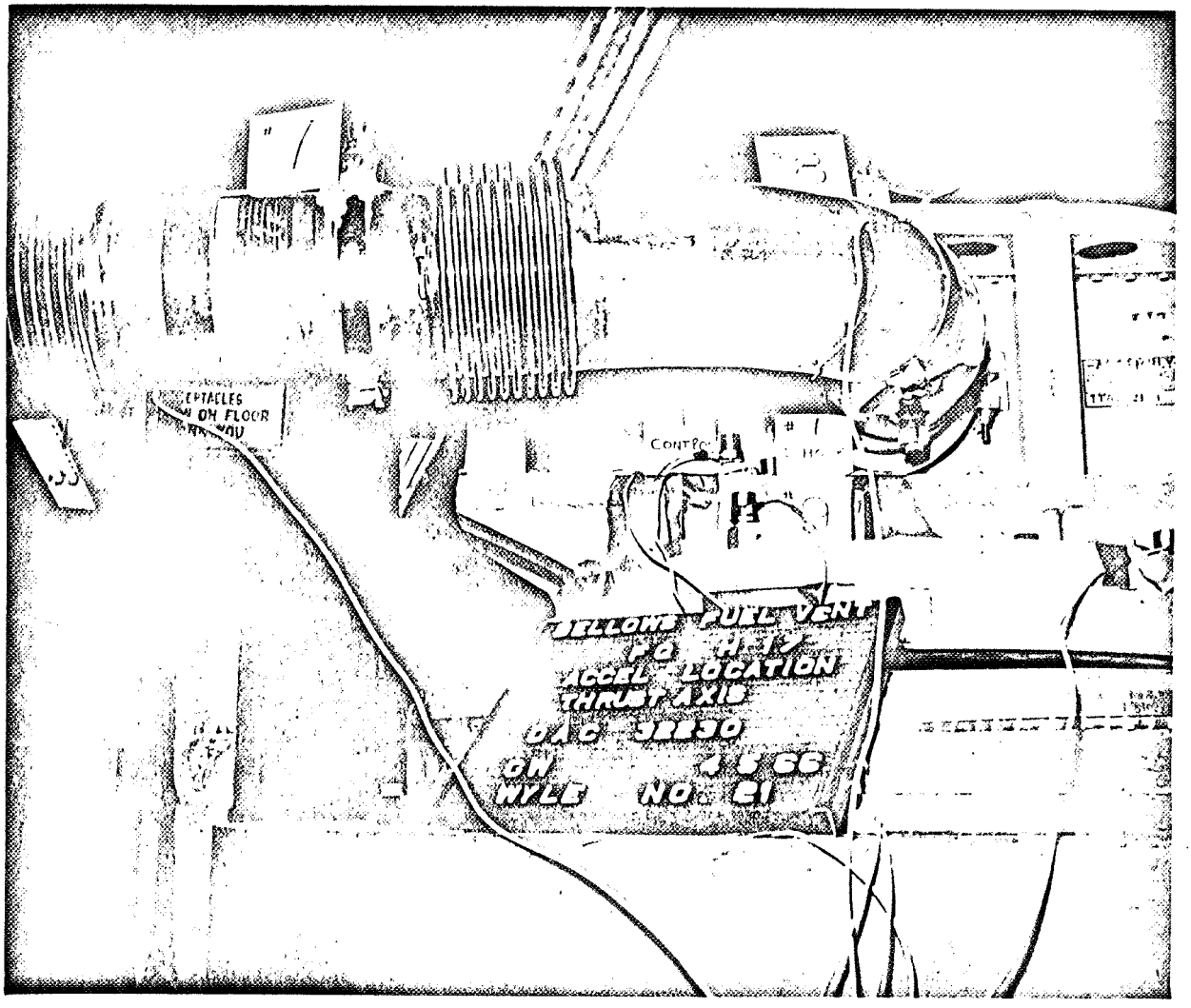
PHOTOGRAPH NUMBER 22

TANGENTIAL (B) AXIS
ACCELEROMETER LOCATIONS



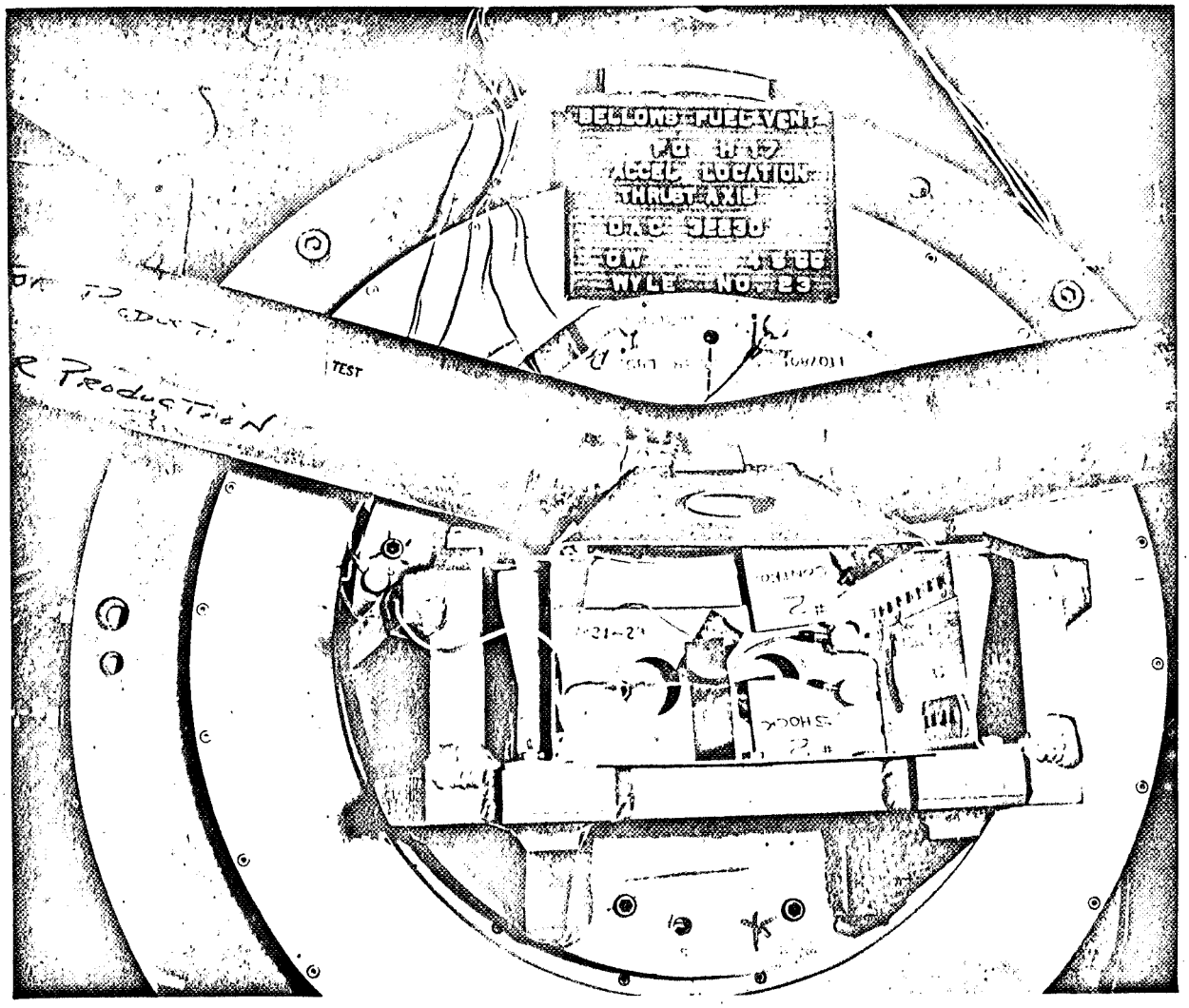
PHOTOGRAPH NUMBER 23

TANGENTIAL (B) AXIS
ACCELEROMETER LOCATIONS



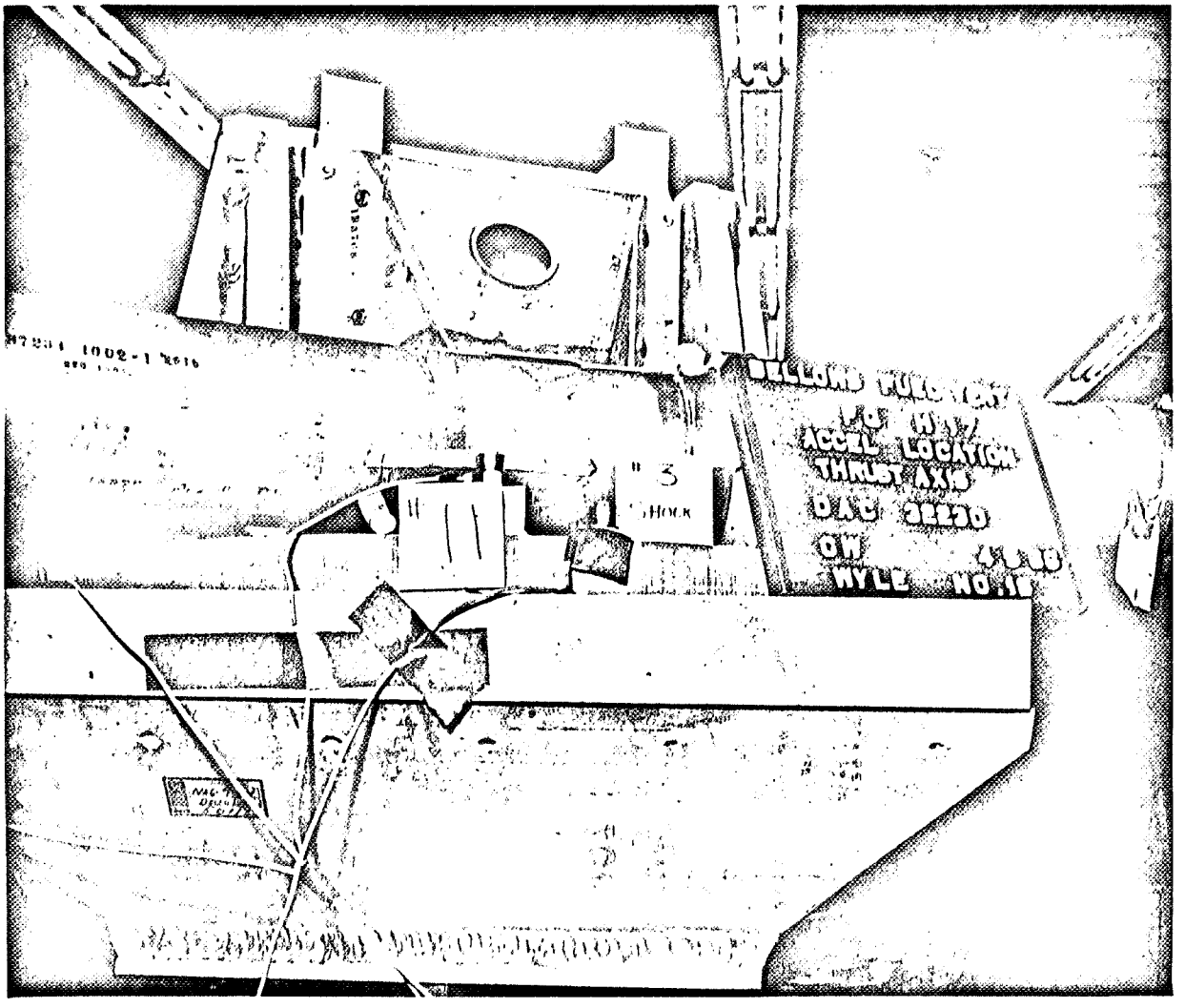
PHOTOGRAPH NUMBER 24

THRUST (C) AXIS
ACCELEROMETER LOCATIONS



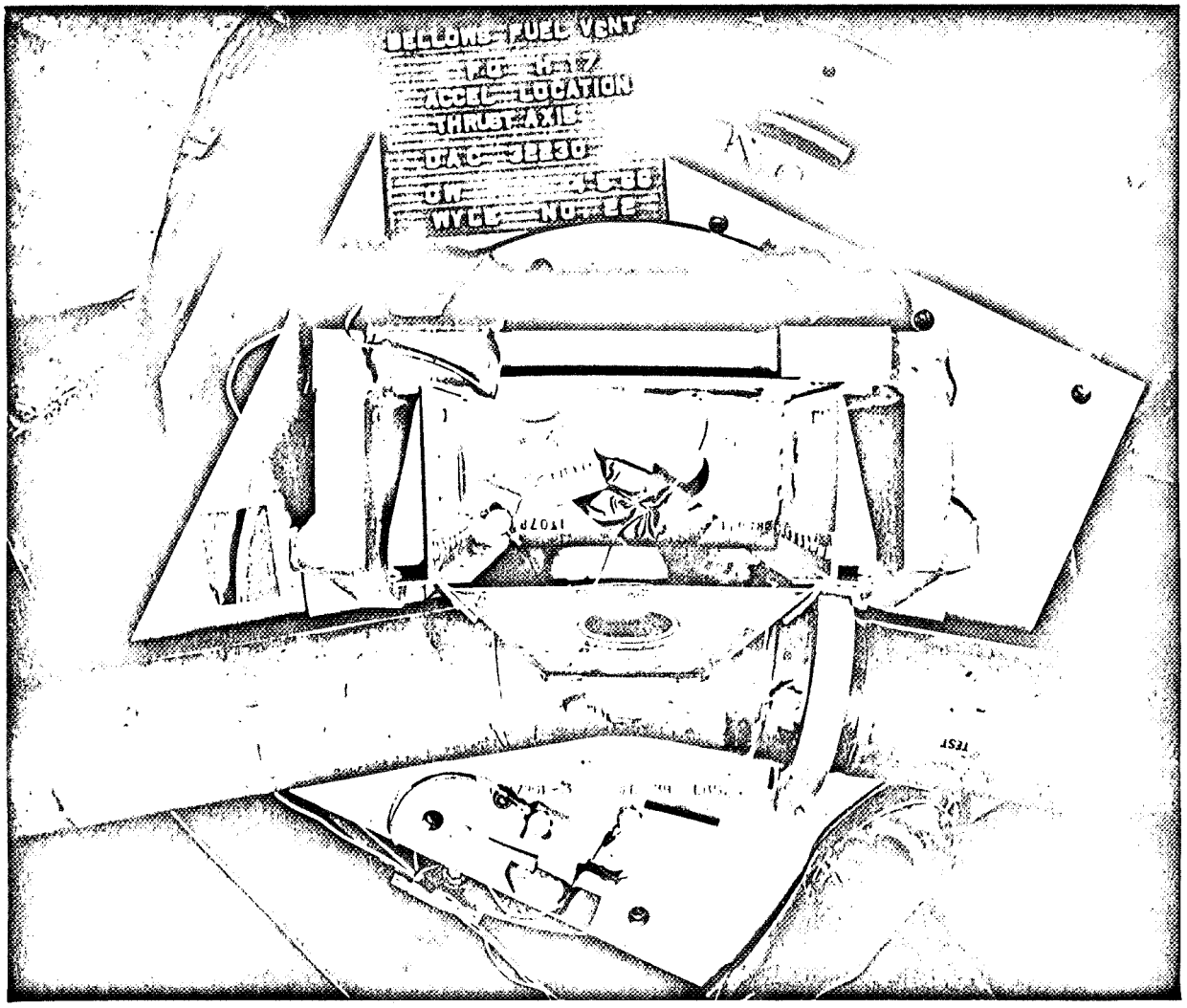
PHOTOGRAPH NUMBER 25

THRUST (C) AXIS
ACCELEROMETER LOCATIONS



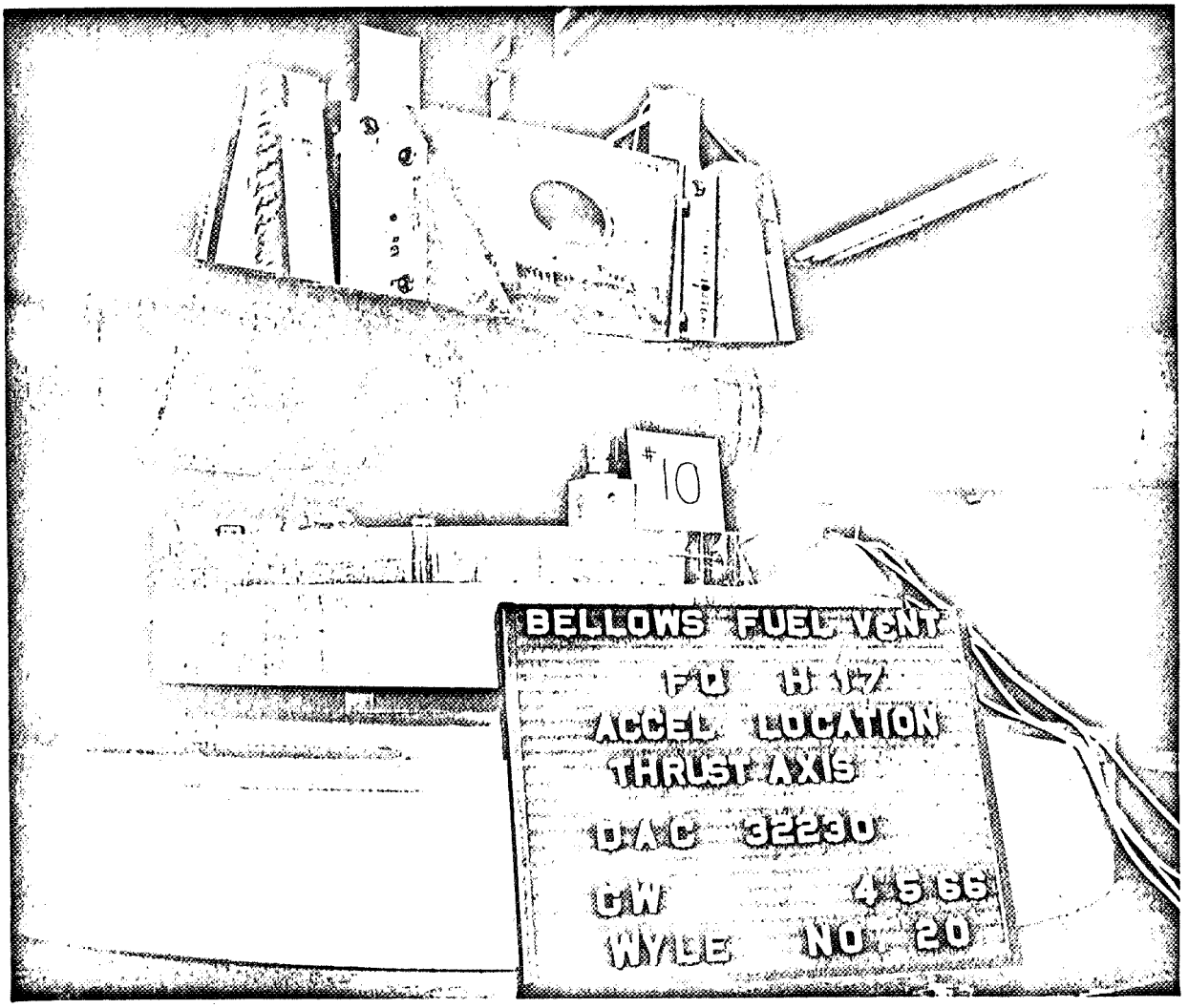
PHOTOGRAPH NUMBER 26

THRUST (C) AXIS
ACCELEROMETER LOCATIONS



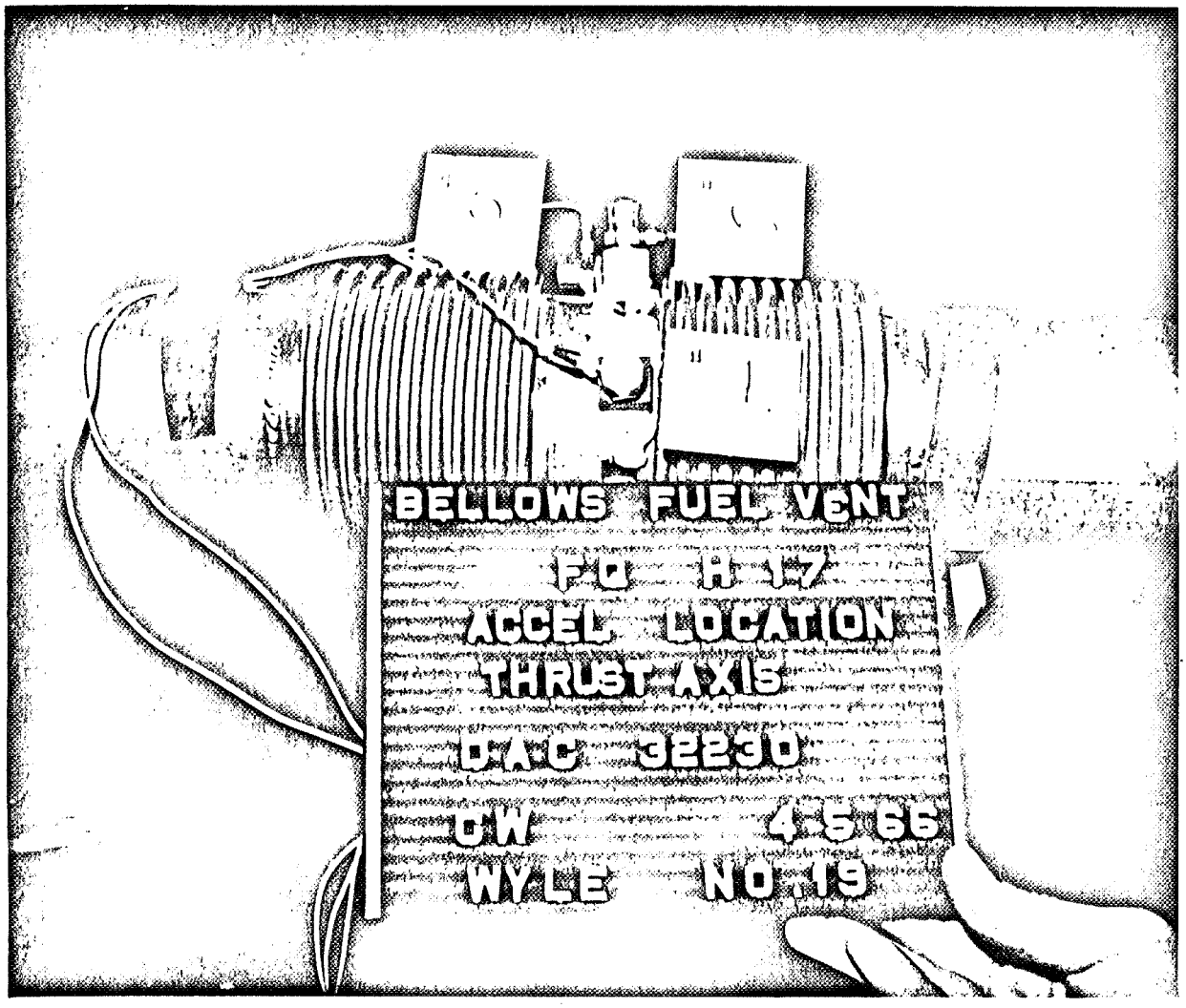
PHOTOGRAPH NUMBER 27

THRUST (C) AXIS
ACCELEROMETER LOCATIONS



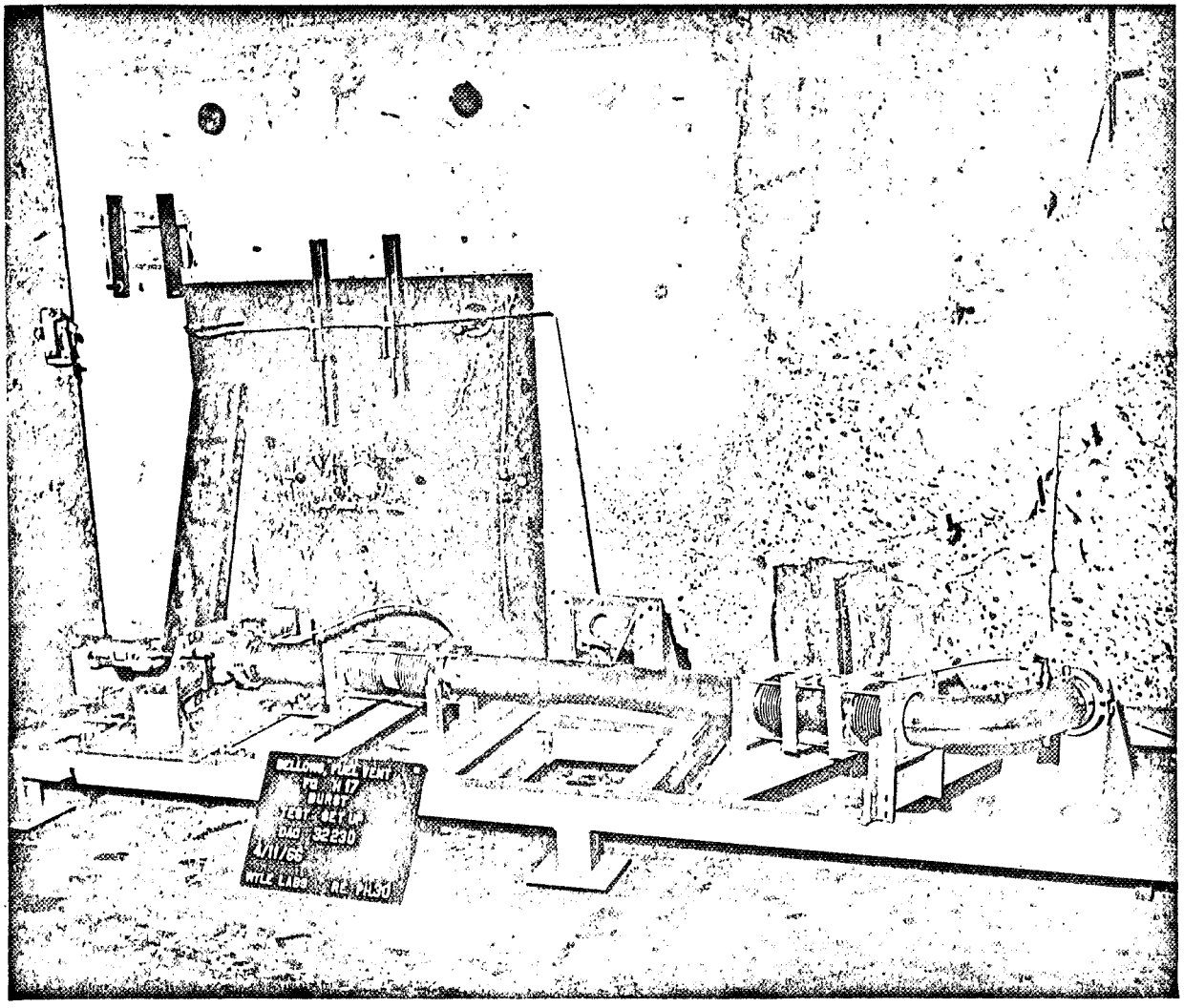
PHOTOGRAPH NUMBER 28

THRUST (C) AXIS
ACCELEROMETER LOCATIONS



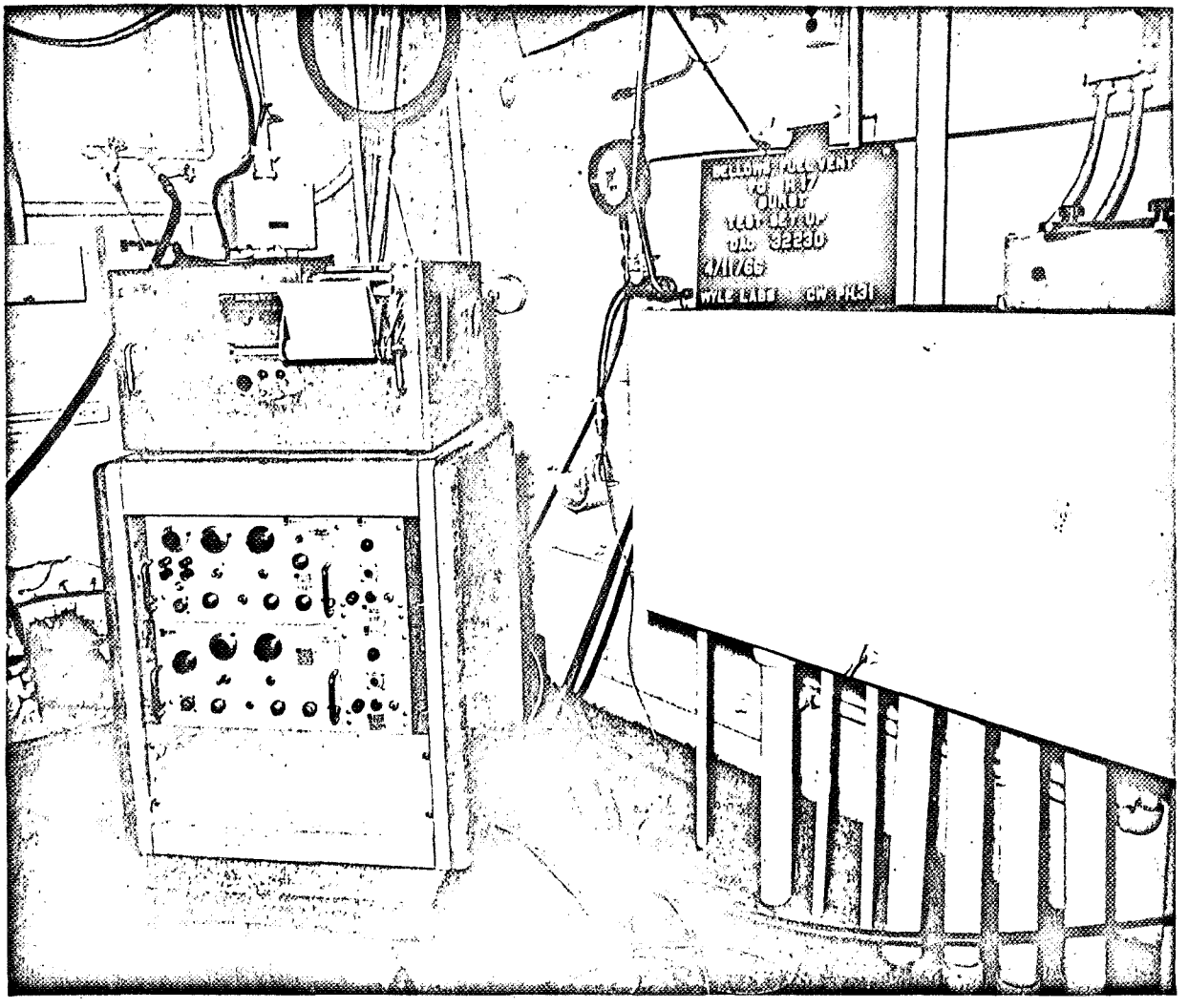
PHOTOGRAPH NUMBER 29

THRUST (C) AXIS
ACCELEROMETER LOCATIONS



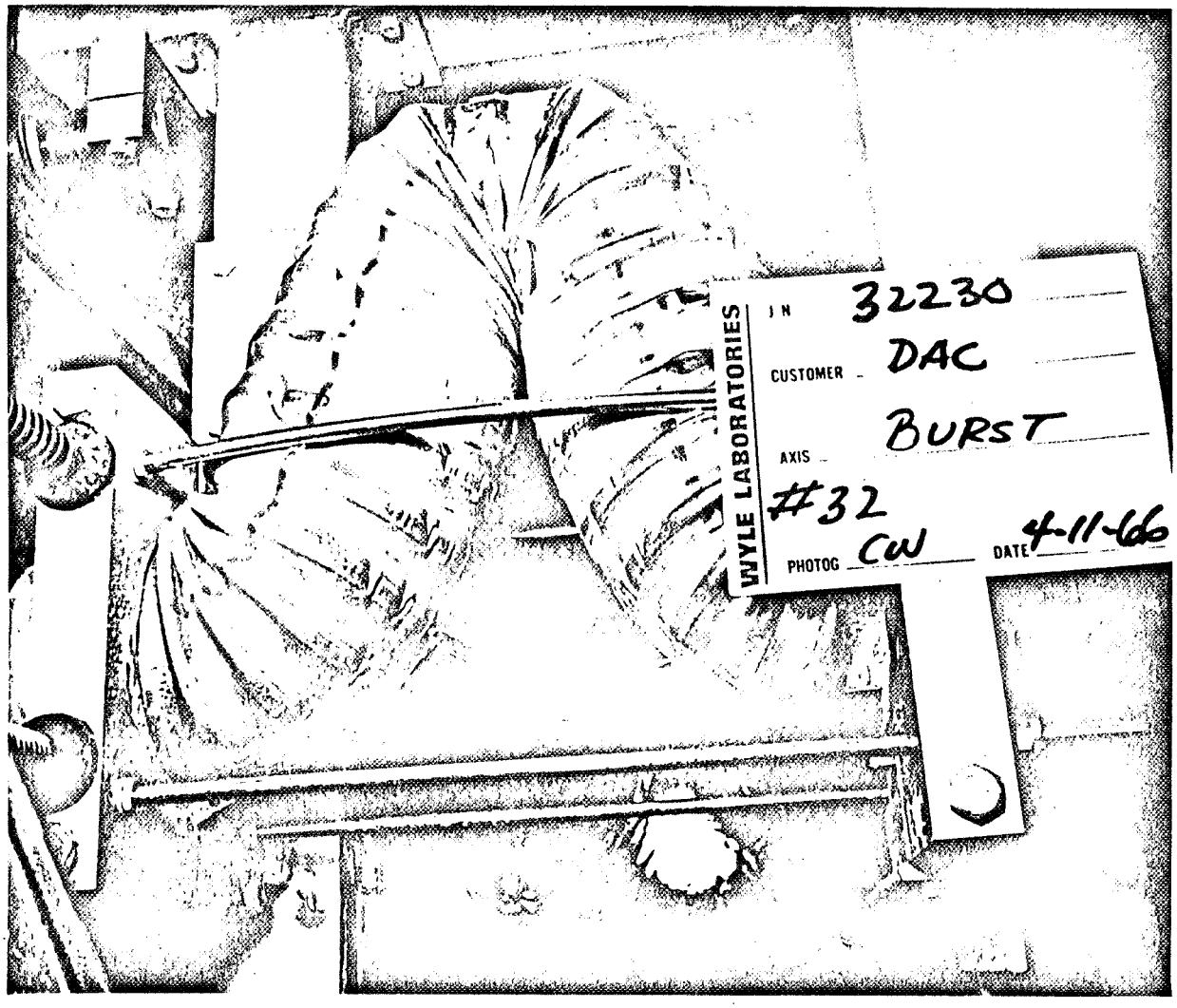
PHOTOGRAPH NUMBER 30

BURST TEST SETUP



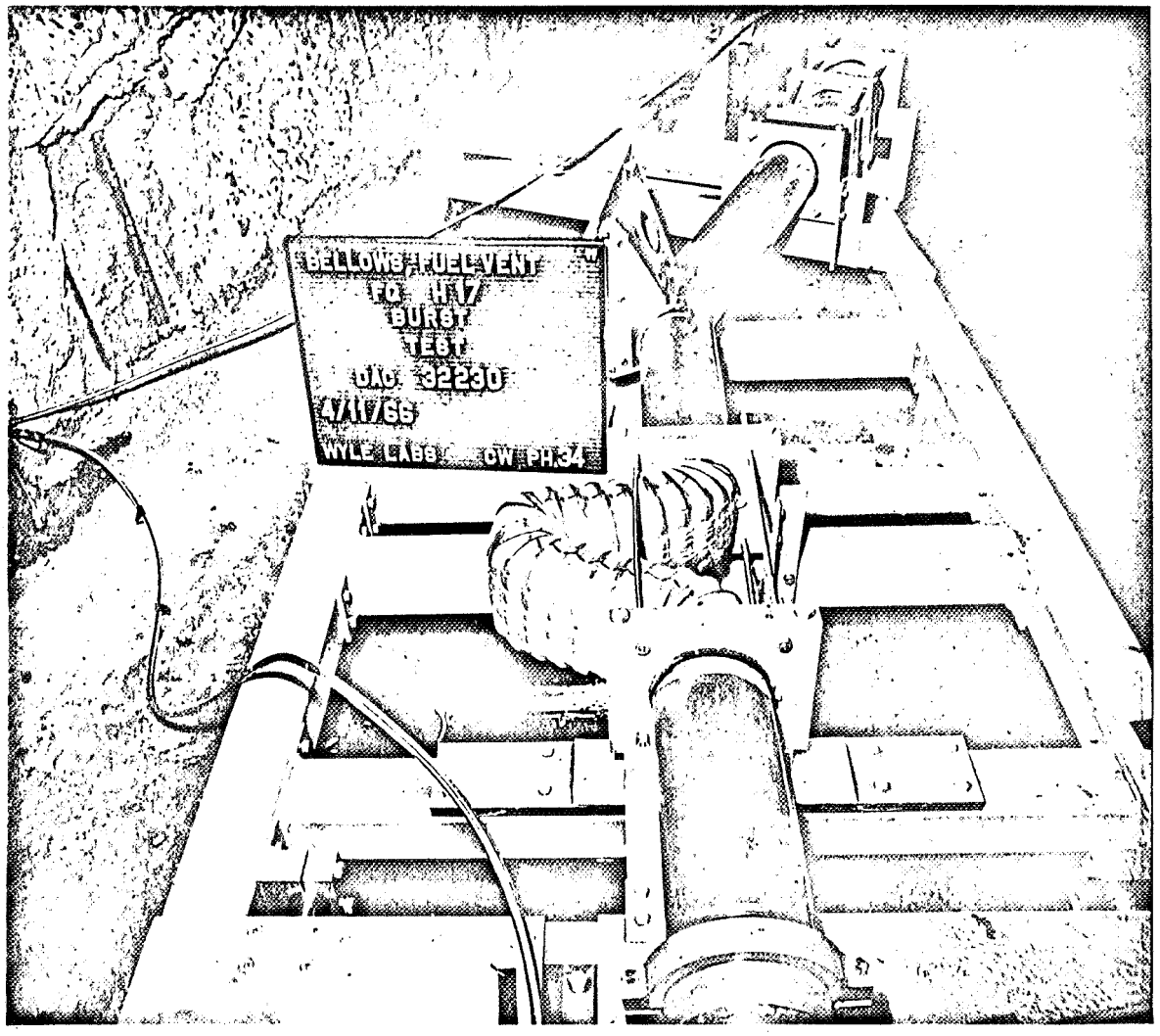
PHOTOGRAPH NUMBER 31

BURST TEST INSTRUMENTATION



PHOTOGRAPH NUMBER 32

BELLOWS DAMAGE AFTER BURST TEST

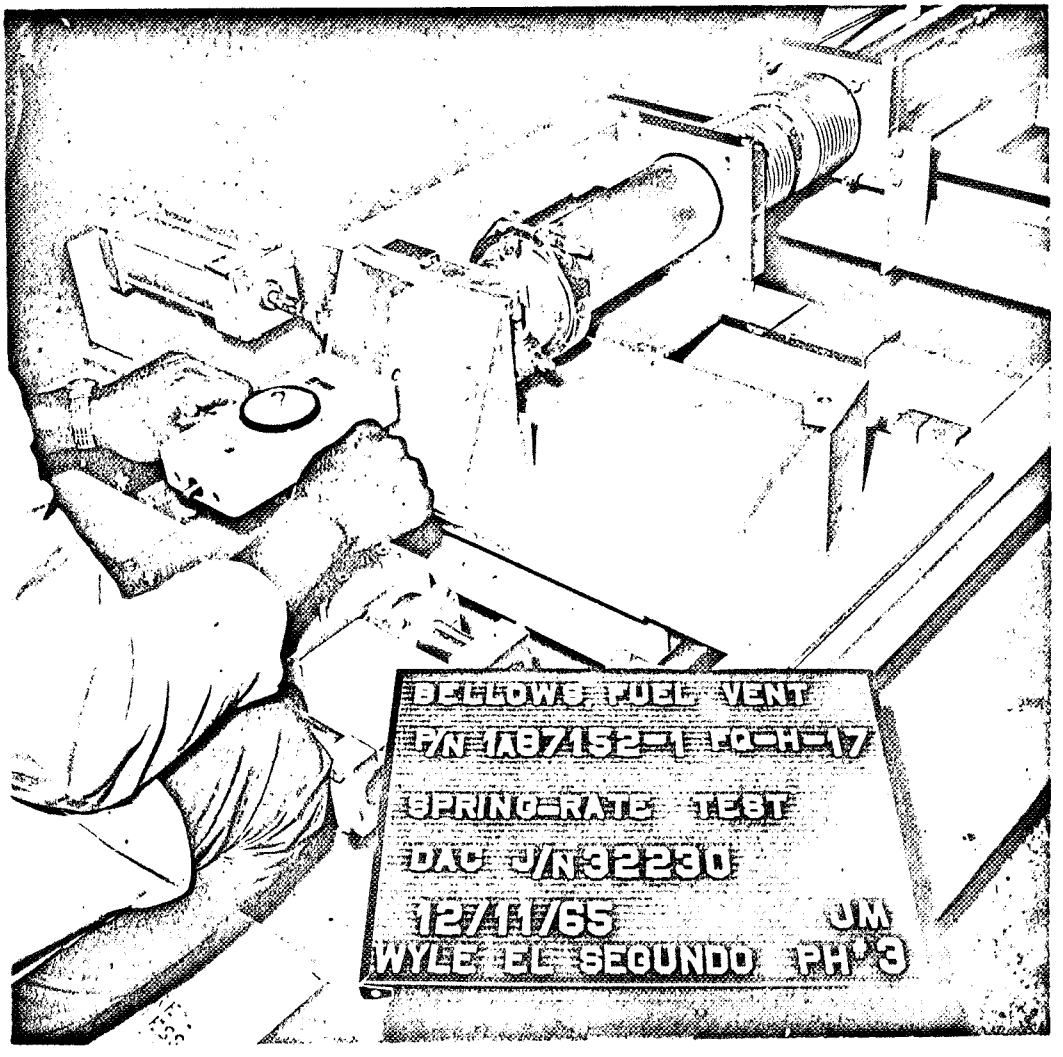


PHOTOGRAPH NUMBER 33

BELLOWS DAMAGE AFTER BURST TEST

PHOTOGRAPH NUMBER 34

DAMAGE AFTER BURST TEST

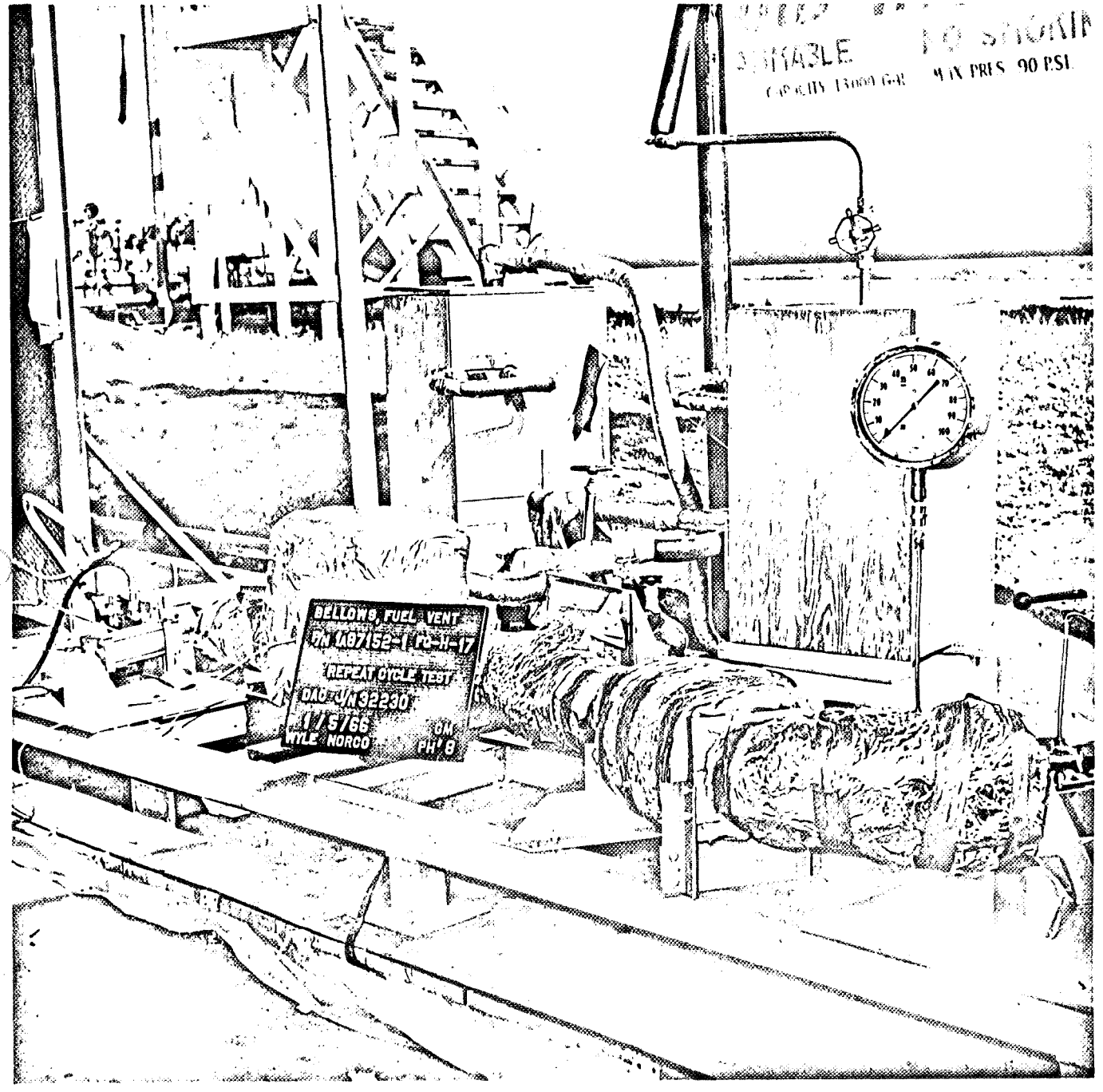


PHOTOGRAPH NUMBER 35

SPRING RATE TEST SETUP

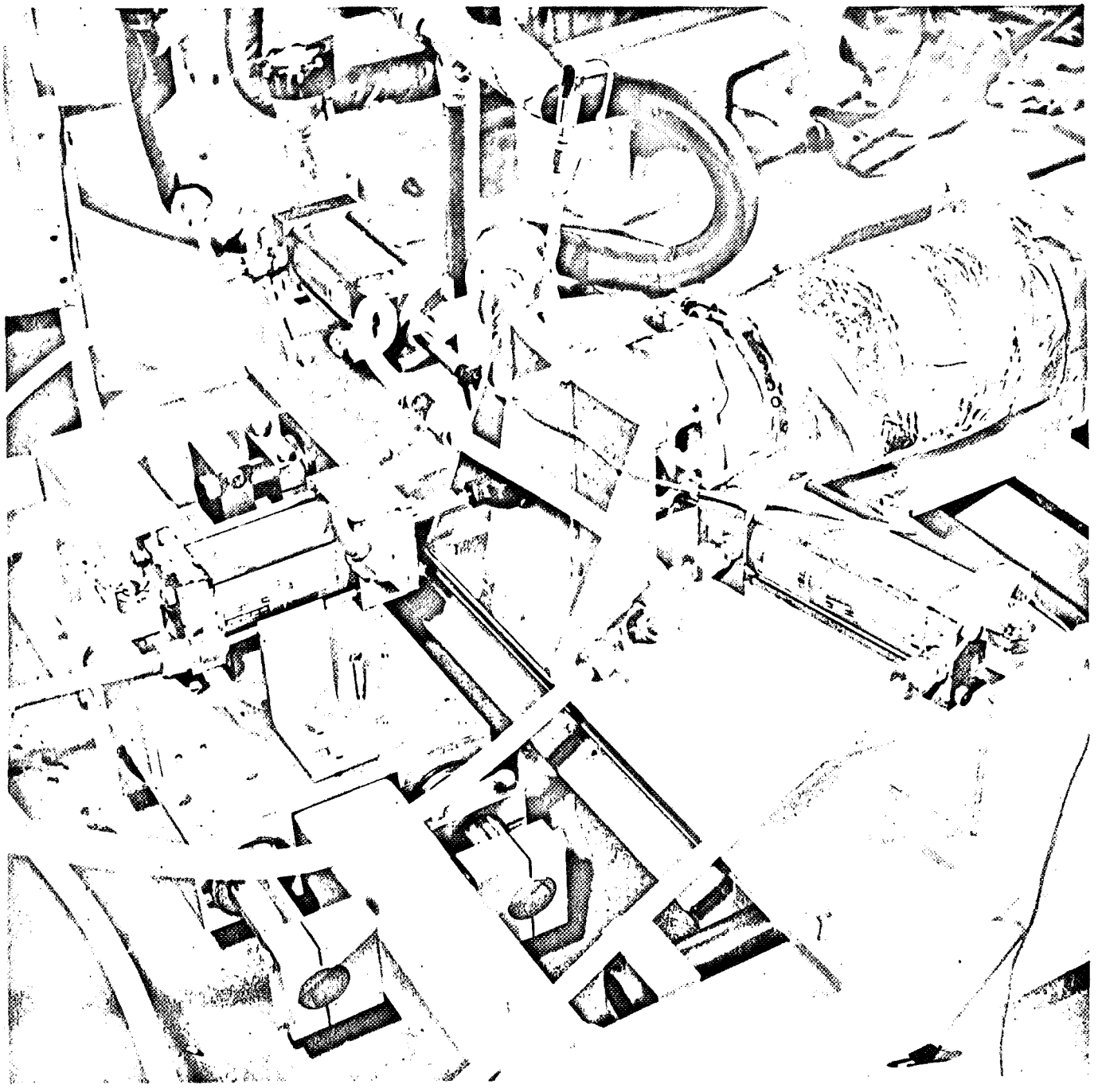
DELETED PHOTOGRAPH NUMBER 36

(A)



PHOTOGRAPH NUMBER 37

DEFLECTION CYCLE TEST SETUP



PHOTOGRAPH NUMBER 38

PNEUMATIC ACTUATION SYSTEM
REPEAT CYCLE TEST

WYLE JOB NO 32230
NOD NO 1A
PO NO. T&M 0301A
DATE 3/25/66

NOTICE OF DEVIATION

WYLE LABORATORIES • EL SEGUNDO, CALIF

TM-DSV4B-ENV-R5776
Page E-69

TO: DOUGLAS AIRCRAFT COMPANY

ATTN: MR. V. R. WHITE

PART NAME BELLOWS, PROPULSIVE FUEL VENT

PART NO. 1A75152-1 SERIAL NO 042

TEST FORMAL QUALIFICATION

SPECIFICATION 1TO 2861B PARAGRAPH NO. 5.11

NOTIFICATION MADE TO: MR. ED ALTERMAN

DATE 3/25/66 BY R. URENE VIA VERBAL

SPECIFICATION REQUIREMENTS:

PHASE AND EQUALIZING CONTROL SYSTEM CHECKS TO BE MADE WITH DUMMY SPECIMEN.

DESCRIPTION OF DEVIATION:

DUMMY SPECIMEN NOT AVAILABLE, PHASE CHECKS MADE WITH BARE FIXTURES. EQUALIZATION AND PROGRAM TAPE MADE WITH BARE FIXTURES.

SPECIMEN DISPOSITION CONTINUE TEST

COMMENTS - RECOMMENDATIONS:

DISTRIBUTION:
ORIGINAL: QUALITY CONTROL
3 COPIES: CUSTOMER
1 COPY: JOB CONTROL
1 COPY USAFQAR
(All AF Contracts)
1 COPY: BRANCH 560
1 COPY:
WL 109A

TEST WITNESS: J. SCHULTZ ED ALTERMAN TEST ENGINEER R. URENE
REPRESENTING DOUGLAS A/C BRANCH HEAD J. TORCHIN

ORIGINAL NOTICE OF DEVIATION SIGNED BY TEST WITNESS

NOTICE OF DEVIATION

PAGE NUMBER 70
WYLE JOB NO 32230
NOD NO. 2
PO NO. T&M 0301A
DATE 3/29/66

WYLE LABORATORIES • EL SEGUNDO, CALIF

TO: DOUGLAS AIRCRAFT COMPANY

ATTN: MR. V. R. WHITE

PART NAME BELLOWS, PROPULSIVE FUEL VENT

PART NO. 1A87152-1 SERIAL NO 042

TEST FORMAL QUALIFICATION

SPECIFICATION 1T02861B PARAGRAPH NO. 5.11

NOTIFICATION MADE TO: ED ALTERMAN

DATE 3/29/66 BY J. WOOD VIA VERBAL

SPECIFICATION REQUIREMENTS:

ACCELEROMETER NUMBER 7 WILL BE MOUNTED IN THE DIRECTION OF VIBRATION.

DESCRIPTION OF DEVIATION:

ACCELEROMETER NUMBER 7 WAS MOUNTED IN A VERTICAL CROSSTALK POSITION.

NOTE: CHANGE TO RADIAL AXIS (A) PER NOTICE OF DEVIATION NUMBER 4.

SPECIMEN DISPOSITION PROCEED WITH SINUSOIDAL VIBRATION

COMMENTS - RECOMMENDATIONS: CHANGE ACCELEROMETER NUMBER 7 TO LINE OF VIBRATION (C) FOR RANDOM.

DISTRIBUTION:
ORIGINAL: QUALITY CONTROL
(3) COPIES: CUSTOMER
1 COPY: JOB CONTROL
1 COPY USAFQAR
(All AF Contracts)
1 COPY: BRANCH 560
1 COPY: _____
WL 109A

TEST WITNESS: J. SCHULTZ / E. ALTERMAN TEST ENGINEER R. URENE
REPRESENTING DOUGLAS A/C BRANCH HEAD J. TORCHIN

ORIGINAL NOTICE OF DEVIATION SIGNED BY TEST WITNESS

NOTICE OF DEVIATION

WYLE JOB NO.	32230
NOD NO.	3
PO NO.	T&M 0301A
DATE	3/30/66

WYLE LABORATORIES • EL SEGUNDO, CALIF

TO: DOUGLAS AIRCRAFT COMPANY

ATTN: MR. V. R. WHITE

PART NAME BELLOWS, PROPULSIVE FUEL VENT

PART NO. 1A87152-1 SERIAL NO. 042

TEST FORMAL QUALIFICATION

SPECIFICATION 1T02861B PARAGRAPH NO.

NOTIFICATION MADE TO: ED ALTERMAN

DATE 3/30/66 BY R. URENE VIA VERBAL

SPECIFICATION REQUIREMENTS:

THREE SHOCKS AT 20G, 10 MS, PER AXIS. (C AXIS)

DESCRIPTION OF DEVIATION:

