

1801112-11 PSA-35  
QUALIFICATION TESTING  
BERGEN PATERSON

C. F. BRAUN SPECIFICATION 400-20  
TVA "STRIDE"

FROM



PREPARED BY

*R. F. Whitney*  
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Test Engineer  
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APPROVED BY

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Quality Control Manager

REV.	DATE	BY	APPD. BY	PAGES AFFECTED	
A	4-21-80	<i>RFW</i>	<i>WSW</i>	Page 6 Page 9	Correct Acceleration Requirement Par. 1.1
		8208250437 PDR ADCK 05000259 P	820818 PDR		

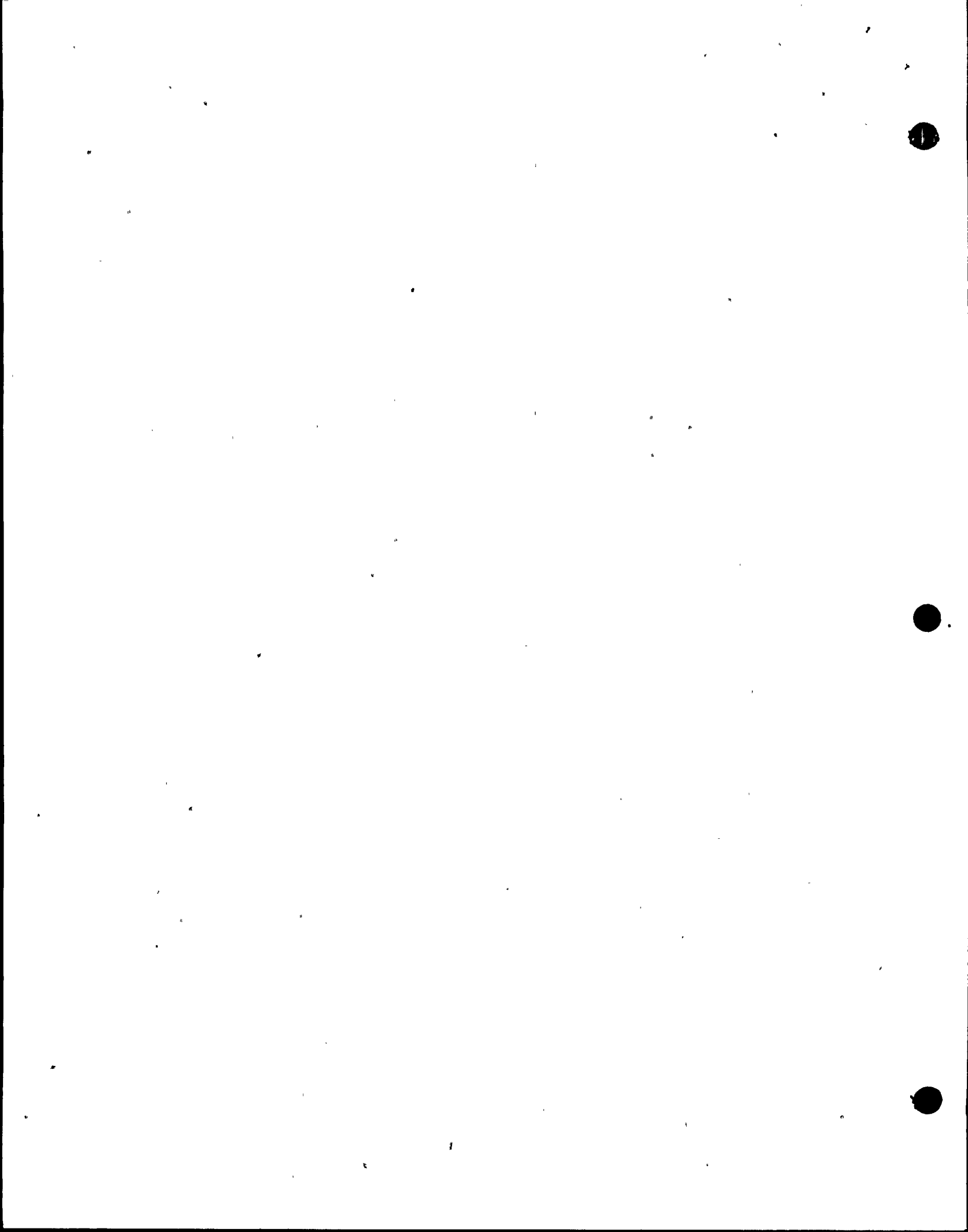
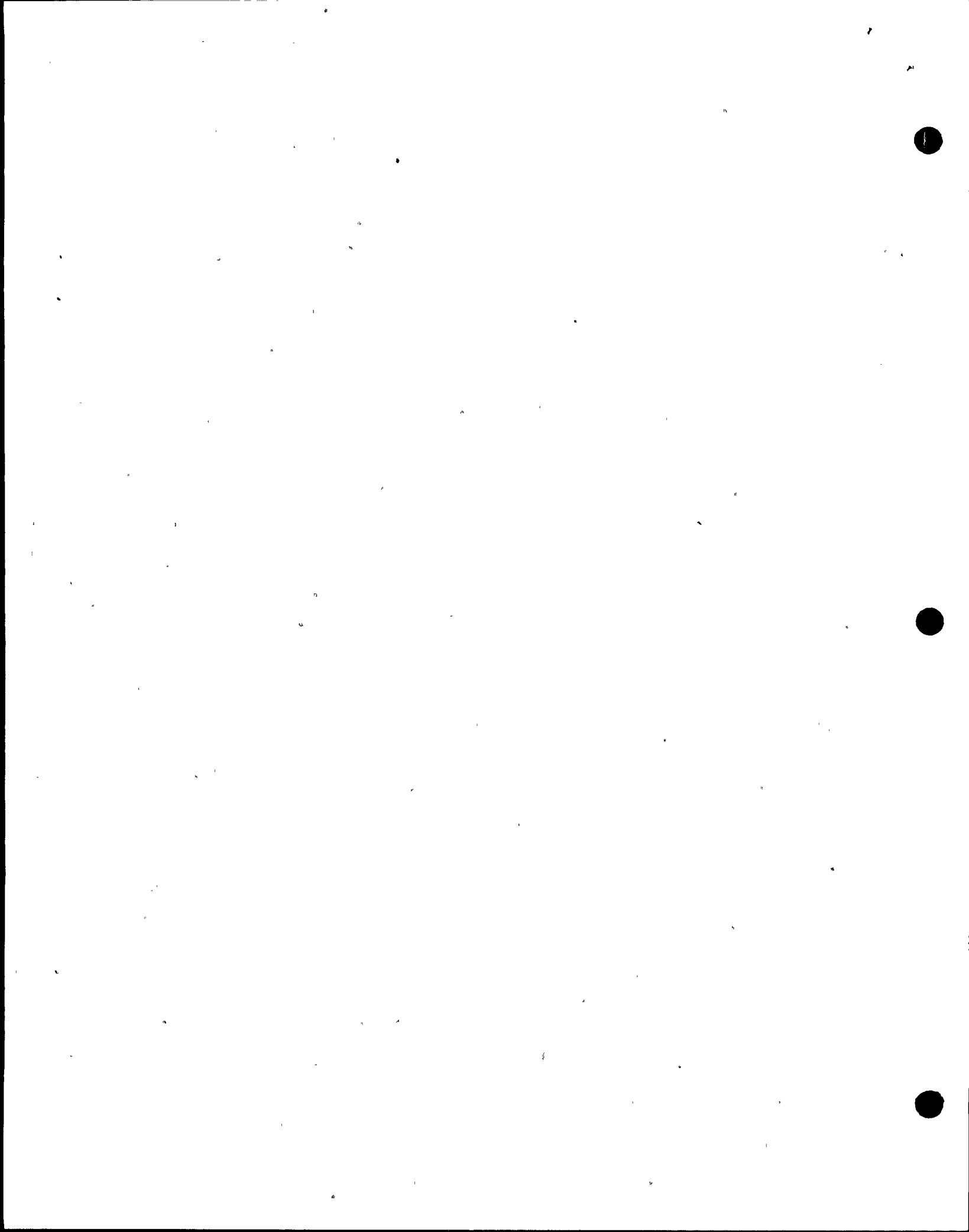


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ADMINISTRATIVE DATAPURPOSE OF TEST

To determine the ability of the 1801112-11 Shock Arrestor to meet the Qualification Test requirements.

MANUFACTURER

PACIFIC SCIENTIFIC COMPANY, KIN-TECH DIVISION, 1346 S. State College Boulevard, Anaheim, California.

MANUFACTURER'S TYPE OR MODEL NO.

P/N 1801112-11 MODEL PSA-35

APPLICABLE DOCUMENTS

C.F. BRAUN Specification 400-20 Rev. 5  
PSCO Drawing 1801112-11  
PSCO Qualification Test Procedure DR 1506 Rev. 3  
PSCO Acceptance Test Procedure I.T. 534 Rev. J

QUANTITY OF ITEMS TESTED

Two (2) P/N 1801112-11 Shock Arrestors S/N 5192 and 5193 were used for the test program. They were selected at random from a production lot. The test units were built in accordance with ASME Boiler and Pressure Vessel Code Section III, Subsection NF. Summer 1977 Agenda and Code Case 1644-5. Each of the test units were subjected to all of the required tests.

