FORM NO. 28-650 (11-66)

155

DOUGLAS

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

ENGINEERING LABORATORIES & SERVICES
TECHNICAL MEMORANDUM

TO: H. T. Sorensen, A-290

FROM: T. J. Sereno, A-270; ext. 2461

SUBJECT: OXIDIZER TANK RELIEF VALVE VIBRATION AND SHOCK TESTS

COPIES TO: D. D. Hofferth, H. B. Mitchell, W. Keller, G. Cameron, D. Dearing, C. Hansen, A3-860; T. J. Sereno, A-270; M. Taugher, A-293, (1 reproducible and 1 blue line) C.W. Wilson, A3-860(12)

CATALOG NO. PDL 86257-1

REPORT NO. TM-DSV4B-ENV-R6094-1

DATE 12/7/67

REQUESTED BY D. D. Hofferth

E.W.O. 27557 TCD IT06426 J

TEST PLAN & ITEM NO. FQ 1-9A 41412

SALES ORDER 5769-6404

CLASSIFICATION OR RESTRICTION: Unclassified

PREPARED BY: J. L. Heinzelman

APPROVED BY: T. J. Sereno

M. Taugher - Prime Lab. Test Engr.

APPROVAL SIGNATURES CERTIFY THAT ALL REQUIREMENTS OF REPORT HAVE BEEN MET INCLUDING THE REPORTING OF NEW TECHNOLOGY/REPORTABLE ITEMS PER SPB'S 92 AND 93. DISCLOSURES ARE MADE ON FORMS 25-207 AND 25-207-1.
NEW TECHNOLOGY: ☐ IS CONTAINED IN THIS REPORT, ☒ IS NOT CONTAINED IN THIS REPORT.

ABSTRACT:

INTRODUCTION

Vibration and shock tests were performed for Formal Qualification testing of two oxidizer tank relief valves S/N 508 and 544. The tests were performed at the vibration and shock facilities of the Douglas Dynamics Laboratory, Santa Monica, California, from March 21 through May 2, 1967.

The tests were authorized under Formal Qualification Test Program SM 46532 and General Test Plan SM 41412 for test plan item FQ 1-9A.

PURPOSE

The purpose of the tests was to demonstrate the ability of the test specimen to meet the requirements of Test Procedure Drawing IT23923, revision [illegible] and Test Control Drawing IT06426, revision J.

The purposes of this technical memorandum are to describe and document the vibration and shock portions of the tests and to transmit the significant vibration and shock data obtained from the tests.

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FACILITY FORM 602
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(THRU)
40 (PAGES)
None (CODE)
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(CATEGORY)

FORM 850-2 (11-66)

	DOUGLAS AIRCRAFT CO, INC. MISSILE & SPACE SYSTEMS DIVISION SANTA MONICA, CALIFORNIA	QUALIFICATION STATEMENT	☐ DE/Q TEST ☒ FORMAL QUAL
PROGRAM Saturn		TEST PLAN AND ITEM NUMBER	DAC 56625 FQ-I-9A
TEST PLAN LINE ITEM TITLE	Oxidizer Tank Relief Valve	PART NO.	1A49590-515 "BD"
TECHNICAL MEMORANDUM NUMBER(S)	TM-DSV-4B-PROP-R6094, dated February 2, 1968 TM-DSV-4B-ENV-R6094-1, dated December 7, 1967 TM-DSV-4B-(SSL)-PL-R-5909-3, dated September 25, 1967		

ENGINEERING RESOLUTIONS AND CONCLUSIONS

1. Qualification status of the 1A49590-515 valve is based on the testing of Specimens #3 and #4. Test specimens #1 and #2 are of the obsolete -513 configuration and are not associated with the qualification of the -515 configuration.

2. External leakage up to 3 scim occurred on Specimen #3. The SCD has been revised to allow 10 scim maximum external leakage by the 1A49590 "AS" change.

3. Internal leakage in excess of the 150 scim allowed for non-vibration environments occurred with Specimen #3 and Specimen #4. These failures are attributed to contamination during test and inadequate methods of keeping moisture and ice out of the specimen as confirmed by successful retests following flushing and drying operations.

Continued on Attached Sheet

(USE CONTINUATION SHEET AS NECESSARY)

STATEMENT OF QUALIFICATION

Based on the Formal Qualification test results presented in the attached report, it is the conclusion of the Douglas Aircraft Company that the above item continues to be qualified for use as intended on the Saturn S-IVB.

DESIGN TECHNOLOGY	RELIABILITY ENGINEERING	PROJECT OFFICE-TEST
D. D. Hofferth Chief Engineer Propulsion	7/22/68 7-18-8 6-19-68	

4. Internal leakage in excess of the 3000 scim allowed for vibration environments occurred with Specimen #3 and Specimen #4. The vibration levels specified for this test were prescribed to include maximum levels, which are experienced during static firing. They are significantly more severe than the levels experienced during vehicle flight modes. Vibration testing accomplished under I-9C tested lift-off and flight levels separate from static firing levels. These test results proved that the high leakage rates experienced during the vibration phase of formal qualification testing are not experienced at the lower flight levels. Since all vent gas, during static firing, is ducted away from the test stand and adequate helium is available from a ground supply, the high leakage rate is not significant at that time.

5. The high cracking pressures of Specimen #3 are attributed to inadequate methods of keeping moisture and ice out of the specimen. The valve continued to function within specification after it was baked dry.

6. The low reseat pressures of Specimen #3 during thermal vacuum are attributed to facility limitations causing a flow restriction at the valve inlet. This was evidenced by large differences between inlet pressures and ullage pressure during valve operation. The valve reseated within specification during post thermal vacuum in the normal functional facility.

7. The high cracking pressures of Specimen #4 are attributed to a leak in the reference bellows in the controller portion of the specimen. This specimen was unlike Specimen #3 insofar as #4 was the only -515 valve made without a helium backfill in the reference bellows. The lack of helium did not lend itself to the efficient method of detecting leaks employed by the vendor in the manufacture of all other bellows.

EQUIPMENT

Test Specimens

The test specimens were two oxidizer tank relief valves, test plan item FQ 1-9A, manufactured by W. O. Leonard, Incorporated, Pasadena, California, manufacturer's P/N 217250-2. The test specimens were identified as follows:

TEST SPECIMEN NO.	SERIAL NO.	PART NUMBER
3	508	1A49590-515AN
4	544	1A49590-515AK-1036

Each test specimen, in turn, was installed on vibration test fixture 1T02802 with associated hardware and components in accordance with test assembly drawing 1T07503. The test fixture weighed approximately 146 pounds.

Test Equipment

Vibration and shock test equipment included the following:

ITEM	MANUFACTURER	MODEL	TAG/SER. NO.
Oscillographs	CEC	5-124	3036(#1) 3037 (#2)
Galvanometers	CEC	7-326	*
Accelerometers	Endevco	*	*
Charge Amplifiers	Endevco	2713A	*
	Unholtz-Dickie	*	*
Tape Recorder	Ampex	PR10	640519
Tape Recorder	Ampex	CP100	625831
Equalizer/Analyzer	Ling	ASDE-80	611825-12
X-Y Recorder	Moseley	2	986
Oscillator	Technical Products	TP626	611595-2
Analyzer	Techncial Products	TP627	611595-3
Integrator	Technical Products	TP633	611595-1
Vibration System	Ling	A-259 (1)	611825
Waveform Synthesizer	Exact	200	634060
Camera	Polaroid	--	562276-2
Memoscope	Hughes	105A	---
Tracking Filters	Spectral Dynamics	SD101A	641625, 641626
Digital Data System	Douglas	--	---

* Channel assignments and instrumentation information are presented on pages A1 through A6.

Accuracy and repeatability were verified by standard calibration procedures during the periodic calibration and certification of the test equipment.

PROCEDURE

Each test specimen, in turn, was installed on the vibration exciter head for excitation in the thrust axis and was supported on a slip table for excitation in the radial and tangential axes. Accelerometers were installed in the locations and orientations described on pages A1 through A6 and shown on page A7.

Tests, consisting of sinusoidal sweeps, followed by random excitation, and then shock pulses, were performed in each of the three mutually perpendicular axes defined on page A7.

Sinusoidal sweeps were performed from 5 to 2000 to 5 cps with the frequency changing at the rate of one octave per minute. Input levels were as follows:

FREQUENCY (cps)	LEVEL
5 - 25	0.032 inch D.A. Disp.
25 - 47	1.0g (0 - peak)
47 - 200	.0088 inch D.A. Disp.
200 - 2000	17.5g (0 - peak)

Tracking filters with 20 cps bandwidth were used on the control accelerometer and the alternate control accelerometer. The filtered signal from the control accelerometer was used in the control circuit at frequencies below 200 cps. The filtered signal from the alternate control accelerometer was monitored and its acceleration level constrained so as not to exceed test specification levels at frequencies below 200 cps. This peak limiting was accomplished with the use of override control techniques at the control console. The unfiltered signal from the control accelerometer was used for control above 200 cps.

Sinusoidal data were recorded on oscillograph charts, FM magnetic tape, and the digital data system.

Random vibration tests were performed for each axis in the following steps:

1. With the test specimen installed, the spectral density equalizer was set to 1/4 of the full-power specification, and the spectrum was checked visually by examination of the equalizer meters.

2. When the setting appeared satisfactory, a brief full-power run was made, during which time the signal response of the control accelerometer was recorded on a magnetic tape loop and subsequently analyzed.

PROCEDURE (continued)

3. When the tape loop analysis showed a satisfactory spectrum, the remainder of the full-power run was completed.

Random vibration tests were performed for a total duration of 12 minutes in each axis. Input levels were as follows:

FREQUENCY (cps)	LEVEL
20 - 60	.01 g^2/cps
60 - 120	+10 db/octave
120 - 2000	.1 g^2/cps

Random data were recorded by the digital data system, and on FM magnetic tape.

Before the shock tests were performed, system accuracy was checked as follows:

1. Horizontal scale accuracy was verified by standard calibration procedures during the periodic calibration and certification of the memoscope.

2. Vertical input deflection was adjusted by inserting a calibration signal corresponding to a known acceleration level and adjusting the memoscope potentiometer until the trace peaks coincided with the desired vertical scale divisions.

Shock pulses were shaped by a waveform synthesizer, displayed on a memoscope, and photographed by a Polaroid camera. The input level for all axes was as follows:

Number . . . . . Three pulses per axis
Input Shape . . . . Half sine wave
Acceleration . . . . 20g (0 - peak)
Duration . . . . . 10 ± milliseconds

Shock response data were recorded on oscillograph charts and FM tape.

Low temperature, pressure, and operational requirements associated with the vibration and shock tests were controlled, monitored, and documented by the prime laboratory, group ADDO.

RESULTS AND DISCUSSION

Sinusoidal data are presented as plots of Acceleration versus Frequency on the following pages:

SERIAL NO.	AXIS	PAGE NUMBER
544	Radial	A8 through A10
544	Tangential	A11 through A13
544	Thrust	A14 through A16
508	Radial	A17 through A19
508	Tangential	A20 through A22
508	Thrust	A23 through A24*

* Data below 15 cps on pages A23, A24, and A25 were invalid because of an incompatible noise-to-signal ratio. However, the input was verified by closely monitoring the control signal on the console meters during the test.

Random vibration data are presented as equalization control plots of Spectral Density versus Frequency on the following pages:

SERIAL NO.	AXIS	PAGE NUMBER
544	Radial	A26
544	Tangential	A27
544	Thrust	A28
508	Radial	A29
508	Tangential	A30
508	Thrust	A31

Shock test data re presented as photographic plots of Acceleration versus Time on page A32 for S/N 544 and on page A33 for S/N 508. These data were approved by the Task Force representative.

Oscillograph charts and FM tapes of response accelerometer signals recorded during sinusoidal and random vibration testing and shock tests are stored in the AGBI files in accordance with the deferred data policy described in memorandum A270-AGBO-66145.

Vibration and shock test requirements for Formal Qualification testing of test specimens S/N 544 and S/N 508 were satisfactorily met.

ATTACHMENTS

Pages A1 through A33

FORM 80 28-509 (2-61)

DOUGLAS

INSTRUMENTATION CHANNEL ASSIGNMENT - DYNAMIC TEST

TEST TITLE: OXIDIZER TANK RELIEF VALVE
S.O. 5769-6404 EWO 27557 TPD 1T23723 TCD LT06926
P/N SPECIMEN 1A49590-51 S/N AK4036 S/N 544
ENGINEER: MVV EXT.
TECHNS.
STANDARD ACCEL. TYPE S/N CAL. DUE

TAPE REC. MODEL CP100 S/N 625831 FACILITY 249 UNIT 128
RECORD SPEED 15 IN/SEC 27KC TAPE REEL NO.
OSCILLOGRAPH TYPE 5-124 S/N 3036 #1, 3037 #2
PAPER SPEED 25 MM/SEC
TIMING LINES — SEC PAPER —

REPORT NO. R6094-1
PAGE A1
SHEET 1 OF 1
DATE 3-21, 22-67
LINE ITEM EQ-17A
RUN NO. SINE - RANDOM
AXIS RADIAL

LOC. NO.	TAPE REC. CHAN.	OSC CHAN #1	OSC CHAN #2	XDCR CABLE NO.	MEASUREMENT LOCATION	RESR. AXIS	XDCR MODEL	SERIAL NO.	XDCR AMP MODEL	SERIAL NO.	OSC GALVO MODEL	SERIAL NO.	TAPE REC AMP MODEL	RANDOM ~~SERIAL NO.~~ G	SINE SWEEP UP CALIB LEVEL g's PK	SINE SWEEP DOWN CALIB LEVEL ~~MVV~~ G PK	CHARGE SENS. Pc/PKG	LOC. NO.
1	1	3	3	1	CONTROL - UNDER VALVE ON DOME	SHAKE	2242C	ND51	8PMCVA	EI-11823	7-326	14072 / 13300		20 RMS	15	15	2.00	1
2	2	11		2	ALT. CONTROL - ON DOME ABOVE VALVE	SHAKE	2242C	NC65	8PC	EI-11824	7-326	11261		50 RMS	50	50	2.15	2
3	3	9		3	ON VALVE } TRIAX	∥ TO VALVE	2242C	NA44	2713A	KB23	7-326	11128		300 PK	100	100	2.05	3
4	4	5		4	ON VALVE } TRIAX	TANG.	2242C	JA46	2713A	KB18	7-326	18965		100 PK	100	30	2.17	4
5	5		5	5	ON VALVE } TRIAX	⊥ TO DOME	2242C	ND07	2713A	KB33	7-326	13362		100 PK	100	100	2.05	5
6	6		7	6	BELLOWS FLANGE } BIAX	∥ TO VALVE	2242C	FA71	2713A	KB31	7-326	18760		300 PK	100	100	1.88	6
7	7		9	7	BELLOWS FLANGE } BIAX	⊥ TO DOME	2242C	FA87	2713A	KA92	7-326	9505		300 PK	100	100	1.85	7
8																		8
9																		9
0																		0
1																		1
2																		2
3	13				SINE OSCILLATOR													3
4	14				VOICE CUE													4
5		7			CONTROL - FILTERED	SHAKE	2242C	ND51	2713A	KB14	7-326	11261		20 RMS	15	15	2.00	5
6		13			ALTERNATE CONTROL FILTERED	SHAKE	2242C	NC65	2713A	KB89	7-326	11128		50 RMS	50	50	2.15	6
7																		7
8																		8
9																		9
0																		0
					HEAD MONITOR	SHAKE	2236C	HB54	8PMCVA	EI-11826	—	—					26.0	

NOTES & SKETCHES

DURING RANDOM RUN CHAN. 2 SATURATED DURING 1ST & 2ND 3 1/2 MINUTE RUNS. RECALIBRATED FOR LAST 5 MINUTES OF RANDOM TEST.

SHOCK PULSES WERE RECORDED OVER FIRST PART OF RANDOM TEST BUT SHOULD HAVE ABOUT 8 MINUTES OF DATA.