FOUR SHOCKS CARRIED OUT - THIRD SHOCK 246 FAILED TO OPERATE. (C AXIS)

NOTE: CHANGE TO RADIAL AXIS (A) PER NOTICE OF DEVIATION NUMBER 4.

SPECIMEN DISPOSITION CONTINUE TEST

COMMENTS - RECOMMENDATIONS:

DISTRIBUTION:
(3) ORIGINAL: QUALITY CONTROL
COPIES: CUSTOMER
1 COPY: JOB CONTROL
1 COPY USAFQAR
(All AF Contracts)
1 COPY: BRANCH 560
1 COPY:
WL 109A

TEST WITNESS: J. SCHULTZ / E. ALTERMAN TEST ENGINEER R. URENE

REPRESENTING DOUGLAS A/C BRANCH HEAD J. TORCHIN

ORIGINAL NOTICE OF DEVIATION SIGNED BY TEST WITNESS

REPORT NUMBER 32630V
PAGE NUMBER 72

NOTICE OF DEVIATION

WYLE JOB NO 32230
NOD NO 4
PO NO. T&M 0301A
DATE 4/1/66

WYLE LABORATORIES • EL SEGUNDO, CALIF

TO: DOUGLAS AIRCRAFT COMPANY

ATTN: MR. V. R. WHITE

PART NAME BELLOWS, PROPULSIVE FUEL VENT

PART NO. 1A87152-1 SERIAL NO. 042

TEST FORMAL QUALIFICATION

SPECIFICATION 1T02861B PARAGRAPH NO. 5 11

NOTIFICATION MADE TO: MR. E. ALTERMAN

DATE 4/1/66 BY R. URENE, VIA VERBAL

SPECIFICATION REQUIREMENTS:

AFTER COMPLETING TWO AXES OF TESTING, DIRECTIONS B AND C FIGURE 5 OF TCD 1T02861, A DISCREPANCY WAS NOTED BETWEEN AXIS DEFINITION FIGURE 5 AND AXIS DESCRIPTION PER PARAGRAPH 5.11.3

DESCRIPTION OF DEVIATION:

AXES DEFINITIONS PER FIGURE 5, TCD 1T02861 IN ERROR.

FIGURE 5: AXIS B - CORRECT. (SPECIMEN AXIS B)
FIGURE 5: AXIS A SHOULD BE SPECIMEN AXIS C
FIGURE 5: AXIS C SHOULD BE SPECIMEN AXIS A
FIGURE 5, AXIS C, RUN AT C LEVEL (INCORRECT).

SPECIMEN DISPOSITION CONTINUE TESTING

COMMENTS - RECOMMENDATIONS: RUN FIGURE 5, AXIS A AT C LEVEL. RERUN FIGURE 5, AXIS C AT MODIFIED A LEVEL.

DISTRIBUTION:
ORIGINAL: QUALITY CONTROL
(3) COPIES: CUSTOMER
1 COPY: JOB CONTROL
1 COPY USAFQAR
(All AF Contracts)
1 COPY: BRANCH 560
1 COPY:

TEST WITNESS: J. SCHULTZ / E. ALTERMAN TEST ENGINEER R. URENE
REPRESENTING DOUGLAS A/C BRANCH HEAD J. TORCHIN

ORIGINAL NOTICE OF DEVIATION SIGNED BY TEST WITNESS

NOTICE OF DEVIATION

WYLE JOB NO 32230
NOD NO. 5
PO NO. T&M 0301A
DATE 4/1/66

WYLE LABORATORIES • EL SEGUNDO, CALIF

TM-DSV4B-ENV-R5776
Page E-73

TO: DOUGLAS AIRCRAFT COMPANY

ATTN: MR. V. R. WHITE

PART NAME BELLOWS, PROPULSIVE FUEL VENT

PART NO. 1A87152-1 SERIAL NO. 042

TEST FORMAL QUALIFICATION

SPECIFICATION 1T02861B PARAGRAPH NO. 5.11

NOTIFICATION MADE TO: MR. ED ALTERMAN

DATE 4/1/66 BY R. URENE VIA VERBAL

SPECIFICATION REQUIREMENTS: FIGURE 5, AXIS A (FLIGHT AXIS) LEVELS

SINUSOIDAL		
5-44 CPS	-	0.04 IN. DA
44-250 CPS	-	4G PEAK
250-320 CPS	-	0.0013 IN. DA
320-2000 CPS	-	7.0G PEAK

120 SECONDS			
20-200 CPS	-	0.03 G^2/CPS	
200-280 CPS	-	22 DB/OCTAVE	
280-800 CPS	-	0.36 G^2/CPS	
800-1500 CPS	-	-12 DB/OCTAVE	
1500-2000 CPS	-	0.03 G^2/CPS	17.5 GRMS

600 SECONDS			
20-200 CPS	-	0.012 G^2/CPS	
200-280 CPS		22 DB/OCTAVE	
280-800 CPS		0.14 G^2/CPS	
800-1500 CPS		-12 DB/OCTAVE	
1500-2000 CPS		0.012 G^2/CPS	10.8 GRMS

SPECIMEN DISPOSITION CONTINUE TEST

COMMENTS - RECOMMENDATIONS

DISTRIBUTION:
ORIGINAL QUALITY CONTROL
3 COPIES CUSTOMER
1 COPY JOB CONTROL
1 COPY USAFQAR
(All AF Contracts)
1 COPY BRANCH 560
1 COPY:
WL 109A

TEST WITNESS ED ALTERMAN TEST ENGINEER R. URENE
REPRESENTING DOUGLAS A/C BRANCH HEAD J. TORCHIN

ORIGINAL NOTICE OF DEVIATION SIGNED BY TEST WITNESS

NOTICE OF DEVIATION

WYLE JOB NO	32230
NOD NO	5
PO NO	T&M 0301A
DATE	4/1/66

PAGE 2

WYLE LABORATORIES • EL SEGUNDO, CALIF

DESCRIPTION OF DEVIATION:

FIGURE 5 AXIS A (FLIGHT AXIS) RUN AT THE FOLLOWING LEVELS:

SINUSOIDAL	
5-44 CPS	0.04 IN. DA
44-2000 CPS	4.0G PEAK

120 SECONDS		
20-200 CPS	0.03 G^2/CPS	
200-280 CPS	+10 DB/OCTAVE	
280-800 CPS	0.090 G^2/CPS	
800-1500 CPS	-5.5 DB/OCTAVE	
1500-2000 CPS	0.03 G^2/CPS	10.3 GRMS

600 SECONDS		
20-200 CPS	0.012 G^2/CPS	
200-280 CPS	+10 DB/OCTAVE	
280-800 CPS	0.036 G^2/CPS	
800-1500 CPS	-5.5 DB/OCTAVE	
1500-2000 CPS	0.012 G^2/CPS	6.6 GRMS

NOTICE OF DEVIATION

WYLE JOB NO 32230
NOD NO 6
PO NO T&M 0301A
DATE 4/11/66

WYLE LABORATORIES • EL SEGUNDO, CALIF

TO: DOUGLAS AIRCRAFT COMPANY

ATTN: MR. V. R. WHITE

PART NAME BELLOWS, PROPULSIVE FUEL VENT

PART NO. 1A87152-1 SERIAL NO. 042

TEST FORMAL QUALIFICATION

SPECIFICATION 1T02861B PARAGRAPH NO. 5.9

NOTIFICATION MADE TO: ED ALTERMAN

DATE 4/11/66 BY A. SNOW VIA VERBAL

SPECIFICATION REQUIREMENTS:

IMMERSE THE ENTIRE TEST SPECIMEN IN WATER TO PERFORM THE LEAKAGE TEST.