TEST COMPLETION DATE

1 February 1980

TEST CONDUCTED BY

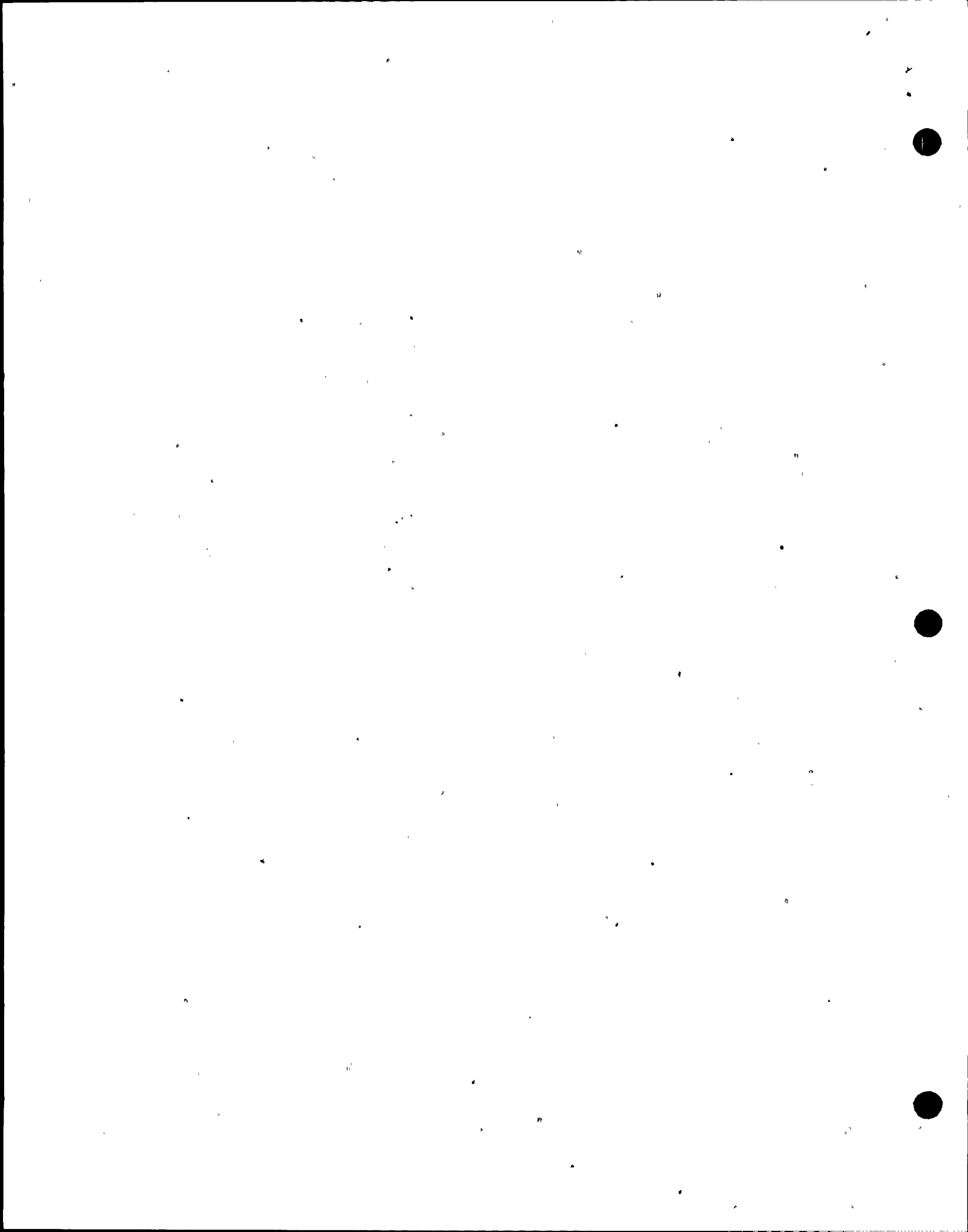
PACIFIC SCIENTIFIC COMPANY, KIN-TECH DIVISION, ANAHEIM, CALIFORNIA

SECURITY CLASSIFICATION OF ITEMS

Unclassified

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EQUIPMENT LIST

<u>TEST</u>		<u>TOLERANCE</u>	<u>CALIBRATION DATE</u>	<u>CALIBRATION PERIOD</u>
Dimensional Examination	Standard Micrometers Height Gages, etc.	(Data on file in Quality Control Dept.)		
Acceleration/Load	1801-TF-2 Fixture Meylan Digital Timer Model 112	<u>±</u> .01 sec.	9/24/79 & 1/24/79	4 months
Breakaway Friction Force	1801-TF-2 Fixture Pressure Gauge	<u>±</u> 1%	1 /11/80	3 months
Lost Motion	Dial Indicator - .001/Div.	<u>±</u> 1/2 div.	11/21/79	6 months
Dynamic Load	Mts. Load Cycling Machine Model 311.31 S/N 416 Lebow Load Cell Model 661.023A-02 S/N 999	<u>±</u> 0.5%	6/19/79	12 months
	C. L. Collins Linear Motion Transducer Model LMT 12911, S/N 19447	<u>±</u> 1%	—	Daily
	Omega Digital Thermometer Model 2175A With Thermocouple	<u>±</u> 1%	9/5/79	12 months
Abnormal Environment	B.T.C. Steam Chamber 0-100 PSI Pressure Gage	<u>±</u> 1%	1 /7/80	3 months
	Omega Digital Thermometer Model 2175A With Thermocouple	<u>±</u> 1%	9/5/79	12 months

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CERTIFICATION

I, the undersigned, being a registered Professional Engineer in the State of California, competent in the testing and evaluation of Mechanical Shock Arrestors, certify that this report truly and accurately presents results of tests performed in accordance with the approved test procedures.

Certified by *R.F. Whitney*

Quality Engineer

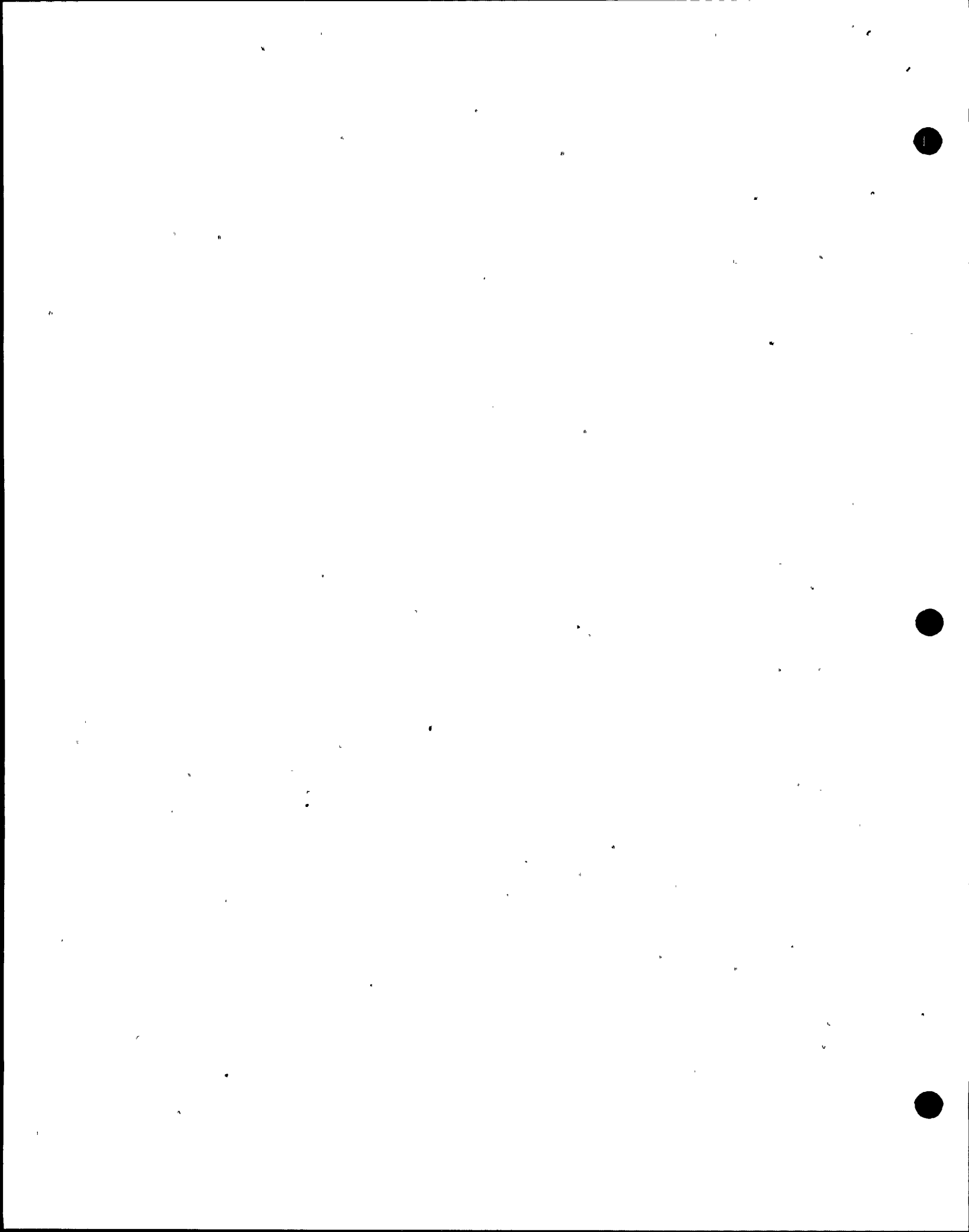
State of California

Registration No. 1919

Date 7 February 1980**PACIFIC SCIENTIFIC • KIN-TECH DIVISION**

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TESTING1.0 Acceptance Tests1.1 Requirements