FORM NO. 28-508 (2-65)

DOUGLAS

INSTRUMENTATION CHANNEL ASSIGNMENT DYNAMIC TEST

TEST TITLE OXIDIZER TANK RELIEF VALVE
S/O 5769-6404 EWO 27557 TPP IT 23929 TCD IT 06926
P/N SPECIMEN 1A49590-51 AK-1036 S/N 544
ENGINEER MW EXT
TECHNS.
STANDARD ACCEL. TYPE S/N CAL DUE

TAPE REC. MODEL CP100 S/N 625831 FACILITY 249 UNIT 128
RECORD SPEED 15 IN/SEC 27KC TAPE REEL NO.
OSCILLOGRAPH TYPE 5-124 S/N 3037 #2, 3036 #1
PAPER SPEED 25 MM/SEC
TIMING LINES — SEC PAPER —

REPORT NO R6094-1
PAGE A2
SHEET 1 OF 1
DATE 3-23-67
LINE ITEM FQ-19A
RUN NO. SINE - RANDOM
AXIS TANGENTIAL

LOC. NO.	TAPE REC. CHAN	OSC CHAN #1	OSC CHAN #2	XDCR CABLE NO.	MEASUREMENT LOCATION	RESP. AXIS	XDCR MODEL	SERIAL NO.	XDCR AMP. MODEL	SERIAL NO.	OSC GALVO MODEL	SERIAL NO.	TAPE REC AMP. MODEL	RANDOM ~~SERIAL NO.~~ G	SINE SWEEP UP CALIB LEVEL g's PK	SINE SWEEP DOWN CALIB ~~INSERT~~ G PK	CHARGE SENS. Pc/PKG	LOC. NO.
1	1	3	3	1	CONTROL - UNDER VALVE ON DOME	SHAKE	2242C	ND51	8PMCVA	EI-11823	7-326	14072 / 13300		15 RMS	20	20	2.00	1
2	2	11		2	ALT. CONTROL - ON DOME ABOVE VALVE	SHAKE	2242C	NC65	8PC	EI-11824	7-326	11261		25 RMS	100	100	2.15	2
3	3	9		3	ON VALVE } TRIAX	∥ TO VALVE	2242C	NA44	2713A	KB23	7-326	11128		300 PK	100	30	2.05	3
4	4	5		4	ON VALVE } TRIAX	TANG.	2242C	JA46	2713A	KB18	7-326	18965		100 PK	100	100	2.17	4
5	5		5	5	ON VALVE } TRIAX	⊥ TO DOME	2242C	ND07	2713A	KB33	7-326	13362		100 PK	100	100	2.05	5
6	6		7	6	BELLOWS FLANGE } BIAX	∥ TO VALVE	2242C	FA71	2713A	KB31	7-326	18760		300 PK	100	100	1.88	6
7	7		9	7	BELLOWS FLANGE } BIAX	⊥ TO DOME	2242C	FA69	2713A	KA92	7-326	9505		100 PK	100	100	1.85	7
8																		8
9																		9
0																		0
1																		1
2																		2
3	13				SINE OSCILLATOR													3
4	14				VOICE CUE													4
5		7			CONTROL - FILTERED	SHAKE	2242C	ND51	2713A	KB14	7-326	11261		15 RMS	20	20	2.00	5
6		13			ALTERNATE CONTROL FILTERED	SHAKE	2242C	NC65	2713A	KB89	7-326	11128		25 RMS	100	100	2.15	6
7																		7
8																		8
9																		9
0																		0
					HEAD MONITOR	SHAKE	2236C	HB54	8PMCVA	EI-11826	—	—					26.0	

NOTES & SKETCHES

FORM NO. 28-598 (7-65)

DOUGLAS

INSTRUMENTATION CHANNEL ASSIGNMENT DYNAMIC TEST

TEST TITLE OXIDIZER TANK RELIEF VALVE
S/O 5769-6404 EWO 27557 TPD IT 23923 TCD IT06426
P/N SPECIMEN 1A49590-51 SAK-1036-S/N 544
ENGINEER MVV EXT
TECHNS.
STANDARD ACCEL. TYPE S/N CAL DUE

TAPE REC. MODEL CP100 S/N 625831 FACILITY 249 UNIT 128
RECORD SPEED 15 IN/SEC 27KC TAPE REEL NO.
OSCILLOGRAPH TYPE 5-124 S/N 3036 #1 3037 #2
PAPER SPEED .25 ~~MM~~ IN/SEC
TIMING LINES — SEC PAPER —

REPORT NO R6094-1
PAGE A3
SHEET 1 OF 1
DATE 3-23-67
LINE ITEM FQ-19A
RUN NO. SINE-RANDOM
AXIS THRUST

3-27-67

LOC. NO.	TAPE REC. CHAN	OSC CHAN #1	OSC CHAN #2	XDCR CABLE NO.	MEASUREMENT LOCATION	RESP. AXIS	XDCR MODEL	SERIAL NO.	XDCR AMP MODEL	SERIAL NO.	OSC GALVO MODEL	SERIAL NO.	TAPE REC AMP MODEL	RANDOM ~~SERIAL NO.~~ G	SINE SWEEP UP CALIB LEVEL g's PK	SINE SWEEP DOWN CALIB ~~INSERT MVV~~ G PK	CHARGE SENS. Pc/PKG	LOC. NO.
1	1	3	3	1	CONTROL - UNDER VALVE ON DOME	SHAKE	2242C	ND51	8PMCVA	EI-11823	7-326	14072 ~~13300~~		15 RMS	20	20	2.00	1
2	2	11		2	ALT. CONTROL - ON DOME ABOVE VALVE	SHAKE	2242C	NC65	8PC	EI-11824	7-326	11261		15 RMS	100	100	2.15	2
3	3	9		3	ON VALVE } TRIAX	∥ TO VALVE	2242C	NA44	2713A	KB23	7-326	11128		300 PK	100	100	2.05	3
4	4	5		4	ON VALVE } TRIAX	TANG. TO	2242C	JA46	2713A	KB18	7-326	18965		100 PK	100	100	2.17	4
5	5		5	5	ON VALVE } TRIAX	⊥ DOME	2242C	ND07	2713A	KB33	7-326	13362		100 PK	100	100	2.05	5
6	6		7	6	BELLOWS FLANGE } BIAX	∥ TO VALVE	2242C	FA71	2713A	KB31	7-326	18760		300 PK	100	100	1.88	6
7	7		9	7	BELLOWS FLANGE } BIAX	⊥ TO DOME	2242C	FA89	2713A	KA92	7-326	9505		100 PK	100	100	1.85	7
8																		8
9																		9
0																		0
1																		1
2																		2
3	13				SINE OSCILLATOR													3
4	14				VOICE CUE													4
5		7			CONTROL - FILTERED	SHAKE	2242C	ND51	2713A	KB14	7-326	11261		15 RMS	20	20	2.00	5
6		13			ALTERNATE CONTROL FILTERED	SHAKE	2242C	NC65	2713A	KB89	7-326	11128		15 RMS	100	100	2.15	6
7																		7
8																		8
9																		9
0																		0
					HEAD MONITOR	SHAKE	2236C	HB54	8PMCVA	EI-11826	—	—					260	

NOTES & SKETCHES

FORM NO. 28-598 (2-65)

DOUGLAS

INSTRUMENTATION CHANNEL ASSIGNMENT DYNAMIC TEST

TEST TITLE OXIDIZER TANK RELIEF VALVE
S/O 5769-6404 EWO 27557 TPD 1T23923 TCD 1T06926
P/N SPECIMEN 1A49590-515AN S/N 508
ENGINEER MVV EXT
TECHNS.
STANDARD ACCEL. TYPE S/N CAL DUE

TAPE REC. MODEL CP100 S/N 625831 FACILITY 249 UNIT 128
RECORD SPEED 15 IN/SEC 27KC TAPE REEL NO.
OSCILLOGRAPH TYPE 5-124 S/N 3036 #1 3037 #2
PAPER SPEED .25 IN/SEC
TIMING LINES — SEC PAPER —

REPORT NO. R6094-1
PAGE A4
SHEET 1 OF 1
DATE 4-24-67
LINE ITEM FQ-19A
RUN NO. SINE-RANDOM
AXIS RADIAL

LOC. NO.	TAPE REC. CHAN	OSC CHAN #1	OSC CHAN #2	XDCR CABLE NO.	MEASUREMENT LOCATION	RESR AXIS	XDCR MODEL	SERIAL NO.	XDCR AMP MODEL	SERIAL NO.	OSC GALVO MODEL	SERIAL NO.	SHOCK ~~TAPE REC AMP MODEL~~ G PK	RANDOM ~~SERIAL NO.~~ G	SINE SWEEP UP CALIB LEVEL g's PK	DOWN CALIB ~~INSERT MVR~~ G PK	CHARGE SENS. Pc/PKG	LOC NO.
1	1	3	3	1	CONTROL + UNDER VALVE ON DOME	SHAKE	2242C	ND51	8PMCVA	E1-11823	7-326	11962 / 13300	20	20 RMS	20	20	2.00	1
2	2	11		2	ALT. CONTROL ON DOME ABOVE VALVE	SHAKE	2242C	HB88	8PC	E1-11824	7-326	10037	30	100/50 RMS	100	50	1.95	2
3	3		5	3	ON VALVE } TRIAX	∥ TO VALVE	2242C	NA44	2713A	KB23	7-326	6250	30	300 PK	300	100	2.05	3
4	4		11	4	ON VALVE } TRIAX	TANG.	2242C	FA50	2713A	KB18	7-326	18791	30	100 PK	30	100	1.84	4
5	5		15	5	ON VALVE } TRIAX	⊥ TO DOME	2242C	ND07	2713A	KB33	7-326	7075	30	100 PK	30	100	2.05	5
6																		6
7																		7
8																		8
9																		9
0																		0
1																		1
2																		2
3	13				SINE OSCILLATOR													3
4	14				VOICE CLIE													4
5		7			CONTROL - FILTERED	SHAKE	2242C	ND51	2713A	KB14	7-326	11261		20 RMS	20	20	2.00	5
6		11			ALTERNATE CONTROL FILTERED	SHAKE	2242C	HB88	2713A	KB89	7-326	11128		100/50 RMS	100	50	1.95	6
7																		7
8																		8
9																		9
0																		0
					HEAD MONITOR	SHAKE	2235C	HB94	8PMCVA	E1-11826	—	—					26.0	

NOTES & SKETCHES

FORM NO. 28-508 (7-57)

DOUGLAS

INSTRUMENTATION CHANNEL ASSIGNMENT DYNAMIC TEST

REPORT NO. R6094-1
PAGE A5

SHEET 1 OF 1
DATE 4-28-67
LINE ITEM FQ-17A
RUN NO. SINE-RANDOM
AXIS TANGENTIAL

TEST TITLE OXIDIZER TANK RELIEF VALVE
S.O. 5769-6404 EWO 27557 TPD 1T23923 TCD 1T06926
P/N SPECIMEN 1A49590-515AN S/N 508
ENGINEER MVV EXT
TECHNS.
STANDARD ACCEL. TYPE S/N CAL DUE

TAPE REC. MODEL CP100 S/N 625831 FACILITY 249 UNIT 128
RECORD SPEED 15 IN/SEC 27KC TAPE REEL NO.
OSCILLOGRAPH TYPE 5-124 S/N 3036 #1, 3037 #2
PAPER SPEED .25 IN/SEC
TIMING LINES — SEC PAPER —

LOC. NO.	TAPE REC. CHAN	OSC CHAN #1	OSC CHAN #2	XDCR CABLE NO.	MEASUREMENT LOCATION	RESP. AXIS	XDCR MODEL	SERIAL NO.	XDCR AMP MODEL	SERIAL NO.	OSC GALVO MODEL	SERIAL NO.	SHOCK ~~TAPE REC AMP MODEL~~ G PK	RANDOM ~~SERIAL NO.~~ G	SINE SWEEP UP CAL IB LEVEL g's PK	SINE SWEEP DOWN CAL IB ~~INSERT MVV~~ G PK	CHARGE SENS. Pc/PKG	LOC NO.
1	1	3	3	1	CONTROL - UNDER VALVE ON DOME	SHAKE	2242C	ND51	8PMCVA	EI-11823	7-326	11968 / 13300	20	20 RMS	18	18	2.00	1
2	2	11		2	ALT. CONTROL - ON DOME ABOVE VALVE	SHAKE	2242C	4B88	8PC	EI-11824	7-326	10037	30	50 RMS	50	50	1.95	2
3	3		5	3	ON VALVE } TRIAX	∥ TO VALVE	2242C	NA44	2713A	KB23	7-326	6250	30	300 PK	300	100	2.05	3
4	4		11	4	ON VALVE } TRIAX	TANG.	2242C	FA50	2713A	KB18	7-326	18791	30	300/100 PK	100	100	1.84	4
5	5		15	5	ON VALVE } TRIAX	⊥ TO DOME	2242C	ND07	2713A	KB33	7-326	7075	30	300 PK	100	100	2.05	5
6																		6
7																		7
8																		8
9																		9
0																		0
1																		1
2																		2
3	13				SINE OSCILLATOR													3
4	14				VOICE CUE													4
5		7			CONTROL - FILTERED	SHAKE	2242C	ND51	2713A	KB14	7-326	11261		20 RMS	18	18	2.00	5
6		15			ALTERNATE CONTROL FILTERED	SHAKE	2242C	HB88	2713A	KB89	7-326	11128		50 RMS	50	50	1.95	6
7																		7
8																		8
9																		9
0																		0
					HEAD MONITOR	SHAKE	2236C	HB94	8PMCVA	EI 11826	—	—					26.0	

NOTES & SKETCHES

FORM NO. 28-505 (2-65)

DOUGLAS

INSTRUMENTATION CHANNEL ASSIGNMENT DYNAMIC TEST

REPORT NO. R6094-1
PAGE A6

SHEET 1 OF 1
DATE 5-2-67
LINE ITEM FQ-I9A
RUN NO. SINE - RANDOM
AXIS THRUST

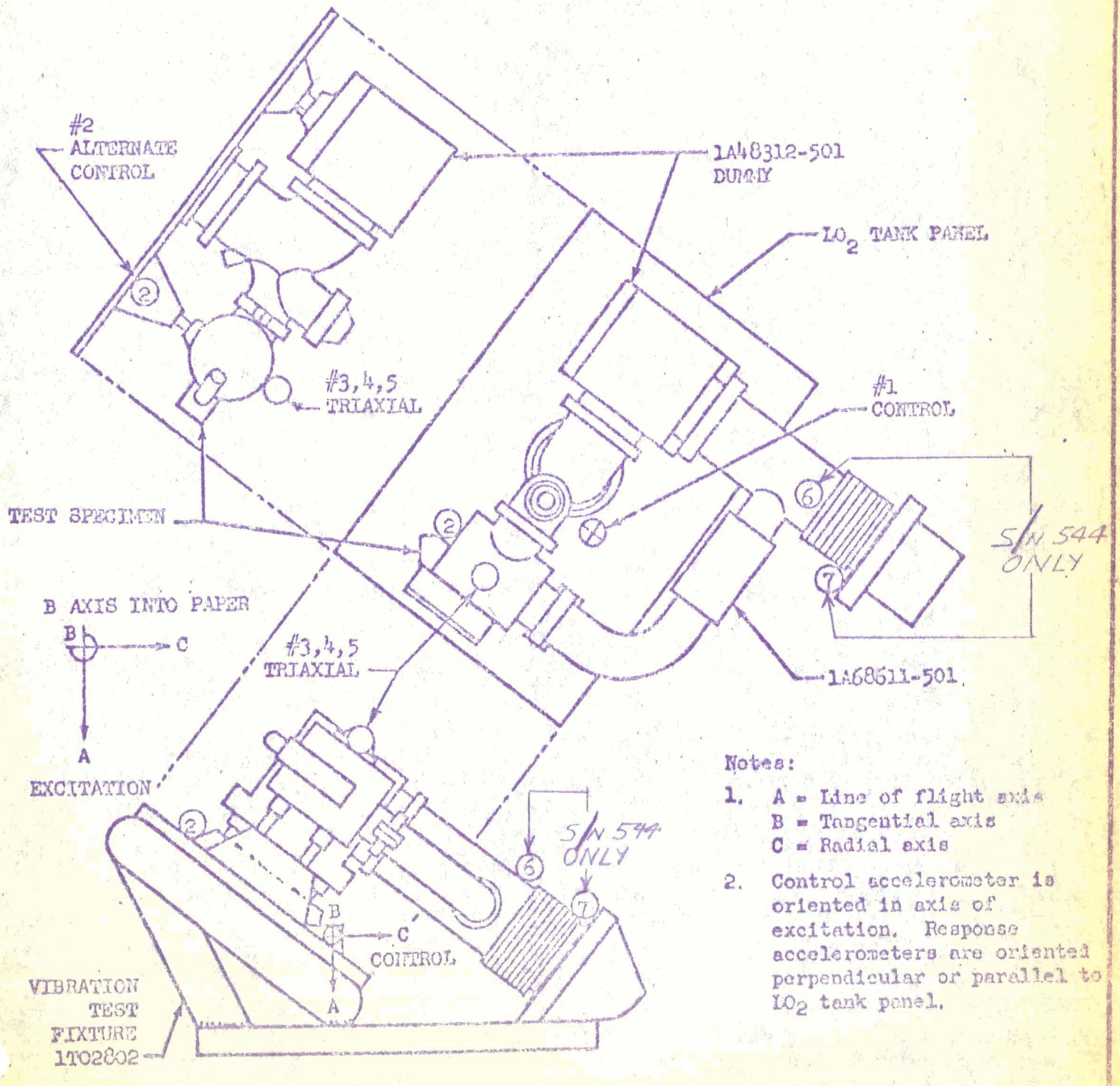
TEST TITLE OXIDIZER TANK RELIEF VALVE
S/O 5769-6404 EWO 27557 TCD 1T23923 1T06426
P/N SPECIMEN 1A49590-515AN S/N 508
ENGINEER MVV EXT
TECHNS
STANDARD ACCEL. TYPE S/N CAL DUE

TAPE REC. MODEL CP100 S/N 625831 FACILITY 249 UNIT 128
RECORD SPEED 15 IN/SEC 27KC TAPE REEL NO
OSCILLOGRAPH TYPE 5-124 S/N 3036 #1 3037 #2
PAPER SPEED 25 IN/SEC
TIMING LINES — SEC PAPER —

LOC. NO.	TAPE REC. CHAN	OSC CHAN #1	OSC CHAN #2	XDCR CABLE NO.	MEASUREMENT LOCATION	RESP. AXIS	XDCR MODEL	SERIAL NO.	XDCR AMP MODEL	SERIAL NO.	OSC GALVO MODEL	SERIAL NO.	SHOCK #1 ~~TAPE REC AMP MODEL~~ G PK	SHOCK #2 ~~TAPE REC AMP MODEL~~ #3 G PK	RANDOM ~~SERIAL NO.~~ G	SINE SWEEP UP CALIB LEVEL g's PK	SINE SWEEP DOWN CALIB ~~INSERT MVR~~ G PK	CHARGE SENS. Pc/PKG	LOC. NO.
1	1	3	3	1	CONTROL - UNDER VALVE ON DOME	SHAKE	2242C	ND51	8PMCVA	E1-11823	7-326	11952 / 13700	20	20	20 RMS	20	20	2.00	1
2	2	11		2	ALT. CONTROL - ON DOME ABOVE VALVE	SHAKE	2242C	HB88	8PC	E1-11824	7-326	10037	30	30	100 RMS	100	50	1.95	2
3	3		5	3	ON VALVE } TRIAX	∥ TO VALVE	2242C	NA44	2713A	KB23	7-326	6250	30	30	100 PK	300/30	100	2.05	3
4	4		11	4	ON VALVE } TRIAX	TANG.	2242C	FA50	2713A	KB18	7-326	18791	30	10	300 PK	30	100	1.84	4
5	5		15	5	ON VALVE } TRIAX	⊥ TO DOME	2242C	ND07	2713A	KB33	7-326	7075	30	30	100 PK	30	100	2.05	5
6																			6
7																			7
8																			8
9																			9
0																			0
1																			1
2																			2
3	13				SINE OSCILLATOR														3
4	14				VOICE CUE														4
5		7			CONTROL - FILTERED	SHAKE	2242C	ND51	2713A	KB14	7-326	11261			20 RMS	20	20	2.00	5
6		15			ALTERNATE CONTROL FILTERED	SHAKE	2242C	HB88	2713A	KB89	7-326	11128			100 RMS	100	50	1.95	6
7																			7
8																			8
9																			9
0																			0
					HEAD MONITOR	SHAKE	2235C	HB54	8PMCVA	E1-11826	—	—						26.0	

NOTES & SKETCHES

CHAN. 3 DOWNSWEEP TO 30 G AT 600 CPS. — POST CALIB. AT 30 G.