DESCRIPTION OF DEVIATION:

THE TEST SPECIMEN WAS ENCAPSULATED IN POLYETHYLENE SHEETING WHICH WAS FILLED WITH WATER. THE LEAKAGE TEST WAS THEN PERFORMED.

SPECIMEN DISPOSITION CONTINUE TEST

COMMENTS · RECOMMENDATIONS:

DISTRIBUTION:
ORIGINAL: QUALITY CONTROL
(3) COPIES: CUSTOMER
1 COPY: JOB CONTROL
1 COPY USAFQAR
(All AF Contracts)
1 COPY: BRANCH 560
1 COPY:
WL 109A

TEST WITNESS J. SCHULTZ / E. ALTERMAN TEST ENGINEER R. URENE
REPRESENTING DOUGLAS A/C BRANCH HEAD J. TORCHIN

ORIGINAL NOTICE OF DEVIATION SIGNED BY TEST WITNESS

FIXTURE CERTIFICATION FOR VIBRATION TESTING

SPECIMEN DESCRIPTION Bellows, Propulsive Fuel Vent DATE 4 April 66

SPECIMEN PART NUMBER 1A87152-1, S/N 042

AXIS Specimen (C) (Thrust)

REMARKS

APPROVAL FOR SPECIMEN ORIENTATION AND ALIGNMENT: DATE

Ed Allerman 4/4/66 — 4-4-66

Keith Elliott — 4-4-66

John R. Schulz — 4/4/66

APPROVAL FOR ACCELEROMETER LOCATION: DATE

Ed Allerman 4/4/66 — 4-4-66

Keith Elliott — 4-4-66

John R. Schulz — 4/4/66

APPROVAL FOR CONTROL METHOD FOR QUALIFICATION TEST: DATE

Please Capital
Ed Allerman 4/4/66 — 4-4-66

Keith Elliott — 4-4-66

John R. Schulz — 4/4/66

REMARKS:

FIXTURE CERTIFICATION FOR VIBRATION TESTING

SPECIMEN DESCRIPTION BELLOWS, PROPULSIVE FUEL VENT DATE 26 MAR 1966

SPECIMEN PART NUMBER 1A87152-1, S/N. 042

AXIS TANG. (B)

REMARKS

APPROVAL FOR SPECIMEN ORIENTATION AND ALIGNMENT:	DATE
Ed Alterman	3-26-66
[illegible]	3-26-66
JRB	3-26-66

APPROVAL FOR ACCELEROMETER LOCATION:	DATE
Ed Alterman	3-26-66
[illegible]	3-26-66
JRB	3-26-66

APPROVAL FOR CONTROL METHOD FOR QUALIFICATION TEST: PHASE CONTROL	DATE
Ed Alterman	3-26-66
[illegible]	3-26-66

REMARKS:

FIXTURE CERTIFICATION FOR VIBRATION TESTING

SPECIMEN DESCRIPTION BELLOWS, PROPULSIVE, FUEL VENT DATE 3-29-66

SPECIMEN PART NUMBER 1A87152-1, S/N 042

AXIS (C) RADIAL

REMARKS Should have been identified as VADIAL (A) Axis - See NOTICE OF DEVIATION Number 4

Jewood (4/27/66)

APPROVAL FOR SPECIMEN ORIENTATION AND ALIGNMENT: DATE

Ed Alfermann 3-29-66

3-29-66

Keith Elliott 3-29-66

APPROVAL FOR ACCELEROMETER LOCATION: DATE

Ed Alfermann 3-29-66

3-29-66

Keith Elliott 3-29-66

APPROVAL FOR CONTROL METHOD FOR QUALIFICATION TEST: DATE

Phase Control

Keith Elliott 3-29-66

Ed Alfermann 3-29-66

REMARKS:

NOTE

Omission of page No. 79 from the sequence of pages in Wyle Laboratories Test Report No. 32230, Revision A, is the result of a typographical error. The test report is complete as presented herein.

FIXTURE CERTIFICATION FOR VIBRATION TESTING

SPECIMEN DESCRIPTION Bellows Propulsive Fuel vent DATE 4-6-66

SPECIMEN PART NUMBER 1A87152-1, S/N 042

AXIS Radial (A)

REMARKS Rerun of Radial axis at higher level

APPROVAL FOR SPECIMEN ORIENTATION AND ALIGNMENT:	DATE
Ed Allerman	4-6-66
Keith Elliott	4-6-66
[illegible]	4-6-66

APPROVAL FOR ACCELEROMETER LOCATION:	DATE
Ed Allerman	4-6-66
Keith Elliott	4-6-66
[illegible]	4-6-66

APPROVAL FOR CONTROL METHOD FOR QUALIFICATION TEST:	DATE
PHASE CONTROL Ed Allerman	4-6-66
Keith Elliott	4-6-66
[illegible]	4-6-66

REMARKS:

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS PROPELLANT FUEL VENT

Part Number: 1A 87152-1

Test Procedure Drawing No: 7T02861 Change Letter: ~~E~~ B

Manufacturer's S/N: 042 Test Plan Line Item: FP-H-17

Test Laboratory: WYLE Location: EL SEGUNDO

Douglas Test Representative: [signature] Date: 12-9-65

Test Witness: T.S. Herron [signature]
Douglas Q.C. Customer Q.C.

Pre-test Inspection per paragraph: 5.7

Test Specimen No: 1

Test Start (Date, Time): 09.30, 12-9-65

Test Completed (Date, Time): 10:05, 12-9-65

Test Specimen Weight: *

Accept: ____ Reject: ____

Comments:

* UNABLE TO WEIGH SPECIMEN DUE TO SPECIMEN BEING WELDED TO FIXTURE

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: Bellows, Propulsive Fuel Vent

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: Wyle Labs Location: Norco, CALIF

Douglas Test Representative: John R. Schulz Date: 1-6-66

Test Witness: [signature] Douglas Q.C. _____ Customer Q.C.

Proof Pressure Test (Internal) Per Paragraph: 5.8 - After Repeat Cycle Test (Pressu

Test Specimen No: 1 _____ Complete Test Data Sheets _____ Total

Test Start (Date, Time): 1-4-66 0900

Test Completed (Date, Time): 1-4-66 0915

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
51	81	29.374

Gaseous Helium

Test Parameter	Units	Required	Actual
Temperature	°F	70(±25)	51
Pressure	psig	46(±2)	44
Time at Pressure	minutes	5	5

Accept: _____ Reject: _____

Comment: NO EVIDENCE OF STRUCTURAL FAILURE OR PERMANENT DISTORTION

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE LABS Location: NORCO, CALIF.

Douglas Test Representative: John R. Schulz Date: 1-6-66

Test Witness: [19] Douglas Q.C. [illegible] Customer Q.C.

Proof Pressure Test (Internal) Per Paragraph: 5.8 - After Repeat Cycle Test (Deflection)

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 1415 1-5-66

Test Completed (Date, Time): 1420 - 1-5-66

Ambient Room Conditions:	Temperature °F	RH %	Atm. Press. In. Hg abs.
	67	66	29.429

Gaseous Helium

Test Parameter	Units	Required	Actual
Temperature	°F	70(±25)	67
Pressure	psig	46(±2)	44.5
Time at Pressure	minutes	5	5

Accept: Reject:

Comment: Bellows has permanent set
Reference FARR A162586

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO, CALIF.

Douglas Test Representative: John R. Schultz Date: 4/11/66

Test Witness: T. Sutherland for J. Olsen
Douglas Q.C. Customer Q.C.

Proof Pressure Test (Internal) Per Paragraph: 5.8 - After Vibration and Shock

Test Specimen No: 1 Data Sheets ____ Complete Test ____ Total

Test Start (Date, Time): 4-11-66 1340

Test Completed (Date, Time): 4-11-66 1345

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
67	65	29.82

Gaseous Helium

Test Parameter	Units	Required	Actual
Temperature	°F	70(±25)	67
Pressure	psig	46(±2)	46
Time at Pressure	minutes	5	5

Accept: ____ Reject: ____

Comment: ____

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A87152-1

Test Procedure Drawing No: IT02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL-SEGUNDO

Douglas Test Representative: John R. Schultz Date: 12/10/65

Test Witness: J421 Douglas Q.C. Customer Q.C.

Leakage Test Per Paragraph: 5.9 - Initial

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 1130 AM, 12-10-65

Test Completed (Date; Time): 1141 AM. 12-10-65

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
68 °F	58 %	29.74 in. HG

Leakage

Test Parameter	Units	Required	Actual
Temperature	°F	70(±25)	68 °F
Pressure	psig	31(±2)	31 PSIG
Leakage	max. SCCM	0.0	NONE

Accept: ✓ Reject:

Comment:

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE LABS Location: NORCO, CALIF.

Douglas Test Representative: John R. Schulz Date: 1-6-66.

Test Witness: JTO Douglas Q.C. Customer Q.C.

Leakage Test Per Paragraph: 5.9 - After Repeat Cycle Test (Pressure)

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 1-4-66 0930

Test Completed (Date; Time): 1-4-66 0945

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
53	78	29.369

Leakage

Test Parameter	Units	Required	Actual
Temperature	°F	70(±25)	53
Pressure	psig	31(±2)	29.5
Leakage	max. SCCM	0.0	0

Accept: Reject:

Comment:

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A 87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: Wyle Labs. Location: Norco, Calif

Douglas Test Representative: John R. Schulz Date: 1-6-66

Test Witness: M G Warner 1730 Douglas Q.C. Customer Q.C.

Leakage Test Per Paragraph: 5.9 - After Repeat Cycle Test (Deflection)

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 1-5-66 1420

Test Completed (Date; Time): 1-5-66 1430

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
67	66	29.429

Leakage

Test Parameter	Units	Required	Actual
Temperature	°F	70(±25)	67
Pressure	psig	31(±2)	30.5
Leakage	max. SCCM	0.0	0

Accept: Reject:

Comment:

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A87152-1

Test Procedure Drawing No: 1TO 2861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO, CALIF.

Douglas Test Representative: John R. Schultz Date: 4/11/66

Test Witness: T.B. Herron for J. Olson
Douglas Q.C. Customer Q.C.

Leakage Test Per Paragraph: 5.9 - After Vibration and Shock

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 4-11-66 1350

Test Completed (Date; Time): 4-11-66 1355

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
67	65	29.82

Leakage

Test Parameter	Units	Required	Actual
Temperature	°F	70(±25)	67
Pressure	psig	31(±2)	31
Leakage	max. SCCM	0.0	Ø

Accept: Reject:

Comment:

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861 Change Letter: A

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE LABS. Location: EL SEGUNDO, CALIF.

Douglas Test Representative: Ed Altermann Date: 12-29-65

Test Witness: J421 Douglas Q.C. Customer Q.C.

Flow Test Per Paragraph: 5.10

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 12/16/65 1000

Test Completed (Date, Time): 12/16/65 1800

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
54	53	29.63

Specimen Flow (GROSS)

	Temperature °F	Inlet Pressure psig	Press. Differential psid	HELIUM Flow lb/sec
Required	70(±25)	31(±2) max.	1.5 max.	1.5 min.
Actual * 1	70	31	1.21	1.5
(Minimum Increments 3 Required) 2	FOR ADDITIONAL RESULTS SEE ATTACHED			
3	CURVE SHOWING CORRECTED RESULTS OF			
4	ALL RUNS.			
5				

* RESULTS OBTAINED FROM CURVE AT SPECIFIED CONDITIONS.

Test Plan Line Item: FQ-H-17

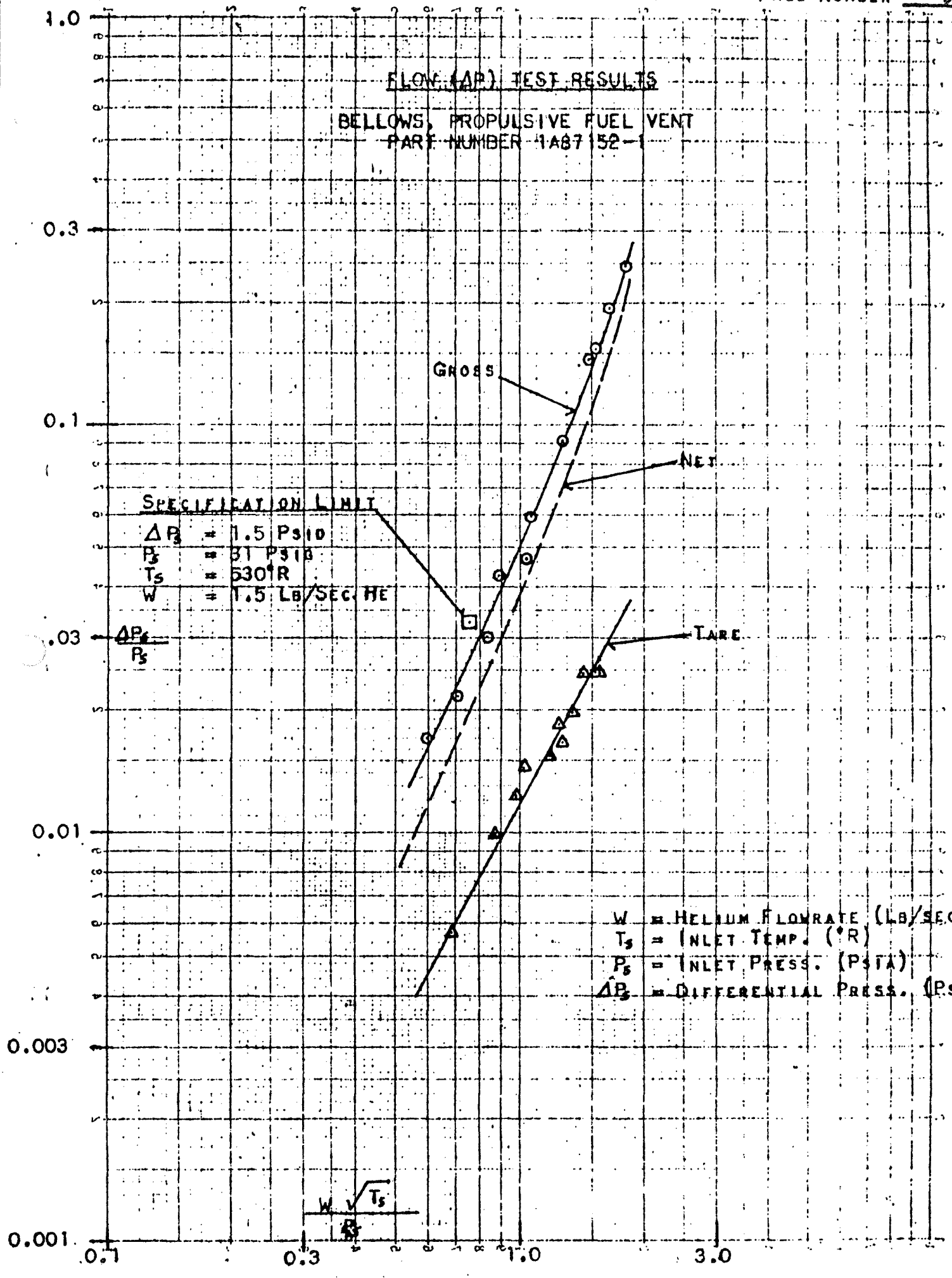
Flow Test Per Paragraph: 5.10

Tare Pressure Drop

	Temperature °F	Inlet Pressure psig	Press. Differential psid	HELIUM Flow lb/sec
Required	70(±25)	31(±2) max.		
Actual * 1	70	31	0.31	1.5
2	FOR OTHER CONDITIONS		SEE ATTACHED CURVE	
3				
4				
5				
* RESULTS SELECTED FROM CURVE AT SPECIFIED CONDITION.				

Accept: X Reject:

Comment: SUBTRACTING THE TARE FROM THE GROSS RESULTS IN A NET ΔP OF 0.90 psid AT THE SPECIFIED CONDITIONS. MAX. ALLOWABLE ΔP IS 1.5 psid.


FLOW (ΔP) TEST RESULTS
BELLOWS, PROPULSIVE FUEL VENT
PART NUMBER 1A87152-1
GROSS
NET
TARE
SPECIFICATION LIMIT
ΔPs = 1.5 PSID
Ps = 31 PSIA
Ts = 530°R
W = 1.5 LB/SEC. HE
ΔPs/Ps
W √Ts / Ps
W = HELIUM FLOWRATE (LB/SEC.)
Ts = INLET TEMP. (°R)
Ps = INLET PRESS. (PSIA)
ΔPs = DIFFERENTIAL PRESS. (PSID
1.0
0.3
0.1
.03
0.01
0.003
0.001
0.1
0.3
1.0
3.0

WYLE LABORATORIES — DATA SHEET

TEST PURPOSE: QUALIFICATION TEST

TEST: FLOW (ΔP) TEST, GROSS

SPEC: 1T02861 REV B

PARA: 5.10

REMARKS:

COMP.: DAC

TESTED BY: [illegible]

BARO. 29.63 "HG., LAB TEMP. 54 °F

14:55 DATE: 12/16/65

PAGE OF PAGE

JOB NO: 32230

P/N: 1A87152-1

S/N: 42

UNIT: 1

DATA POINT	GROSS RUN NO.	SPECIMEN INLET PRESS P_s 1 (psig)	SPECIMEN INLET TEMP T_s 2 (MV)	SPECIMEN DIFF PRESS. ΔP_s 3 (psid)	ORIFICE INLET PRESS P_o 4 (psig)	ORIFICE INLET TEMP T_o 5 (MV)	ORIFICE DIFF PRESS ΔP_o 6 (psid)	P_s 7 (Psia)	T_s 8 (°R)	$\sqrt{T_s}$ 9 (°R^1/2)	W HELIUM 10 (LB/SEC)	PLOT $\frac{W\sqrt{T_s}}{P_s}$ 11	PLOT $\frac{\Delta P_s}{P_s}$ 12	13	14	REMA
1	2	24.2	0.92	9.6	33.2	0.80	1.26	38.75	534	23.108	3.027	1.805	.2477			
2	2	27.5	0.75	8.2	36.0	0.68	1.20	42.05	526	22.935	3.059	1.668	.1950			
3	2	31.5	0.52	7.0	39.5	0.50	1.15	46.05	516	22.716	3.123	1.541	.1520			
4	3	12.3	0.88	3.95	17.5	0.80	0.61	26.85	532	23.065	1.736	1.491	.1471			
5	3	18.0	0.78	2.95	22.5	0.79	0.58	32.55	528	22.978	1.821	1.285	.09063			
6	3	24.1	0.52	2.30	28.0	0.54	0.49	38.65	516	22.716	1.814	1.066	.05951			
7	3	31.5	0.21	1.95	34.3	0.40	0.43	46.05	502	22.405	1.834	.8923	.04235			
8	4	13.0	0.85	1.30	15.2	0.70	0.33	27.55	531	23.043	1.243	1.040	.04719			
9	4	20.4	0.88	1.05	22.0	0.75	0.28	34.95	532	23.065	1.267	.8361	.03004			
10	4	26.8	0.80	0.90	28.0	0.65	0.24	41.35	529	23.000	1.271	.7070	.02177			
11	4	32.5	0.70	0.80	33.2	0.60	0.20	47.05	524	22.891	1.233	.5999	.01700			
12																
13	SPEC. LIMIT	31	—	1.5	—	—	—	45.70	530	23.022	1.50	.7556	.0328			
14																
15																
16																
17																
18																
19																
20																

APPENDIX A

WYLE LABORATORIES — DATA SHEET

TEST PURPOSE: QUALIFICATION TEST — PAGE OF PAGES

TEST: FLOW (ΔP) TEST, TARE — COMP.: DAC — JOB NO: 32230

SPEC: 1T02861 REV B — TESTED BY: W. Fry — P/N: 1A87152-1

PARA: 5.10 — BARO. 29.63 "Hg., LAB TEMP. 54 °F — S/N: 42

REMARKS: — 14.55 DATE: 12/16/65 — UNIT: 1

DATA POINT	TARE RUN NO.	SPECIMEN INLET PRESS P_s 1 (Psig)	SPECIMEN INLET TEMP T_s 2 (MV)	SPECIMEN DIFF PRESS ΔP_s 3 (Psid)	ORIFICE INLET PRESS P_o 4 (Psig)	ORIFICE INLET TEMP T_o 5 (MV)	ORIFICE DIFF. PRESS. ΔP_o 6 (Psid)	P_s 7 (Psia)	T_s 8 (°R)	$\sqrt{T_s}$ 9 (°R$^{1/2}$)	W HELIUM 10 (LB/SEC)	PLOT $\frac{W\sqrt{T_s}}{P_s}$ 11	PLOT $\frac{\Delta P_s}{P_s}$ 12	13	14	REMARKS
1	1	15.2	0.90	0.73	20.3	0.70	0.75	29.75	533	23.087	2.009	1.559	.02454			
2	1	22.0	0.85	0.61	26.5	0.68	0.64	36.55	531	23.043	2.020	1.274	.01669			
3	3	10.0	0.90	0.30	11.2	0.85	0.27	24.55	533	23.087	1.041	.9790	.01222			
4	3	16.0	0.90	0.44	18.0	0.80	0.36	30.55	533	23.087	1.349	1.019	.01440			
5	3	22.0	0.82	0.36	23.5	0.80	0.32	36.55	530	23.022	1.376	.8667	.009849			
6	3	32.8	0.72	0.27	33.5	0.80	0.27	47.35	525	22.913	1.421	.6876	.005702			
7	4	20.0	0.97	0.86	24.8	0.80	0.85	34.55	536	23.152	2.264	1.517	.02489			
8	4	25.0	0.80	0.78	29.0	0.70	0.79	39.55	529	23.000	2.309	1.343	.01972			
9	4	30.0	0.50	0.68	33.5	0.52	0.72	44.55	515	22.694	2.335	1.189	.01526			
10	5	24.8	0.96	0.97	29.0	0.70	0.86	39.35	536	23.152	2.402	1.413	.02465			
11	5	31.5	0.62	0.84	35.0	0.50	0.80	46.05	521	22.825	2.499	1.239	.01824			
12																
13																
14																
15																
16																
17																
18																
19																
20																

TEST PURPOSE: QUALIFICATION
JOB NO: 32230 COMPANY: IAC
P/N: 1A 152-1 TEST: GROSS
S/N: 42 SPEC: 1T02861, Rev B
UNIT: 1 PARA: 5.10
DATE: 12/16/65 TESTED BY: [illegible]
REMARKS:

L = [illegible] 29.63 "Hg Abs.
03 ~ OR[illegible]CE [illegible]
D ~ OR[illegible]CE DIA: 500
COMPUTED BY: Vanderberg
II = 0.49116 PSI/"Hg
III = I x II = 14.55 PSIA
IV = 460.0

VI = 0.0[illegible]13 PSI/"H_2O
VII = [illegible] = 22.[illegible]
I = [illegible] = 0.3729 ([illegible])
[illegible] = 0.0[illegible] "Hg/"H_2O
A = [illegible] 33.[illegible]31 in^2
G = 1.0 (AIR)

MASS FLOW SHEET

FUNCTION	EST. WEIGHT FLOW HELIUM	ORIFICE PRESSURE		ORIFICE TEMPERATURE		ORIFICE ΔP		$\rho = \frac{0.3729}{T}$	ρΔP	$(\rho\Delta P)^{1/2}$	GRAPHS Re	K	X	Y	F	$W = .665 AK(\rho\Delta P)^{1/2}$			W
OPER.			② + III		④ + IV		⑥ x VI	③ ÷ ⑤	⑦ x ⑧	⑨ ½			⑦/③			⑩ x VII	⑪ x ⑫	⑪ x ⑬	⑭ x ⑮
UNITS	LB/SEC	PSIG	PSIA	°F	°R	INCHES WATER	PSI	LB/FT³			x10⁶								LB/SEC
COL.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1	3.05	33.2	47.75	69	529		1.26	.03366	.04241	.2059	3.5	.6680	.026	.9927	1.000	22.1663	22.004	4.531	3.027
2	3.09	36.0	50.55	63	523		1.20	.03604	.04325	.2080	3.6	.6680	.024	.9933			22.018	4.580	3.059
3	3.10	39.5	54.05	55	515		1.15	.03914	.04501	.2122	3.6	.6680	.021	.9940			22.033	4.675	3.123
4	1.75	17.5	32.05	69	529		0.61	.02259	.01378	.1174	2.0	.6705	.019	.9947			22.049	2.589	1.736
5	1.84	22.5	37.05	68	528		0.58	.02617	.01518	.1232	2.2	.6698	.016	.9955			22.067	2.719	1.821
6	1.82	28.0	42.55	57	517		0.49	.03069	.01504	.1226	2.2	.6698	.012	.9967			22.093	2.709	1.814
7	1.80	34.3	48.85	51	511		0.43	.03565	.01533	.1238	2.1	.6702	.009	.9975			22.111	2.737	1.834
8	1.23	15.2	29.75	64	524		0.33	.02117	.006986	.08358	1.42	.6728	.011	.9970			22.100	1.847	1.243
9	1.27	22.0	36.55	66	526		0.28	.02591	.007255	.08518	1.45	.6725	.008	.9978			22.118	1.884	1.267
10	1.27	28.0	42.55	62	522		0.24	.03040	.007296	.08542	1.45	.6725	.006	.9983			22.129	1.890	1.271
11	1.23	33.2	47.75	60	520		0.20	.03424	.006848	.08275	1.42	.6728	.004	.9988	1.000	22.1163	22.140	1.832	1.233

APPENDIX A

TEST PURPOSE: [illegible]
JOB NO: [illegible]
P/N: [illegible]
S/N: 42
UNIT: 1
DATE: [illegible]
REMARKS:

COMPANY: [illegible]
TEST: TARE
SPEC: [illegible] Rev B
PARA: 5.0
TESTED BY: [illegible]

[illegible]
OD ~ ORIFICE [illegible]
D ~ O[illegible] DIA. 6.500
COMPUTED BY: Vanderberg
II = 0.49116 PSI/"Hg
III = I x II = 14.55 PSIA
IV = 460.0

[illegible]
[illegible] = 0.37[illegible]
[illegible] = 0.9[illegible] "Hg/"[illegible]
A = [illegible] / 33.1831 [illegible]
G = 1.0[illegible] (AIR)

MASS FLOW SHEET

FUNCTION →	EST. WEIGHT FLOW HELIUM	ORIFICE PRESSURE		ORIFICE TEMPERATURE		ORIFICE ΔP		$\rho = \frac{0.3[illegible]}{T}$	$\rho\Delta P$	$(\rho\Delta P)^{1/2}$	GRAPHS Re	K	X	Y	F	W = .[illegible]			W
											Re [illegible]	Re vs K		X vs Y	T vs E				
OPER. →			② + III		④ + IV		⑥ x VI	③ [illegible] / ⑤	① x ⑧	⑤ ½			① / ③			⑬ x VII	⑨ x ⑩	⑪ x ⑩	⑨ x ⑩
UNITS →	LB/SEC	PSIG	PSIA	°F	°R	[illegible]	PSI	LB/FT³			x10⁶								LB/SEC
COLUMN →	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	⑲
1	2.03	20.3	34.85	64	524		0.75	.02480	.01860	.1364	2.4	.6685	.022	.9938	1.000	22.1663	22.029	3.005	2.009
2	2.03	26.5	41.05	63	523		0.64	.02927	.01873	.1369	2.4	.6685	.016	.9955			22.067	3.021	2.020
3	1.05	11.2	25.75	71	531		0.27	.01808	.004882	.06987	1.2	.6740	.010	.9973			22.106	1.545	1.041
4	1.36	18.0	32.55	69	529		0.36	.02294	.008258	.09087	1.58	.6718	.011	.9970			22.100	2.008	1.349
5	1.38	23.5	38.05	69	529		0.32	.02682	.008582	.09264	1.6	.6716	.008	.9978			22.118	2.049	1.376
6	1.43	33.5	48.05	69	529		0.27	.03387	.009145	.09563	1.65	.6715	.006	.9983			22.129	2.116	1.421
7	2.29	24.8	39.35	69	529		0.85	.02774	.02358	.1536	2.7	.6690	.022	.9938			22.029	3.384	2.264
8	2.32	29.0	43.55	64	524		0.79	.03099	.02448	.1565	2.7	.6690	.018	.9950			22.055	3.452	2.309
9	2.32	33.5	48.05	56	516		0.72	.03472	.02500	.1581	2.7	.6690	.015	.9958			22.073	3.490	2.335
10	2.42	29.0	43.55	64	524		0.86	.03099	.02665	.1629	2.75	.6688	.020	.9944			22.042	3.591	2.402
11	2.50	35.0	49.55	55	515		0.80	.03588	.02870	.1694	2.85	.6686	.016	.9955	1.000	22.1663	22.067	3.738	2.499
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			

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APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT.

Part Number: 1A87152-1

Test Procedure Drawing No: 1TO 2861B Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO.

Douglas Test Representative: [signature] Date: 3-26-66

Test Witness: [signature] 3-26-66 Douglas Q.C. [signature] Customer Q.C.

Vibration Test Per Paragraph: 5.11.4

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 26 MARCH 1966 15:00

Test Completed (Date, Time): 26 MARCH 1966 16:15

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
70.0	70	29.78

Axis Orientation: B

Sinusoidal Sweep Test

	Temperature °F	Sweep Rate oct/min	Frequency cps	Amplitude
Required	70(±25)	1.0	5 to 44	0.04 inch D.A.
Actual	70	1.0	5 - 44	0.04 INCH DA.
Required	70(±25)	1.0	44 to ~~250~~ 2000	4.0 G's Peak
Actual	70	1.0	44-2000	4.0 G's PEAK.
Required	70(±25)	1.0	250 to 320	~~0.0013 inch D.A.~~
Actual				
Required	70(±25)	~~1.0~~	320 to 2000	7.0 G's Peak
Actual				

Accept: Reject:

Comment: Directions B & C specification requirements, List 4.0 G PK From 44 to 2000 CPS. g.f.