The test units were examined and tested to the requirements of I.T. 534, enclosure 1. Photograph 1 identifies the test units. Photograph 2 shows the acceleration test fixture. The breakaway friction must not exceed 500 lbs. and the snubber must limit the acceleration to .015 G maximum (.59 seconds for 1 inch travel). The calculations are as follows:

$$a = \frac{2S}{386t^2} = + \frac{2 \times 1}{386 \times (.59)^2} = .015 G$$

1.2 Procedure1.2.1 Breakaway Friction

The breakaway friction was measured with the unit extending and retracting. The measurements were made at mid position and approximately 1/2 inch away from the fully retracted and fully extended position.

1.2.2 Acceleration

A constant load was applied to the snubber and the time required for the unit to travel 1 inch was recorded. The test was made with tension and compression loads,

1.3 Results

Both snubbers met the requirements.

S/N	Friction-Lbs. (500 lbs. max.)	Acceleration (0.59 sec. Min.)	
		Ext.	Retr.
5192	425 lbs.	1.99 sec.	1.83 sec.
5193	485 lbs.	1.54	1.52

Refer to Appendix 1 for actual data sheets I.T. 534, Page 4.

2.0 Dynamic Load Cycling, Room Temperature2.1 Requirements

Rated load (50,000 lbs) shall be applied for ten seconds at each step in both tension and compression between 3 and 33 Hz in 5 Hz steps. The lost motion during dynamic cycling shall not exceed .040 inch. The unit spring rate shall be calculated from the load/deflection photographs between 8 and 18 Hz. The average value shall be equal to or greater than  $600 \times 10^3$  lbs./inch less 10%.

$$\text{Spring Rate} = \frac{\text{Full Rated Load (peak to peak)}}{\text{Total deflection less lost motion}}$$

2.2 Procedure

The snubber was installed in an MTS load cycling machine and positioned to approximately mid-position of travel. A linear motion transducer was installed to measure unit travel or displacement. A load cell was in line with the unit centerline to measure axial load. Refer to set-up in Photograph 3. The displacement and axial load were monitored on an oscilloscope with the displacement on the vertical axis and the load on the horizontal axis. Refer to the photographs on pages 11 thru 14. The input motion was a displacement that varied as a sine wave which resulted in a load being developed in both tension and compression. Rated load was applied for 10 seconds at each of the seven frequency steps.

2.3 Results

The unit met the requirements. Refer to oscilloscope photos and Appendix 2.

S/N	Data Summary	
	Lost Motion - Inches (.040 inch max.)	Spring Rate Lbs/Inch (540 X $10^3$ Lbs/Inch Min.)
5192	.037	1150 x $10^3$
5193	.032	1210 x $10^3$

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### 3.0 Abnormal Ambient Environment

#### 3.1 Requirements

The shock arrestors at room ambient condition shall be placed in a chamber capable of maintaining pressure and temperature. The chamber conditions shall then be adjusted to the Phase I Condition and then allowed to decay gradually through Phase II, III and IV as outlined.

- (1) Phase I: 330F, (-)2 to (+)15 psig, all steam for 3 hours  
330F, (+)30 psig, all steam for 45 seconds
- (2) Phase II: 310F, (-)2 to (+)15 psig, all steam for 6 hours
- (3) Phase III: 250F, 0 to 15 psig, 100 percent relative humidity (RH) for 24 hours
- (4) Phase IV: 250F to 100F, 0 to 15 psig, 100 percent relative humidity for 1 day (24 hours)

Following the steam test the unit shall be stabilized at 200°F and subjected to the breakaway friction and acceleration test.

#### 3.2 Procedure

The PSA 35 snubbers were placed in the Steam Chamber .

Refer to photograph 4. The chamber was sealed and a quantity of water was introduced into the chamber. Heat was applied to the chamber and the temperature was monitored with a thermocouple. The chamber conditions were adjusted to 330°F and + 15 psig (Phase I). The air was vented from the chamber which resulted in the units being subjected to "all steam". The temperature was maintained at 330°F minimum and the pressure was allowed to vary between 0 and 15 psig. The superheated steam condition was obtained by draining water from the chamber in order to keep the pressure from increasing above 15 psig. A log was maintained of the temperature and pressure. Refer to pages 19 thru 21.

After 3 hours the pressure was increased to 30 psig for 45 seconds by adding more water, and then reduced to the condition of Phase II and maintained for 6 hours.

The temperature was then allowed to drop to 250°F and the pressure was maintained between 0 and 15 psig, Phase III. After 24 hours the cham-

ber temperature was adjusted to between 250°F and 100°F while maintaining the pressure between 0 and 15 psig. (Phase IV). These conditions were held for another 24 hour period. The chamber was then opened and the units were visually examined. The snubbers were stabilized at 200°F for 2 hours and then subjected to the breakaway friction and acceleration tests.

### 3.3 Results

The exterior of the units displayed a darkening in color, but there was no base metal corrosion. The friction and acceleration values were met at 200°F.

A	S/N	Friction - lbs. (500 lbs. max.)	Acceleration (0.59 sec. min.)	
			Ext.	Retr.
	5192	460 lbs.	1.46	1.43
	5193	450 lbs.	1.29	1.28

### 4.0 Dynamic Load Cycling at 200°F

#### 4.1 Requirements

Same as Paragraph 2.1 except the unit shall be at 200°F. (10 seconds at each step, between 3 and 33 Hz in 5 Hz steps.)

#### 4.2 Procedure

Same as Paragraph 2.2 except the unit shall be stabilized at 200°F for 2 hours before load cycling. A temperature chamber was placed around the snubber which was installed in the load cycling fixture. Refer to Photograph 5.

#### 4.3 Results

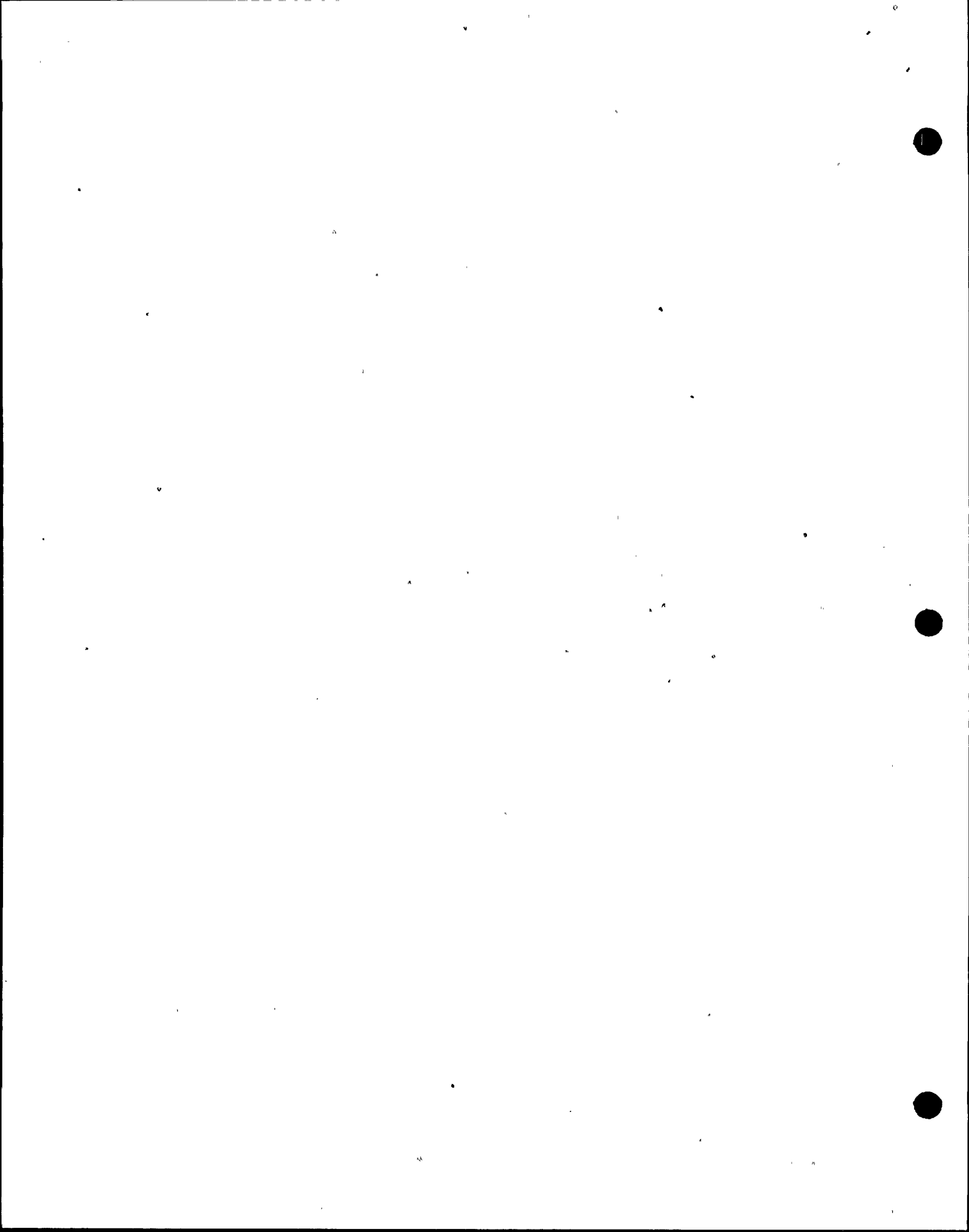
The unit met the requirements. Refer to Pages 15 thru 18 for the load cycling photographs. The maximum lost motion during cycling was:

S/N	5192	.040 inch (8 Hz)
S/N	5193	.037 inch (8 Hz)

### 5.0 Additional Load Cycling, Room Temperature

#### 5.1 Requirements

A total of 5,000 cycles is required for each snubber. All cycles applied during testing of Paragraph 2.0 and 4.0 shall be subtracted from 5,000



and the remaining cycles shall be run at room temperature at rated load and at 3 Hz.

### 5.2 Procedure

The procedure details were the same as Paragraph 2.2, except all cycles were applied at 3 Hz. The cycles were run as follows:

<u>Frequency</u>	<u>Temperature</u>	<u>Cycles</u>	
		<u>S/N 5192</u>	<u>S/N 5193</u>
3 - 33 Hz	75°F	1430	1260
3 - 33	200	1330	1290
3	75	<u>2240</u>	<u>2450</u>
	<b>TOTAL</b>	<b>5000 Cy</b>	<b>5000 Cy</b>

### 5.3 Results

There was no failure. Each snubber was in good condition after the test.

### 6.0 Summary and Conclusion

The shock arrestors met all requirements of the test program. There was no failure or damage to the units.

	<u>S/N 5192</u>	<u>S/N 5193</u>
1. Lost Motion .040 inch-max.	.040 inch	.037 inch
2. Breakaway Friction 500 lbs. max.	460 lbs.	485 lbs.
Acceleration Test 0.59 sec.-min.	1.43 sec.	1.52 sec.
3. Dynamic Test Response	(Refer to load-displacement photographs)	
4. Spring Constants 600 x 10 <sup>3</sup> ) - ( 60 x 10 <sup>3</sup> ) = 540 x 10 <sup>3</sup> lbs/inch	1260 x 10 <sup>3</sup> lbs/in.	1365 x 10 <sup>3</sup> lbs/in.

P/N 1801112-11

S/N 5192

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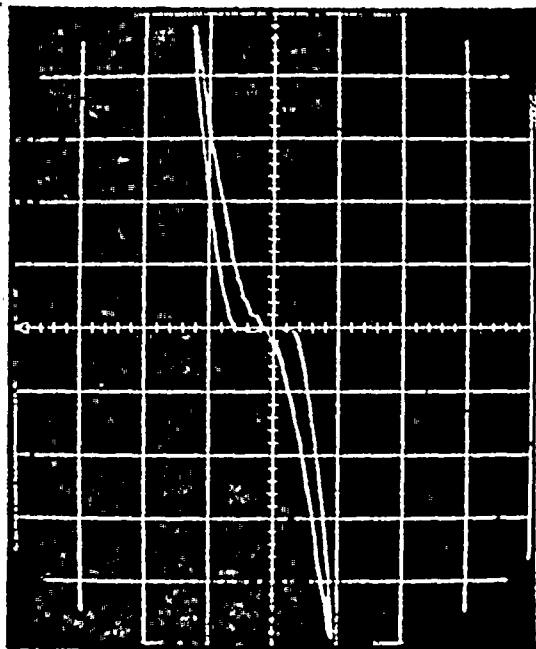
DATE 1-24-80

PSA-35

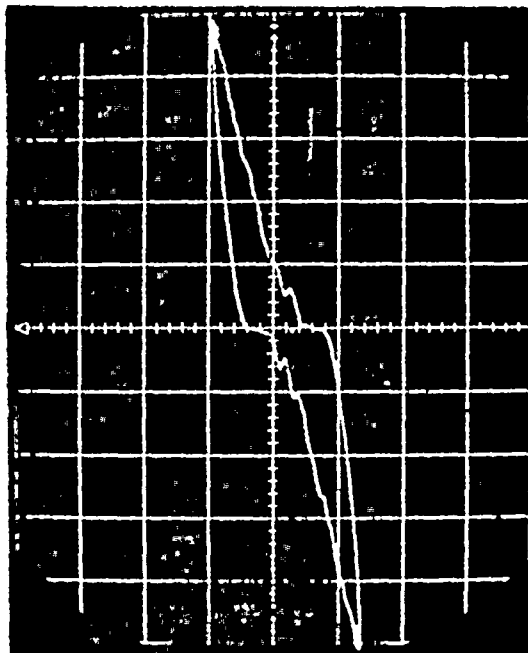
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75°F

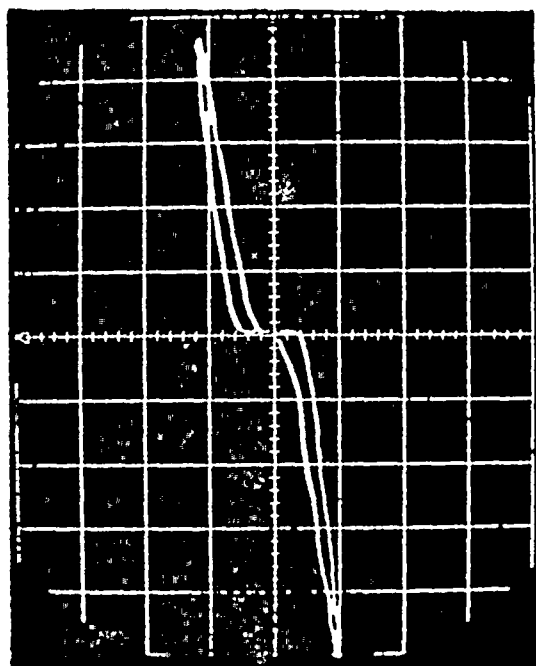
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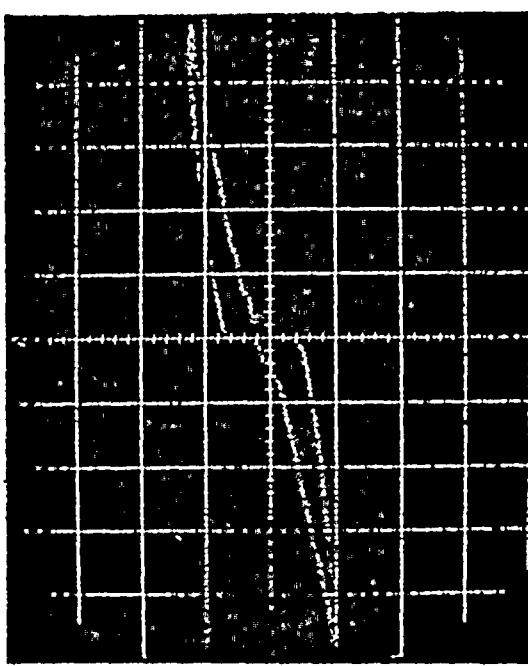
8 Hz