Notes:

1. A = Line of flight axis
   B = Tangential axis
   C = Radial axis
2. Control accelerometer is oriented in axis of excitation. Response accelerometers are oriented perpendicular or parallel to LO_2 tank panel.

Test Assembly and Accelerometer Locations

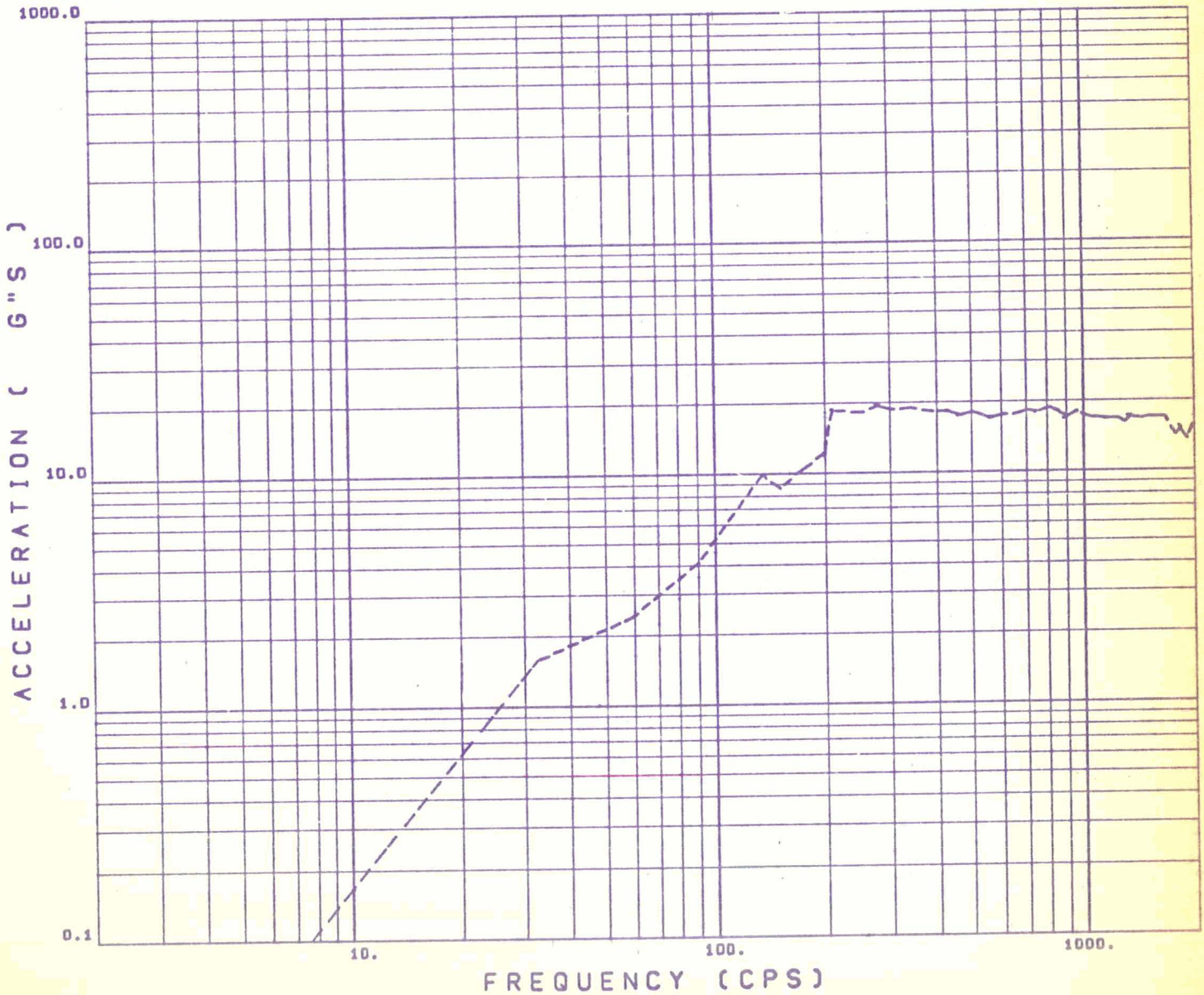
DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. A8
REPORT NO. R6094-1

SINUSOIDAL FREQUENCY SWEEP
SIV-B OXIDIZER TANK RELIEF VALVE
(FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/21/67
AXIS OF EXCITATION.... RADIAL
PICK UP NUMBER (1)... 1 ND51 UNFILTERED
PICK UP RESPONSE..... RADIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. A9
REPORT NO. R6094-1

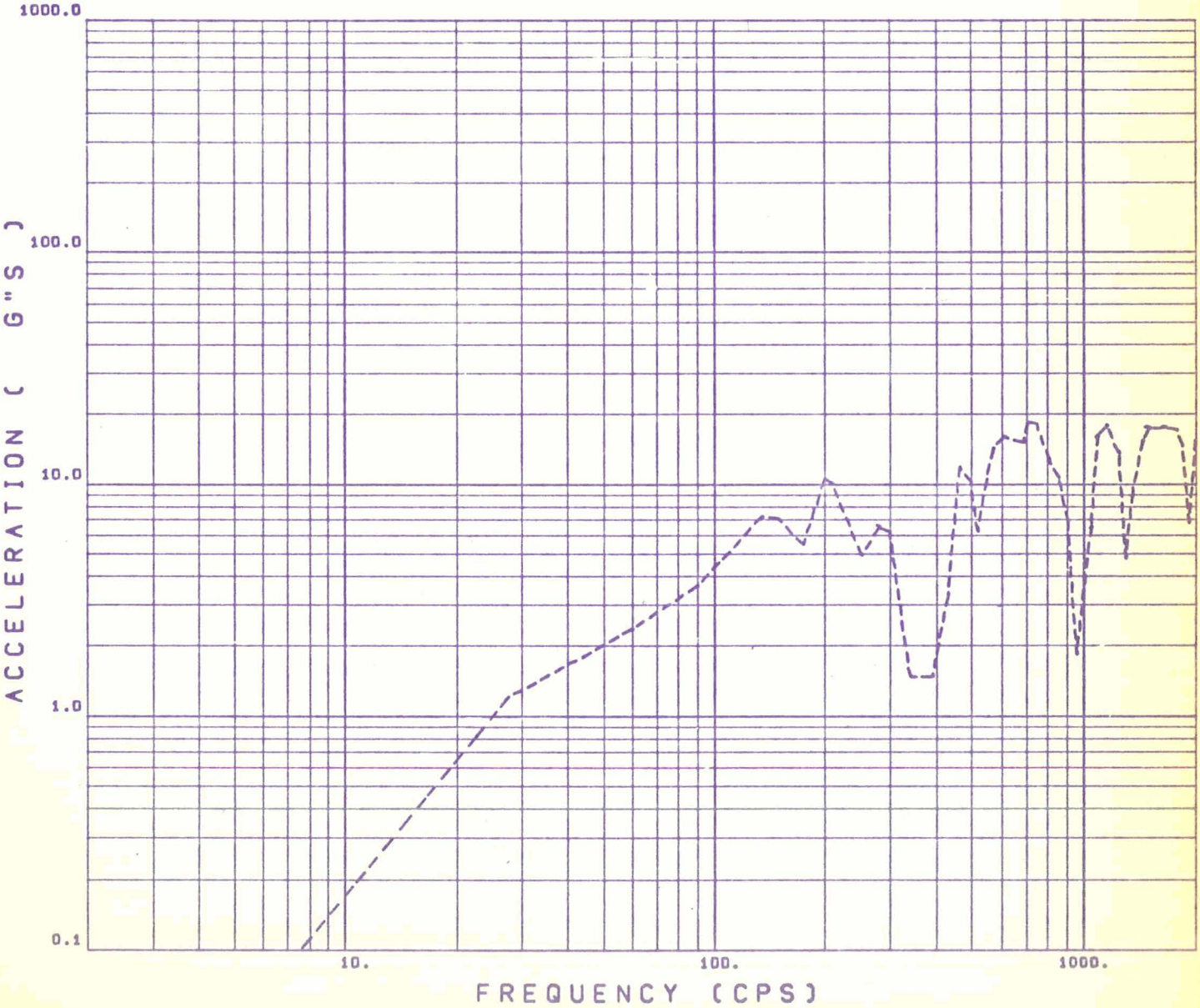
SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE

(FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/21/67
AXIS OF EXCITATION.... RADIAL
PICK UP NUMBER (1)... 1 ND51 FILTERED
PICK UP RESPONSE..... RADIAL
INPUT ACCEL.PER PAGE.. _____



DOUGLAS AIRCRAFT COMPANY , INC.

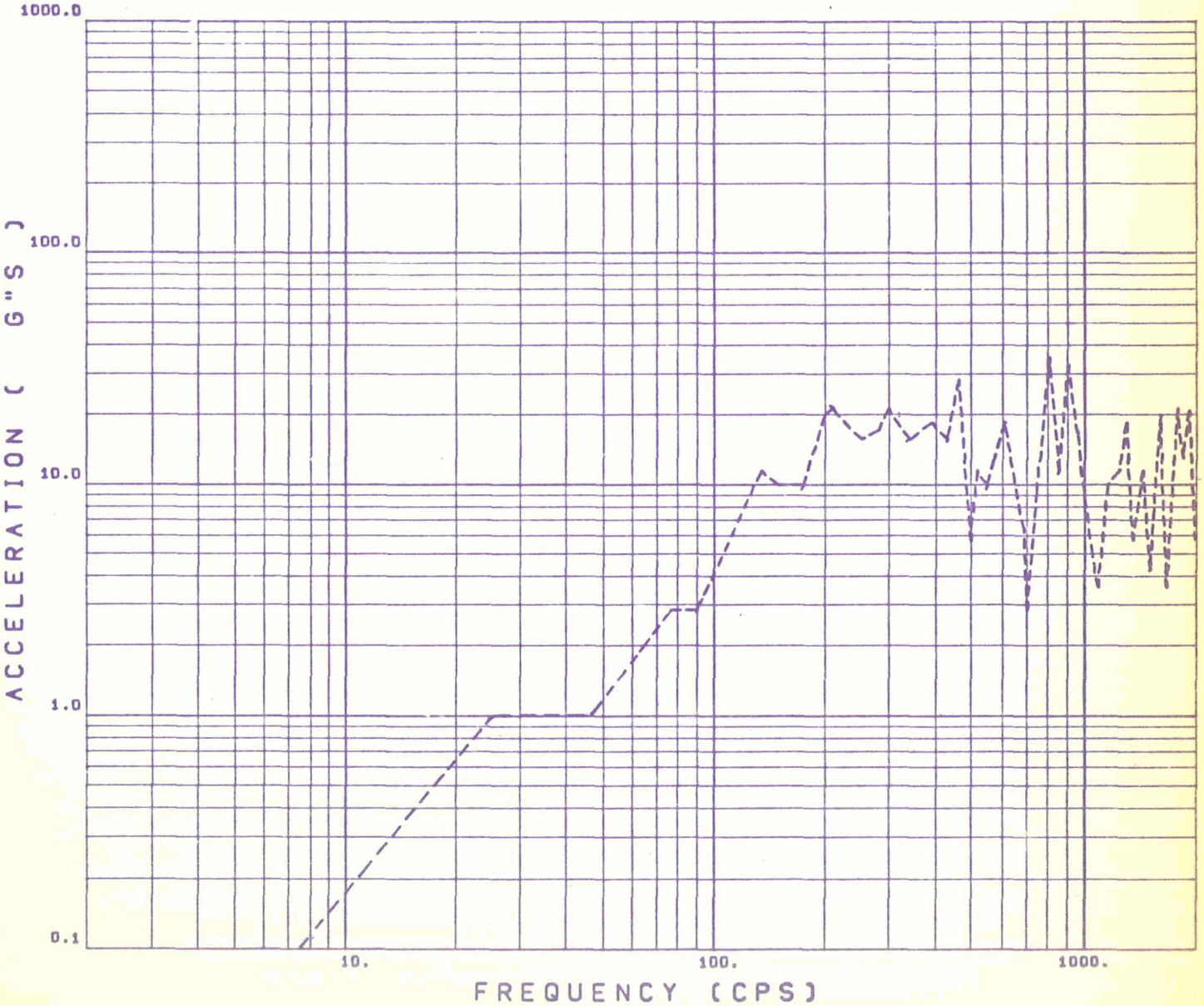
PAGE NO. A10
REPORT NO. E6099-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT---
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/21/67
AXIS OF EXCITATION.... RADIAL
PICK UP NUMBER (2)... 2 NC65 FILTERED
PICK UP RESPONSE..... RADIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

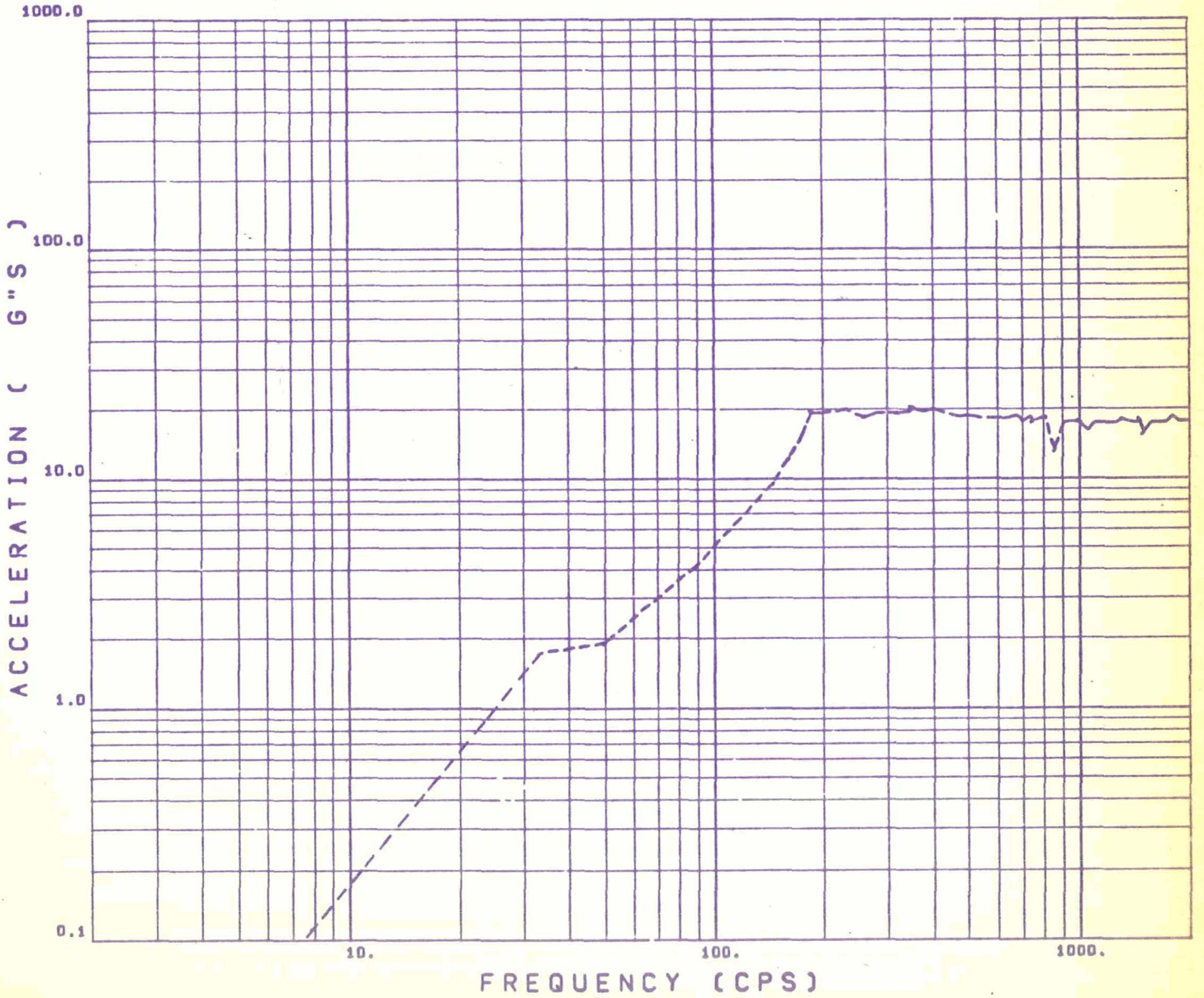
PAGE NO. A11
REPORT NO. R6097-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/23/67
AXIS OF EXCITATION.... TANGENTIAL
PICK UP NUMBER (1)... 1 ND51 UNFILTERED
PICK UP RESPONSE..... TANGENTIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. A12
REPORT NO. R6097-1