FORMAL QUALIFICATION TEST DATA SHEET

Vibration Test Per Paragraph: 5.11.5 Test Plan Line Item: FQ-H-17

Random Vibration Test

	Direction	Frequency cps	Amplitude	Duration Seconds	Temp. °F
Required	A	20 to 200	0.03 G^2/cps	120	70(±25)
Actual					
Required	A	20 to 200	0.012 G^2/cps	600	70(±25)
Actual					
Required	A	200 to 280	22 db/octave	720	70(±25)
Actual					
Required	A	280 to 800	0.36 G^2/cps	120	70(±25)
Actual					
Required	A	280 to 800	0.14 G^2/cps	600	70(±25)
Actual					
Required	A	800 to 1500	-12 db/octave	720	70(±25)
Actual					
Required	A	1500 to 2000	0.03 G^2/cps	120	70(±25)
Actual					
Required	A	1500 to 2000	0.012 G^2/cps	600	70(±25)
Actual					
Required	B and ¢	20 to 200	0.03 G^2/cps	120	70(±25)
Actual	B	20-200	0.03	120	70
Required	B and ¢	20 to 200	0.012 G^2/cps	600	70(±25)
Actual	B	20 TO 200	0.012	600	70
Required	B and ¢	200 to 280	10 db/octave	720	70(±25)
Actual	B	200 TO 280	10 db/oct	720	70
Required	B and ¢	280 to 800	0.090 G^2/cps	120	70(±25)
Actual	B	280 TO 800	0.090	120	70

FORMAL QUALIFICATION TEST DATA SHEET

Vibration Test Per Paragraph: 5.11.5 Test Plan Line Item: FQ-H-17

	Direction	Frequency cps	Amplitude	Duration Seconds	Temp. °F
Required	B and ~~C~~	800 to 1500	-5.5 db/octave	720	70(±25)
Actual	B	800 - 1500	-5.5 db/oct.	720	70
Required	B and ~~C~~	1500 to 2000	$0.03G^2$/cps	120	70(±25)
Actual	B	1500 - 2000	0.03	120	70
Required	B and ~~C~~	1500 to 2000	$0.012\ G^2$/cps	600	70(±25)
Actual:	B	1500 - 2000	0.012	600	70

Accept: Reject:

Comments: Table above does not include the following Band

	Direction	Freq. (cps)	Amplitude	Duration	Temp.
Required	B	280 - 800	0.036 g²/cps	600 Sec.	70±25
Actual	B	280 - 800	0.036 g²/cps g.T.	600 Sec.	70°

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: Bellows, Propulsive Fuel vent

Part Number: 1A87152-1

Test Procedure Drawing No: 1TO 28618 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ H17

Test Laboratory: WYLE Location: El Segundo

Douglas Test Representative: Ed Allum Date: 3-26-66

Test Witness: J. Olsen 3/26/66 (24)
Douglas Q.C. Customer Q.C.

Vibration Test per paragraph: 5.11.5

Test Specimen No: 1

Test Start (Date, Time): 3-26-66/1757

Test Completed (Date, Time): 3-26-66/1929

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
70	70	29.78

Test Parameter	Data Record Number		
	Magnetic Tape	Oscillograph	X-Y Plotter
Sinusoidal Axes			
A			
B			
C			
Random Axes			
~~A~~			
B	II 11, 12, 13, 14, 15		
~~C~~			

Accept: _____ Reject: _____

DYNAMICS SECTION
VIBRATION TEST DATA SHEET
SINUSOIDAL

JOB NO. 322[illegible]
SHEET ____ OF ____
I D NO. ____

DATE	TIME	AXIS	TEMP (°F)	SINUSOIDAL FREQ. (CPS)	SINUSOIDAL DISP. ("DA)	SINUSOIDAL ACCEL (±G)	TEST TIME (MIN)	COMMENTS	NAME
		B	AMB	5-44	0.04	—		TEST REQUIREMENT	
				44-2000	—	4.0		SWEEP 5-2000-5 AT 1 OCT/MIN.	
26MAR	15:00	B	AMB	AS ABOVE		LEVELS	6'-0"	STOP AT 320 CPS ON UPSWEEP TO CHECK SYSTEM M Howett	
26MAR	15:50	B	AMB	AS ABOVE			3'-0"	STOP AT 2000 CPS TO CHECK #11 ACCEL & DAC REPS. CHECK DUCT M Howett	
26MAR	16:15	B	AMB	AS ABOVE			8'-32"	RUN COMPLETED M Howett	

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SIGNED: [signature]

DYNAMICS SECTION
VIBRATION TEST DATA SHEET
RANDOM B AXIS

JOB No. 32230
SHEET ____ OF ____
I D No. ____

DATE	TIME	AXIS	TEMP (F)	RANDOM FREQ. (CPS)	RANDOM PSD (G^2/CPS)	RANDOM ACCEL (GRMS)	TEST TIME (MIN)	COMMENTS	NAME
								TEST REQUIREMENT	
7-26-66	1757	B	Amb.	20-200	.012		0'30"	START Full power Low Level run To	
				200-280	+10db/oct	6.6		cut Tapes	
				280-800	.036				
				800-1500	-5.5db/oct				
	1758			1500-2000	.012			STOP To Plot tapes	
								D. E. La Roche	
	1839	B	Amb.	Above	Levels		8'15"	START Full Power Low Level run	
	1848							STOP To check system	
								D. E. La Roche	
	1849	B	Amb.	Above	Levels		1'15"	Resume Full Power Low Level RUN	
	1851							complete Low Level RUN	
	1855	B	Amb.	20-200	.03	10.3	0'25"	START Full power High Level run To	
				200-280	+10db/oct			cut Tapes	
				280-800	.090				
				800-1500	-5.5db/oct.				
	1856			1500-2000	.03			STOPPed To Plot Tapes	
								D. E. La Roche	

SIGNED: R. Allen

DYNAMICS SECTION
VIBRATION TEST DATA SHEET
RANDOM B AXIS

JOB NO. 32230
SHEET ____ OF ____
I D NO. ____

DATE	TIME	AXIS	TEMP (F)	RANDOM FREQ. (CPS)	RANDOM PSD (G^2/CPS)	RANDOM ACCEL (GRMS)	TEST TIME (MIN)	COMMENTS	NAME
								TEST REQUIREMENT	
3-26-66	1927	B	Amb.	20-200	.03	10.3	1'35"	Resume Full Power high Level run	
				200-280	+10db/oct				
				280-800	.090				
				800-1500	-5.5db/oct				
	1929			1500-2000	.03			completed high Level run D.E. La Roche	

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SIGNED: R. Breen

W-035

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT.

Part Number: 1A87152-1.

Test Procedure Drawing No: ITO 2861-B Change Letter: B.

Manufacturer's S/N: '042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO.

Douglas Test Representative: Ed Allen Date: 3-26-66

Test Witness: T.S. Herron for J. Olsax
Douglas Q.C. Customer Q.C.

Shock Test Per Paragraph: 5.12

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 26MAR1966 - 21:00

Test Completed (Date, Time): 26MAR1966 - 22:41.

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
70	70	29.78

Axis Orientation: B.

Shock Test:

Test Parameter	Units	Required		Actual #1	Actual #2	Actual #3
Temperature	°F	70(±25)		70	70	70
Amplitude (1/2 Sine Wave Pulse)	G's	20 Peak	249	20	20	21
			246	18	19	19
Time	milliseconds	10(±2)	249	9	9	9
			246	9	10	10

Accept: Reject:

Comments:

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: Bellows, Propulsive Fuel Vent

Part Number: 1A 87152-1

Test Procedure Drawing No: 1 To 2861B Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: El Segundo

Douglas Test Representative: [signature] Date: 3-29-66

Test Witness: 1819 3-26-66 [signature]
Douglas Q.C. Customer Q.C.

Vibration Test Per Paragraph: 5.11.4

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 3-29-66 2141

Test Completed (Date, Time): 3-29-66 2235

Ambient Room Conditions:	Temperature °F	RH %	Atm. Press. In. Hg abs.
	56	77	29.79

Axis Orientation: C (* 'A' ACTUAL)

Sinusoidal Sweep Test

	Temperature °F	Sweep Rate oct/min	Frequency cps	Amplitude
Required	70(±25)	1.0	5 to 44	0.04 inch D.A.
Actual	56	1.0	5-44	0.04
Required	70(±25)	1.0	44 to ~~250~~ 2000	4.0 G's Peak
Actual	56	1.0	44 To 2000	4.0
Required	70(±25)	1.0	250 to 320	~~0.0013 inch D.A.~~
Actual				
Required	70(±25)	~~1.0~~	320 to 2000	7.0 G's Peak
Actual				

Accept: Reject:

Comment: * AXIS ORIENTATION ON DATA sheet IS IDENTIFIED AS C BUT ACTUAL ORIENTATION IS "A". TEST WAS repeated AT A HIGHER LEVEL AS Required for AXIS "A"

Sheet 1 of 3

SEE NOD NO. 4

DYNAMICS SECT[illegible]
VIBRATION TEST DATA SHEET
Sinusoidal cycle C Axis

JOB No. 32230
SHEET ____ OF ____
I D No. ____

DATE	TIME	AXIS	TEMP (°F)	SINUSOIDAL FREQ. (CPS)	SINUSOIDAL DISP. ("DA)	SINUSOIDAL ACCEL (±G)	TEST TIME (MIN)	COMMENTS	NAME
		*						TEST REQUIREMENT 5cps To 2000 cps To 5 cps	
3-29-66	2141	C	Amb.	5-44	0.04	—	9'	at 1 oct/min.	
				44-2000	—	4		Start vib. sweep	
	2150							Stop To check system at 2000 cps	
								D. E. La Roche	
	2216	C	Amb	Above	Levels		0'45"	Resume sine sweep	
	2217							Stopped To check system @ 1180 cps	
								D. E. La Roche	
	2227	C	Amb.	Above	Levels		8	Resume down sweep	
	2235							completed sinusoidal cycle	
								D. E. La Roche	
4-4	1355	C**	Amb	Above	Levels			Completed Cycle from 5-2000-5	
	1312						17'10	with no apparent damage.	
								R. Breen	

* See Notice of Deviation Number 4 - Actually VADIAL (A) AXIS

** Thrust (C) AXIS

R. Breen

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W589

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: Bellows propulsive Fuel vent

Part Number: 148 7152-1

Test Procedure Drawing No: 1T02861-B Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: F8H17

Test Laboratory: wyle Location: El Segundo

Douglas Test Representative: [signature] Date: 3-26-66

Test Witness: [signature] 3/28/66 [signature]
Douglas Q.C. Customer Q.C.

Vibration Test per paragraph: 5.11.5

Test Specimen No: 1

Test Start (Date, Time): 3-29-66 2305

Test Completed (Date, Time): 3-30-66 0043

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
56	77	29.8

Test Parameter	Data Record Number		
	Magnetic Tape	Oscillograph	X-Y Plotter
Sinusoidal Axes			
A			
B			
C			
Random Axes			
A			
B			
C	#25, 26, 27, 28		

Accept: _____ Reject: _____

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Vibration Test Per Paragraph: 3.11.3 Test Plan Line Item: FQ-H-17

Random Vibration Test

	Direction	Frequency cps	Amplitude	Duration Seconds	Temp. °F
Required	A	20 to 200	0.03 G^2/cps	120	70(±25)
Actual					
Required	A	20 to 200	0.012 G^2/cps	600	70(±25)
Actual					
Required	A	200 to 280	22 db/octave	720	70(±25)
Actual					
Required	A	280 to 800	0.36 G^2/cps	120	70(±25)
Actual					
Required	A	280 to 800	0.14 G^2/cps	600	70(±25)
Actual					
Required	A	800 to 1500	-12 db/octave	720	70(±25)
Actual					
Required	A	1500 to 2000	0.03 G^2/cps	120	70(±25)
Actual					
Required	A	1500 to 2000	0.012 G^2/cps	600	70(±25)
Actual					
Required	B and C	20 to 200	0.03 G^2/cps	120	70(±25)
Actual	C	20-200	0.03	120	56
Required	B and C	20 to 200	0.012 G^2/cps	600	70(±25)
Actual	C	20-200	0.012	600	56
Required	B and C	200 to 280	10 db/octave	720	70(±25)
Actual	C	200-280	10 db/oct	720	56
Required	B and C	280 to 800	0.090 G^2/cps	120	70(±25)
Actual	C	280-800	0.090	120	56

FORMAL QUALIFICATION TEST DATA SHEET

Vibration Test Per Paragraph: 5.11.5 Test Plan Line Item: FQ-H-17

	Direction	Frequency cps	Amplitude	Duration Seconds	Temp. °F
Required	B and C	800 to 1500	-5.5 db/octave	720	70(±25)
Actual	C	800 - 1500	-5.5 db/oct.	720	56
Required	B and C	1500 to 2000	$0.03G^2$/cps	120	70(±25)
Actual	C	1500 - 2000	0.03	120	56
Required	B and C	1500 to 2000	$0.012\ G^2$/cps	600	70(±25)
Actual:	C	1500 - 2000	0.012	600	56

Accept: Reject:

Comments: AXIS ORIENTATION ON DATA sheet IS IDENTIFIED AS "C" BUT ACTUAL ORIENTATION IS "A" TEST WAS repeated at A HIGHER LEVEL AS required for AXIS "A"

Table does not list
The Bandwith Below

	Direct.	Freq. (cps)	Amplitude	Duration	Temp. °F
Actual	C	280-800	$0.036\ g^2$/cps	600 Sec.	56

DYNAMICS SECTION
VIBRATION TEST DATA SHEET

JOB No. 32230
SHEET ____ OF ____
I D No. ____

DATE	TIME	AXIS	TEMP (F)	RANDOM FREQ. (CPS)	RANDOM PSD (G^2/CPS)	RANDOM ACCEL (GRMS)	TEST TIME (MIN)	COMMENTS	NAME
								TEST REQUIREMENT	
3-29-66	2305	Radial	Amb.	20-200	.012		0'30"	START Full Power Low Level run	
				200-280	+10db/oct	6.6		To cut Tapes	
				280-800	.036				
	2306			800-1500	-5.5db/oct			STOPPED To PlOT Tapes	
				1500-2000	.012			D. E. La Roche	
	0005			Above	Levels			Resume Full power Low Level	
	0015						9'30"	complete Low Level run	
								D. E. La Roche	
3-30-66	0020	Radial	Amb.	20-200	.03	10.3	0'30"	START Full Power high Level run To	
				200-280	+10db/oct			Cut Tapes.	
				280-800	.090				
	0021			800-1500	-5.5db/oct.			STOPPED To PlOT Tapes	
				1500-2000	.03			D. E. La Roche	
	0041	Radial	Amb.	Above	Levels	10.3	1'30"	Resume Full Level run	
	0043							completed Random C Axis	
								D. E. La Roche	

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PAGE NO. 110

SIGNED: B. Brown

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1 A87152-1.

Test Procedure Drawing No: 1TO 2861-B Change Letter: B.

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO.

Douglas Test Representative: Ed Albers Date: 3-30-66

Test Witness: 1674 Jackson 3/30/66 Douglas Q.C. Customer Q.C.

Shock Test Per Paragraph: 5.12

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 30 MAR 1966 13:00

Test Completed (Date, Time): 30 MAR 1966 15:00

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
71	74	29.8

Axis Orientation: C

Shock Test:

Test Parameter	Units	Required		Actual #1	Actual #2	Actual #3
Temperature	°F	70(±25)		71	71	71
Amplitude (1/2 Sine Wave Pulse)	G's	20 Peak	249	20	19	19
			246	20	20	20
Time	milliseconds	10(±2)	249	9	8	8
			246	9	8	8

Accept: Reject:

Comments:

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A 87152-1

Test Procedure Drawing No: ITO 2861B Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO

Douglas Test Representative: [signature] Date: 4-4-66

Test Witness: J. L. Olson 1674 4/4/66 _____
Douglas Q.C. Customer Q.C.

Vibration Test Per Paragraph: 5.11.4

Test Specimen No: 1 _____ Complete Test Data Sheets _____ Total

Test Start (Date, Time): 4-4-66 13:55

Test Completed (Date, Time): 4-4-66 14:12

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
75°	64.0	29.85

Axis Orientation: SPECIMEN C THRUST

Sinusoidal Sweep Test

	Temperature °F	Sweep Rate oct/min	Frequency cps	Amplitude
Required	70(±25)	1.0	5 to 44	0.04 inch D.A.
Actual	75°	1.0	5-44	0.04
Required	70(±25)	1.0	44 to ~~250~~ *2000	4.0 G's Peak
Actual	75°	1.0	44-2000	4.0
Required	~~70(±25)~~	1.0	250 to 320	~~0.0013 inch~~ D.A.
Actual				
Required	70(±25)	~~1.0~~	~~320 to 2000~~	7.0 G's Peak
Actual				

Accept: _____ Reject: _____

Comment: * Directions B & C, the Specification requirements List ±4.6 PK From 44 to 2000 CPS

DYNAMICS SECTION
VIBRATION TEST DATA SHEET
Random Vibration

JOB No. _____
SHEET _____ OF _____
I D No. _____

DATE	TIME	AXIS	TEMP (F)	RANDOM FREQ. (CPS)	RANDOM PSD (G^2/CPS)	RANDOM ACCEL (GRMS)	TEST TIME (MIN)	COMMENTS	NAME
								TEST REQUIREMENT	
4-4	1550	Thrust	Amb	20-200	.012	6.6	0'20"	Full Power Low Level	
	1550			200-280	+10db/oct			STOP To check system	
				280-800	.036				
				800-1500	-5.5db/oct.				
				1500-2000	.012			D. E. La Roche	
	2301	Thrust	Amb.	Above Levels			0'30"	Resume Random	
	2302	"	"					STOP To Plot Tapes	
								D. E. La Roche	
	2340	Thrust	Amb.	Above Levels			9'10"	Resume run Full Power Low Level	
	2350							complete run	
								D. E. La Roche	
4-5-66	0000	Thrust	Amb.	20-200	.03		0'30"	Start Full Power high Level run	
	0001			200-280	+10db/oct.			STOP To Plot Tapes	
				280-800	.090			D. E. La Roche	
				800-1500	-5db/oct				
				1500-2000	.03				
4-5-66	0058	Thrust	Amb.	Above Levels			1'30"	Resume Run	
	0100							Complete Run	
								D. E. La Roche	

SIGNED: B Brun

W603E

APPENDIX A

REPORT NO 32230
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FORMAL QUALIFICATION TEST DATA SHEET

Vibration Test Per Paragraph: 5. 11.5 Test Plan Line Item: FQ-H-17

Random Vibration Test

	Direction	Frequency cps	Amplitude	Duration Seconds	Temp. °F
Required	A	20 to 200	0.03 G^2/cps	120	70(±25)
Actual					
Required	A	20 to 200	0.012 G^2/cps	600	70(±25)
Actual					
Required	A	200 to 280	22 db/octave	720	70(±25)
Actual					
Required	A	280 to 800	0.36 G^2/cps	120	70(±25)
Actual					
Required	A	280 to 800	0.14 G^2/cps	600	70(±25)
Actual					
Required	A	800 to 1500	-12 db/octave	720	70(±25)
Actual					
Required	A	1500 to 2000	0.03 G^2/cps	120	70(±25)
Actual					
Required	A	1500 to 2000	0.012 G^2/cps	600	70(±25)
Actual					
Required	~~B~~ and C	20 to 200	0.03 G^2/cps	120	70(±25)
Actual	C	20 to 200	0.03	120	75
Required	~~B~~ and C	20 to 200	0.012 G^2/cps	600	70(±25)
Actual	C	20 to 200	0.012	600	75
Required	~~B~~ and C	200 to 280	10 db/octave	720	70(±25)
Actual	C	200 to 280	+10 db/oct.	720	75
Required	~~B~~ and C	280 to 800	0.090 G^2/cps	120	70(±25)
Actual	C	280 to 800	0.090	120	75

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Vibration Test Per Paragraph: 5.11.5 Test Plan Line Item: FQ-H-17

	Direction	Frequency cps	Amplitude	Duration Seconds	Temp. °F
Required	~~B~~ and C	800 to 1500	-5.5 db/octave	720	70(±25)
Actual	C	800 to 1500	-5.5 db	720	75
Required	~~B~~ and C	1500 to 2000	$0.03G^2$/cps	120	70(±25)
Actual	C	1500 to 2000	0.03	120	75
Required	~~B~~ and C	1500 to 2000	$0.012\ G^2$/cps	600	70(±25)
Actual:	C	1500 to 2000	0.012		75

Accept: _____ Reject: _____

Comments: The Table above does not include the following Ba

	Direction	Freq. (cps)	Amplitude	Duration (sec)	Tem
Required	C	280-800	0.036 g^2/cps	600	70°±25°
Actual	C	280-800	0.036 g^2/cps	600	75°

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A 87152-1.

Test Procedure Drawing No: 1TO 2861-B Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO,

Douglas Test Representative: Ed Allen Date: 4-5-66

Test Witness: T.B. Herron for Jason
Douglas Q.C. Customer Q.C.

Shock Test Per Paragraph: 5.12

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 5 APRIL 1966 10:30.

Test Completed (Date, Time): 5 APRIL 1966 15:55

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
74	65	29.87

Axis Orientation: C

Shock Test:

Test Parameter	Units	Required		Actual #1	Actual #2	Actual #3
Temperature	°F	70(±25)				
Amplitude (1/2 Sine Wave Pulse)	G's	20 Peak	246	19	19	19
			335	19	19	19
			B300	20	19	19
Time	milliseconds	10(±2)	246	9	9	9
			335	8	8	8
			B300	10	9	10

Accept: Reject:

Comments:

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: Bellows, Propulsive Fuel Vent

Part Number: 1A 87152-1

Test Procedure Drawing No: 1TO 2861B Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: Wyle Location: El Segundo

Douglas Test Representative: [signature] Date: 4-6-66

Test Witness: [signature] 4-6-66 [signature]
Douglas Q.C. Customer Q.C.

Vibration Test Per Paragraph: 5.11.4

Test Specimen No: 1 _____ Complete Test Data Sheets _____ Total

Test Start (Date, Time): 4-6-66 2304

Test Completed (Date, Time): 4-6-66 2310

Ambient Room Conditions:	Temperature °F	RH %	Atm. Press. In. Hg abs.
	68	80	29.85

Axis Orientation: Radial (A)

Sinusoidal Sweep Test

	Temperature °F	Sweep Rate oct/min	Frequency cps	Amplitude
Required	70(±25)	1.0	5 to 44	0.04 inch D.A.
Actual				
Required	70(±25)	1.0	44 to 250	4.0 G's Peak
Actual				
Required	70(±25)	1.0	250 to 320	0.0013 inch D.A.
Actual	68	1.0	250-320	.0013
Required	70(±25)	1.0	320 to 2000	7.0 G's Peak
Actual	68	1.0	320-2000	7.0

Accept: _____ Reject: _____

Comment: _____

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Vibration Test Per Paragraph: 5.11.5 Test Plan Line Item: FQ-H-17

Random Vibration Test

	Direction	Frequency cps	Amplitude	Duration Seconds	Temp. °F
Required	A	20 to 200	0.03 G^2/cps	120	70(±25)
Actual	A	20 to 200	0.03	120	68
Required	A	20 to 200	0.012 G^2/cps	600	70(±25)
Actual	A	20 to 200	0.012	600	68
Required	A	200 to 280	22 db/octave	720	70(±25)
Actual	A	200 to 280	+22db/oct.	720	68
Required	A	280 to 800	0.36 G^2/cps	120	70(±25)
Actual	A	280 to 800	0.36	120	68
Required	A	280 to 800	0.14 G^2/cps	600	70(±25)
Actual	A	280 to 800	0.14	600	68
Required	A	800 to 1500	-12 db/octave	720	70(±25)
Actual	A	800 to 1500	-12db/oct.	720	68
Required	A	1500 to 2000	0.03 G^2/cps	120	70(±25)
Actual	A	1500 to 2000	0.03	120	68
Required	A	1500 to 2000	0.012 G^2/cps	600	70(±25)
Actual	A	1500 to 2000	0.012	600	68
Required	B and C	20 to 200	0.03 G^2/cps	120	70(±25)
Actual					
Required	B and C	20 to 200	0.012 G^2/cps	600	70(±25)
Actual					
Required	B and C	200 to 280	10 db/octave	720	70(±25)
Actual					
Required	B and C	280 to 800	0.090 G^2/cps	120	70(±25)
Actual					

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Vibration Test Per Paragraph: _____ Test Plan Line Item: FQ-H-17

	Direction	Frequency cps	Amplitude	Duration Seconds	Temp. °F
Required	B and C	800 to 1500	-5.5 db/octave	720	70(±25)
Actual					
Required	B and C	1500 to 2000	$0.03G^2$/cps	120	70(±25)
Actual					
Required	B and C	1500 to 2000	$0.012\ G^2$/cps	600	70(±25)
Actual:					

Accept: _____ Reject: _____

Comments: _____

DYNAMICS SECTION
VIBRATION TEST DATA SHEET

JOB NO. 32230
SHEET ____ OF ____
I D NO. ____

DATE	TIME	AXIS	TEMP (°F)	SINUSOIDAL FREQ. (CPS)	SINUSOIDAL DISP. ("DA)	SINUSOIDAL ACCEL. (±G)	TEST TIME (MIN)	COMMENTS	NAME
								TEST REQUIREMENT	
4-6-66	2304	Radial	amb.	250-320	.0013	—	6'7"	sweep at 1 oct/min controlling from 2 & 3	
	2310	(A)		320-2000	—	7.0		completed sweep from 250-2000-250	
								D. E. LeRoche	

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R. Reed

DYNAMICS SECTION
VIBRATION TEST DATA SHEET
Radial axis ReRun

JOB No. 32230
SHEET ____ OF ____
I D No. ____

DATE	TIME	AXIS	TEMP (F)	RANDOM FREQ. (CPS)	RANDOM PSD (G^2/CPS)	RANDOM ACCEL (GRMS)	TEST TIME (MIN)	COMMENTS	NAME
								TEST REQUIREMENT	
4-6-66	2335	Radial	Amb.	20-200	0.012	10.8	0'30"	START Full Power Low Level run	
				200-280	+22db/oct.			To cut Tapes	
				280-800	0.14				
	2335			800-1500	-12db/oct			completed 30 second run for Tapes	
				1500-2000	0.12			D. E. La Roche	
4-7-66	0009			Above	Levels		2'30"	Resumed full power Low Level run	
	0017							completed RUN	
								D. E. La Roche	
	0018	Radial	Amb.	20-200	0.03		0'35"	START Full Power high Level run for Tape	
	0019			200-280	+22db/oct	17.5		STOP To evaluate Tapes.	
				280-800	0.36			D. E. La Roche	
				800-1500	-12db/oct				
				1500-2000	0.03				
	0050		Amb.	Above	Levels		1'25"	Resume RUN	
	0052							complete Random Run	
								D. E. La Roche	

SIGNED: R Brill

W6035

APPENDIX A

REPORT NO 32230

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FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A 87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO, CALIF

Douglas Test Representative: John R. Schulz Date: 4-12-66

Test Witness: B. Herrera for J. Olson
Douglas Q.C. Customer Q.C.

Burst Test Per Paragraph: 5.13

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 4-11-66 1430

Test Completed (Date, Time): 4-11-66 1650

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
67	65	29.82

Test Parameter	Units	Required	Actual
Temperature	°F		67
Pressure Rise Rate	psi/minute	500 max.	200
Burst Pressure	psig	78 min.	471
Time	Minutes		36

Accept: Reject:

Comments: TEST SPECIMEN STARTED TO DEFORM AT 164 PSIG

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A 87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location:

Douglas Test Representative: J Mathews 4-7-66 Date: 4-7-66

Test Witness: 1819 DCAS-QAR TEST VERIFICATION
Douglas Q.C. Customer Q.C.

Spring Rate Test Per Paragraph: 5.14

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 4-7-66 1610

Test Completed (Date, Time): 4-7-66 1650

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
66	71	29.85

Spring Rate Test

	Temperature °F	Axial Compression (In.)	Force (lbs)
Required	70(±25)	1/2	
Actual	66	1/2	95.0
Tare	66	—	1.0
Calculated Specimen Spring Rate			94.0

Accept: Reject:

Comments: INSTRUMENT REPLACED: DILLON FORCE GAGE S/N 9015
REASON FOR REPLACEMENT: MISALIGNMENT IN FIXTURE
NEW INSTRUMENT: CHATILLON FORCE GAGE
MODEL DPPH-100
TAG NO. 6872
SER NO. 308
TOLERANCE ± 0.5%
DATE OF REPLACEMENT 4-7-66

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLIE Location: EL SEGUNDO CALIF

Douglas Test Representative: John R. Schulz Date: 12-11-65

Test Witness: _____ DCAS-QAR TEST VERIFICATION
Douglas Q.C. Customer Q.C.

Spring Rate Test Per Paragraph: 5.14

Test Specimen No: 1 _____ Data Sheets _____
Complete Test Total

Test Start (Date, Time): 12-11-65 1130

Test Completed (Date, Time): 12-11-65 1240

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
64		29.93

Spring Rate Test

	Temperature °F	Axial Compression (In.)	Force (lbs)
Required	70(±25)	1/2	
Actual	64	1/2	97.0
Tare	64	—	1.0
Calculated Specimen Spring Rate			96.0

Accept: ACCEPTABLE Reject: _____

Comments: INSTRUMENT REPLACED: DILLON FORCE GAGE S/N 9015

REASON FOR REPLACEMENT: MISSALIGNMENT IN FIXTURE

NEW INSTRUMENT NAME: CHATILLON FORCE GAGE

MODEL NO: DPPH-100
TAG NO: 6872
SERIAL NO: ~~6872~~ 308
TOLERANCE: ± 0.5%
DATE OF REPLACEMENT: 12-11-65

11-21

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: BELLOWS, PROPULSIVE FUEL VENT

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE LABORATORIES Location: NORCO, CALIF

Douglas Test Representative: John R. Schulz Date: 1-6-66

Test Witness: [signature] Douglas Q.C. [signature] Customer Q.C.

Pressure Cycle Test Per Paragraph: 5-15-2

Test Specimen No: 1 _____ Complete Test Data Sheets _____ Total

Test Start (Date, Time): 1-3-66 1400

Test Completed (Date, Time): 1-3-66 1445

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
70	59	29.224

Pressure Scale: _____

Paper Speed: _____

Time Scale: _____

Pressure Cycle Test

	Temperature (°F)	Pressure (Psig) Minimum	Pressure (Psig) Maximum	Total Cycles	Deflection Angular Degrees	Deflection Compress. Inches	Deflection Offset Inches
Required	$400(^{+21}_{-0})$	0	31(±1)	200	$4(^{+1}_{-0})$	1 1/8	1 5/16
Actual	-379 TO -400	0	32	200	4	1 1/8	1 5/16

Accept: _____ Reject: _____

Comments: _____

FORMAL QUALIFICATION TESTS DATA SHEET

Item Name: Bellows, Propulsive Fuel Vent

Part Number: 1A87152-1

Test Procedure Drawing No: 1T02861 Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: Wyle Labs Location: Norco, Calif

Douglas Test Representative: John R. Schulz Date: 1-6-66

Test Witness: [signature] Douglas Q.C. [signature] Customer Q.C.