18 Hz



3 Hz



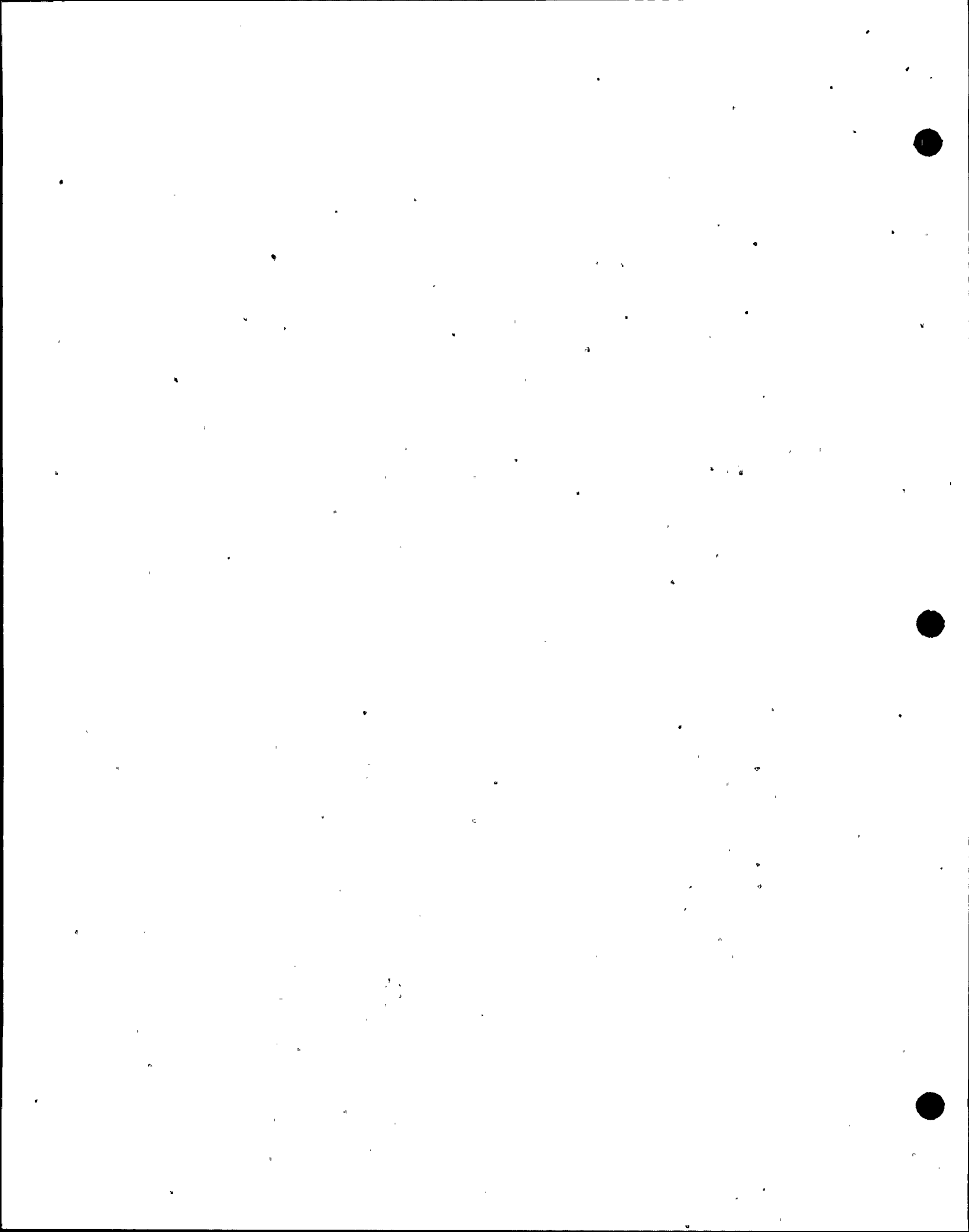
13 Hz

VERTICAL CALIBRATION = .05 Inch / DIV.  
 HORIZONTAL CALIBRATION = 10,000 Lbs. / DIV.

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S/N 5192

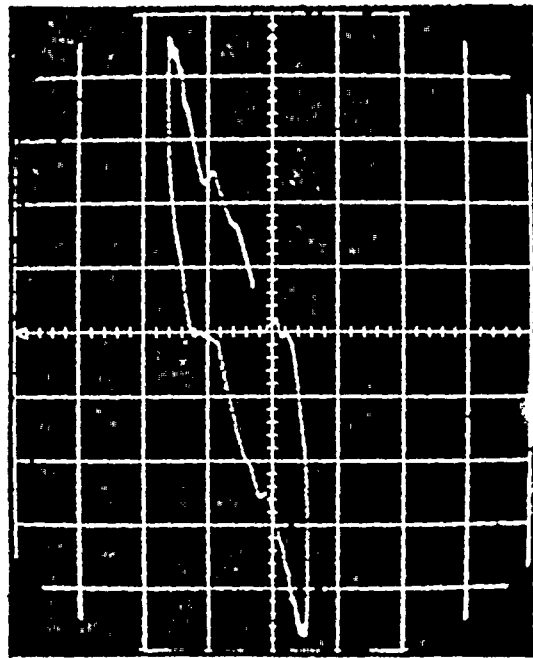
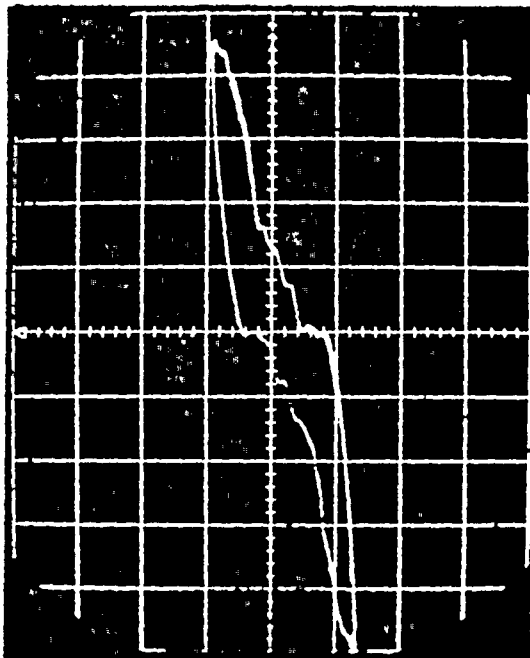
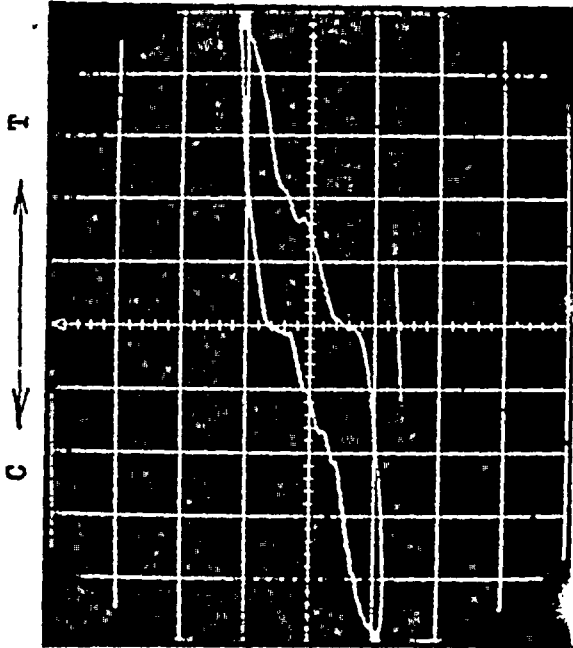
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75°F



CALIBRATION --- VERTICAL --- .05 Inch. / DIV.  
 HORIZONTAL --- 10,000 Lbs. / DIV.

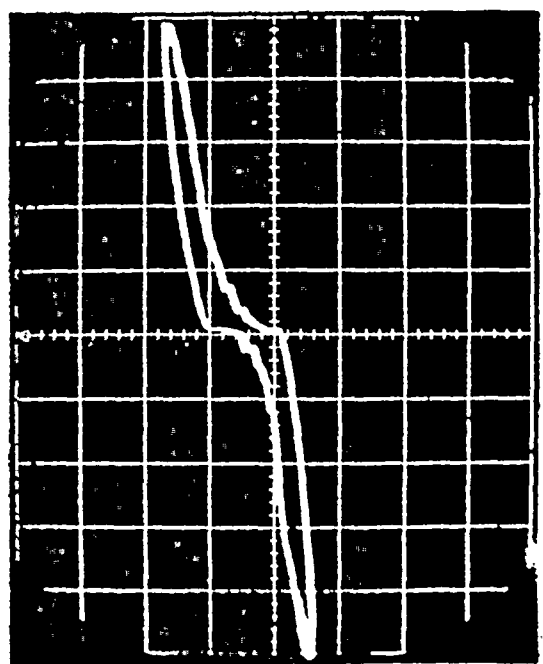
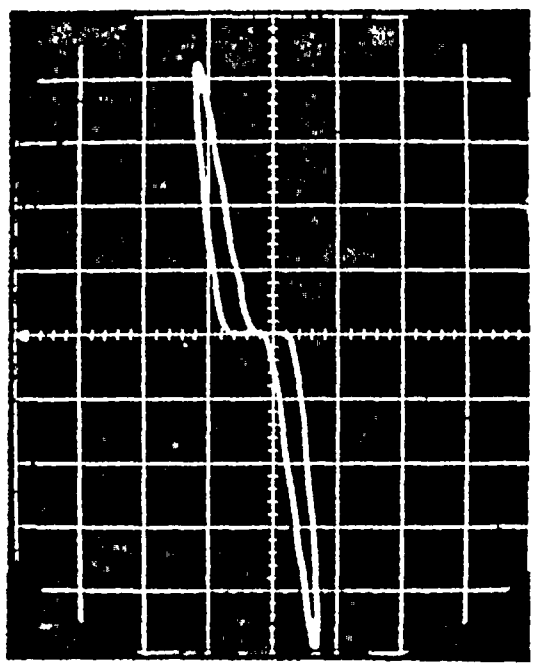
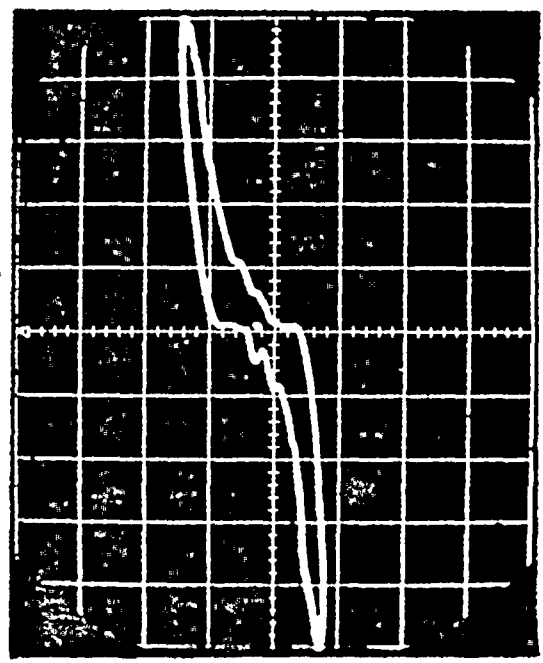
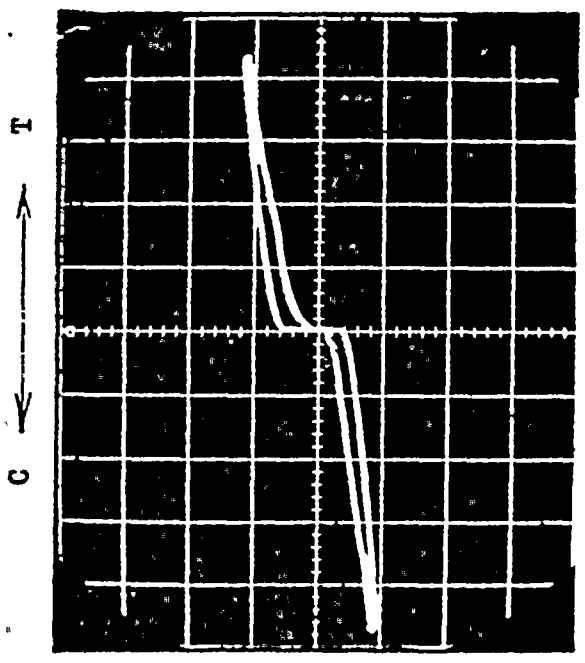
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DATE 1-31-80