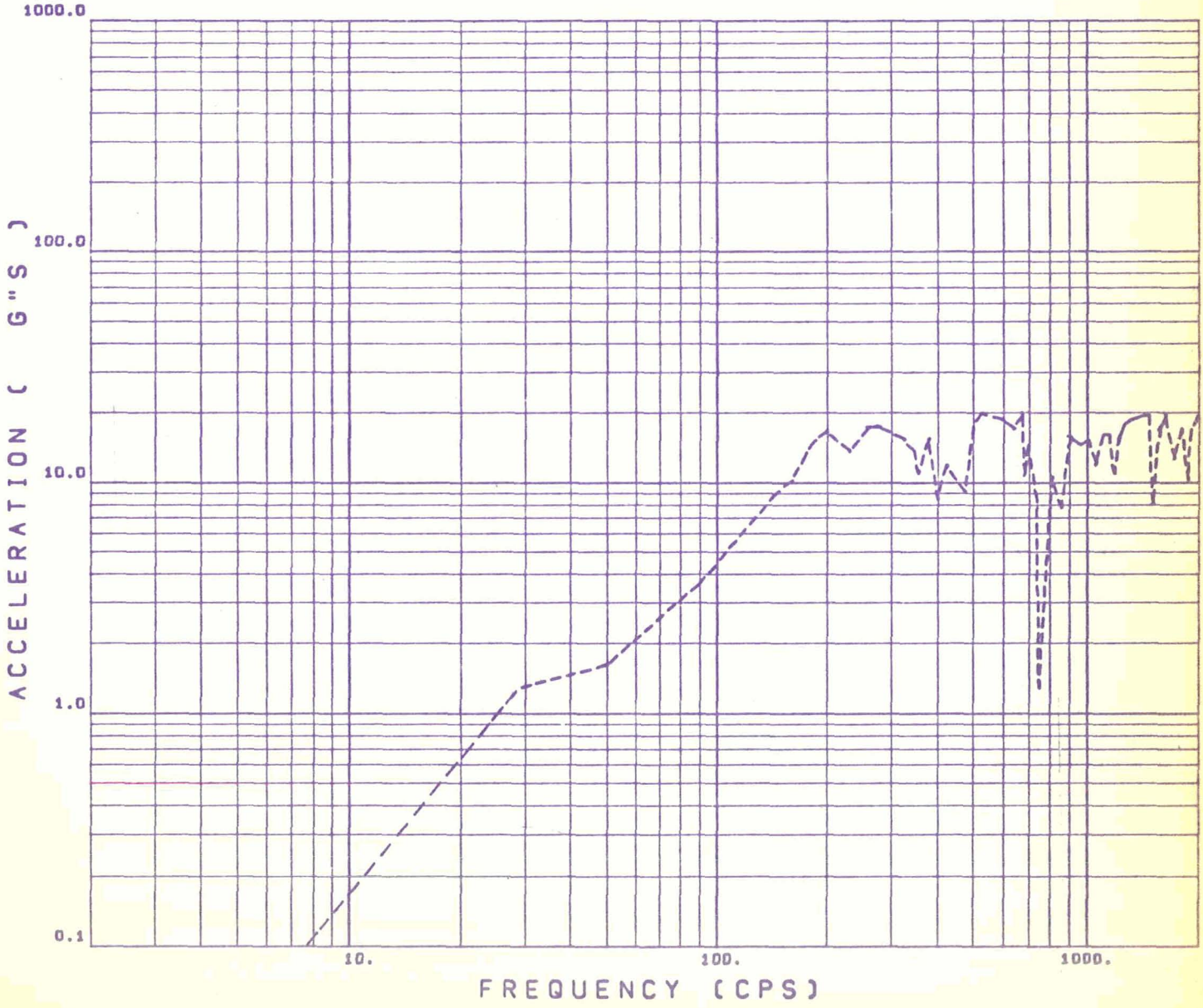
SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE

(FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/23/67
AXIS OF EXCITATION.... TANGENTIAL
PICK UP NUMBER (1)... 1 ND51 FILTERED
PICK UP RESPONSE..... TANGENTIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

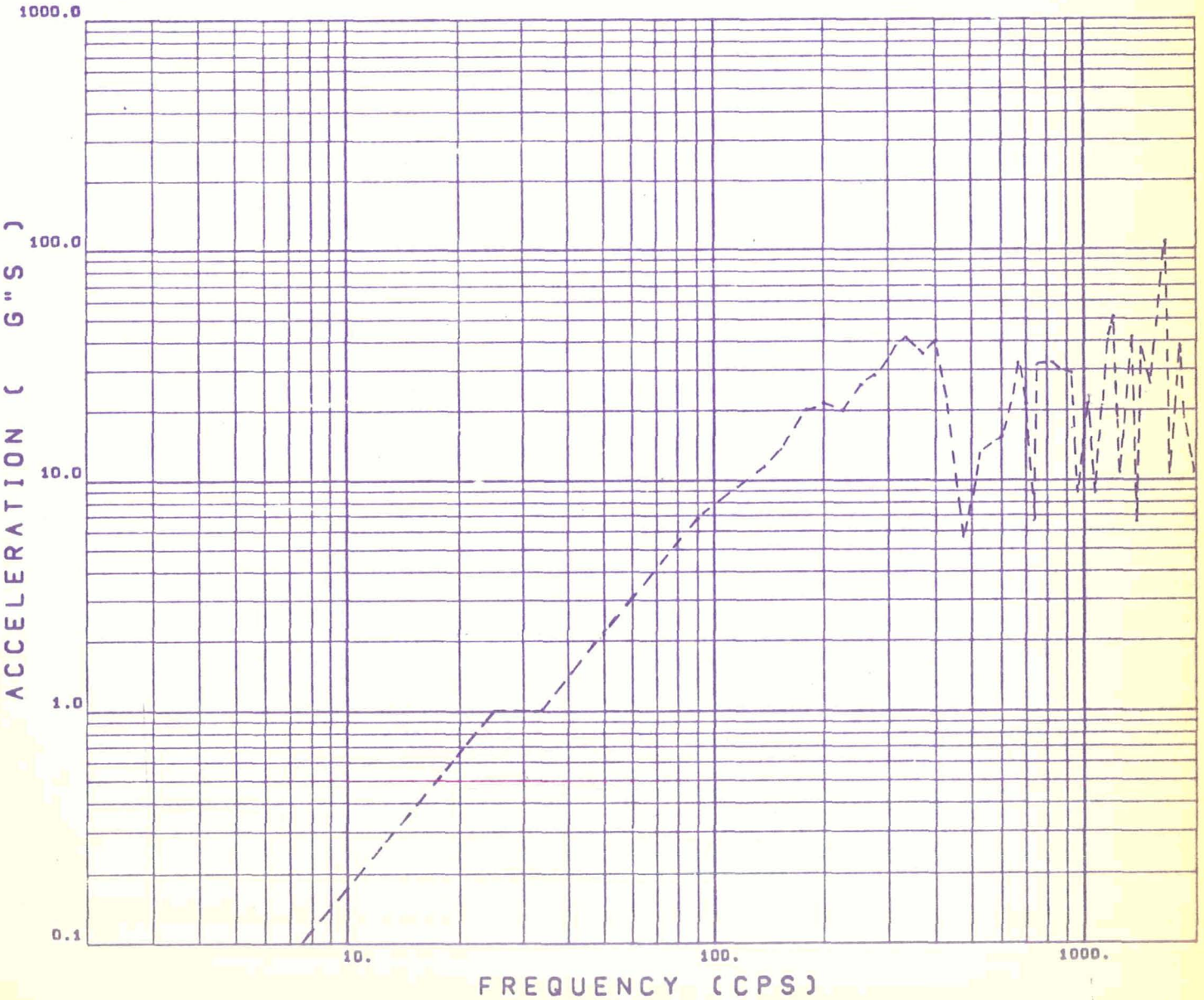
PAGE NO. A13
REPORT NO. R60[illegible]-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT---
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/23/67
AXIS OF EXCITATION.... TANGENTIAL
PICK UP NUMBER (2)... 2 NC65 FILTERED
PICK UP RESPONSE..... TANG
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

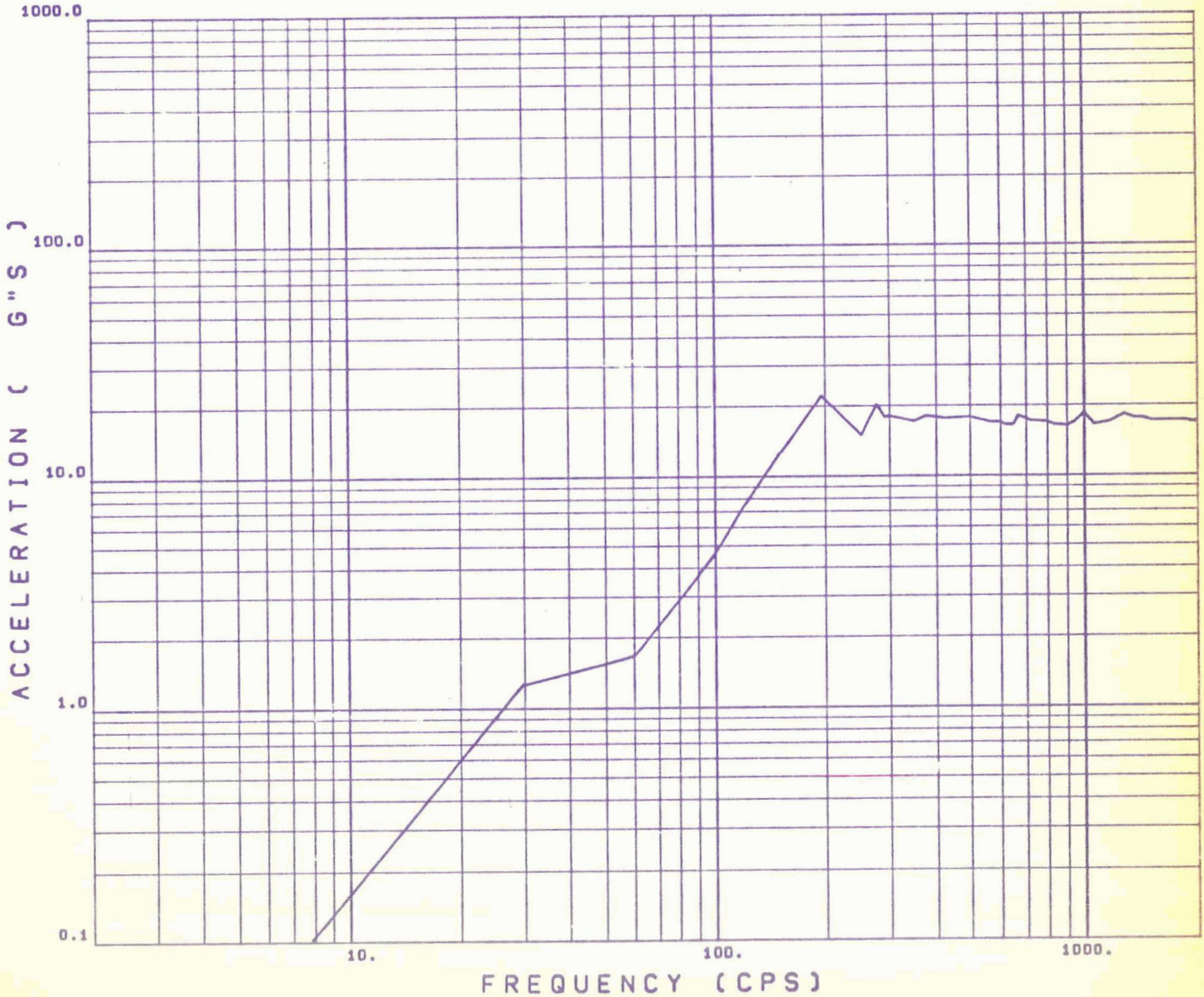
PAGE NO. A14
REPORT NO. R60TT-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/23/67
AXIS OF EXCITATION.... THRUST
PICK UP NUMBER (1)... 1 ND51 UNFILTERED
PICK UP RESPONSE..... THRUST
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

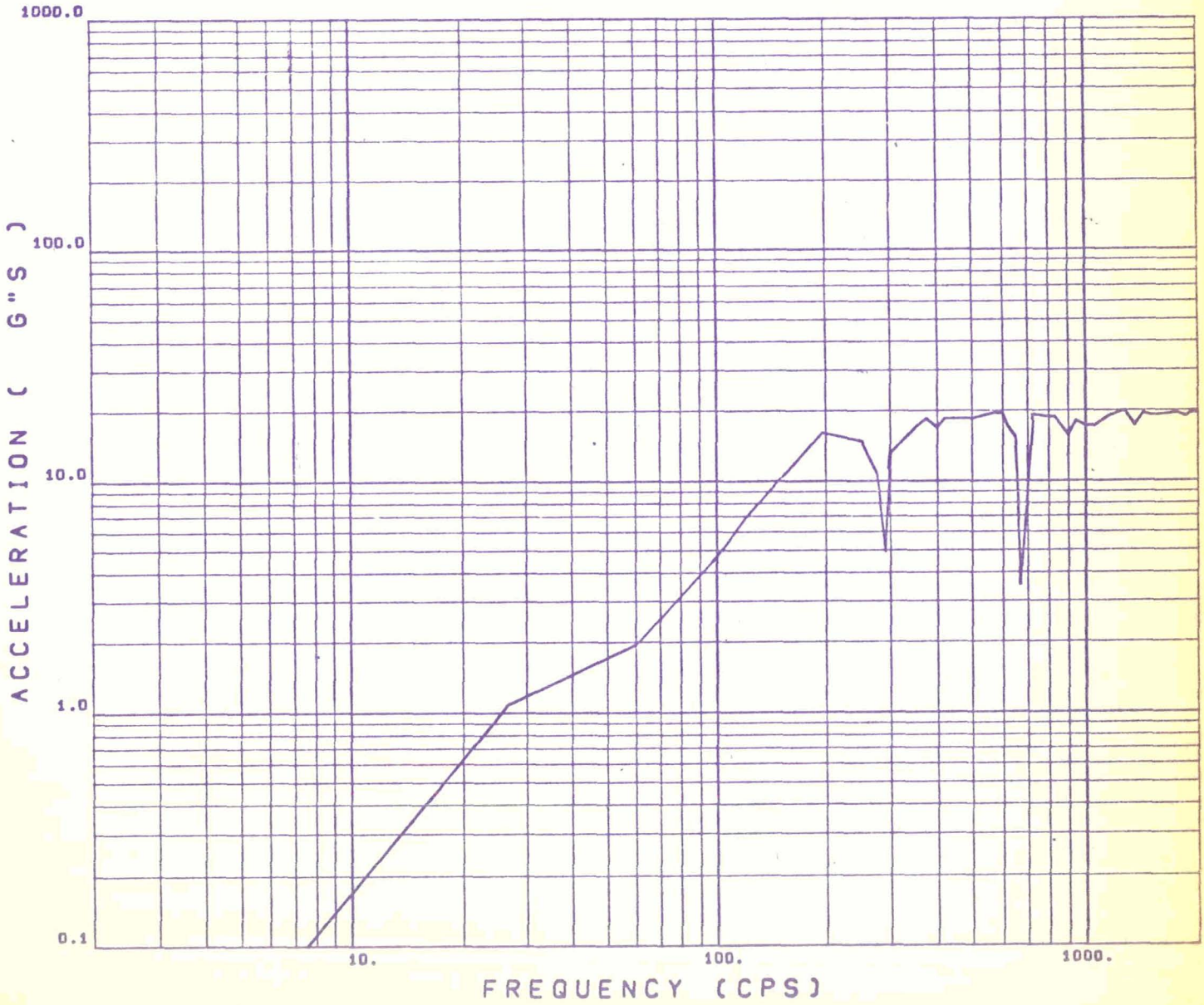
PAGE NO. A15
REPORT NO. R6U74-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/23/67
AXIS OF EXCITATION.... THRUST
PICK UP NUMBER (1)... 1 ND51 FILTERED
PICK UP RESPONSE..... THRUST
INPUT ACCEL.PER PAGE.. A5



DOUGLAS AIRCRAFT COMPANY , INC.

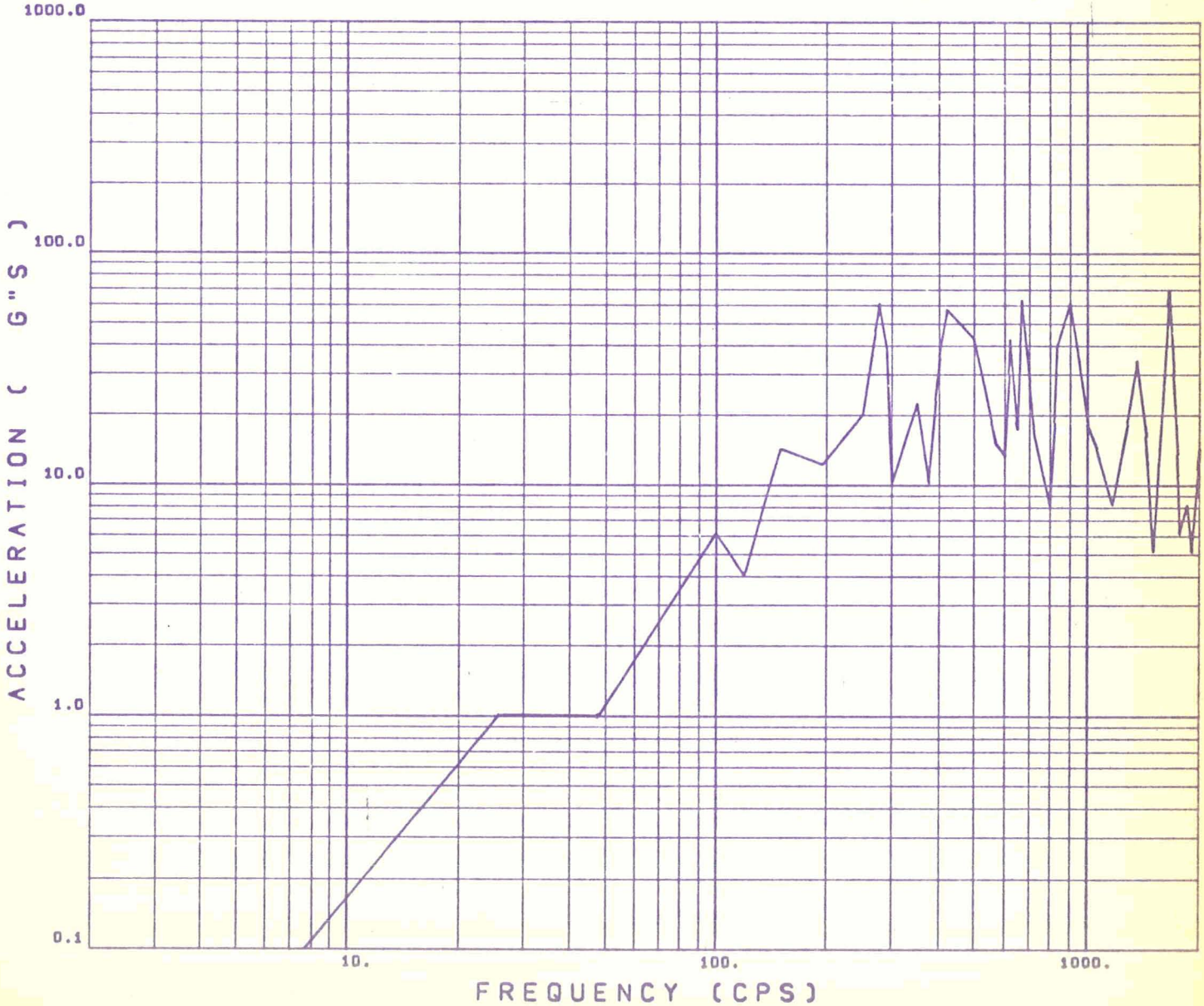
PAGE NO. A16
REPORT NO. R6094-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 544
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT---
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 03/23/67
AXIS OF EXCITATION.... THRUST
PICK UP NUMBER (2)... 2 NC65 FILTERED
PICK UP RESPONSE..... THRUST
INPUT ACCEL.PER PAGE.. 3



DOUGLAS AIRCRAFT COMPANY , INC.