Deflection Cycle Test Per Paragraph: 5.15.4

Test Specimen No: 1 Complete Test Data Sheets Total

Test Start (Date, Time): 1-4-66 1415

Test Completed (Date, Time): 1-5-66 1200

Ambient Room Conditions:

Temperature °F	RH %	Atm. Press. In. Hg abs.
60	68	29.321
67	66	29.429

Deflection Cycle Test

	Temperature (°F)	Pressure psig	Total Cycles	Deflection Cycle Angular Degrees	Deflection Cycle Axial Extension Inches	Deflection Cycle Offset Inches
Required	70(±25)	0	50	0 to 4 to 0	0 to 15/16 to 0	0 to 1 5/16 to 0
Actual	60	0	50	0-4-0	0-15/16-0	0-1 5/16-0
Required	-400(+21 -0)	31(±1)	150	4	15/16 to 1 1/8 to 15/16	1 5/16
Actual	-379 to -400	31.5	150	4	15/16-1 1/8-15/16	1 5/16

Accept: Reject:

Comments:

APPENDIX A

FORMAL QUALIFICATION TEST DATA SHEET

Item Name: Bellows, Propulsive Fuel Vent

Part Number: 1A87152-1

Test Procedure Drawing No: 1T0286 1B Change Letter: B

Manufacturer's S/N: 042 Test Plan Line Item: FQ-H-17

Test Laboratory: WYLE Location: EL SEGUNDO

Douglas Test Representative: John R. Schultz Date: 4/11/66

Test Witness: T.B. Herrmann J. OLSON
Douglas Q.C. Customer Q.C.

Post Test Inspection Per Paragraph: 5.16

Test Specimen No: 1 Complete Test Data Sheets Total

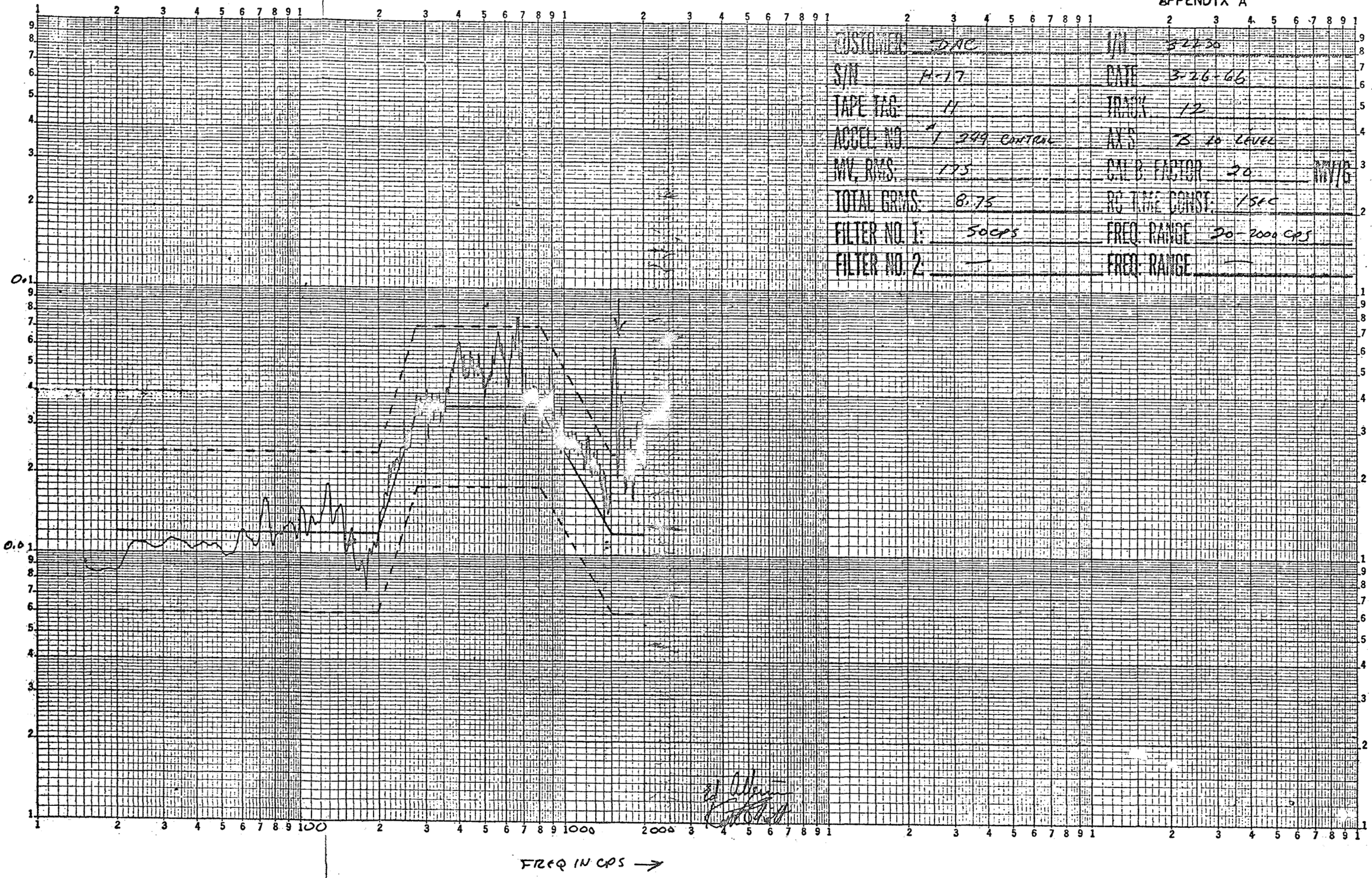
Test Start (Date, Time): 4-11-66 17:00

Test Completed (Date, Time): 4-11-66 17 15

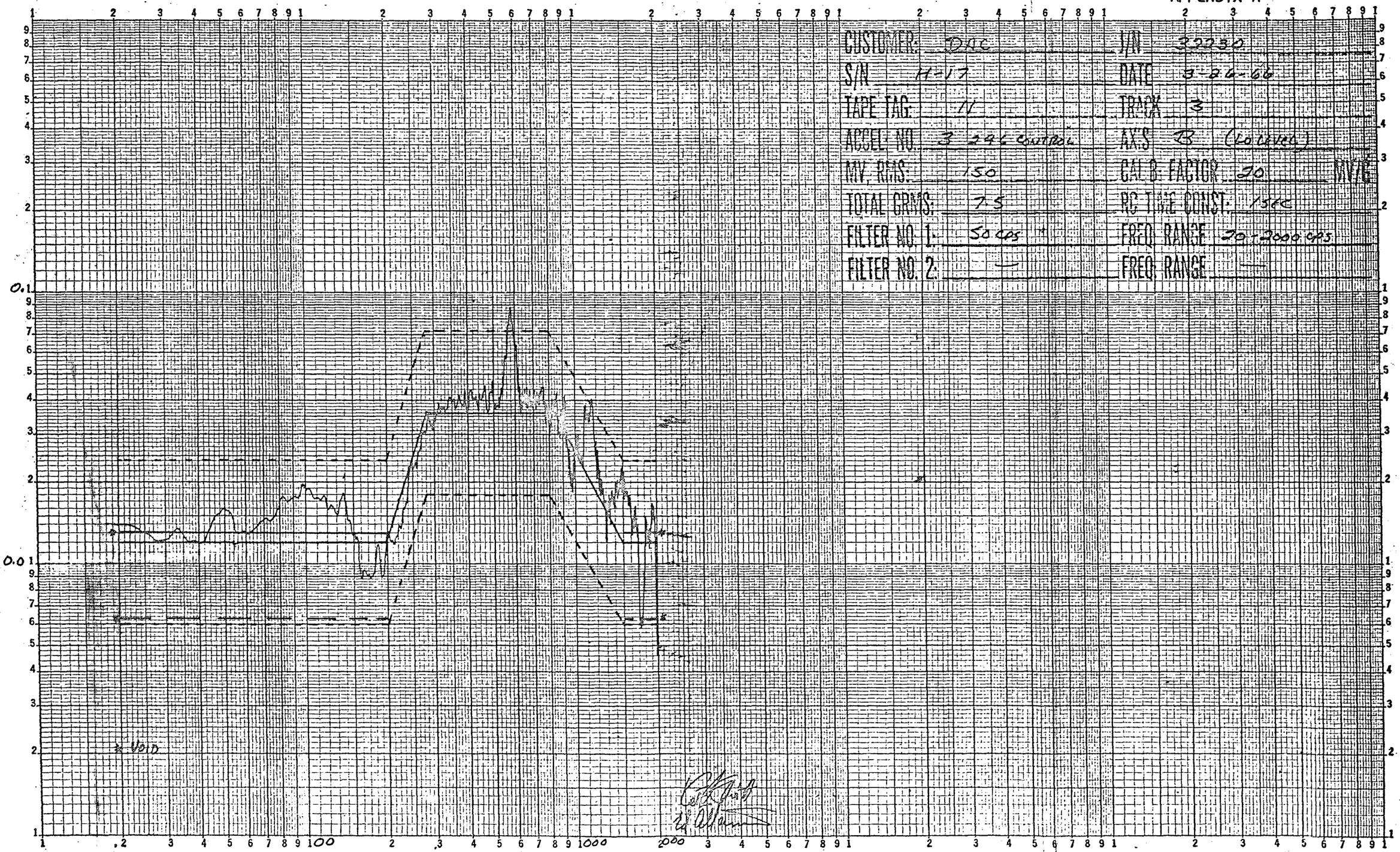
Comments: Bellows Deformed and two pin hole leaks were noted.

Conclusion: Deformation and leaks were a result of the Burst test.

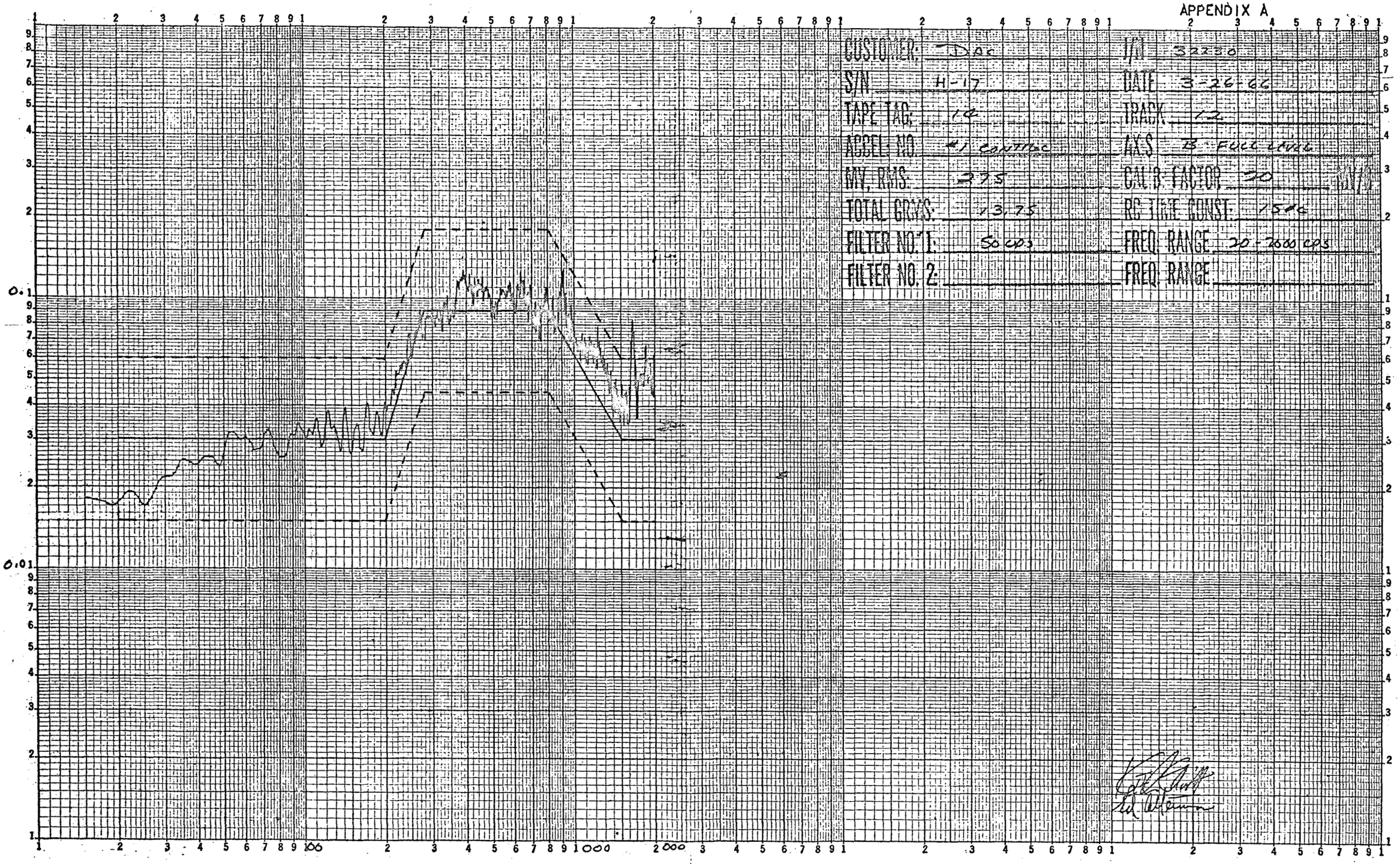
APPENDIX A


CUSTOMER: DAC
S/N: H-17
TAPE TAG: 11
ACCEL. NO.: 1 249 CONTROL
AVG. RMS: 1.75
TOTAL GRMS: 8.75
FILTER NO. 1: 50 cps
FILTER NO. 2: —
J/N: 32230
DATE: 3-26-66
TRACK: 12
AXIS: B to LEVEL
CAL. FACTOR: 20 mv/g
RC TIME CONST: 1 sec
FREQ. RANGE: 20-2000 cps
FREQ. RANGE: —
0.1
0.0
FREQ IN CPS →

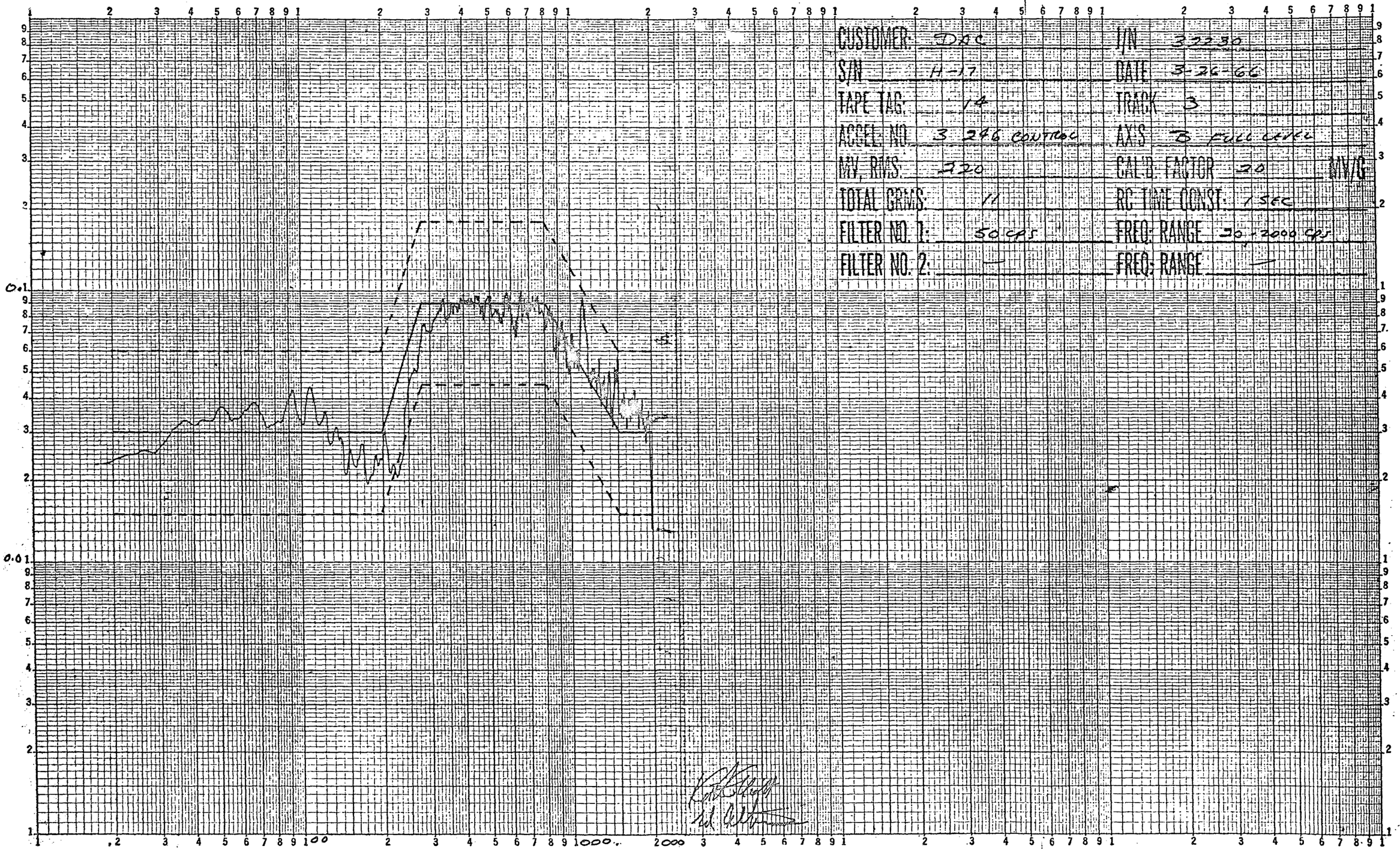
APPENDIX A


CUSTOMER: DNC
J/N 32230
S/N H-17
DATE 3-26-66
TAPE TAG: 11
TRACK 3
ACCEL NO. 3 296 CONTROL
AXIS B (LOCKED)
MV, RMS: 150
CAL B FACTOR 20 MV/G
TOTAL GRMS: 7.5
RC TIME CONST: 1 SEC
FILTER NO. 1: 50 CPS
FREQ RANGE 20-2000 CPS
FILTER NO. 2: —
FREQ RANGE —
0.1
0.01
100
1000
2000
VOID
K+E LOGARITHMIC 47 7522
3 X 5 CYCLES
KEUFFEL & ESSER CO.

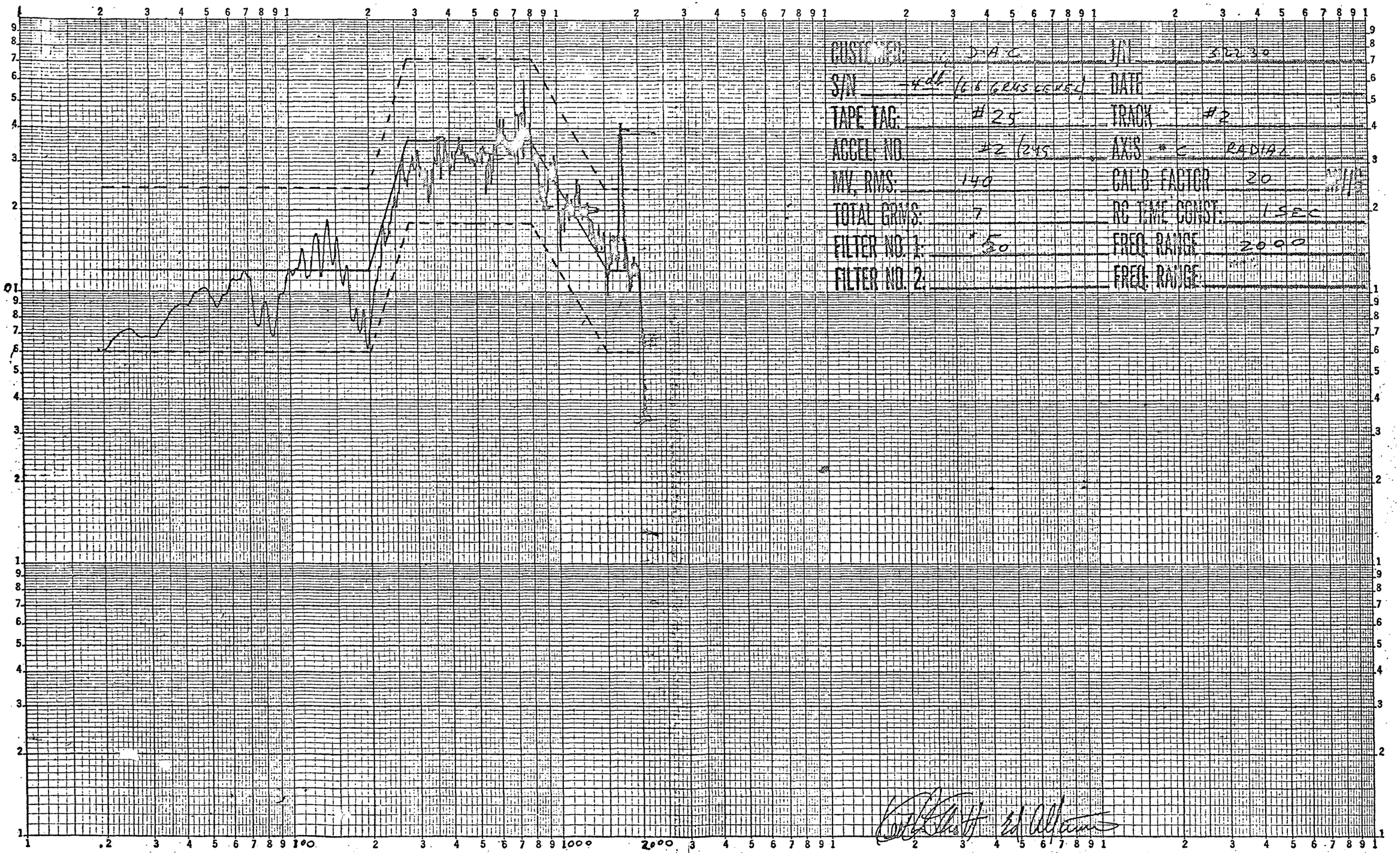
APPENDIX A


CUSTOMER: DAC
I/N 32230
S/N H-17
DATE 3-26-66
TAPE TAG: 14
TRACK 12
ACCEL. NO. #1 CONTROL
AXIS B FULL LEVEL
MV, RMS: 275
CAL'B FACTOR 20 MV/G
TOTAL GRMS: 13.75
RC TIME CONST: 15 sec
FILTER NO. 1: 50 CPS
FREQ. RANGE 20-2000 CPS
FILTER NO. 2:
FREQ. RANGE
0.1
0.01
100
1000
2000
K+E LOGARITHMIC 47 7522
3 X 5 CYCLES
KEUFFEL & ESSER CO.

APPENDIX A

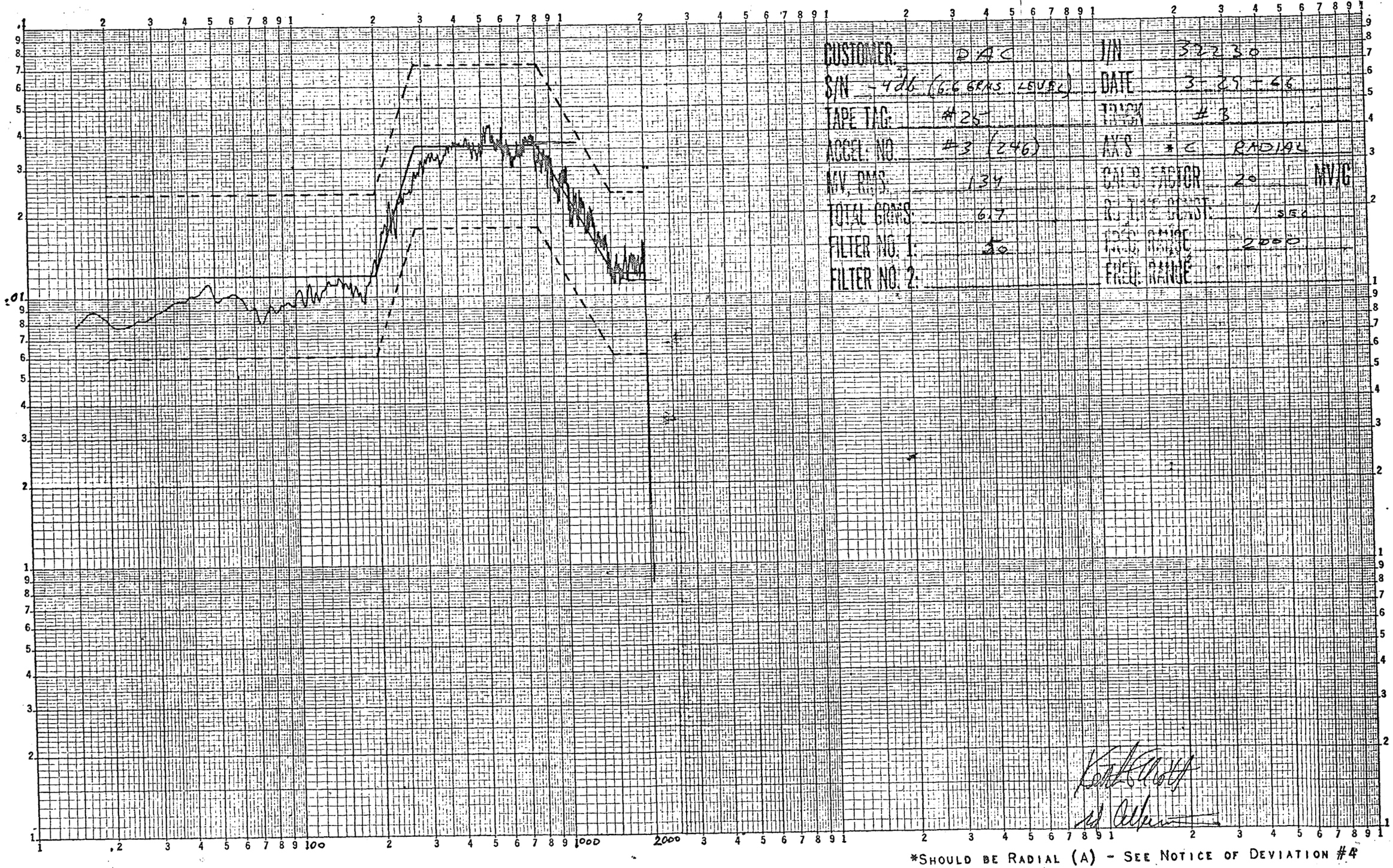

CUSTOMER: DOC
J/N 32230
S/N H-17
DATE 3-26-66
TAPE TAG: 14
TRACK 3
ACCEL. NO. 3 246 CONTROL
AXIS Z FULL CENTER
MV, RMS: 220
CAL'B. FACTOR 20 MV/G
TOTAL GRMS: 11
RC TIME CONST: 1 SEC
FILTER NO. 1: 50 CPS
FREQ. RANGE 30-2000 CPS
FILTER NO. 2: —
FREQ. RANGE —
0.1
0.01
100
1000
2000
K+E LOGARITHMIC 47 7522
3 X 5 CYCLES
KEUFFEL & ESSER CO.