S/N 5192  
PSA-35  
200°F

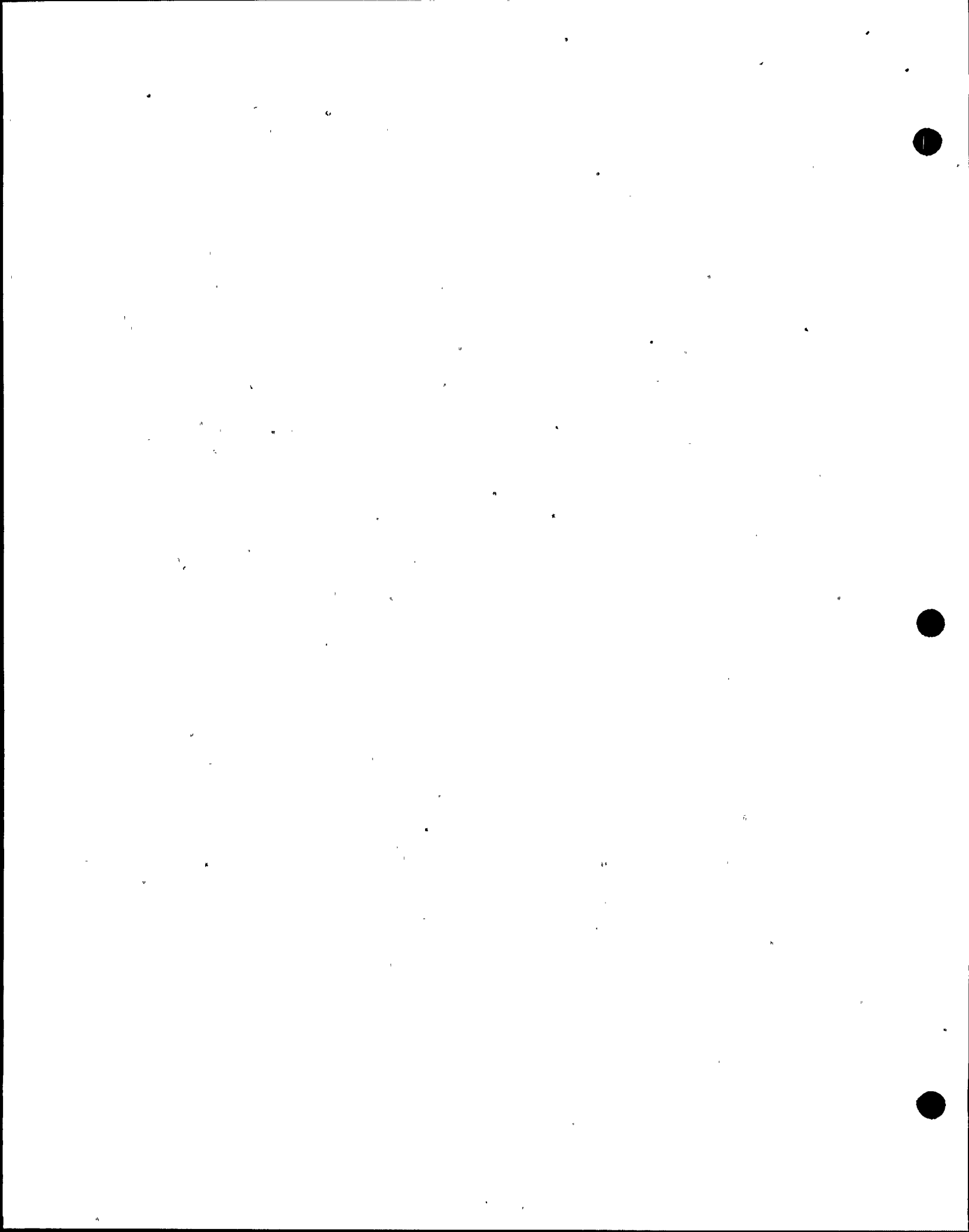
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CALIBRATION -- VERTICAL -- .05 Inch / DIV.  
HORIZONTAL -- 10,000 Lbs. / DIV.

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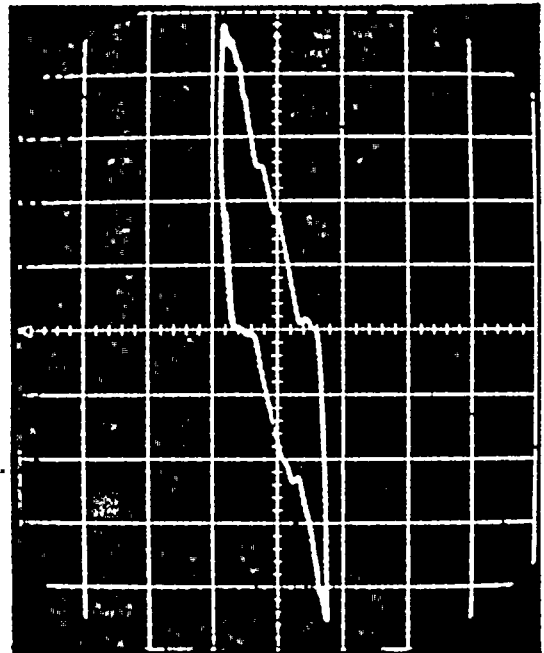
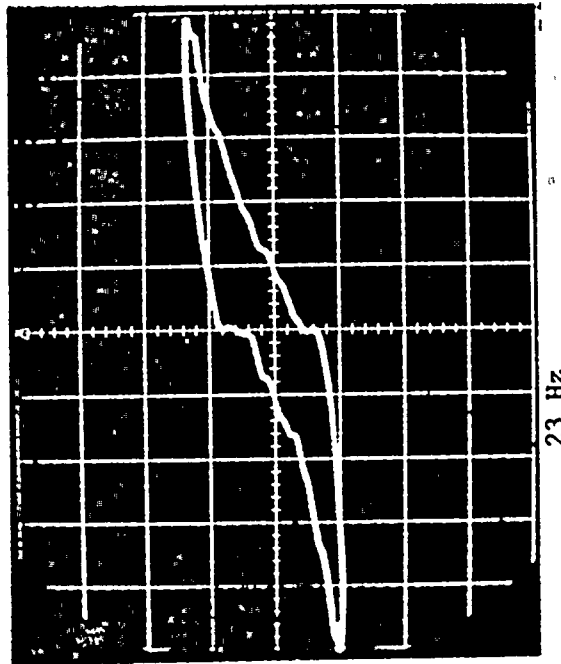
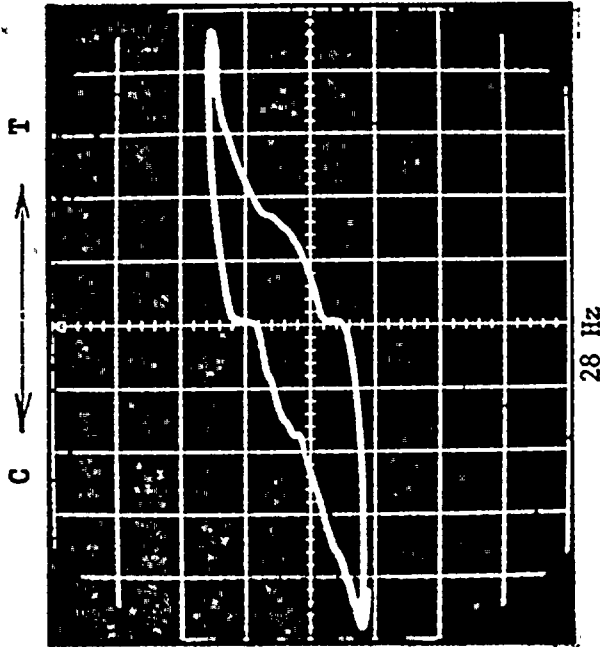
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200°F



VERTICAL = .05 Inch / DIV.  
 HORIZONTAL = 10,000 Lbs. / DIV.