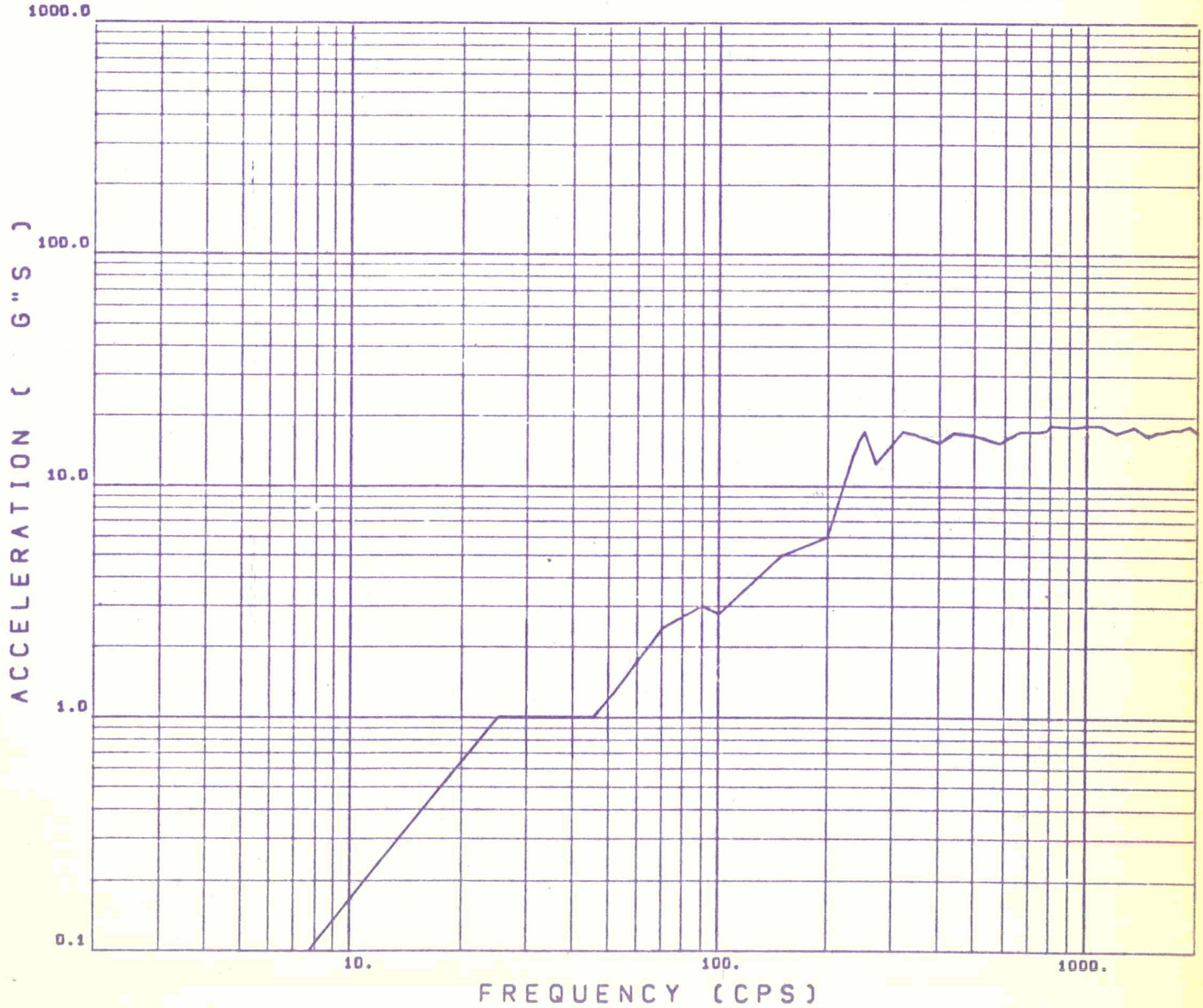
PAGE NO. A17
REPORT NO. R6094-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4/24/67
AXIS OF EXCITATION.... RADIAL
PICK UP NUMBER (1)... 1 ND51 UNFILTERED
PICK UP RESPONSE..... RADIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

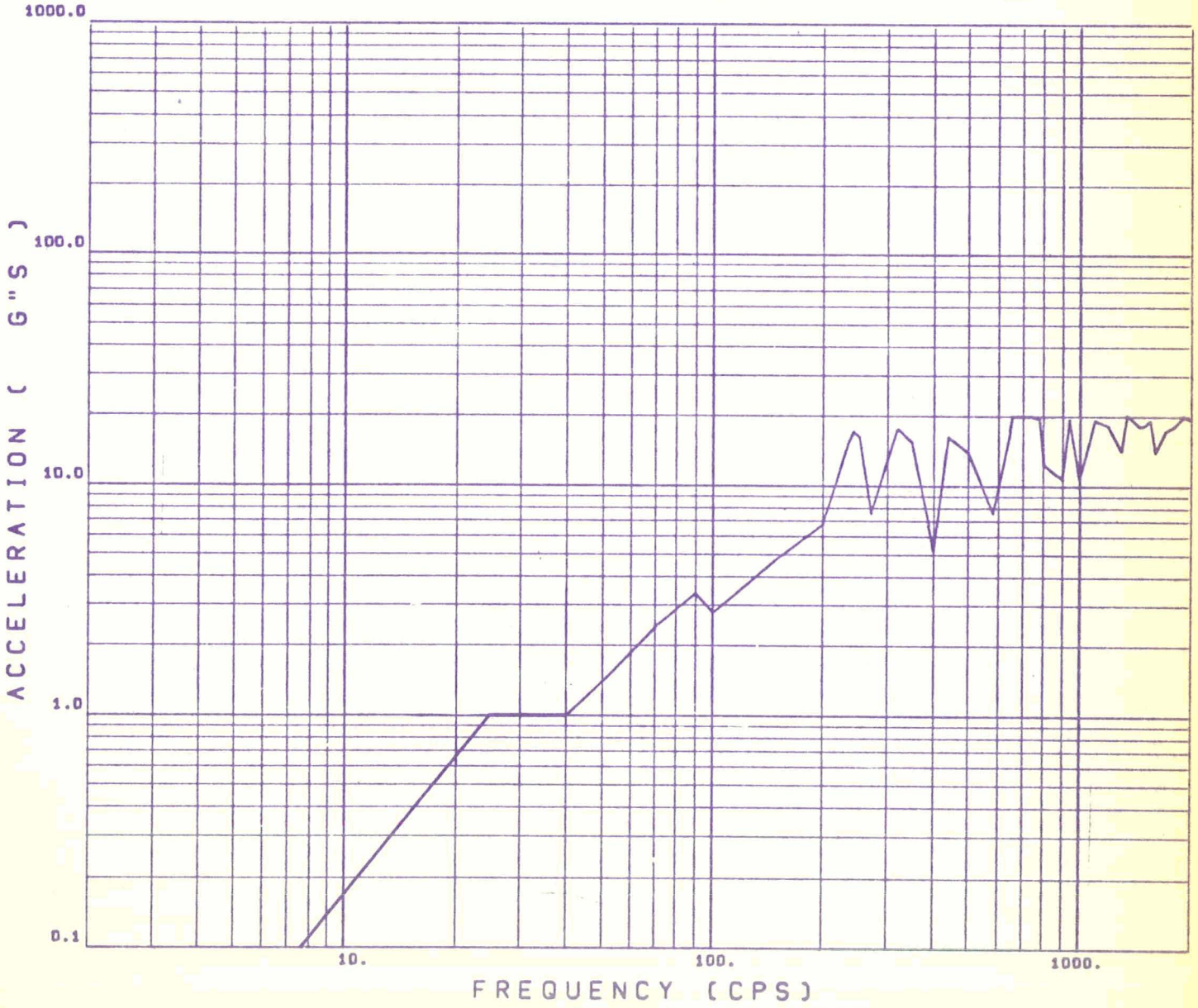
PAGE NO. A18
REPORT NO. R6094-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4/24/67
AXIS OF EXCITATION.... RADIAL
PICK UP NUMBER (1)... 1 ND51 FILTERED
PICK UP RESPONSE..... RADIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

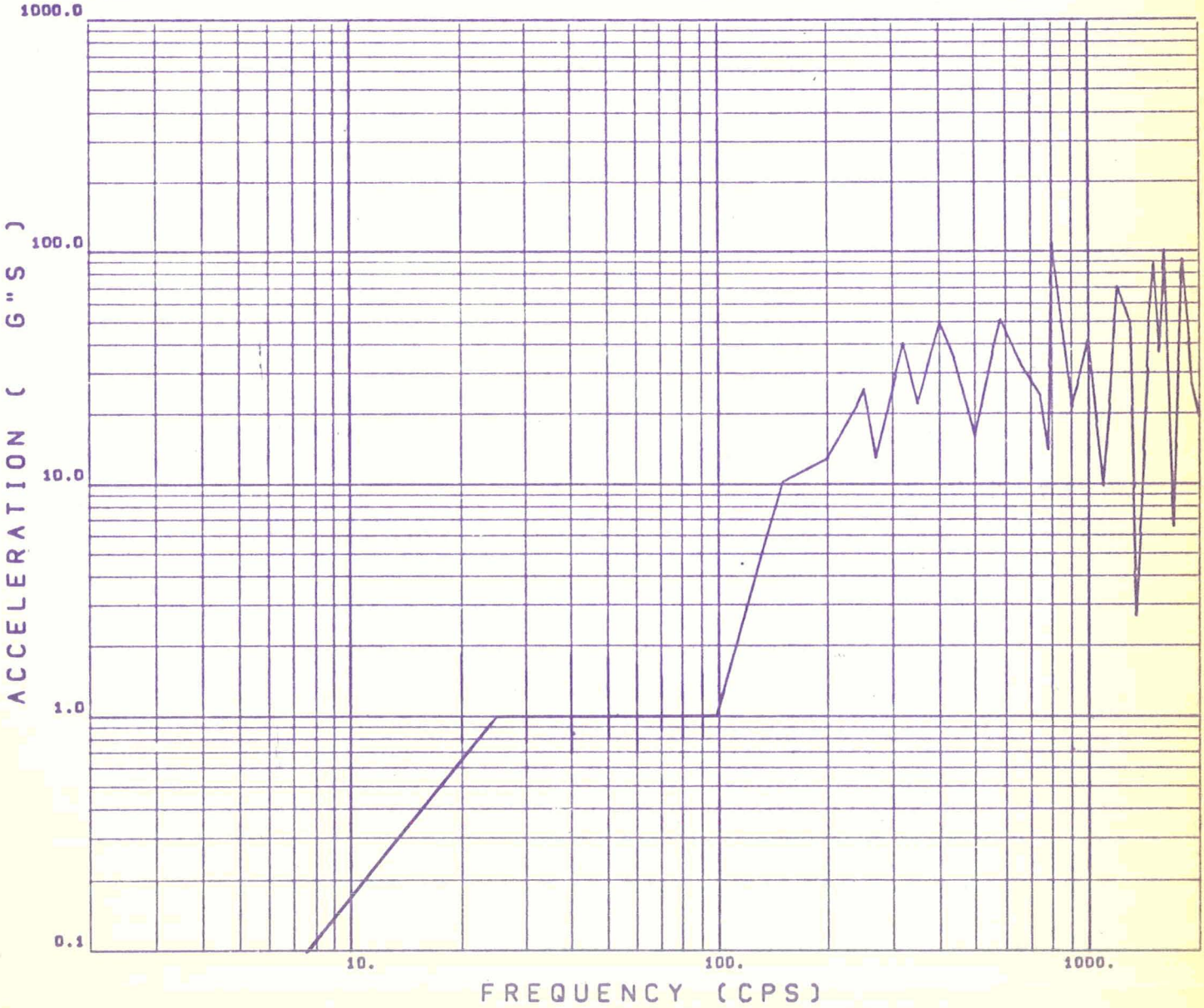
PAGE NO. A19
REPORT NO. R6094-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT---
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4/24/67
AXIS OF EXCITATION.... RADIAL
PICK UP NUMBER (2)... 2 HB88 FILTERED
PICK UP RESPONSE..... RADIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

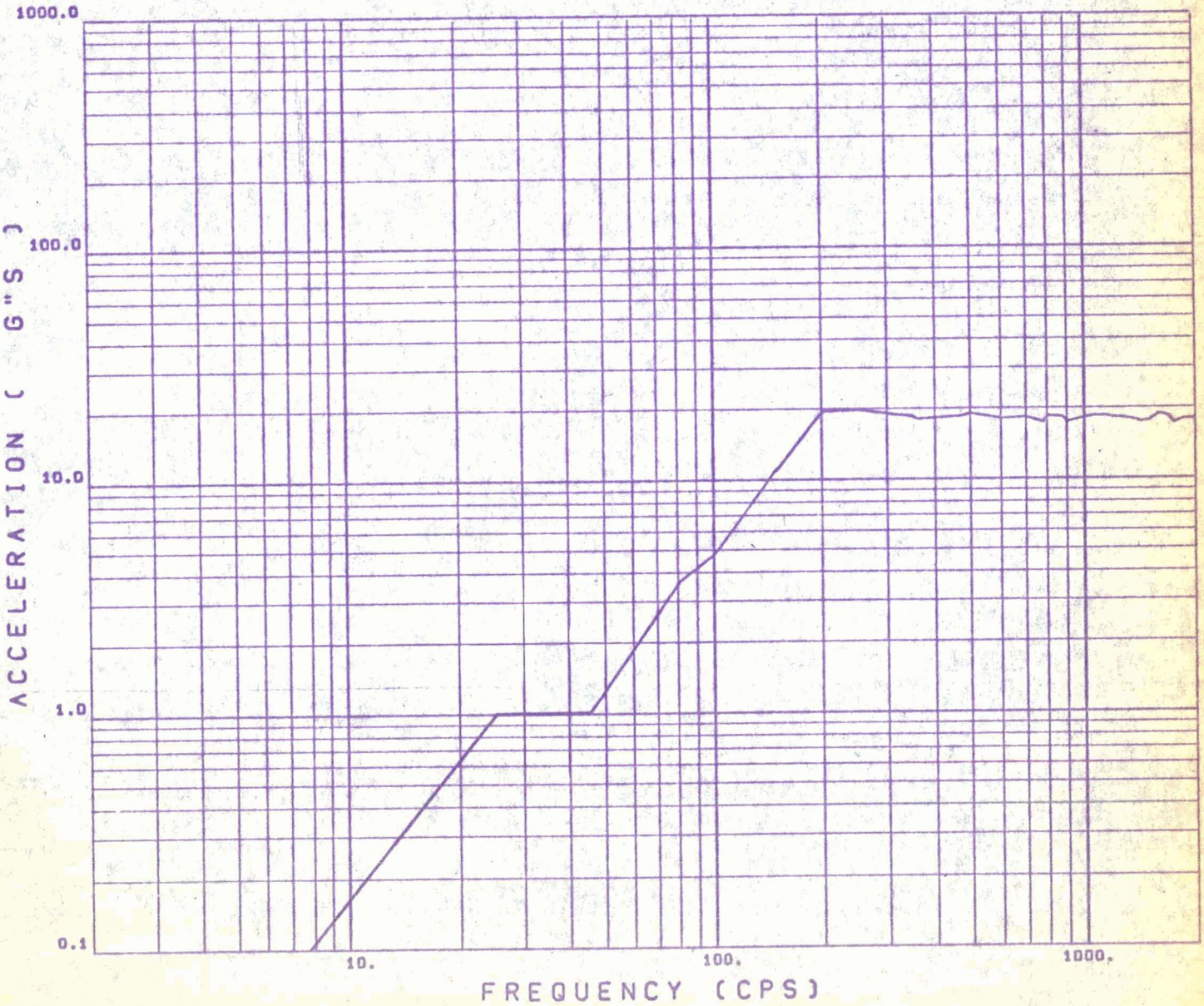
PAGE NO. A20
REPORT NO. R6094-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4/28/67
AXIS OF EXCITATION.... TANGENTIAL
PICK UP NUMBER (1)... 1 ND51 UNFILTERED
PICK UP RESPONSE..... TANGENTIAL
INPUT ACCEL.PER PAGE.. —



DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. A21
REPORT NO. R6094-1

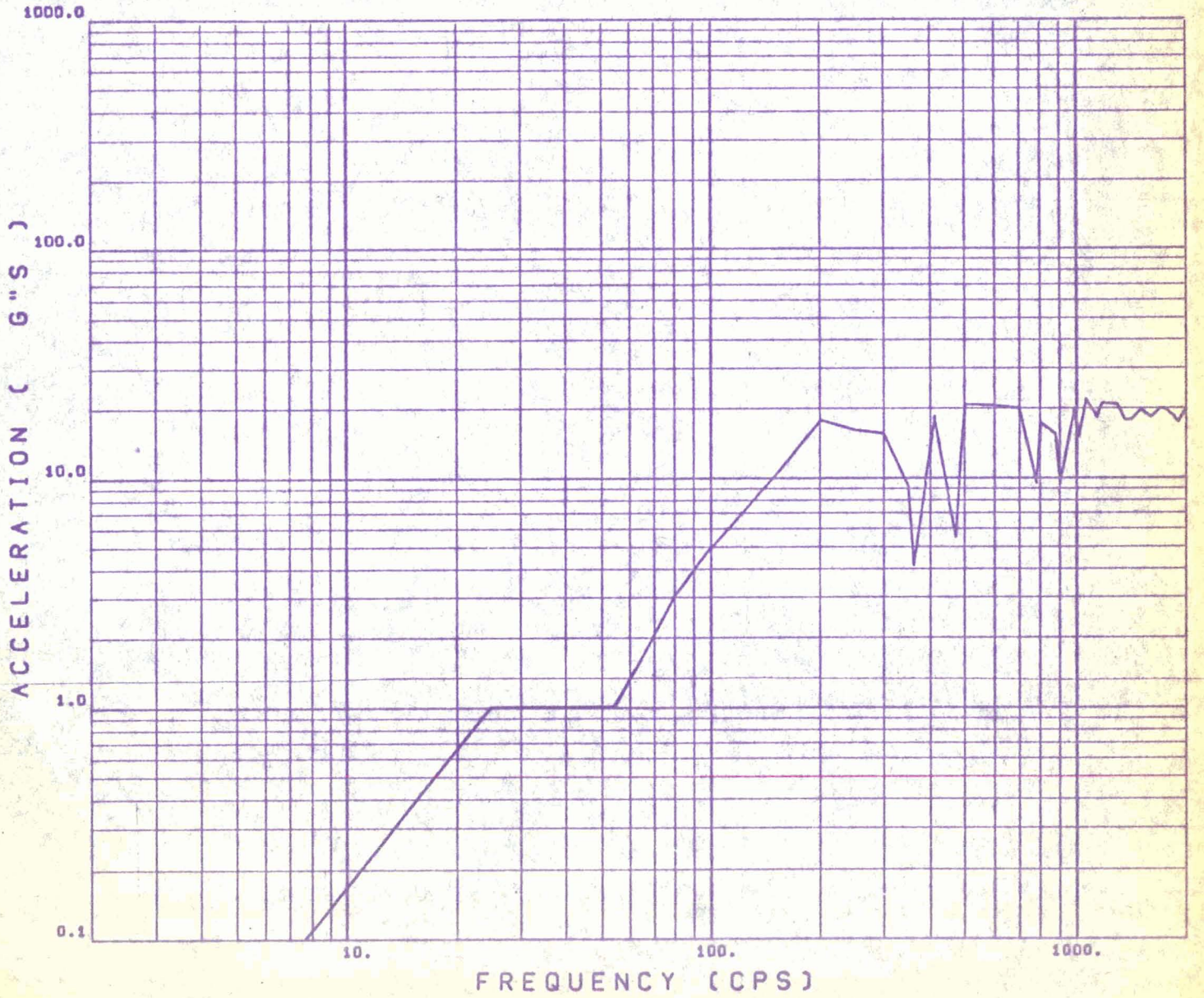
SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE

(FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4/28/67
AXIS OF EXCITATION.... TANGENTIAL
PICK UP NUMBER (1)... 1 ND51 FILTERED
PICK UP RESPONSE..... TANGENTIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

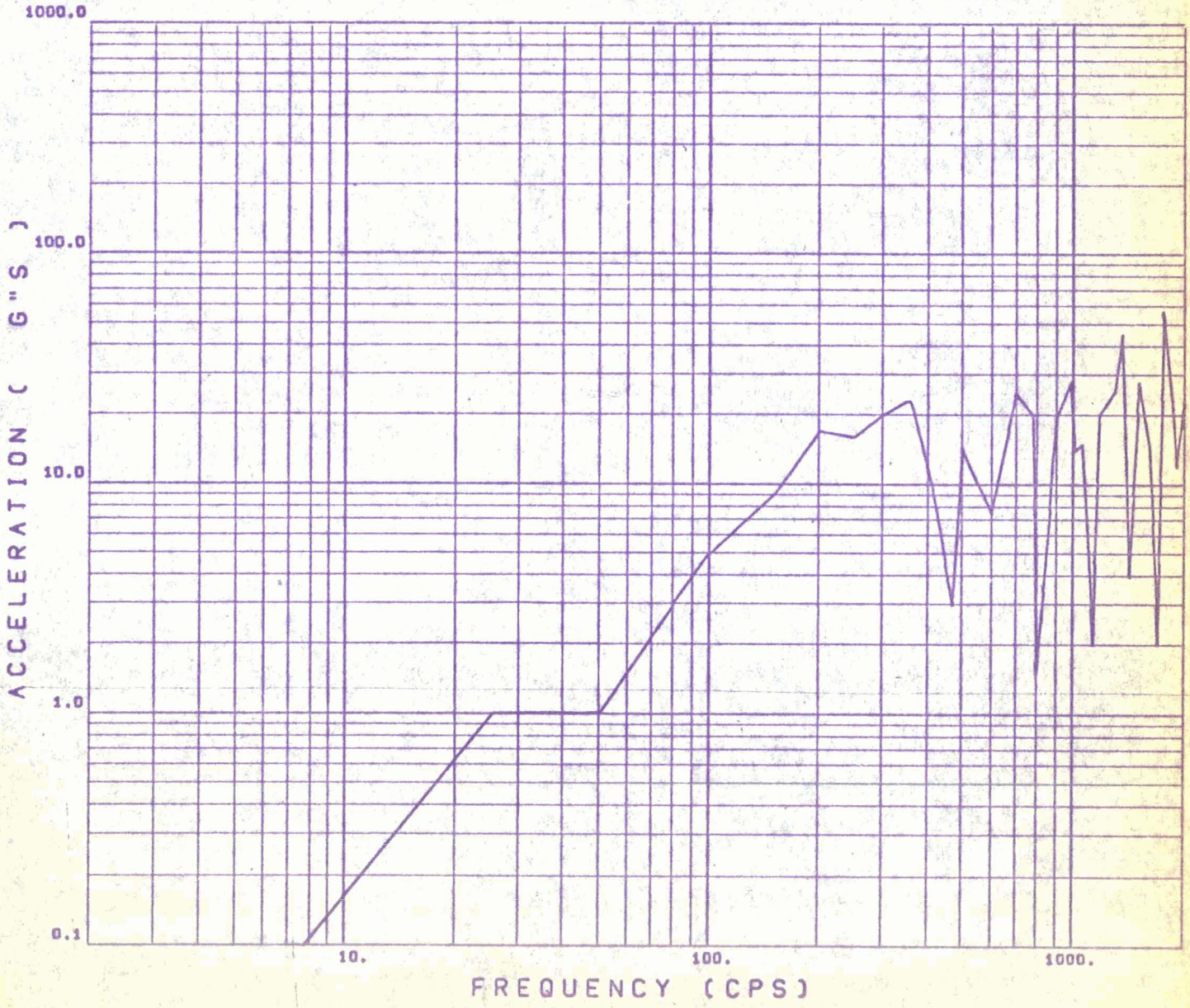
PAGE NO. A22
REPORT NO. R6094-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT---
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 4/28/67
AXIS OF EXCITATION.... TANGENTIAL
PICK UP NUMBER (2)... 2 HB88 FILTERED
PICK UP RESPONSE..... TANGENTIAL
INPUT ACCEL.PER PAGE.. ———



DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. A23
REPORT NO. R60FT-1

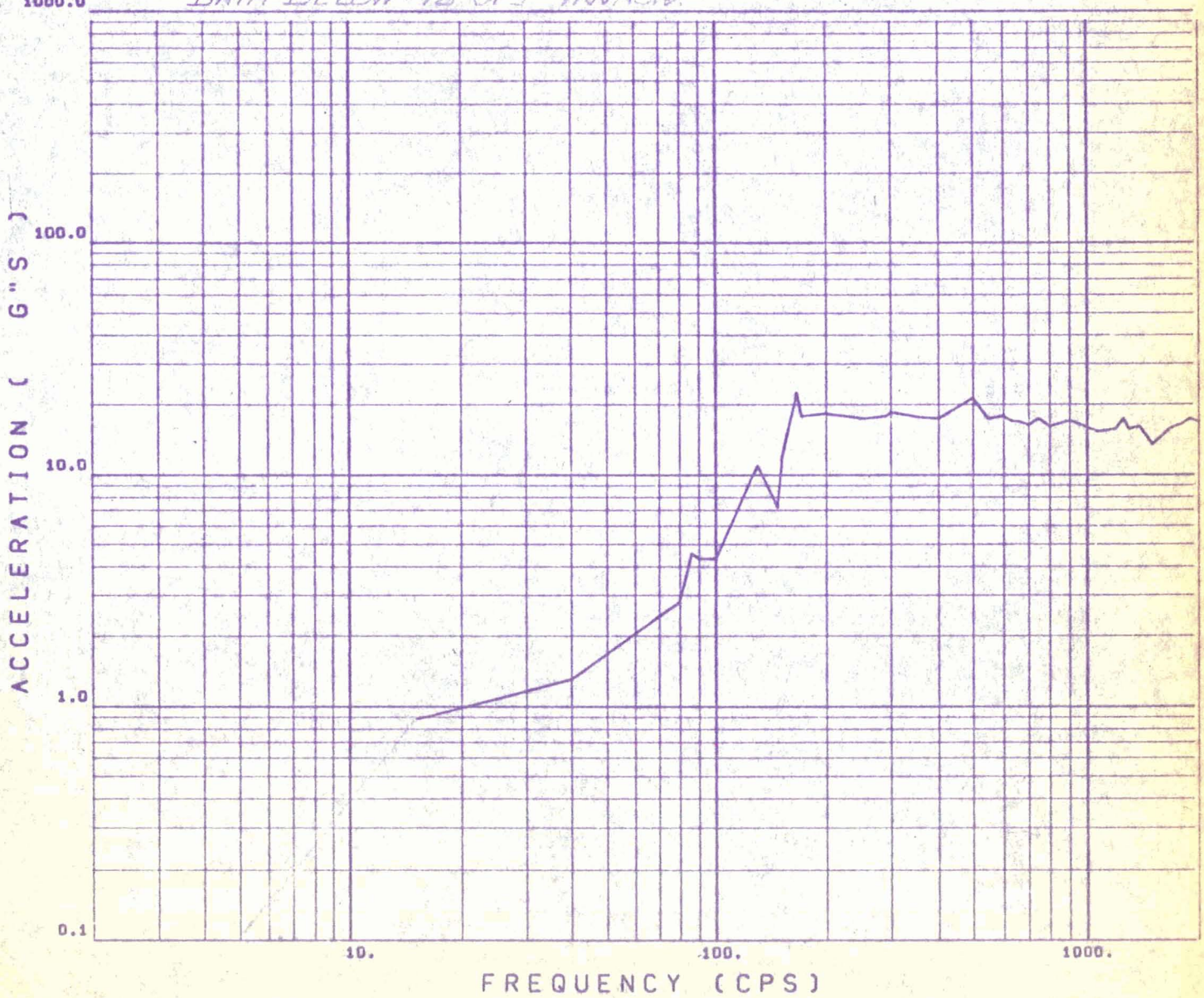
SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A7
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ——
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 05/02/67
AXIS OF EXCITATION.... THRUST
PICK UP NUMBER (1)... 1 ND51 UNFILTERED
PICK UP RESPONSE..... THRUST
INPUT ACCEL.PER PAGE.. —

DATA BELOW 15 CPS INVALID



DOUGLAS AIRCRAFT COMPANY , INC.

PAGE NO. A24
REPORT NO. R6084-1

SINUSOIDAL FREQUENCY SWEEP

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A2
FOR PICK UP LOCATION
COMMENT--- REFERENCE CHANNEL
LEGEND...
UPSWEEP ——
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 05/02/67
AXIS OF EXCITATION.... THRUST
PICK UP NUMBER (1)... 1 ND51 FILTERED
PICK UP RESPONSE..... THRUST
INPUT ACCEL.PER PAGE.. 1

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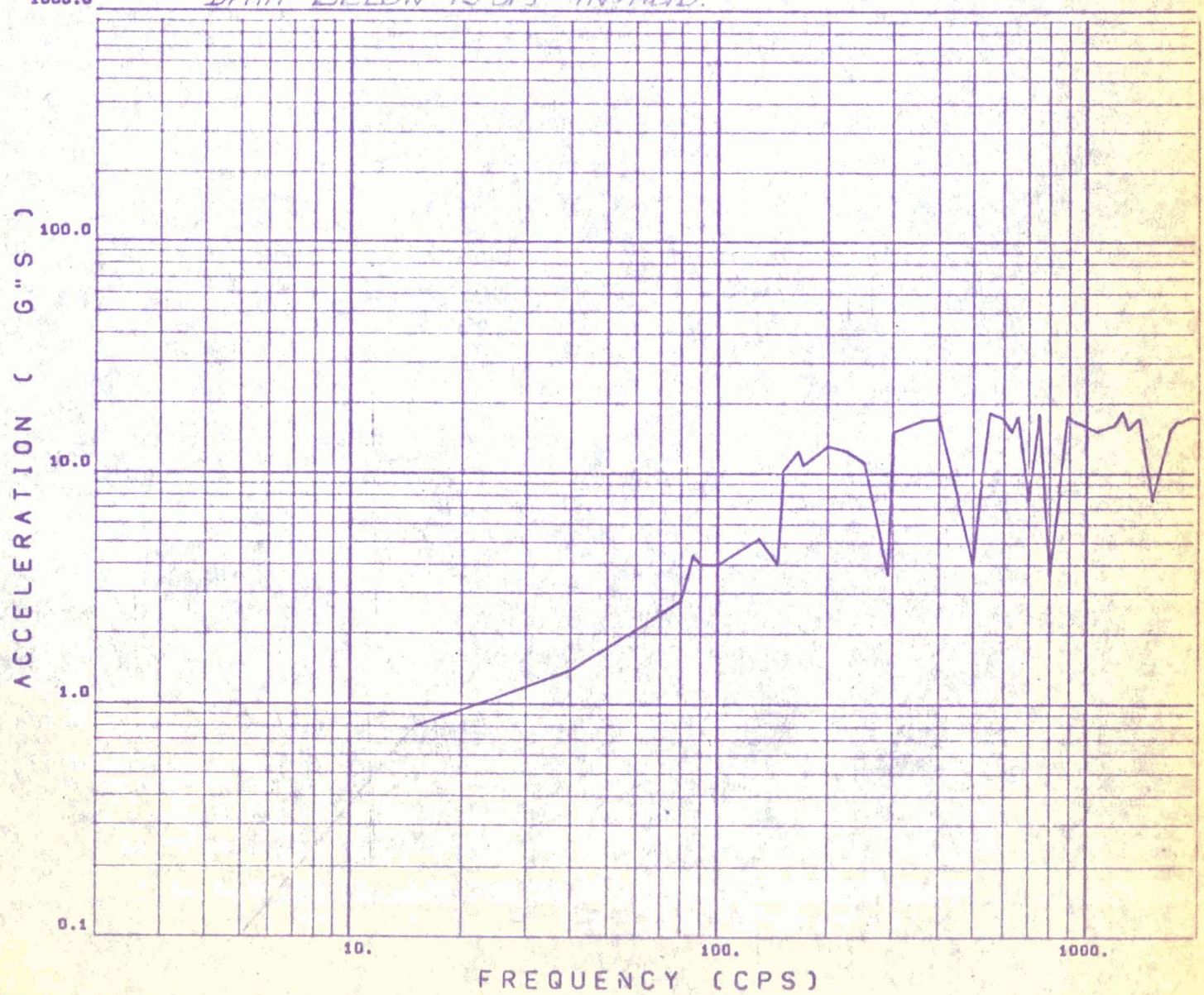

DOUGLAS AIRCRAFT COMPANY , INC.