APPENDIX A



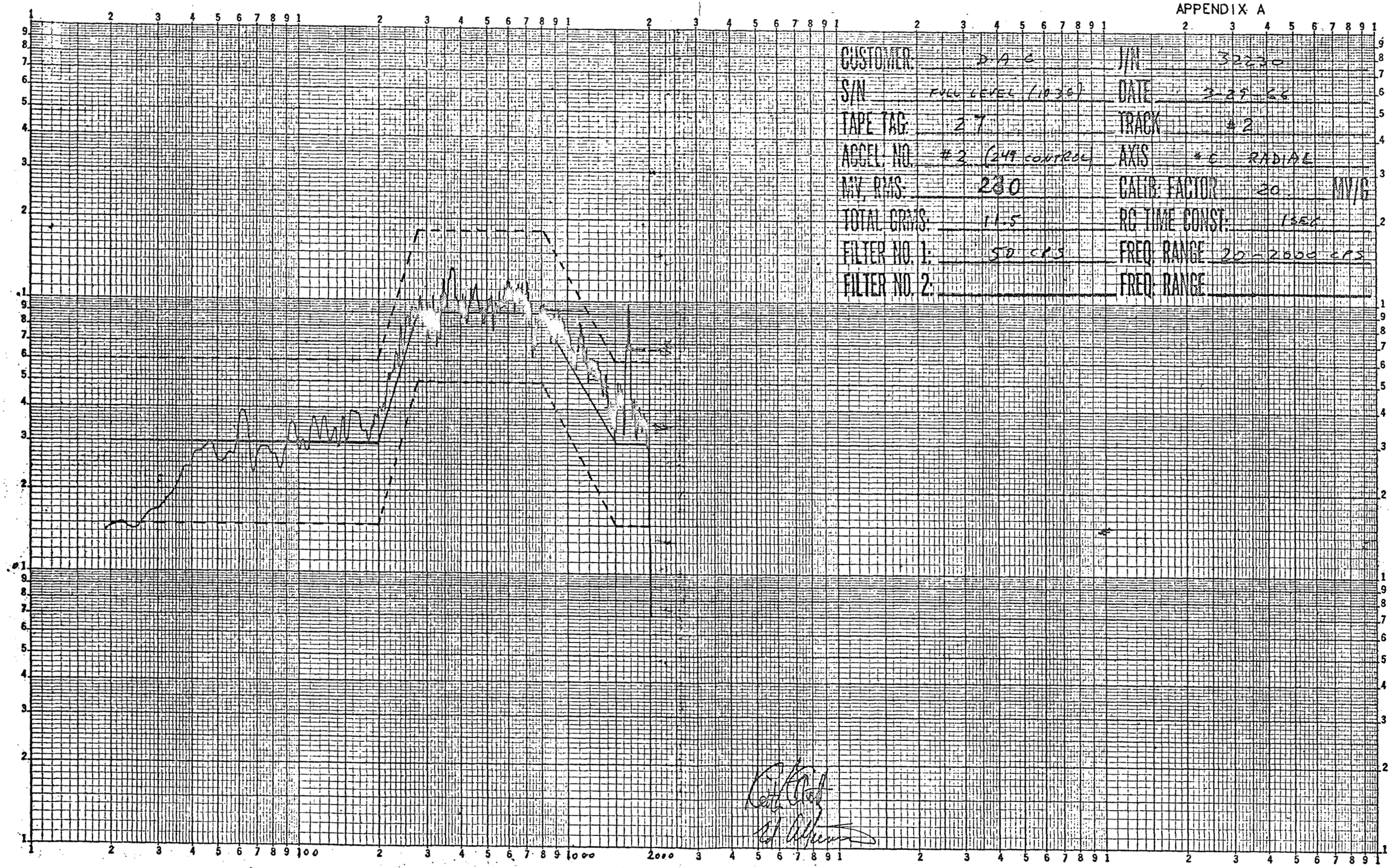
*SHOULD BE RADIAL (A) - SEE NOTICE OF DEVIATION #4

APPENDIX A



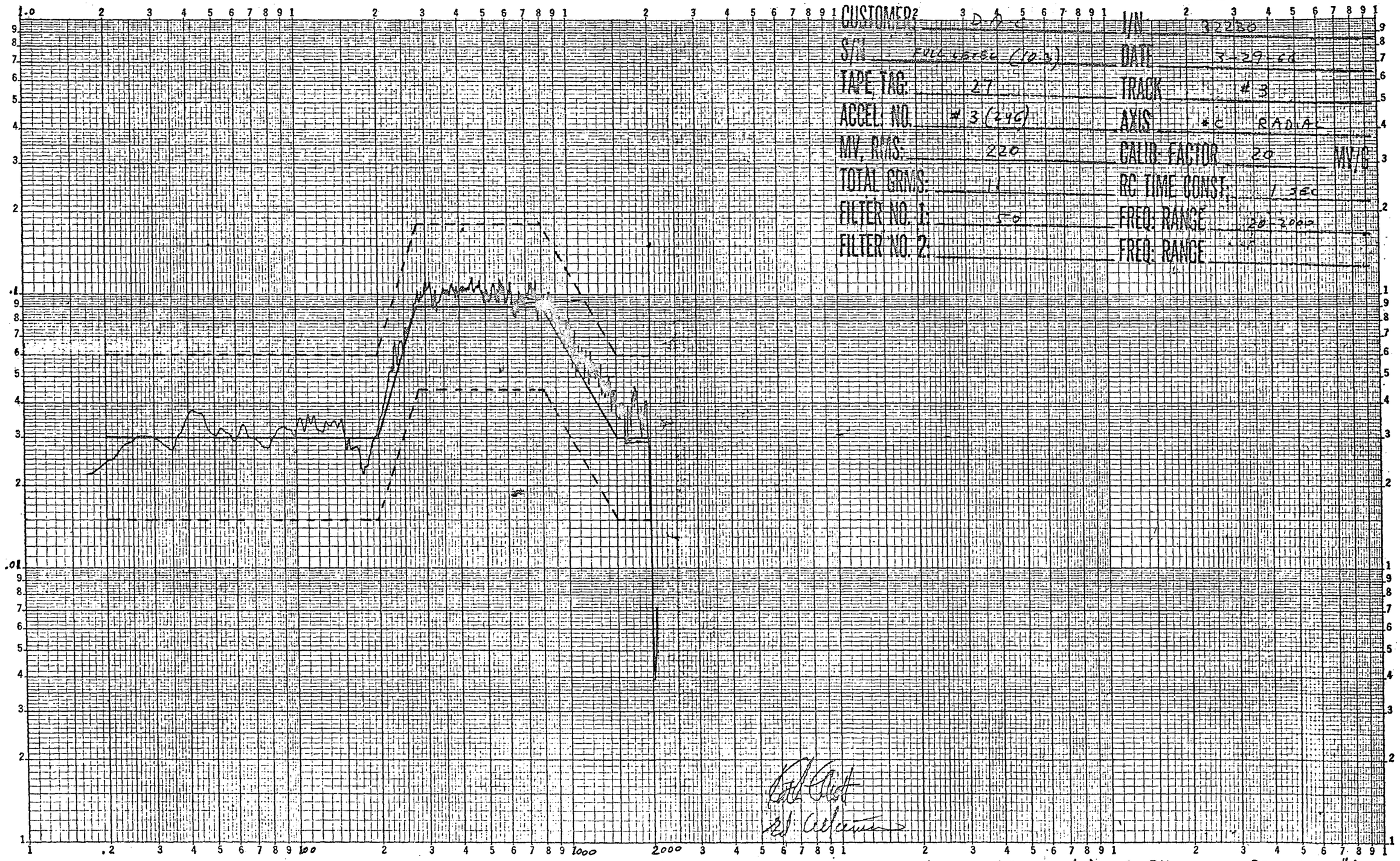
*SHOULD BE RADIAL (A) - SEE NOTICE OF DEVIATION #4

APPENDIX A



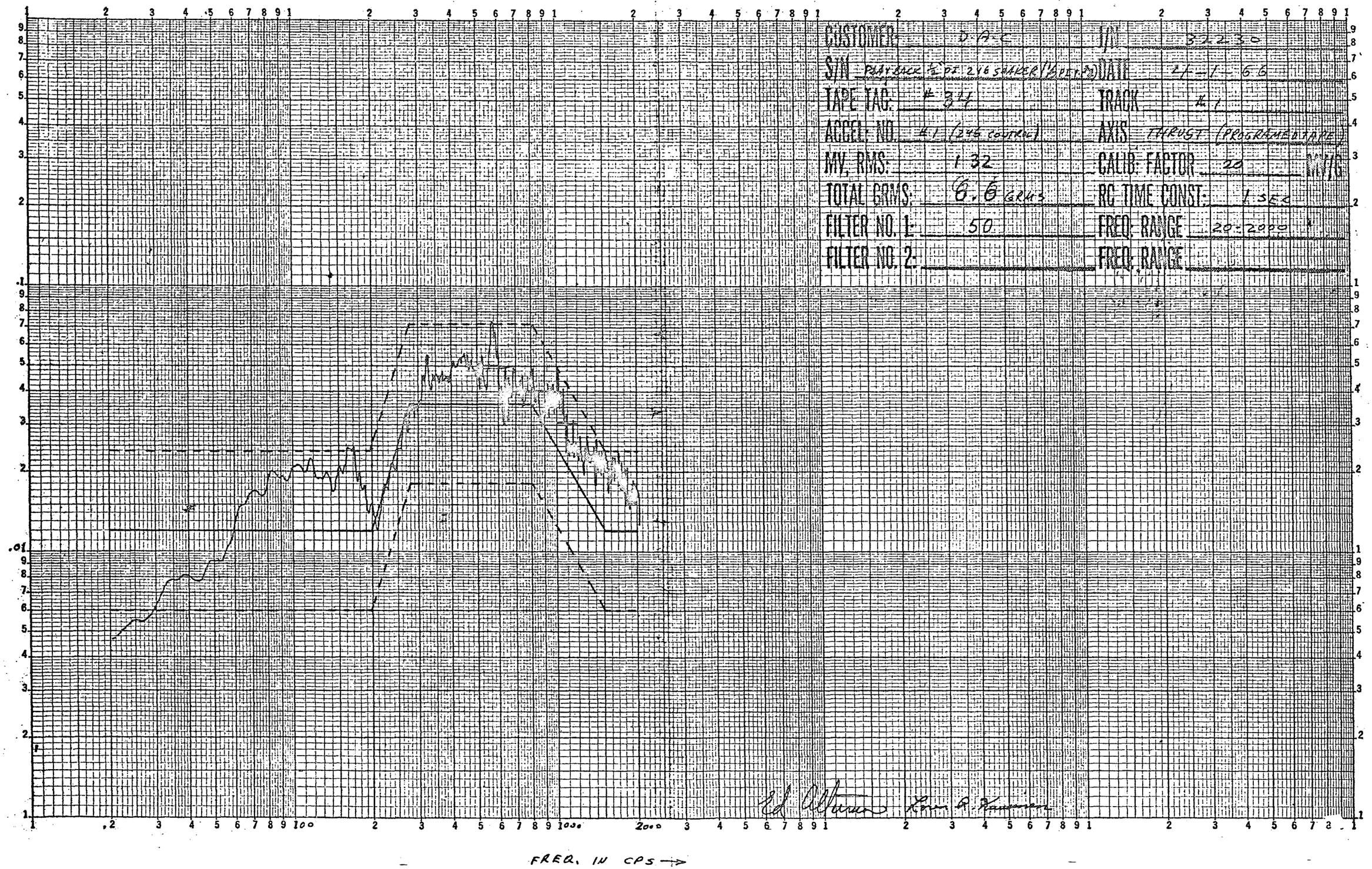
*SHOULD BE RADIAL (A) - SEE NOTICE OF DEVIATION #4

APPENDIX A

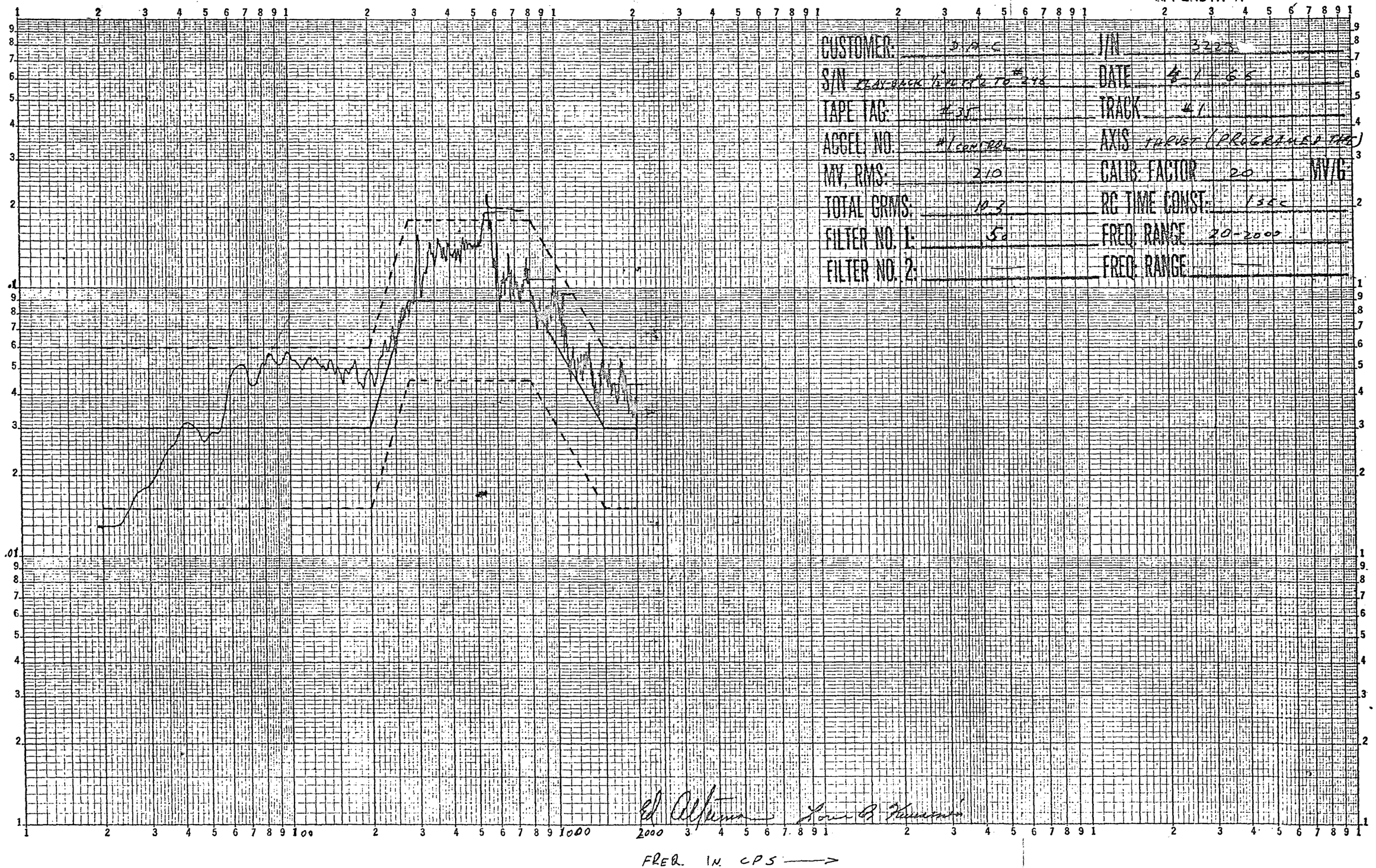


*SHOULD BE RADIAL (A) - SEE NOTICE OF DEVIATION #4

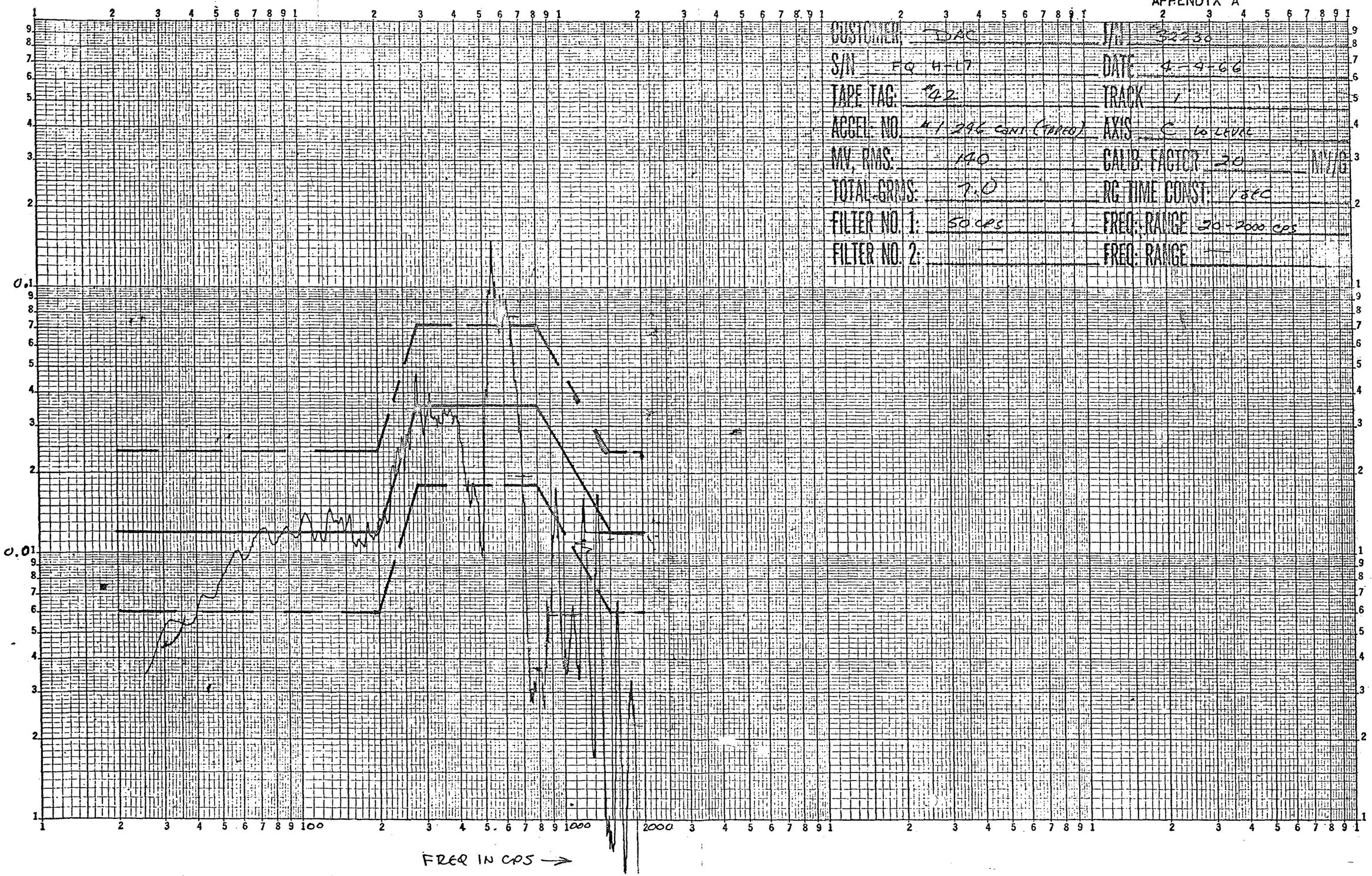
APPENDIX A


CUSTOMER: D.A.C
J/N: 32230
S/N: PLAYBACK ½ OF 246 SHAKER (1/3 OCT. BD)
DATE: 2-1-66
TAPE TAG: #34
TRACK: #1
ACCEL. NO.: #1 (246 CONTROL)
AXIS: THRUST (PROGRAME TAPE)
MV, RMS: 1.32
CALIB. FACTOR: 20 MV/G
TOTAL GRMS: 6.6 GRMS
RC TIME CONST: 1 SEC
FILTER NO. 1: 50
FREQ. RANGE: 20-2000
FILTER NO. 2:
FREQ. RANGE:
FREQ. IN CPS →

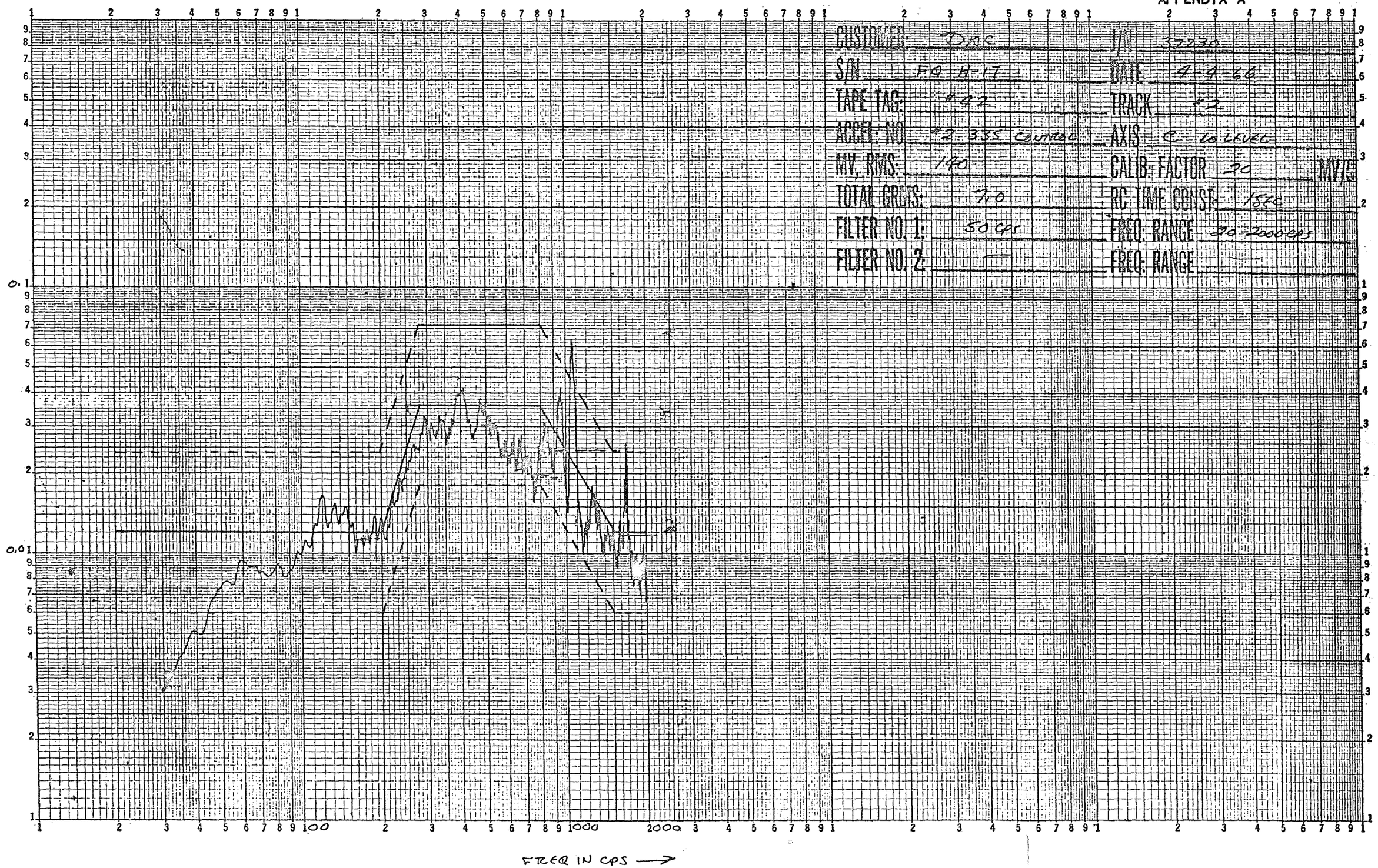
APPENDIX A


CUSTOMER: D.A.C.
J/N 3223
S/N PLAY-BACK ½ PL TO #2 TO #246
DATE 4-1-66
TAPE TAG: #35
TRACK #1
ACCEL. NO. #1 CONTROL
AXIS THRUST (PROGRAMED TAPE)
MV, RMS: 210
CALIB. FACTOR 20 MV/G
TOTAL GRMS: 10.3
RC TIME CONST: 1 SEC
FILTER NO. 1: 50
FREQ. RANGE 20-2000
FILTER NO. 2:
FREQ. RANGE
.01
100
1000
2000
FREQ. IN CPS

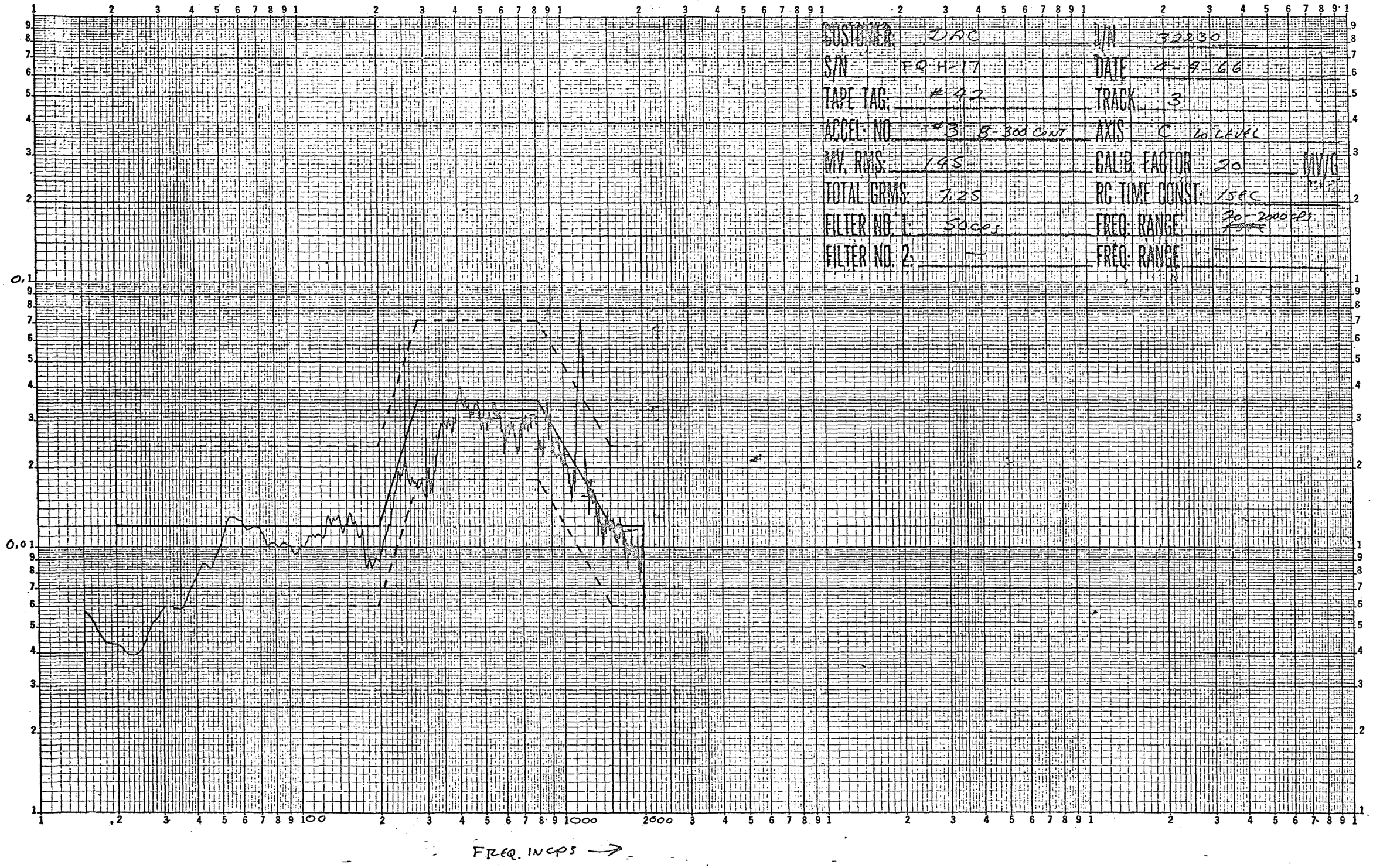
APPENDIX A

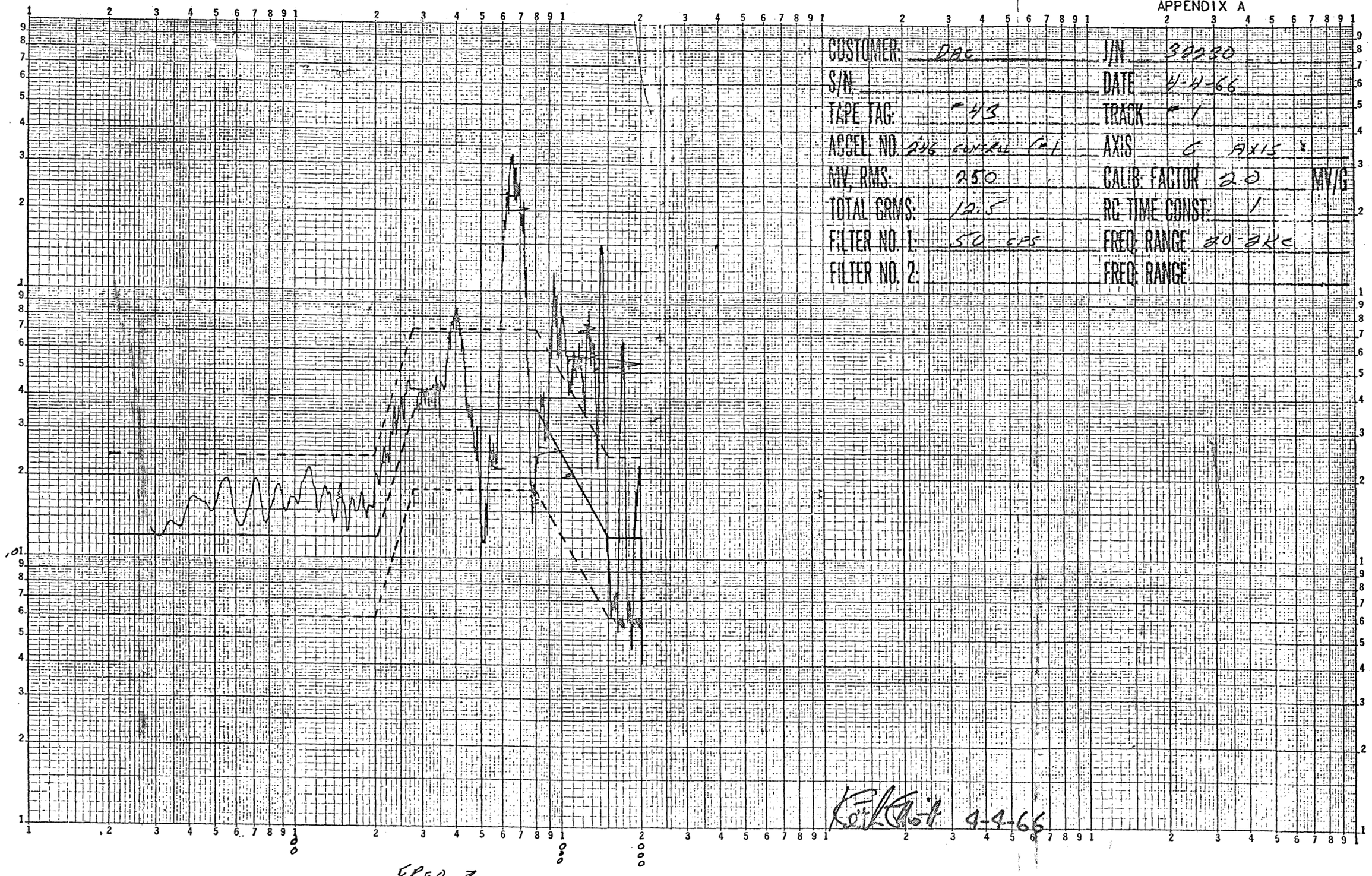

CUSTOMER: DAC
J/N: 32230
S/N: FQ H-17
DATE: 4-4-66
TAPE TAG: #42
TRACK: 1
ACCEL. NO.: #1 296 CONT (TAPED)
AXIS: C LO LEVEL
MV, RMS: 140
CALIB. FACTOR: 20 MV/G
TOTAL GRMS: 7.0
RC TIME CONST: 1 SEC
FILTER NO. 1: 50 CPS
FREQ. RANGE: 20-2000 CPS
FILTER NO. 2: —
FREQ. RANGE: —
0.1
0.01
100
1000
2000
FREQ IN CPS →

APPENDIX A


CUSTOMER: DAC
I/N 32230
S/N FQ H-17
DATE 4-4-66
TAPE TAG: #42
TRACK #2
ACCEL: NO #2 335 CONTROL
AXIS C LO LEVEL
MV, RMS: 140
CALIB: FACTOR 20 MV/G
TOTAL GRMS: 7.0
RC TIME CONST: 1 SEC
FILTER NO. 1: 50 CPS
FREQ: RANGE 20-2000 CPS
FILTER NO. 2: —
FREQ: RANGE —
0.1
0.01
100
1000
2000
FREQ IN CPS