CALIBRATION ---

33 Hz

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S/N 5193

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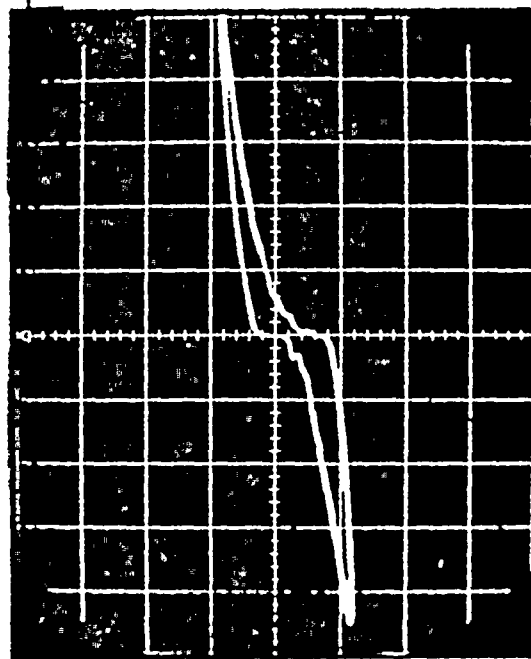
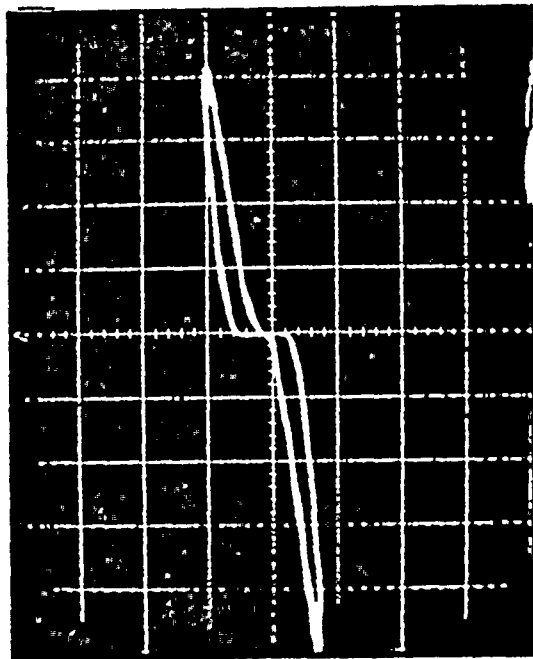
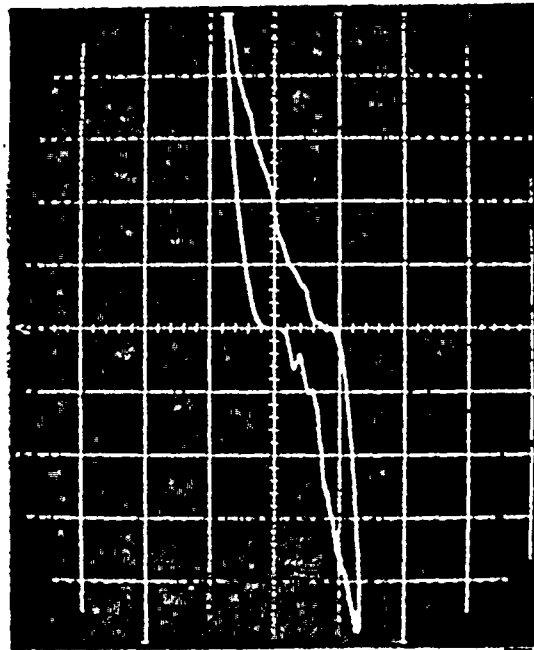
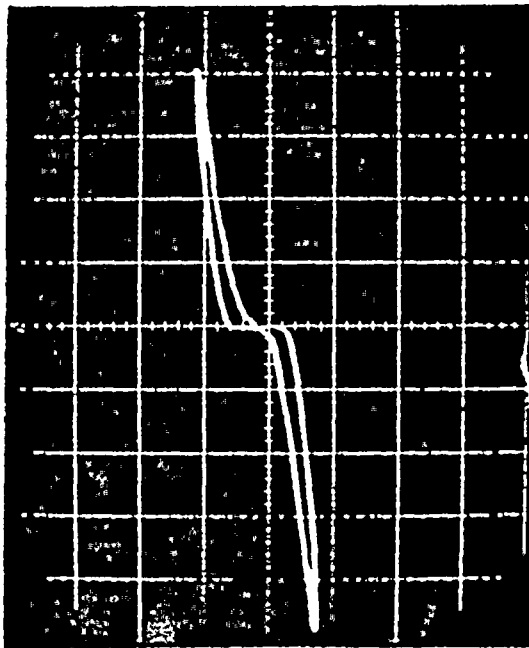
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75°F

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VERTICAL = .05 Inch / DIV.  
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CALIBRATION ---

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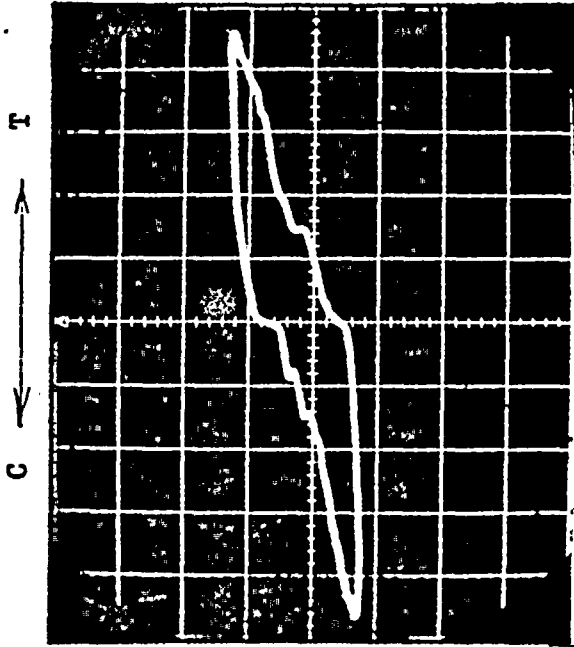
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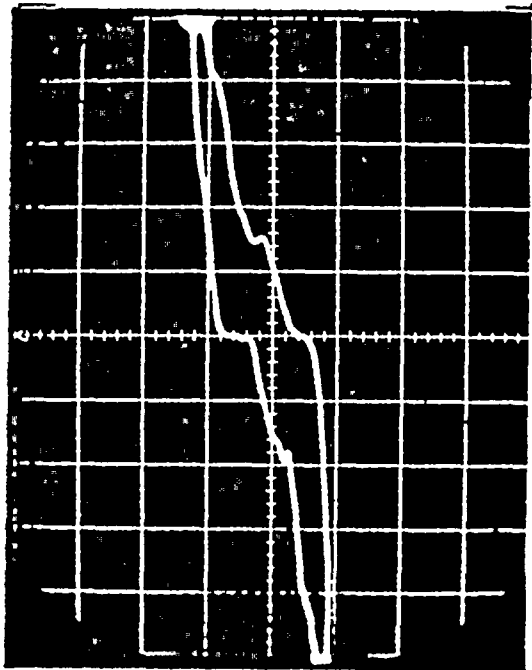
PSA-35

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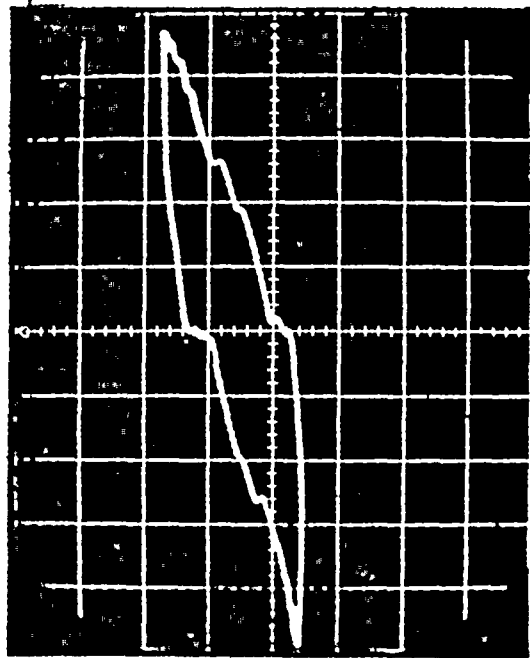
75°F