SINUSOIDAL FREQUENCY SWEEP

PAGE NO. A25
REPORT NO. R6072-1

SIV-B OXIDIZER TANK RELIEF VALVE (FQ I-9A)

CONFIGURATION --- S/N 508
NOTE... SEE PAGE A1
FOR PICK UP LOCATION
COMMENT---
LEGEND...
UPSWEEP ———
DOWNSWEEP ------

TEST CONDITIONS....
TEST DATE..... 05/02/67
AXIS OF EXCITATION.... THRUST
PICK UP NUMBER (2)... 2 HB88 FILTERED
PICK UP RESPONSE..... THRUST
INPUT ACCEL.PER PAGE.. ———

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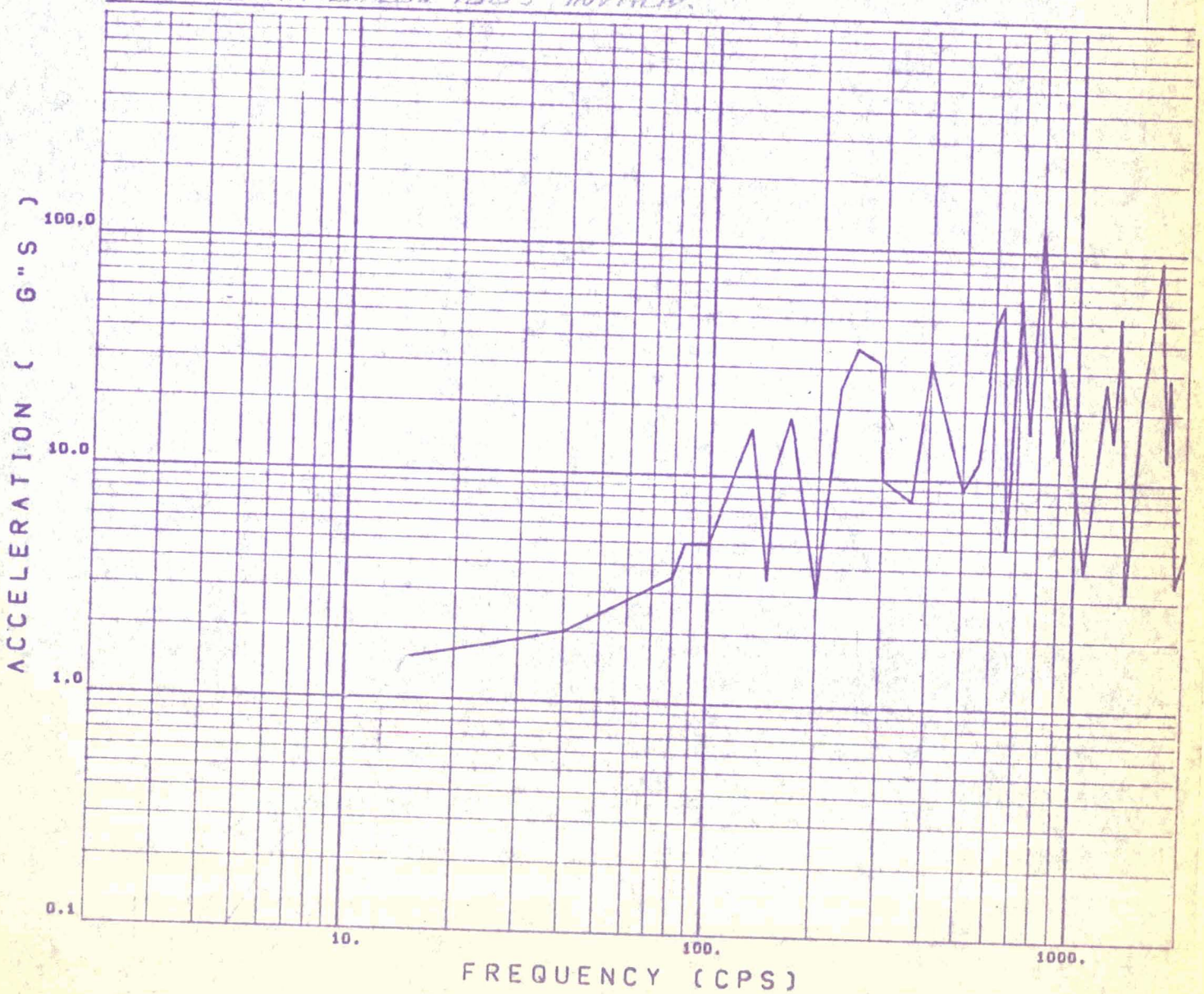


DSV-4B RANDOM VIBRATION TEST

LOX RELIEF VALVE

+1 L
DURING LAST
5 min Run

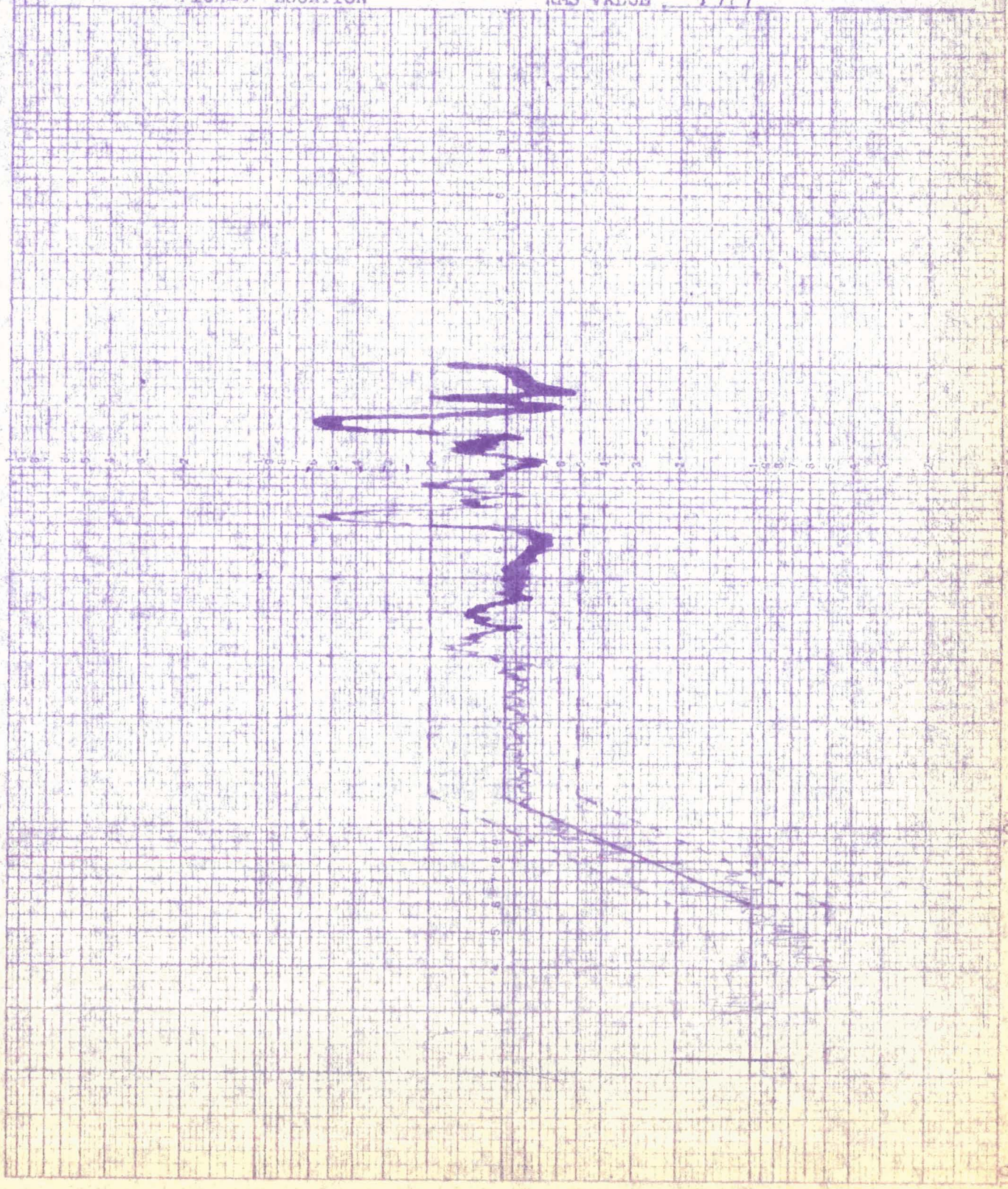
CONFIGURATION

P/N 1A 49590-515AK-1036
S/N 544
NOTE

SEE PAGE A7 FOR
PICK-UP LOCATION

TEST CONDITIONS

TEST DATE 3/22/67
AXIS OF EXCITATION RADIAL
PICK-UP NUMBER 1
PICK-UP RESPONSE RADIAL
INPUT ACCELERATION PER PAGE A26
RMS VALUE 19.4



DSV-4B RANDOM VIBRATION TEST

FQI-9A

LOX RELIEF VALVE

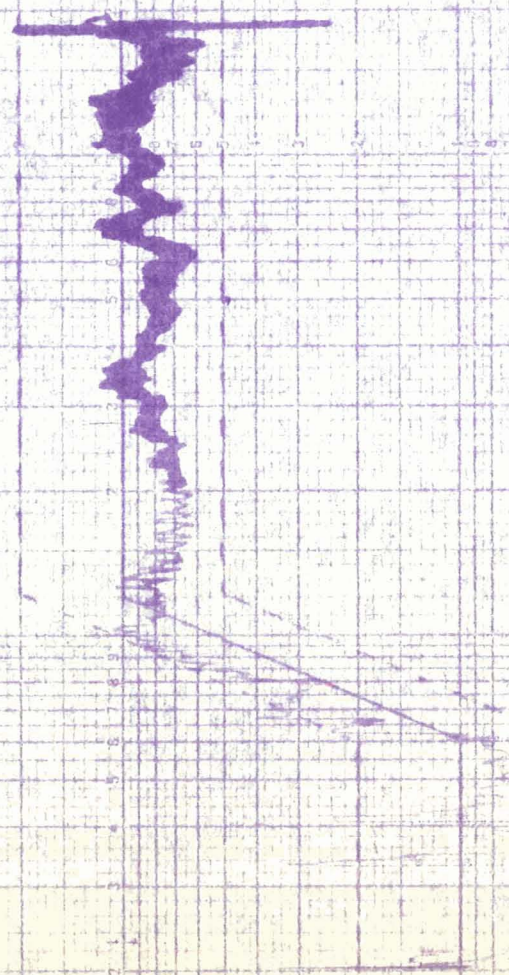
CONFIGURATION

P/N 1A 49590-515AK-1036
S/N 544
NOTE

SEE PAGE A7 FOR
PICK-UP LOCATION

TEST CONDITIONS

TEST DATE 3/23/67 2:55 AM
AXIS OF EXCITATION TANG.
PICK-UP NUMBER 1
PICK-UP RESPONSE TANG.
INPUT ACCELERATION PER PAGE A27
RMS VALUE 14 gs



DSV-4B RANDOM VIBRATION TEST

LOX RELIEF VALVE

FQ I9A

CONFIGURATION -TAKEN DURING LAST 4 MINS OF RUN

P/N 7A 49590-515 AK-1036

S/N 544

NOTE

SEE PAGE A7 FOR PICK-UP LOCATION

TEST CONDITIONS

TEST DATE 3-27-67 9:30 PM

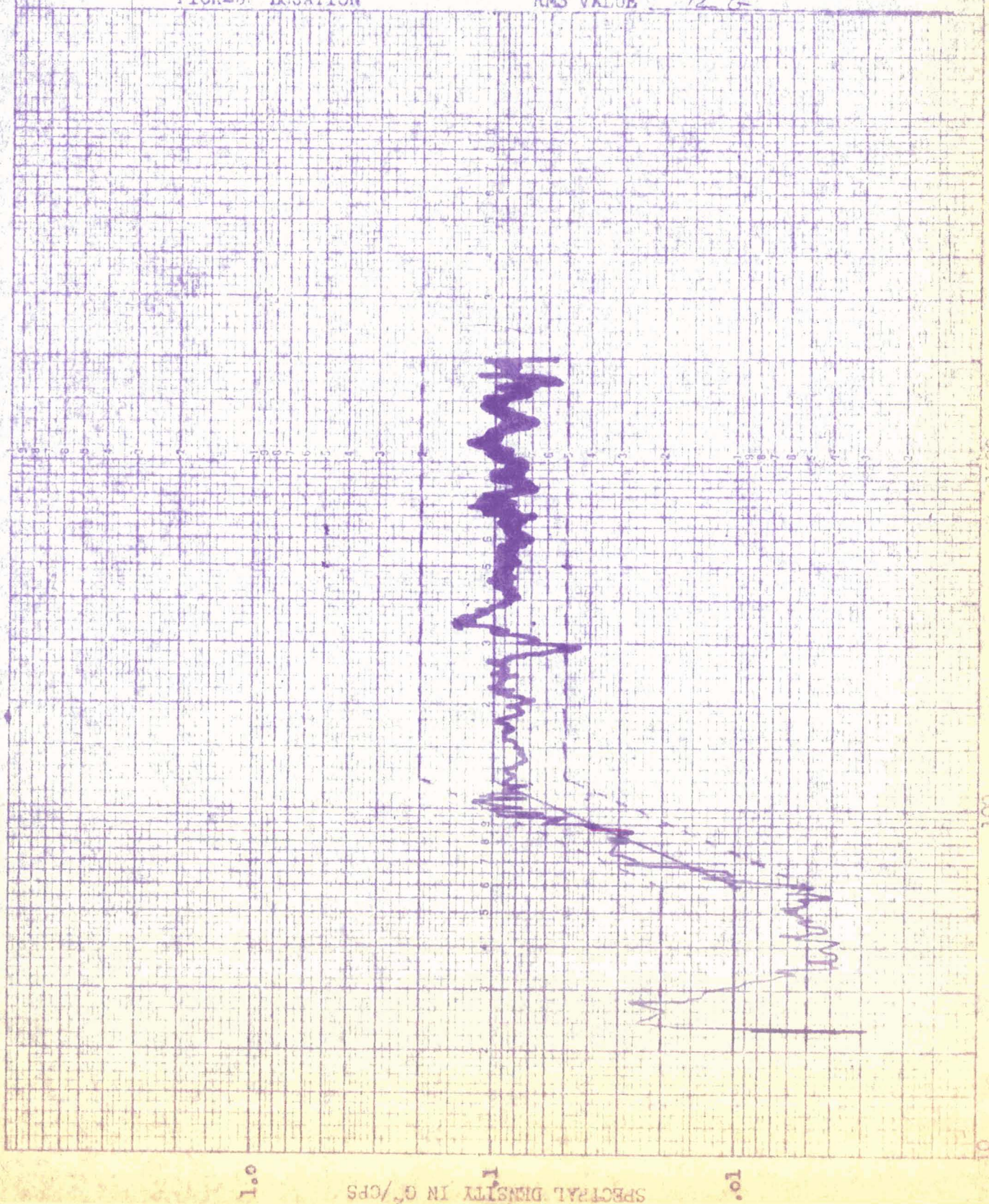
AXIS OF EXCITATION THRUST

PICK-UP NUMBER 1

PICK-UP RESPONSE THRUST

INPUT ACCELERATION PER PAGE A28

RMS VALUE 12 G



DSV-4B RANDOM VIBRATION TEST

LOX RELIEF VALVE

FQ-19A

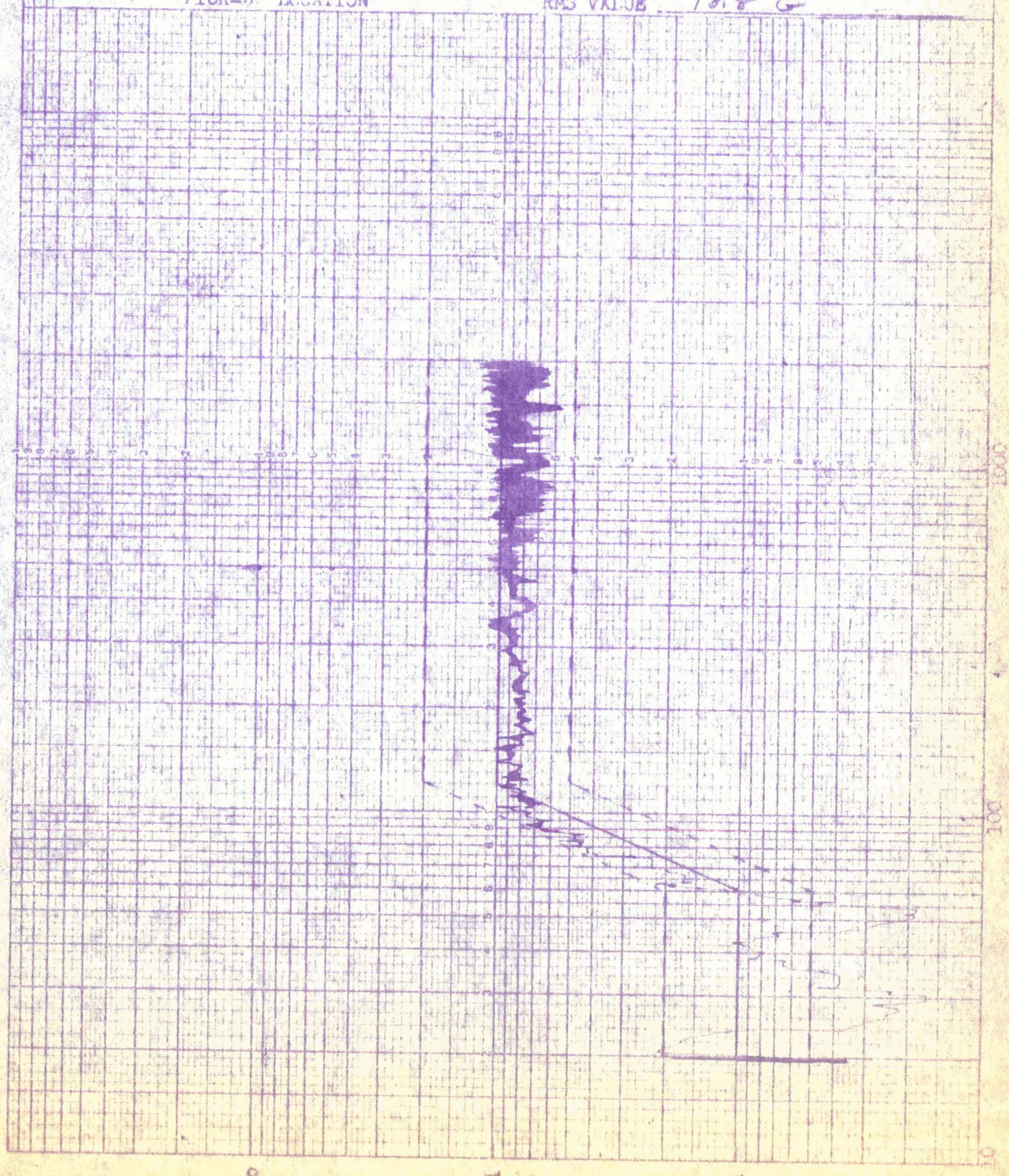
CONFIGURATION

P/N 1A 49590-515AN
S/N 508
NOTE

SEE PAGE A7 FOR
PICK-UP LOCATION

TEST CONDITIONS

TEST DATE 4/25/67
AXIS OF EXCITATION RADIAL
PICK-UP NUMBER 1
PICK-UP RESPONSE RADIAL
INPUT ACCELERATION PER PAGE A29
RMS VALUE 18.8 G