APPENDIX A

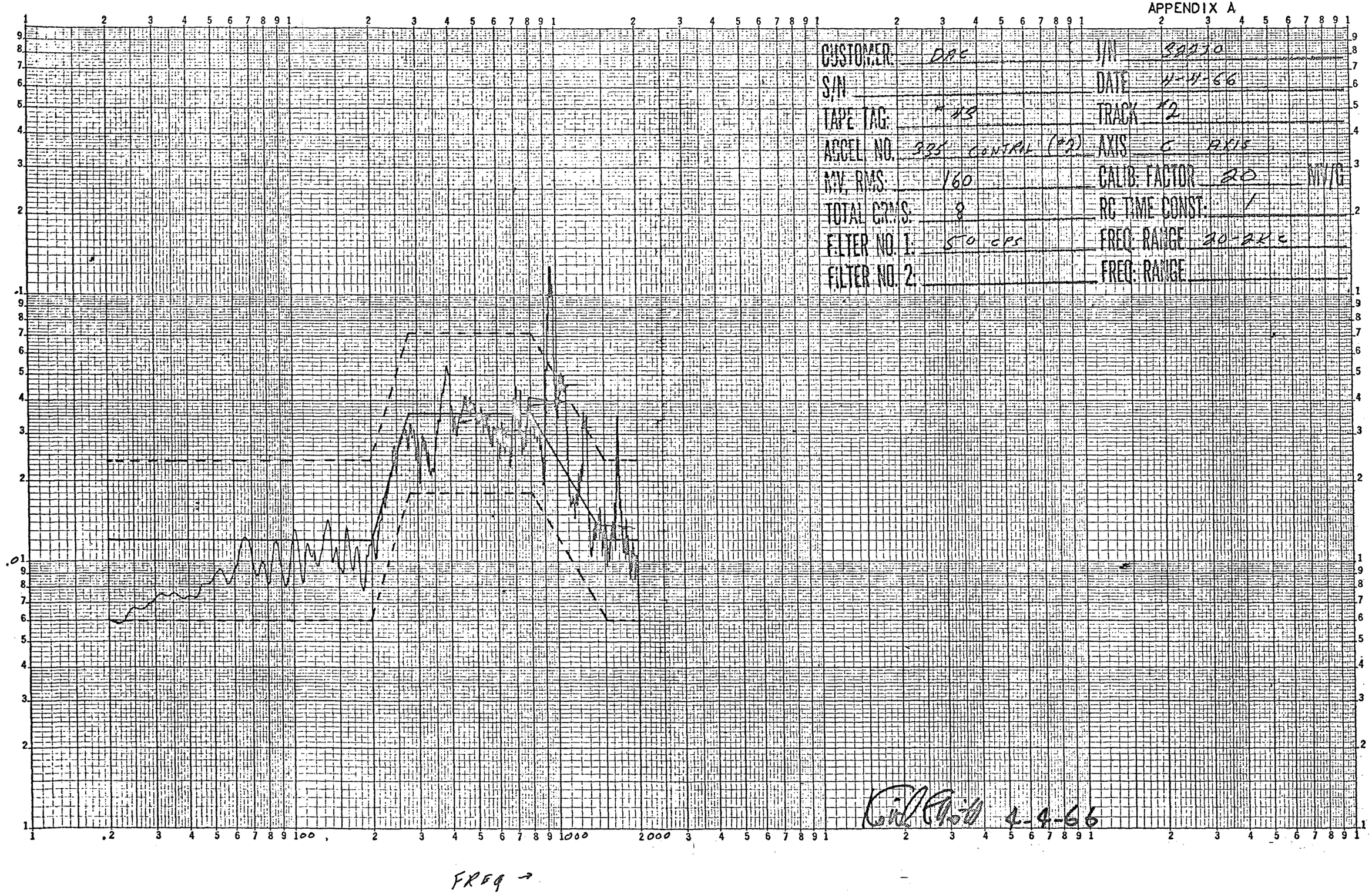

CUSTOMER: DRC
J/N 32230
S/N FQH-17
DATE 4-8-66
TAPE TAG: #42
TRACK 3
ACCEL. NO. #3 B-300 CNT
AXIS C to LEVEL
MV. RMS: 195
CAL'B. FACTOR 20 MV/G
TOTAL GRMS: 7.25
RC TIME CONST. 15 SEC
FILTER NO. 1: 50 cps
FREQ. RANGE 70-2000 cps
FILTER NO. 2: —
FREQ. RANGE —
0.1
0.01
100
1000
2000
FREQ. IN CPS


CUSTOMER: DAC
J/N 32230
S/N
DATE 4-4-66
TAPE TAG: #43
TRACK #1
ACCEL NO. 246 CONTROL #1
AXIS G AXIS
MV, RMS: 250
CALIB. FACTOR 20 MV/G
TOTAL GRMS: 12.5
RC TIME CONST: 1
FILTER NO. 1: 50 CPS
FREQ. RANGE 20-2KC
FILTER NO. 2:
FREQ. RANGE
4-4-66
FREQ →

20 TO 50 SEC IN THE RUN

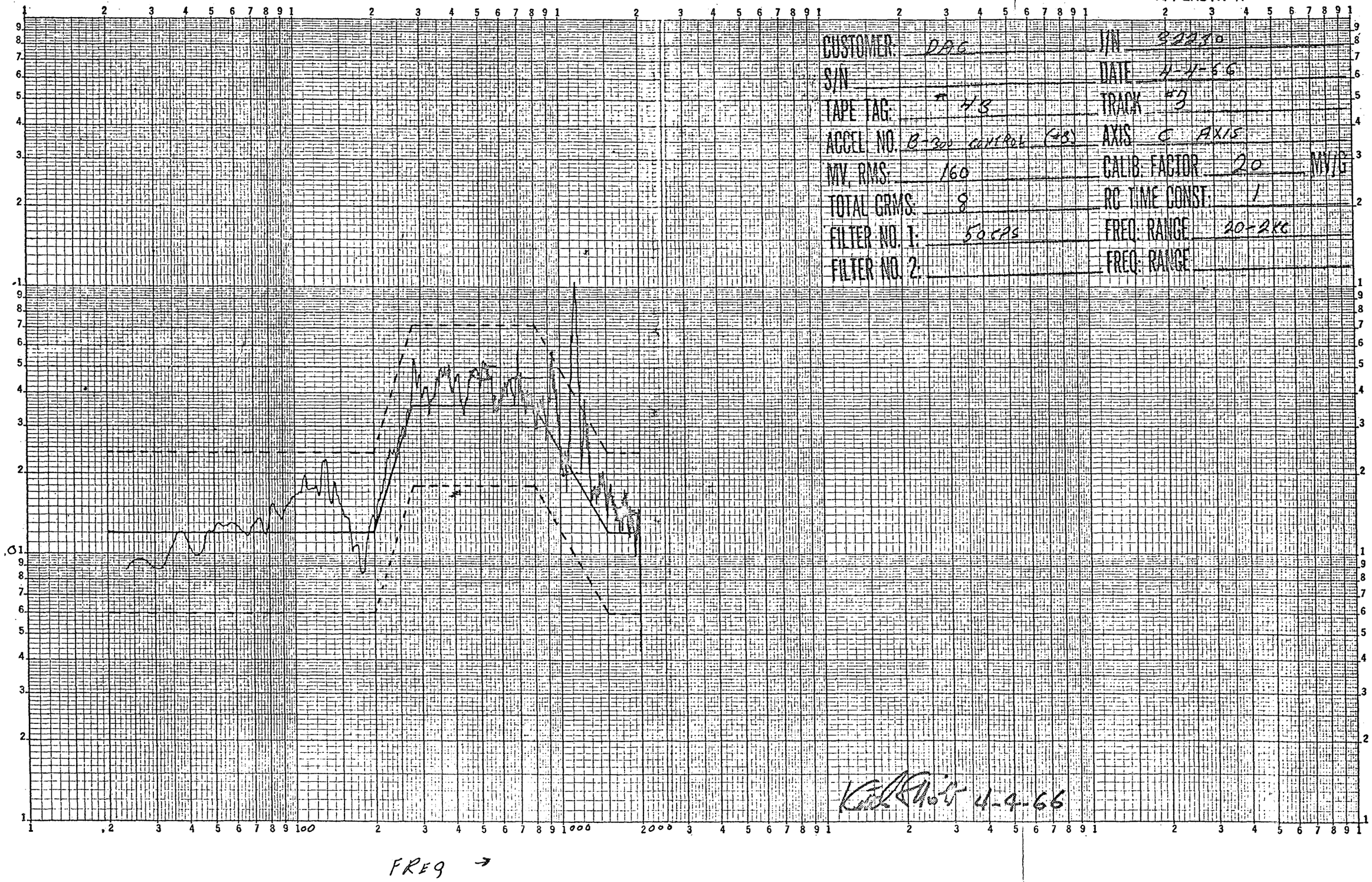
REPORT NUMBER 32230
PAGE NUMBER 142

APPENDIX A

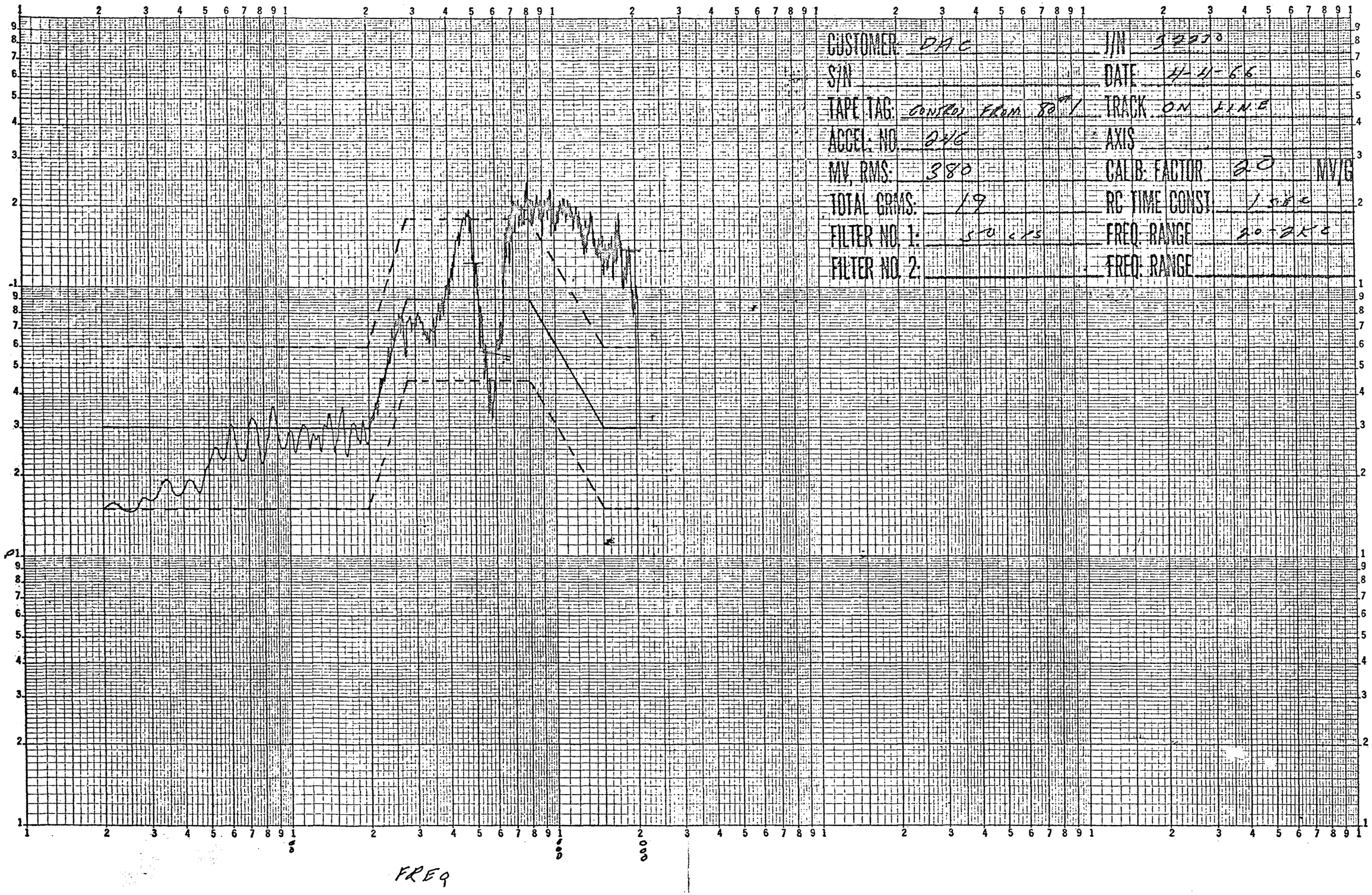


20 TO 50 SEC IN THE RUN

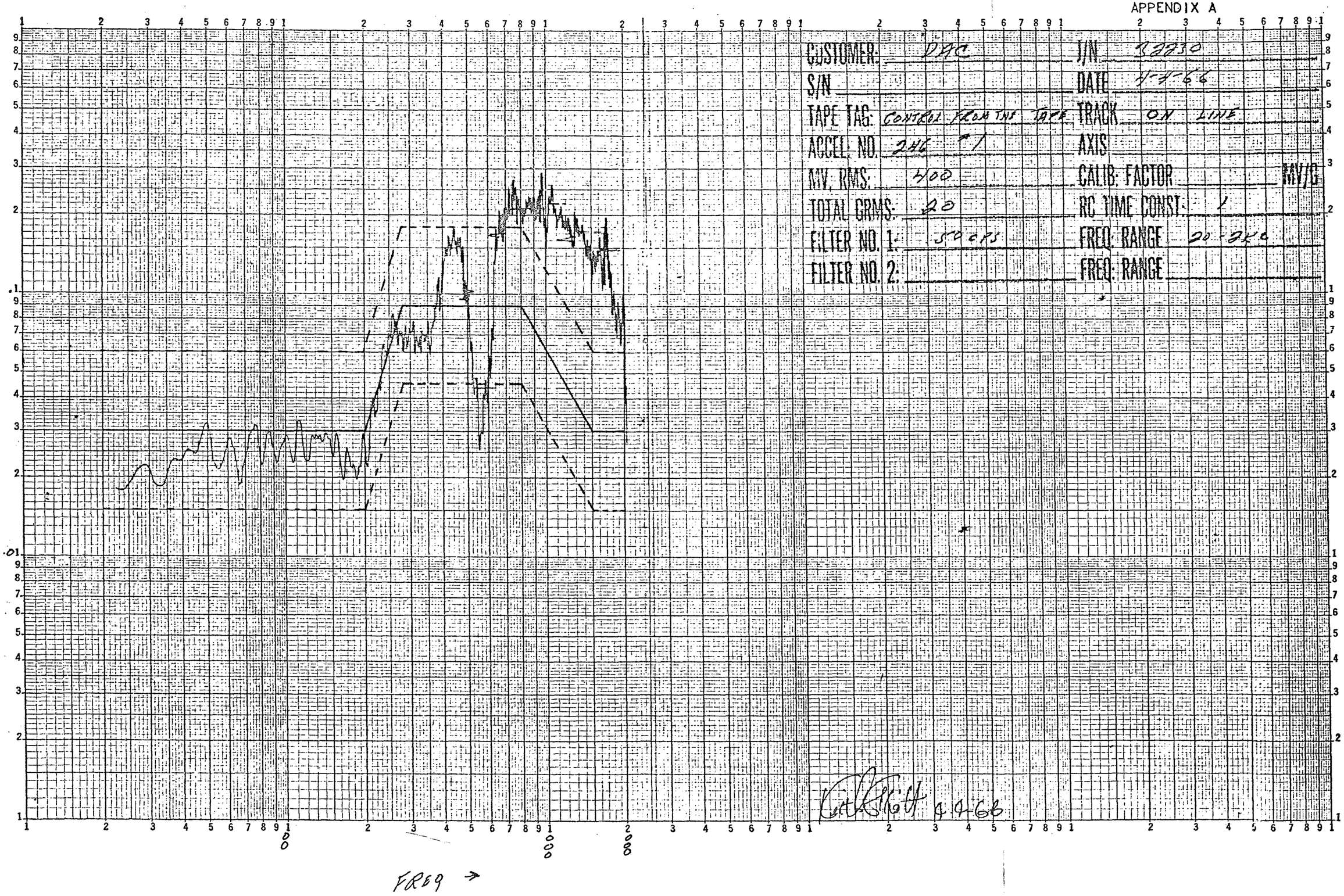
APPENDIX A



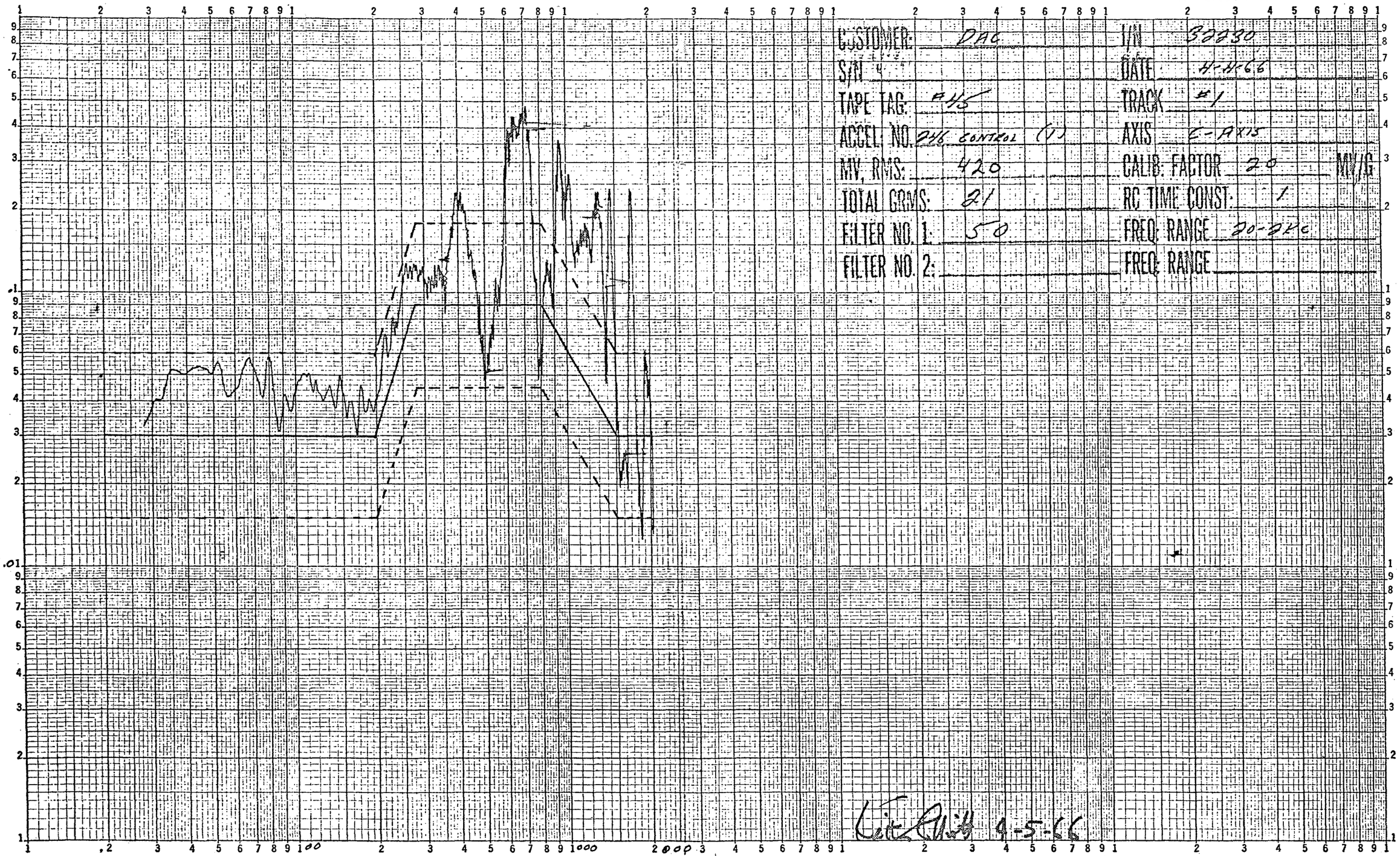
APPENDIX A


CUSTOMER: DAC
J/N: 32230
S/N:
DATE: 4-4-66
TAPE TAG: CONTROL FROM 80%
TRACK: ON LINE
ACCEL. NO.: 246
AXIS:
MV. RMS: 380
CALIB. FACTOR: 20 MV/G
TOTAL GRMS: 19
RC TIME CONST: 1.5 SEC
FILTER NO. 1: 50 & 15
FREQ. RANGE: 20-2KC
FILTER NO. 2:
FREQ. RANGE:
FREQ

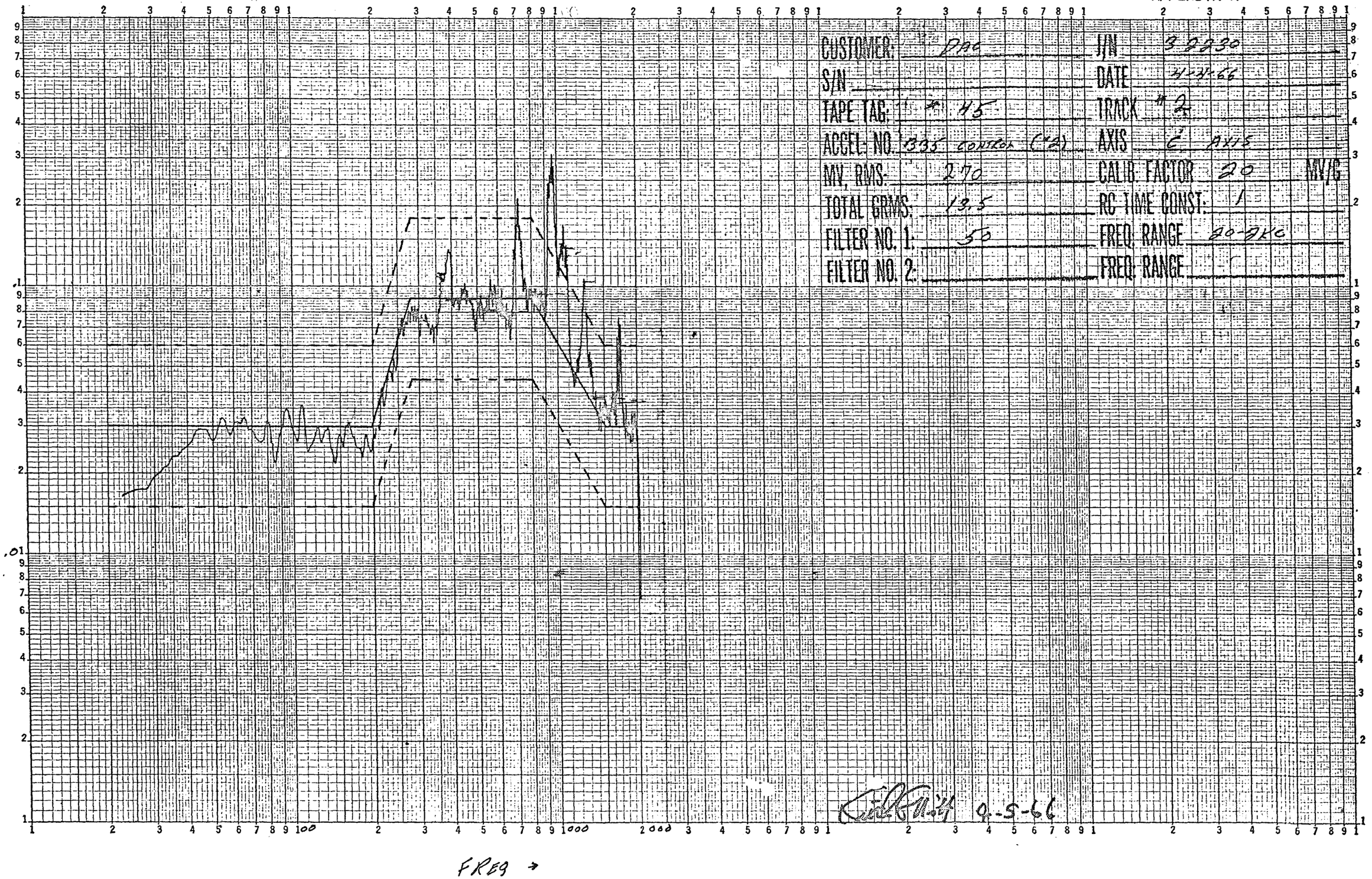
APPENDIX A


CUSTOMER: DAC
J/N 32230
S/N
DATE 4-4-66
TAPE TAG: CONTROL FROM THE TAPE
TRACK ON LINE
ACCEL. NO. 246 #1
AXIS
NV. RMS: 400
CALIB. FACTOR MV/G
TOTAL GRMS: 20
RC TIME CONST: 1
FILTER NO. 1: 50 CPS
FREQ. RANGE 20-2KC
FILTER NO. 2:
FREQ. RANGE
4-4-66
FREQ →

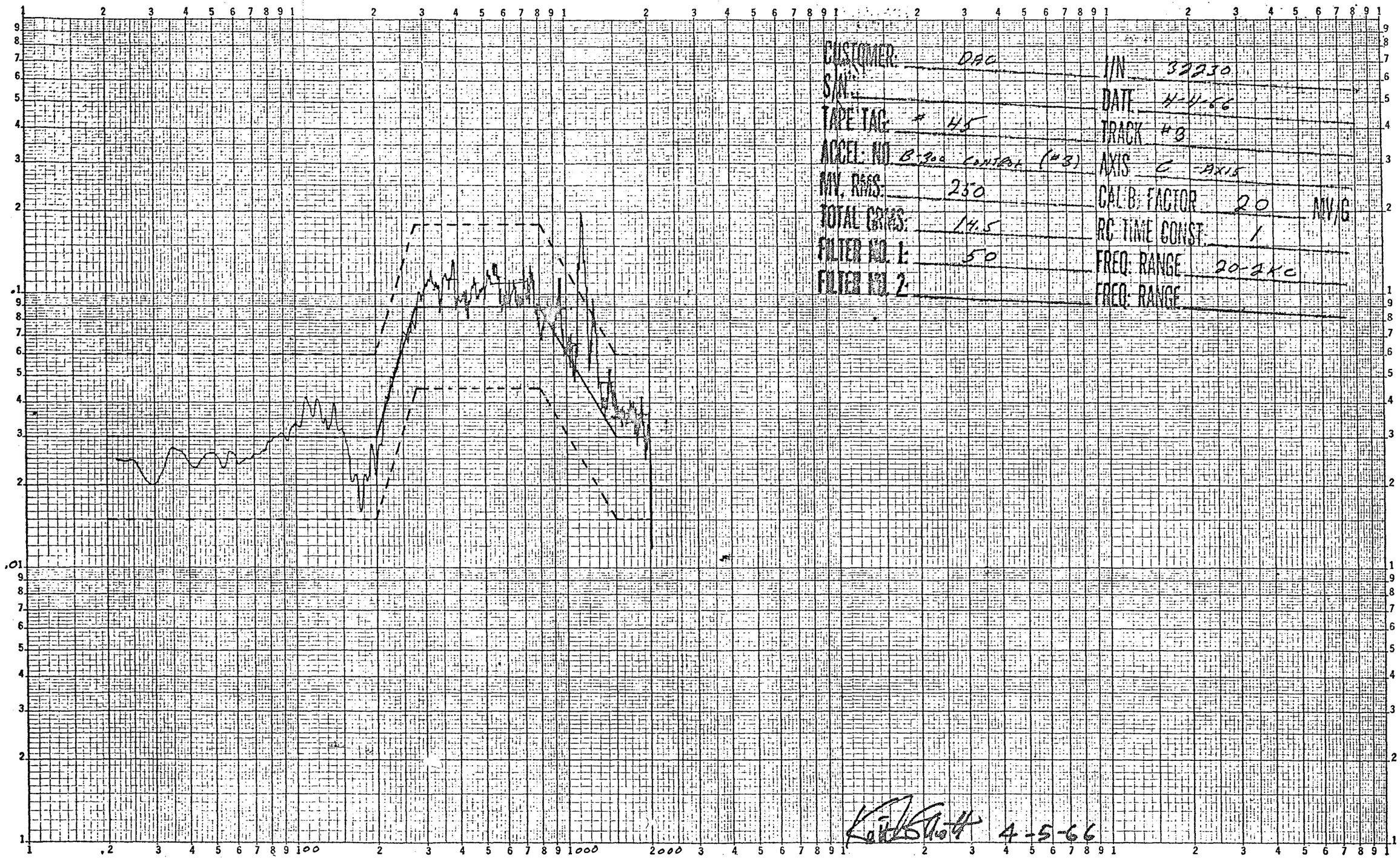
APPENDIX A


CUSTOMER: DAC
S/N
TAPE TAG: #45
ACCEL. NO. 246 CONTROL (V)
MV, RMS: 420
TOTAL GRMS: 21
FILTER NO. 1: 50
FILTER NO. 2:
I/N 32230
DATE 4-4-66
TRACK #1
AXIS E-AXIS
CALIB. FACTOR 20 MV/G
RC TIME CONST. 1
FREQ. RANGE 20-2KC
FREQ. RANGE
9-5-66
FREQ →

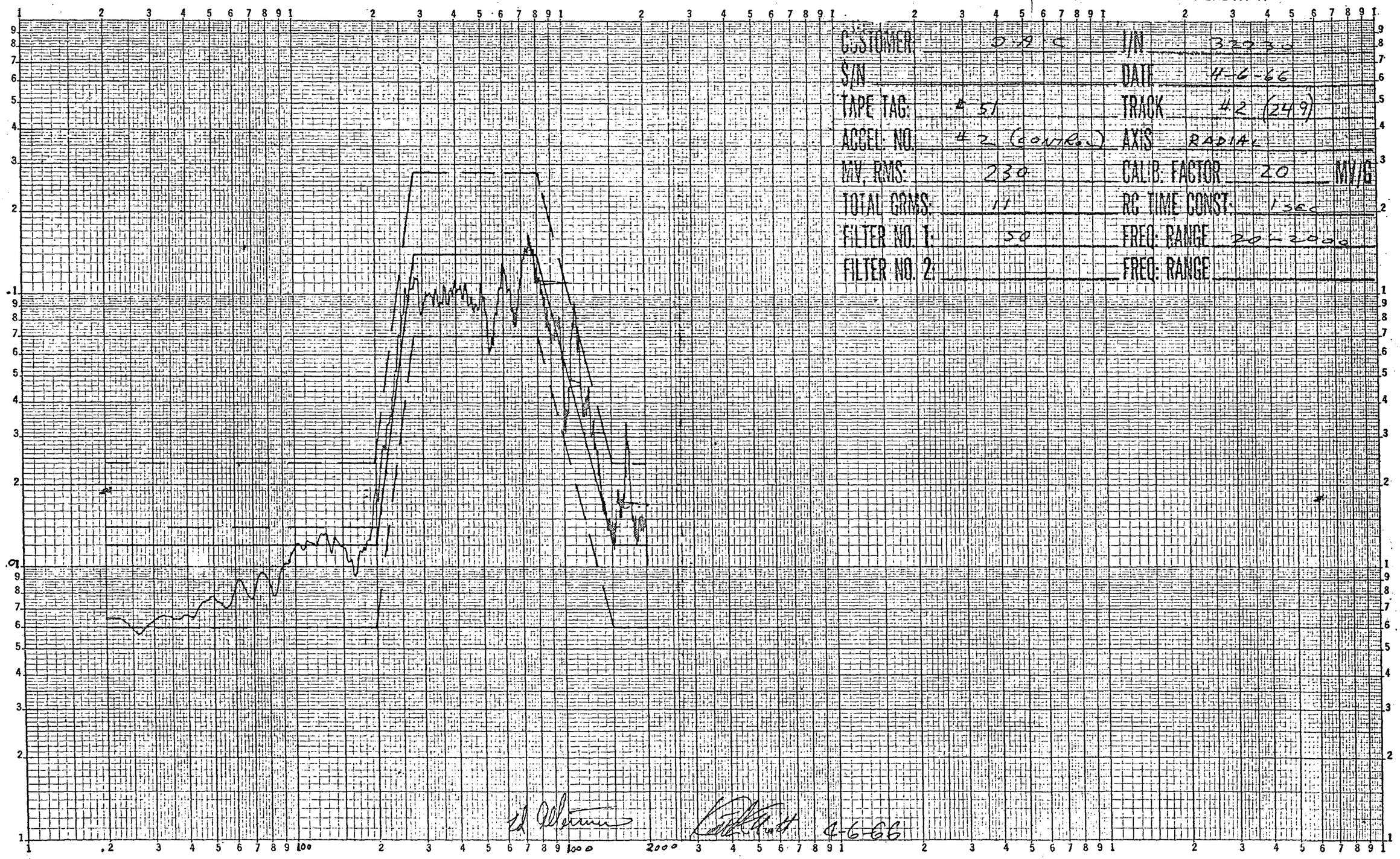
APPENDIX A


CUSTOMER: DAC
J/N 32230
S/N
DATE 4-27-66
TAPE TAG: # 45
TRACK # 2
ACCEL. NO. 1335 CONTROL (#2)
AXIS Z AXIS
MV, RMS: 270
CALIB. FACTOR 20 MV/G
TOTAL GRMS: 13.5
RC TIME CONST: 1
FILTER NO. 1: 50
FREQ. RANGE 20-2KC
FILTER NO. 2:
FREQ. RANGE
4-5-66
.01
100
1000
2000
FREQ →