DSV-4B RANDOM VIBRATION TEST

LOX RELIEF VALVE FQ I-9A

CONFIGURATION

P/N 1A 49590-515AN

S/N 508

NOTE

SEE PAGE A7 FOR PICK-UP LOCATION

TEST CONDITIONS

TEST DATE 4/29/67

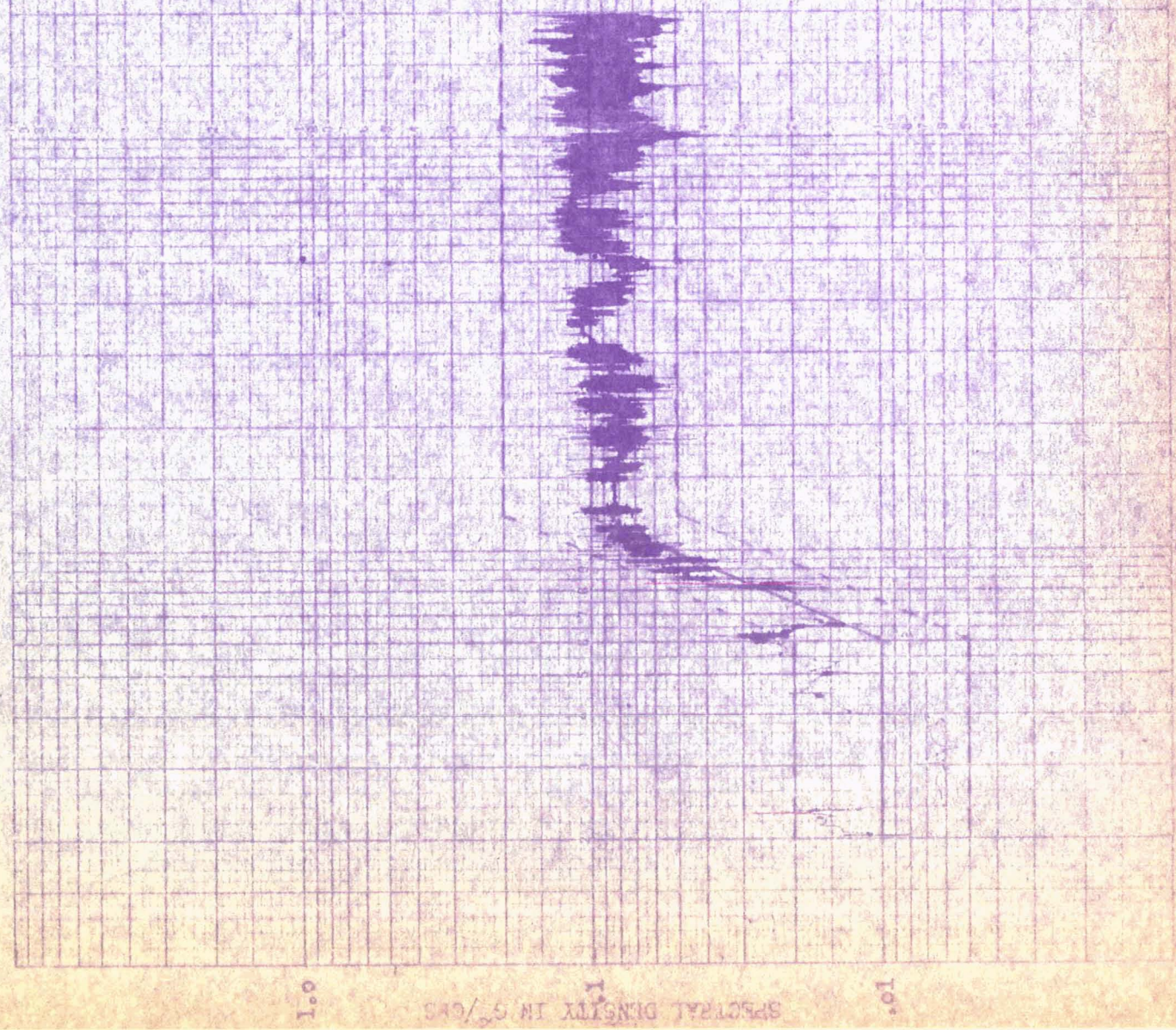
AXIS OF EXCITATION TANG

PICK-UP NUMBER 1

PICK-UP RESPONSE TANG.

INPUT ACCELERATION PER PAGE A30

RMS VALUE 16.3



DOUGLAS AIRCRAFT COMPANY, INC.

D5V-LB RANDOM VIBRATION TEST

LOX RELIEF VALVE FQ-I-9A

CONFIGURATION

P/N 1A 49590-515 AN

S/N 508

NOTE

SEE PAGE A1 FOR PICK-UP LOCATION

TEST CONDITIONS

TEST DATE 5/27/67

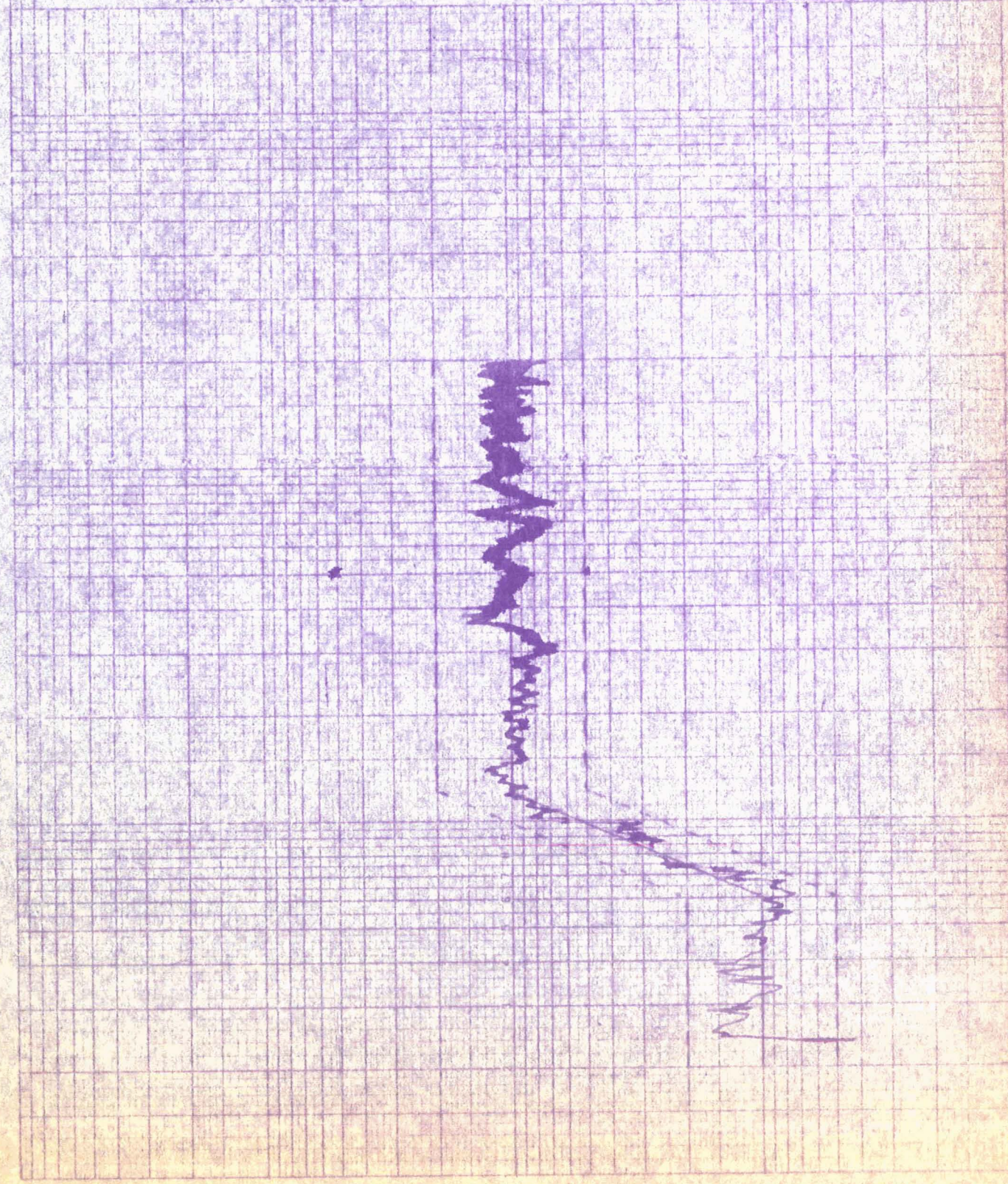
AXIS OF EXCITATION THRUST

PICK-UP NUMBER 1

PICK-UP RESPONSE THRUST

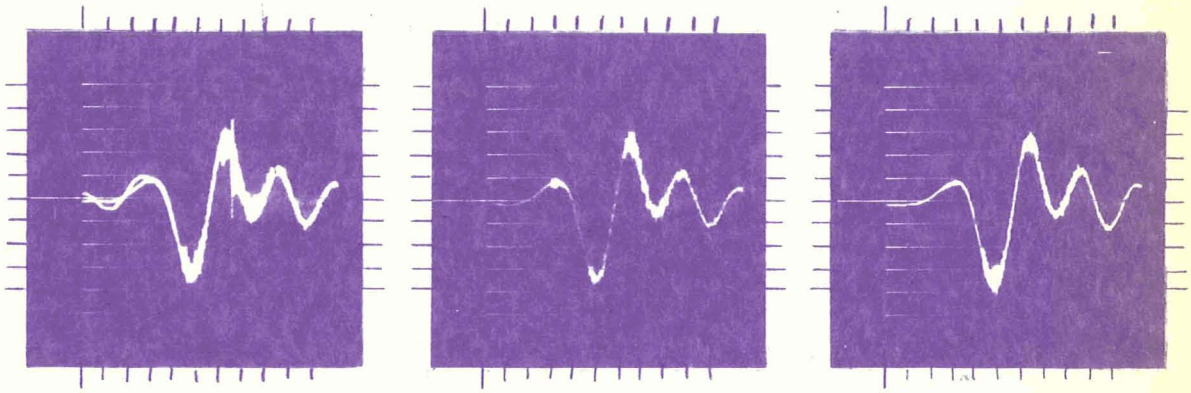
INPUT ACCELERATION PSR PAGE A31

RMS VALUE 13.3 G



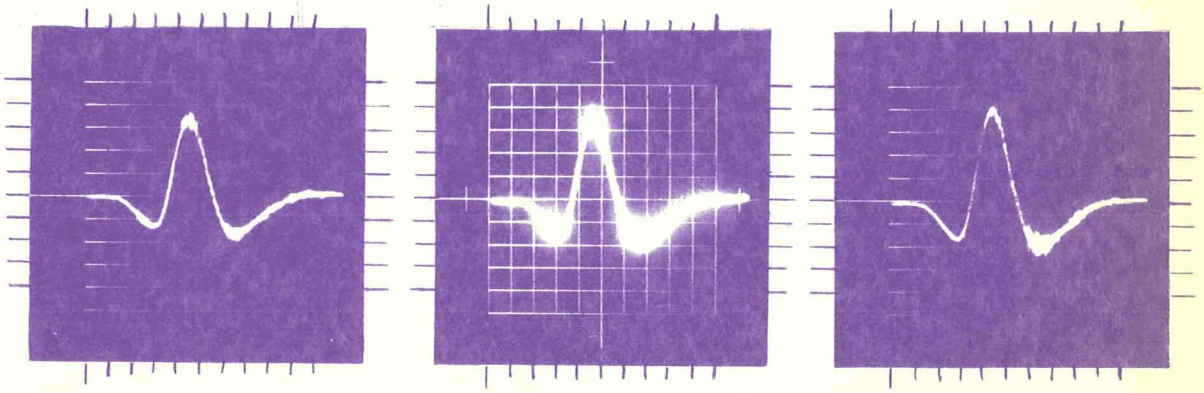
5769-6404
27557
1T06426

SHOCK PULSE
S/N 544

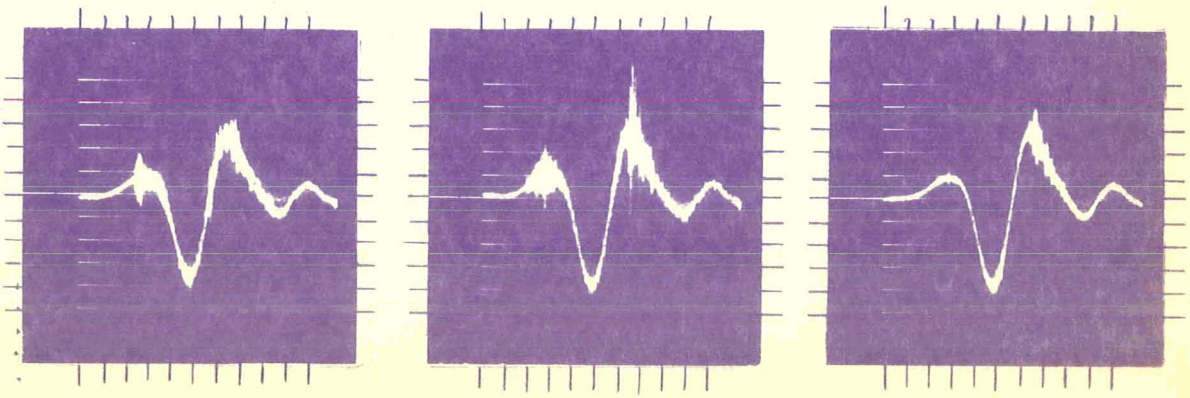


RADIAL AXIS

5 G's/DIVISION



TANGENTIAL AXIS



5 MSEC/DIVISION THRUST AXIS

K+E ALBANENE® LA 1789 TRACING PAPER

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

PREPARED BY: W. SLACK

CHECKED BY:

DATE: 4-29-67

TITLE: OXIDIZER TANK RELIEF VALVE (FQ-I-9A)

DOUGLAS AIRCRAFT COMPANY, INC.

DIVISION

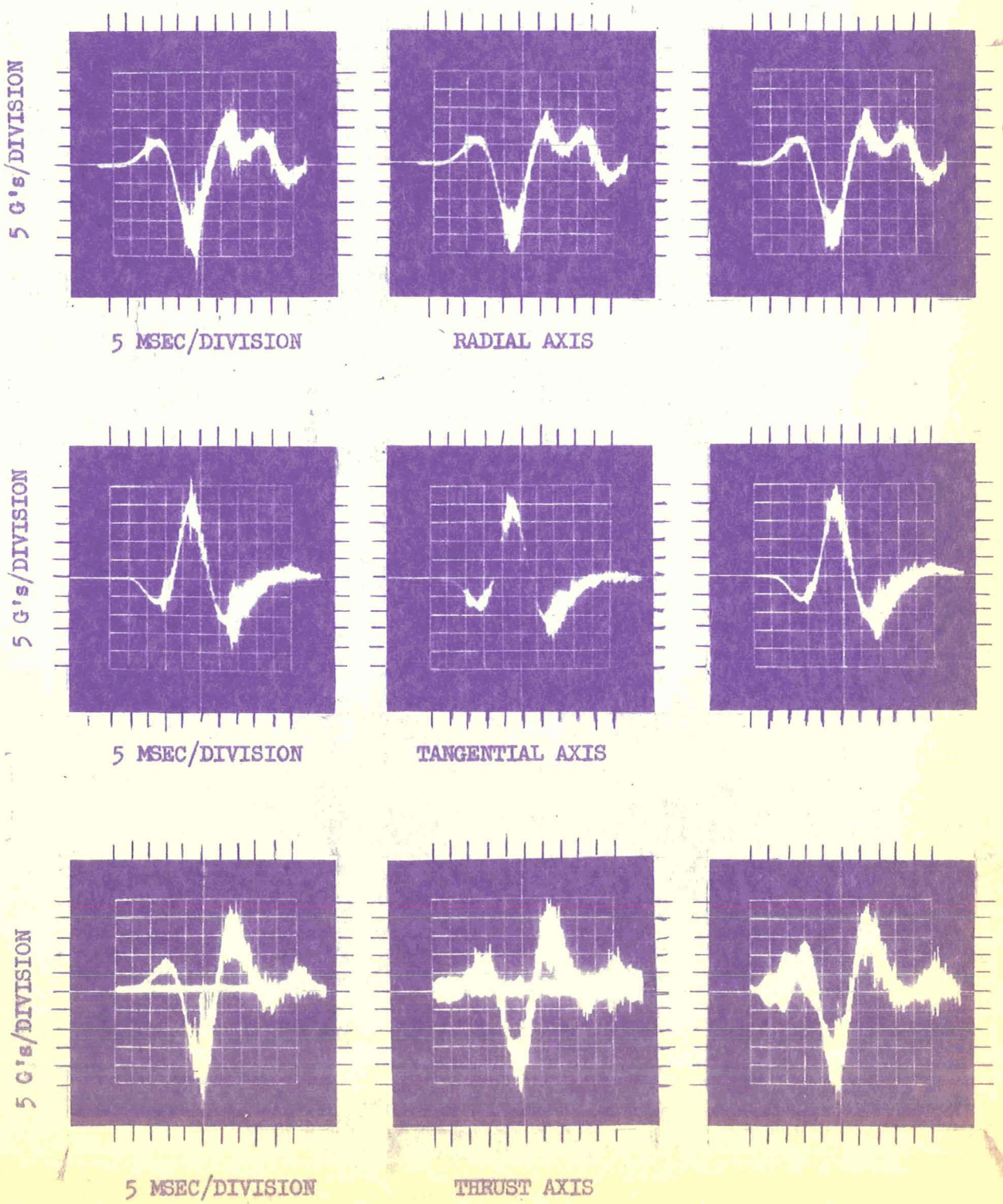
PAGE: A33

MODEL: DSV-4B

REPORT NO.: R6094-1

5769-6404
27557
1T06426

SHOCK PULSE
S/N 508



K+E ALBANENE® LA 1617