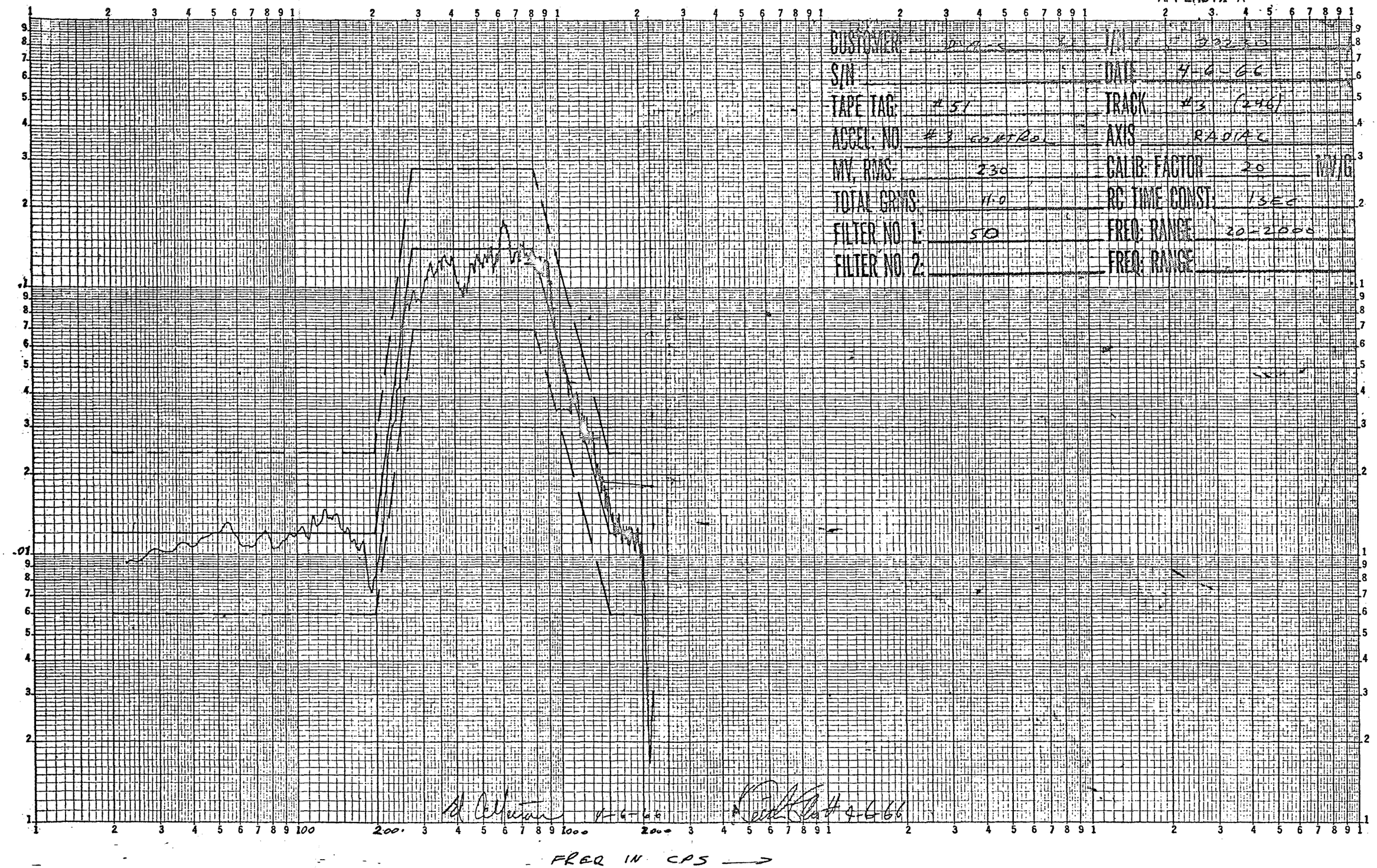
APPENDIX A


CUSTOMER: DAO
S/N:
TAPE TAG: # 45
ACCEL: NO. B-300 CONTROL (#3)
MV. RMS: 250
TOTAL GRMS: 14.5
FILTER NO. 1: 50
FILTER NO. 2:
I/N 32230
DATE 4-4-66
TRACK #3
AXIS C AXIS
CAL.B. FACTOR 20 MV/G
RC TIME CONST. 1
FREQ. RANGE 20-2KC
FREQ. RANGE
4-5-66
FREQ →

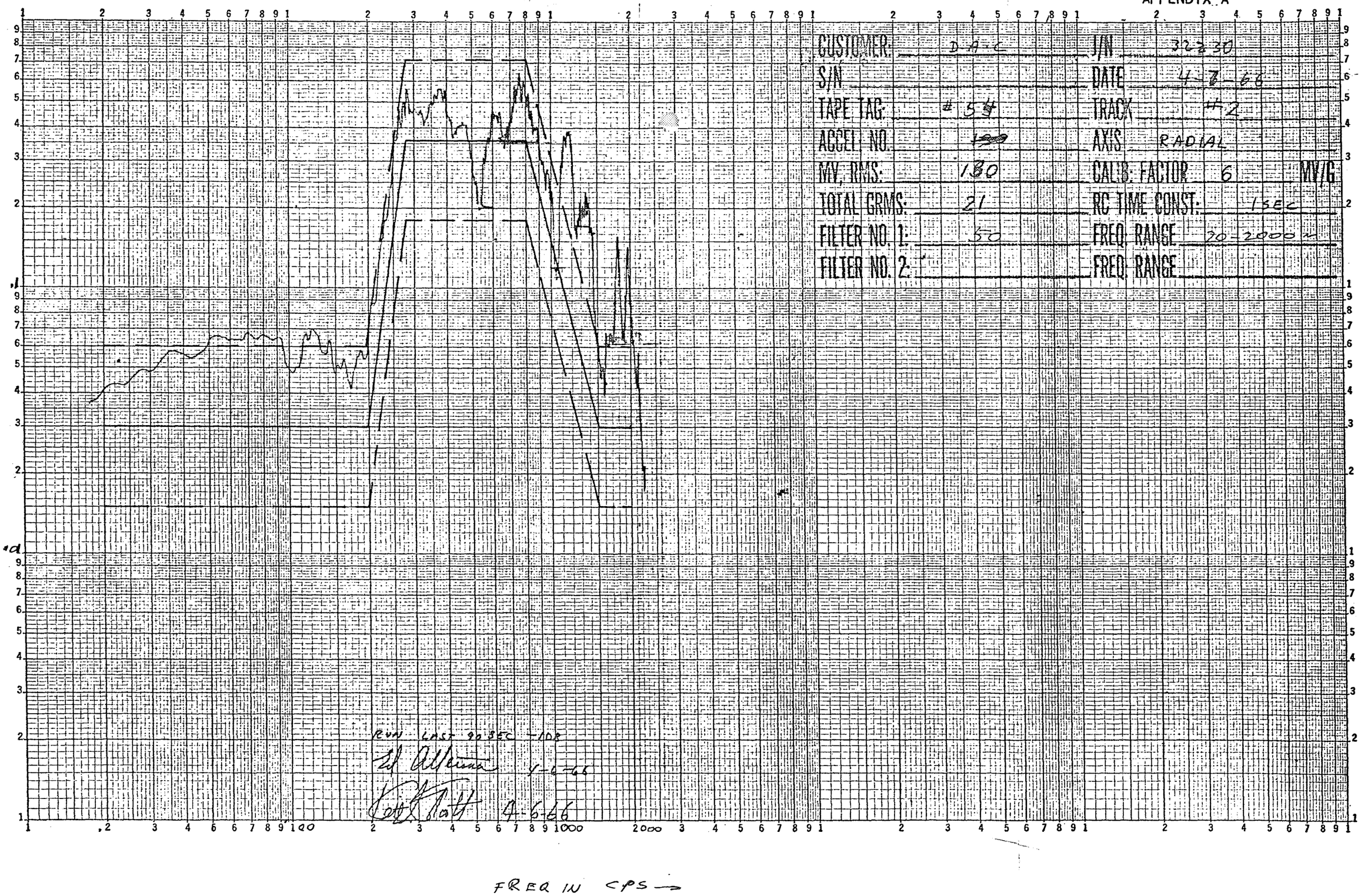
APPENDIX A


CUSTOMER: D-9 C
J/N 32030
S/N
DATE 4-6-66
TAPE TAG: #51
TRACK #2 (249)
ACCEL. NO. #2 (cont.)
AXIS RADIAL
WV. RMS: 230
CALIB. FACTOR 20 MV/G
TOTAL GRMS: 11
RC TIME CONST. 1 sec
FILTER NO. 1: 50
FREQ. RANGE 20-2000
FILTER NO. 2:
FREQ. RANGE
4-6-66
.01
.1
1
100
1000
2000

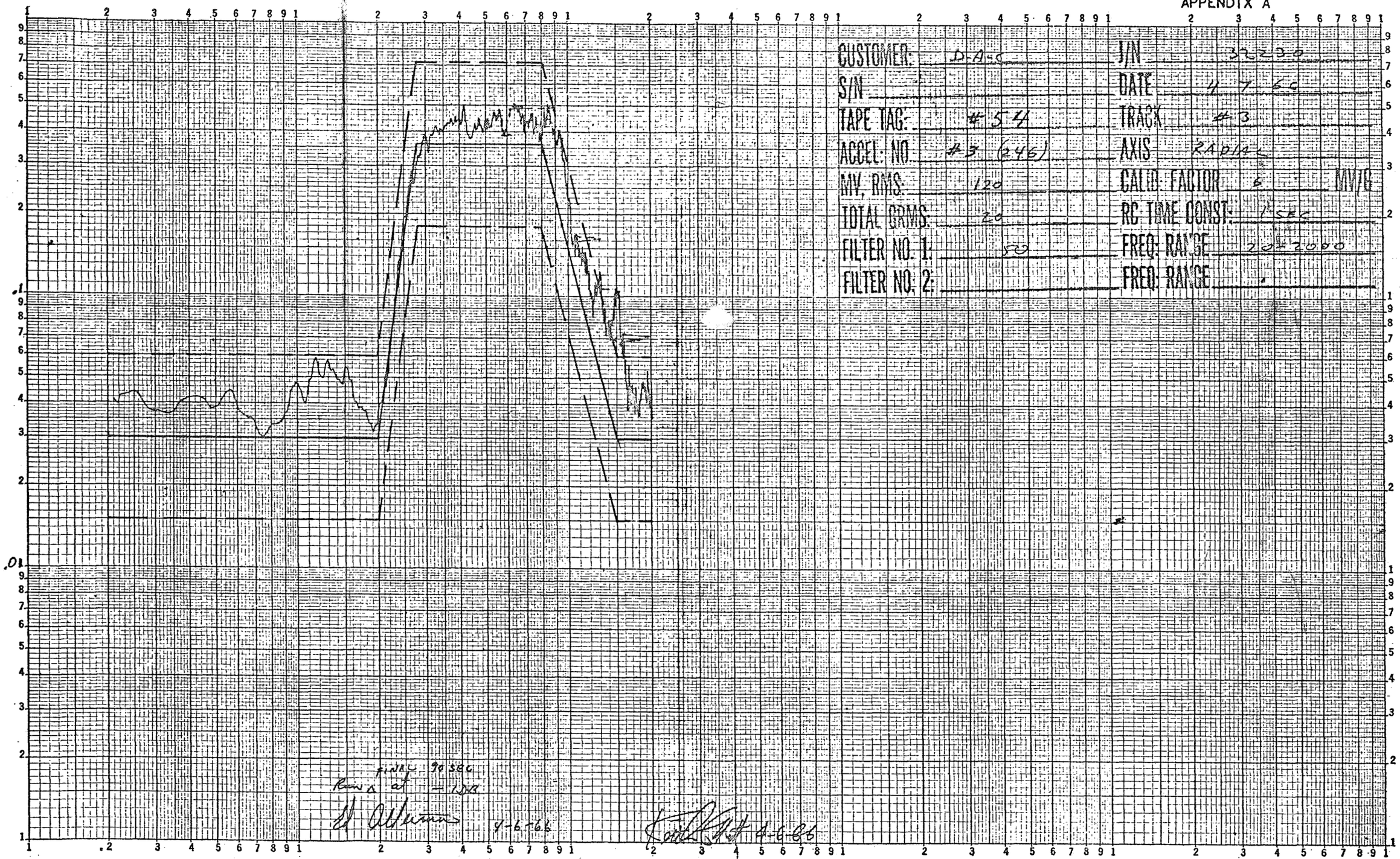
APPENDIX A


CUSTOMER: DOD
S/N:
TAPE TAG: #51
ACCEL. NO: #3 CONTROL
MV, RMS: 230
TOTAL GRMS: 11.0
FILTER NO 1: 50
FILTER NO 2:
J/N: 32230
DATE: 4-6-66
TRACK: #3 (246)
AXIS: RADIAL
CALIB. FACTOR: 20 MV/G
RC TIME CONST: 1 SEC
FREQ. RANGE: 20-2000
FREQ. RANGE:
4-6-66
4-6-66
.01
100
200
1000
2000
FREQ IN CPS

APPENDIX A


CUSTOMER: D-A-C
S/N
TAPE TAG: # 54
ACCEL NO. 180
MV, RMS: 180
TOTAL GRMS: 21
FILTER NO. 1: 50
FILTER NO. 2:
J/N 32230
DATE 4-8-66
TRACK #2
AXIS RADIAL
CALIB. FACTOR 6 MV/G
RC TIME CONST: 1 sec
FREQ. RANGE 20-2000 ~
FREQ. RANGE
RUN LAST 90 SEC -108
4-6-66
4-6-66
FREQ IN CPS

APPENDIX A


CUSTOMER: D-A-C
J/N 32230
S/N
DATE 4 7 66
TAPE TAG: #54
TRACK #3
ACCEL: NO. #3 (246)
AXIS RADIAL
MV, RMS: 120
CALIB: FACTOR 6 MV/G
TOTAL GRMS: 20
RC TIME CONST: 1 SEC
FILTER NO. 1: 50
FREQ: RANGE 20-2000
FILTER NO. 2:
FREQ: RANGE
.1
.01
FINAL 90 SEC
Run A at -1DB
4-6-66
4-6-66

WYLE LABORATORIES

JULY 12, 1966

DOUGLAS AIRCRAFT COMPANY
3000 OCEAN PARK BOULEVARD
SANTA MONICA, CALIFORNIA

ADDENDUM TO REPORT #32230

ATTENTION: MR. JOHN SCHULTZ

REFERENCES: YOUR PURCHASE ORDER NUMBER T&M 0301A
WYLE LABORATORIES JOB NUMBER 32230
REPORT NUMBER 32230
GOVERNMENT CONTRACT NUMBER NAS 7-101

GENTLEMEN:

PURSUANT TO YOUR REQUEST THE ENCLOSED SHEETS LIST THE TOLERANCES OF THE EQUIPMENT UTILIZED IN THE PERFORMANCE OF THE TESTS ON A BELLOWS, PROPULSIVE FUEL VENT, PART NUMBER 1A87152-1, LINE ITEM FQH-17.

FACILITY: EL SEGUNDO
DEPARTMENT: 560
DEPARTMENT MANAGER: [signature]
TEST WITNESS:
QUALITY CONTROL APPROVAL: [signature]
DCAS-QAR:

ENCLOSURES: ADDENDUM SHEETS (5 PAGES)

BLOCK DIAGRAM FIGURE OF REPEAT AND PRESSURE CYCLE SETUP

TESTING DIVISION EL SEGUNDO FACILITY
128 Maryland Street, El Segundo, California 90245
EAstgate 2-1763 ORegon 8-4251 Area Code 213
TWX 213 322-5415 Cable WYLAB

APPARATUS	WYLE/GOV'T. #	TOLERANCE
VIBRATION EXCITER	5093	N/A
VIBRATION EXCITER	10016	N/A
VIBRATION EXCITER	91280	N/A
POWER AMPLIFIER	6375	N/A
POWER AMPLIFIER	6871	N/A
POWER AMPLIFIER	6374	N/A
AUTOMATIC VIBRATION CONTROLLER	6613	±1% FREQUENCY ±4% METER
AUTOMATIC VIBRATION CONTROLLER	6226	±1% FREQUENCY ±4% METER
AUTOMATIC VIBRATION CONTROLLER	6271	±1% FREQUENCY ±4% METER
RANDOM CONSOLE	6534	±0.5 DB
RANDOM CONSOLE	6812	±0.5 DB
PHASE CONTROL UNIT	30581	0-360° ± 3 5-3000 HZ
AM-PM MULTIPLIER	31010	±1% F.S. DC-3000 HZ
AM-PM MULTIPLIER	31009	±1% F.S. DC-3000 HZ
AM-PM MULTIPLIER	S/N 10 RENTAL	±2% F.S. DC-3000 HZ
VOLTMETER	6356	±2% F.S.
CHARGE AMPLIFIER	4530	±1% 10-5000 HZ
CHARGE AMPLIFIER	4529	±1% 10-5000 HZ
CHARGE AMPLIFIER	4531	±1% 10-5000 HZ
CHARGE AMPLIFIER	4532	±1% 10-5000 HZ
CHARGE AMPLIFIER	4533	±1% 10-5000 HZ

APPARATUS	WYLE/GOV'T. #	TOLERANCE
CHARGE AMPLIFIER	4549	±1% 10-5000 HZ
CHARGE AMPLIFIER	99960	±1% 10-5000 HZ
CHARGE AMPLIFIER	99964	±1% 10-5000 HZ
CHARGE AMPLIFIER	99966	±1% 10-5000 HZ
CHARGE AMPLIFIER	99967	±1% 10-5000 HZ
CHARGE AMPLIFIER	99962	±1% 10-5000 HZ
AMPLIFIER	4668	±3%
TAPE RECORDER	S/N 509	±0.5 DB
OSCILLOGRAPH	1085	±0.5% TIME ±2% SPEED
ACCELEROMETER	6437	±2% LINEARITY
ACCELEROMETER	6438	±2% LINEARITY
ACCELEROMETER	6887	±2% LINEARITY
ACCELEROMETER	4376	±2% LINEARITY
ACCELEROMETER	6342	±2% LINEARITY
*ACCELEROMETER	6343	±2% LINEARITY
ACCELEROMETER	6791	±2% LINEARITY
ACCELEROMETER	6793	±2% LINEARITY
ACCELEROMETER	6796	±2% LINEARITY
ACCELEROMETER	6794	±2% LINEARITY
ACCELEROMETER	6795	±2% LINEARITY
ACCELEROMETER	6792	±2% LINEARITY
ACCELEROMETER	8543	±2% LINEARITY
ACCELEROMETER	6574	±2% LINEARITY

*REPLACED ACCELEROMETER ON 4/2/66 - W/N 6438

APPARATUS	WYLE/GOV'T. #	TOLERANCE
ACCELEROMETER	6427	±2% LINEARITY
VOLTMETER	6469	±3% F.S.
VOLTMETER	6823	±3% F.S.
VOLTMETER	6513	±3% F.S.
VOLTMETER	5504	±3% F.S.
VOLTMETER	5523	±3% F.S.
VOLTMETER	6597	±3% F.S.
OSCILLOSCOPE	6456	±5%
OSCILLOSCOPE	6585	±5%
OSCILLOSCOPE	6536	±5%
AMPLIFIER	6504	±2% GAIN
AMPLIFIER	6472	±2% GAIN
AMPLIFIER	6467	±2% GAIN
POWER SUPPLY	6492	±5% REG.
POWER SUPPLY	6511	±5% REG.
POWER SUPPLY	6493	±5% REG.
*WAVE SNYTHESIZER	6615	±5%
**WAVE SNYTHESIZER	30934	±5%
OSCILLOSCOPE	6770	±3%
OSCILLOSCOPE	5535	±3%
X-Y RECORDER	6175	±1% F.S.
AMPLIFIER	6177	N/A
AMPLIFIER	3178	N/A

*USED FOR RADIAL (A) AND THRUST (C) AXES SHOCK TESTS
**USED FOR TANGENTIAL (B) AXIS SHOCK TEST

APPARATUS	WYLE/GOV'T. #	TOLERANCE
LOG CONVERTER	3401	±0.5 DB
SWEEP OSCILLATOR	1046	±1%
PHASE METER	G1312	N/A
FREQUENCY CONVERTER	4354	N/A
ELECTRONIC COUNTER	5427	±1 COUNT
WAVE ANALYZER	6280	±0.25 DB
WAVE ANALYZER	S/N 183 RENTAL	±0.5 DB LINEARITY
STRIP-CHART RECORDER	4320	N/A
MANOMETER	3568	±0.1 INCH
PRESSURE GAUGE	4257	±0.25% F.S.
PORTABLE POTENTIOMETER	2221	±0.03%
MANOMETER	3574	±0.1 INCH
PRESSURE TRANSDUCER	S/N 156	N/A
PRESSURE TRANSDUCER	2512	N/A
PRESSURE TRANSDUCER	S/N 10156	N/A
PRESSURE TRANSDUCER	S/N 354	N/A
PRESSURE TRANSDUCER	S/N 499	N/A
PRESSURE GAUGE	G1103	±0.5% F.S.
PRESSURE GAUGE	G1104	±0.25% F.S.
PRESSURE GAUGE	4213	±0.25% F.S.
STRIP-CHART RECORDER	G1051	N/A
PRESSURE TRANSDUCER	5438	N/A
PRESSURE TRANSDUCER	6675	N/A
DEAD WEIGHT TESTER	G1187	0.1% OF INDICATED
PRESSURE GAUGE	G1046	±0.25% F.S.
PRESSURE GAUGE	G1044	±0.25% F.S.

APPARATUS	WYLE/GOV'T. #	TOLERANCE
DECADE RESISTOR	2063	±0.05%
PRESSURE GAUGE	4183	±0.25% F.S.
PRESSURE GAUGE	4130	±0.5% F.S.
PRESSURE GAUGE	G1055	±0.25% F.S.
PRESSURE GAUGE	G50513	±0.25%
PORTABLE POTENTIOMETER	30045	±0.1%

ADDENDUM F

FAILURE AND REJECTION REPORTS

FAILURE AND REJECTION REPORT

TM-DSV4B-ENV-25776
Page E-1

PRINT · DO NOT WRITE · USE BLACK BALLPOINT PEN ONLY

I- REJECTION

1. REPORT SERIAL NO.: A162586
2. REFERENCE REPORT NO.:
3. DATE: MO. 1 DAY 5 YEAR 66
4. MODEL: DSV4B
5. PART NUMBER: 1A87152-1
6. SUPPLIER: FAIRCHILD PROD. METAL PRODS. CODE: 2670239
7. PART SERIAL NO.: 042
8. QUANTITY IN LOT: 1
9. QTY. REJECTED: 1
10. PART NAME: BELLOWS, PROP. FUEL VENT
11. MANUFACTURER: SAME CODE:
12. REASON FOR REPORT IN DETAIL (NOTE DRAWING OR SPECIFICATION REQUIREMENTS & LOCATION OF DISCREPANCY):
TCDITD2860 ITEM FQH-17 CODE (6)
(1) UPON EXAMINATION OF SPECIMEN AFTER DEFLECTION CYCLE TESTS IT WAS DISCOVERED THAT BOTH BELLOWS HAD DEVELOPED A PERMANENT SET OF APPROX. 4°
(2) A DING WAS NOTED IN THE 4" DIA. BETWEEN THE BELLOWS.
THE FOLLOWING TESTS HAVE BEEN COMPLETED:- PROOF, LEAKAGE, SPRING RATE, FLOW, PRESSURE CYCLE, DEFLECTION CYCLE (AMB & COLD)
BLOCK 18.5 THIS IS A SATURN FORMAL QUALIFICATION TEST PART
13. INSTALLED IN (P/N OR NAME): 1A87436-501 (ASSY.) UNIT NO.:
14. CONDITION:
.1 ☒ INCOMPLETE/TEMPORARY NON-CONFORMANCE
.2 ☐ PERMANENT NON-CONFORMANCE
.3 ☐ CONFORMING BUT UNSATISFACTORY
15. PART OPERATING TIME: .1 HOURS .2 CYCLES
16. PURCHASE ORDER NO.:
17. REC. REGISTER NO.:
18. STATUS:
.1 ☐ RECEIVING
.2 ☐ FAB./ASSEM./INST.
.3 ☐ SYSTEM CHECK OUT
.4 ☐ OPERATIONAL
.5 ☒ OTHER (EXPL. BLK. 12)
19. F.O. OR ASSEM. JOB NO.: 9016174
20. SHIP ORDER NO.: 5769-6404
21. SOURCE INSPECTED: .1 ☒ DACO .2 ☐ GOV'T. .3 ☐ OTHER .4 ☐ NO
22. REJECTION CODE:
23. ROUTE TO: A-290
24. DEPT. REJ. IN: A-290
25. RESP. "Q" STAMP:
26. RESP. AGENCY:
27. RESP. CHANGE:
28. RESP. CHANGE APPROVAL:
29. REPORTED BY: M. W. Warner 2-15-66 STAMP: 736

II- REJECTION CHECK AND APPROVAL

30. APPROVED BY:
31. .1 ☐ M.R.B. ACTION .2 ☐ N.D.A. ACTION

III- DISPOSITION

32. DEFECT CLASSIFICATION: .1 ☐ CRITICAL .2 ☐ MAJOR .3 ☒ MINOR
33. N.D.A. SERIAL NO.:
34. DISPOSITION OF DOUGLAS ITEMS: .1 ACCEPTABLE AS IS QTY. .2 REWORK QTY. .3 SCRAP QTY.
DISPOSITION OF VENDOR ITEMS: .1 ACCEPTABLE AS IS QTY. 1 .2 REWORK OR REPLACE QTY. .3 REPLACE ONLY
35. DISPOSITION AUTHORITY: QUALITY CONTROL 3/22/66 ENGINEERING GOVERNMENT
37. SPECIFIC INSTRUCTIONS: NOT ACCEPTABLE TO ENG FOR USE.
1.1 THE VENDOR IS TO COMPLETE ATTACHED SUPPLEMENTAL FAILURE ANALYSIS REPORT (FORM 60-732) AT THE VENDOR. THE FAILURE ANALYSIS SHALL BE WITNESSED BY A DAC REPRESENTATIVE IN ACCORDANCE WITH ITEM B, INSTRUCTIONS FOR ANALYSIS. THE VENDOR SHALL COMPLETE ITEMS C, D, AND E OF FORM 60-732 AND RETURN COMPLETED REPORT TO DAC AS REQUIRED BY ITEM B
1.2 THE BELLOWS IS TO BE HAND AVAILABLE TO THE VENDOR FOR FAILURE ANALYSIS, AND SUBSEQUENT REPLACE. THE SPECIMEN MAY BE HAND CARRIED AS AUTHORIZED BY ENGG. ORDER 1A87152-1001 [illegible]
1.3 IDENTIFY [illegible]
1.4 AFTER ANALYSIS, RETURN BELLOWS AS IS, TO BE IMPOUNDED IN ACCORDANCE WITH EXISTING DAC/MSSD PROCEDURES FOR ACCOUNTABILITY OF S.M. 41412.
3/21/66 D. Barber A263 ENG6 L/A
37.1 RESULTING CLASSIFICATION NONE

IV- CORRECTIVE ACTION

38. SUPPLEMENTARY FAIL. ANAL. REQ'D BY: .1 ☐ YES .2 ☒ NO D. Barber 3/3/66 DATE
39. CAUSE OF DISCREPANCY:
40. CLASSIFICATION OF CAUSE OF DISCREPANCY: .1 ☐ DESIGN .2 ☐ MANUFACTURE/HANDLING DAMAGE .3 ☐ MISUSE IN OPERATION BY 3/21/66
41. CORRECTIVE ACTION: CODE III TEST PART NO C/A REQ.
42. C/A EFFECTIVITY:
43. C/A SIGNATURE: DATE
44. C/A APPROVAL: DATE 3/21/66

V- DISPOSITION ROUTING

45. PROGRESSIVE RWK. INSP. CHECKS REQ'D: .1 ☐ YES .2 ☐ NO REFER TO
46. BONDROOM DISPOSITION: REPLACEMENT P.O. NO.: BONDROOM SIGNATURE:
47. REWORK P.O. NO.: PLANNER: 48.

VI- REJECTION CLEARANCE

49. M.R.B. RESUBMIT (ENG'G):
50. REWORK ACCEPTANCE AND/OR REJECTION CLEARANCE: PRODUCTION | QUALITY CONTROL | GOVERNMENT

VII- OTHER FUNCTIONS

51. TERM. STOCKROOM:
52. REPL. QTY. NEEDED:
53. ACT. UNIT SHORT:
54. PROD. CONT. SIGNATURE: DATE:
55.
56.

PAGE 1 OF 2

F.R.R. CONTINUATION SHEET

DOUGLAS AIRCRAFT COMPANY, INC.

I- REJECTION	1A. REPORT SERIAL NO.	3A. DATE MO.	DAY	YEAR	4A. MODEL	24A. DEPT. REJ. IN	8A. PART NUMBER	CHG.
	A162586	3	3	6	DSV-4B	A-290	1A87152-1	

12A. REASON FOR REPORT IN DETAIL: (CONTINUED)	13A. INSTALLED IN (P/N OR NAME)	UNIT NO.	23A. REPORTED BY	STAMP
SEE PAGE #1 FOR REPORT	1A87436-501		[signature] 3/3/6	191

III- DISPOSITION

37A. SPECIFIC INSTRUCTIONS: (CONTINUED)

1. ACCEPTABLE TO ENGG FOR TESTS.
2. CONTINUE TESTS INCLUDING VIBRATION TO TEST COMPLETION.
(PER NASA REP. PETE LABERT)
3/3/6 [signature] A263 ENGG L/A

37.1 RESULTING CLASSIFICATION MINOR

56A.
PAGE ___ OF ___