28 Hz



23 Hz

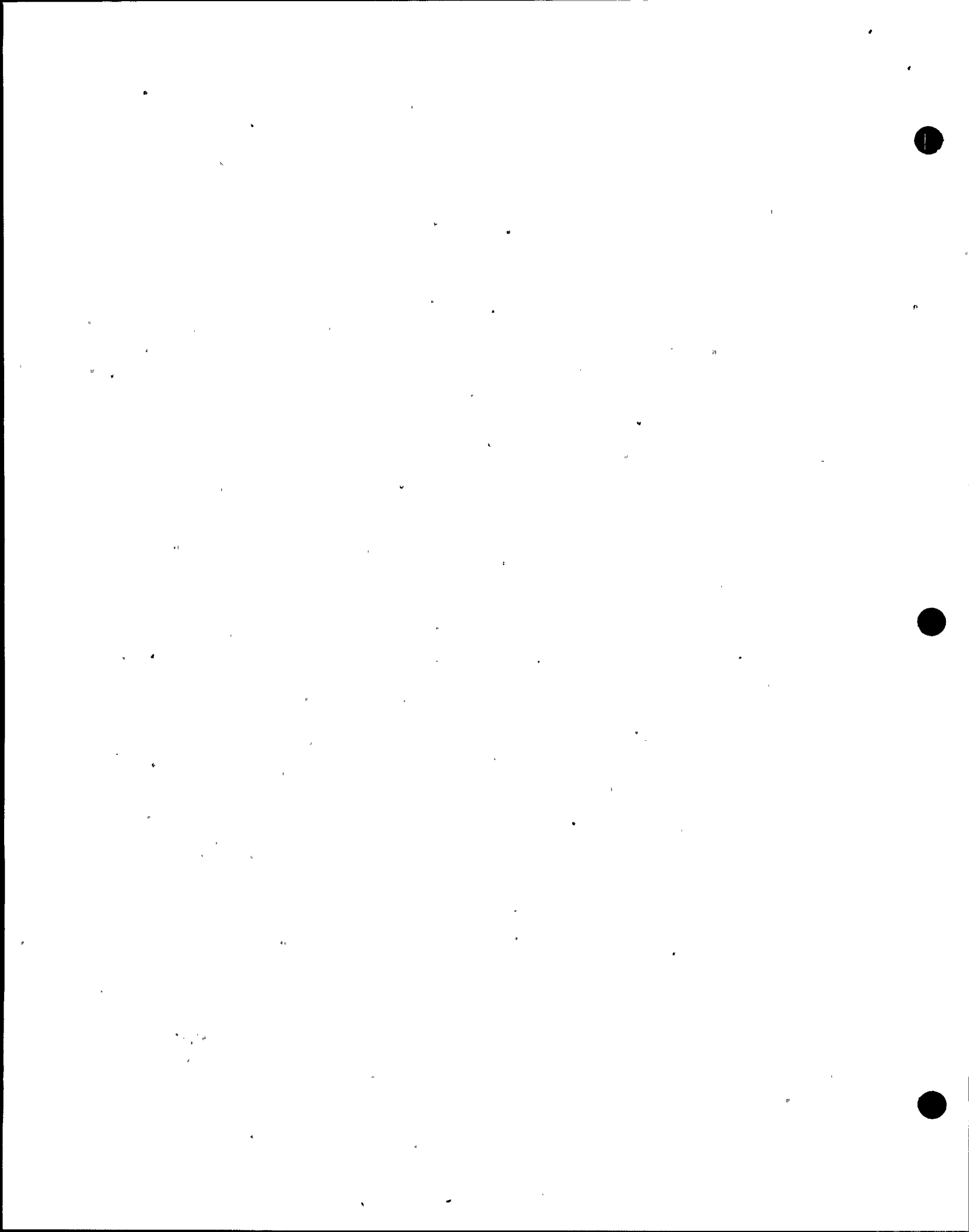


33 Hz

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 HORIZONTAL = 10,000 Lbs. / DIV.

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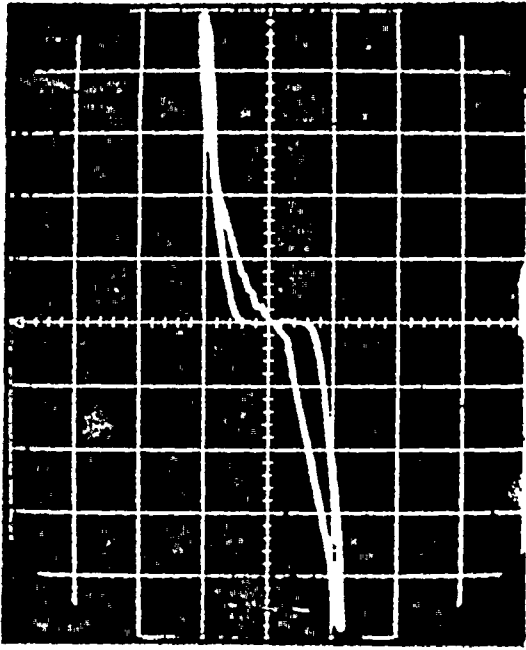


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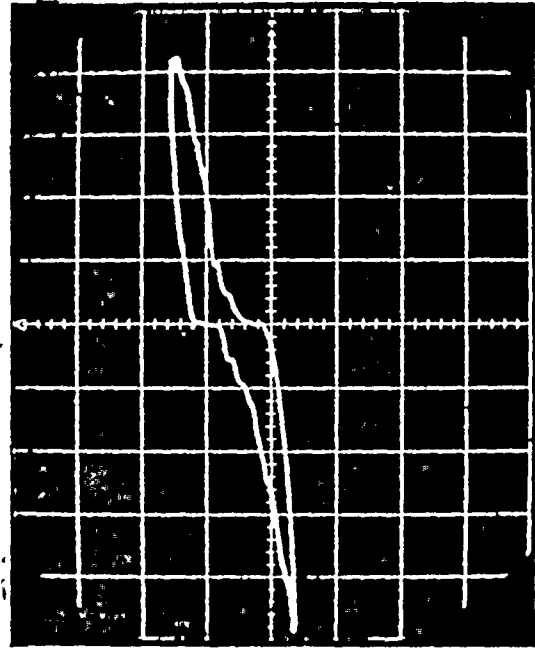
S/N 5193  
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200°F

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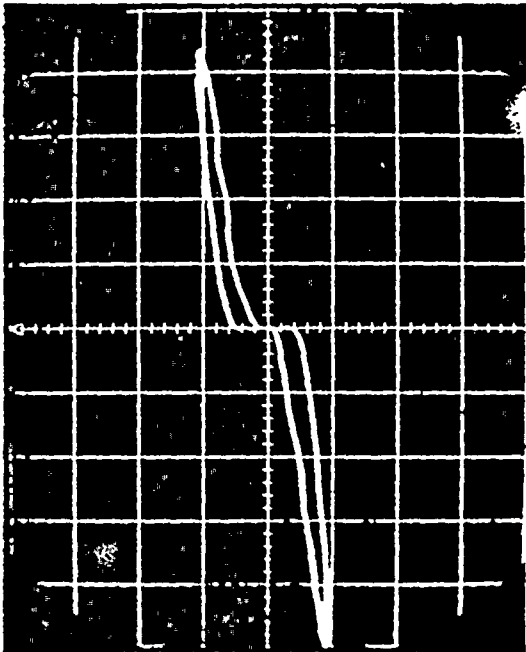
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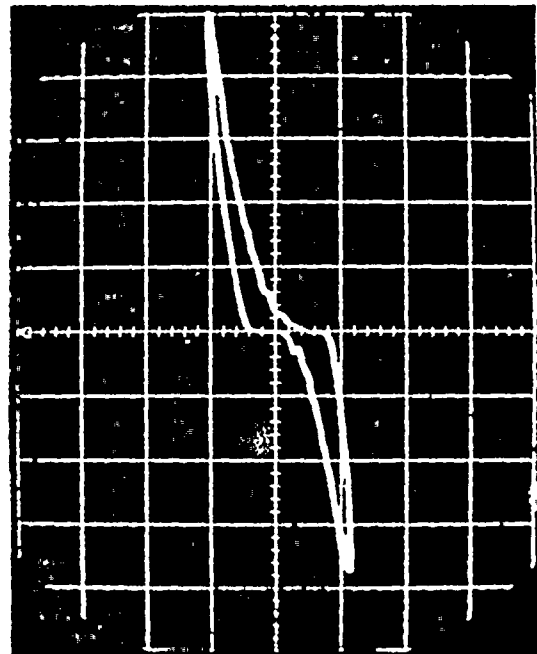
8 Hz



18 Hz



3 Hz



13 Hz

= .05 Inch / DIV.  
= 10,000 Lbs. / DIV.

CALIBRATION --- VERTICAL  
HORIZONTAL

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S/N 5193

REPORT NO. TR 845

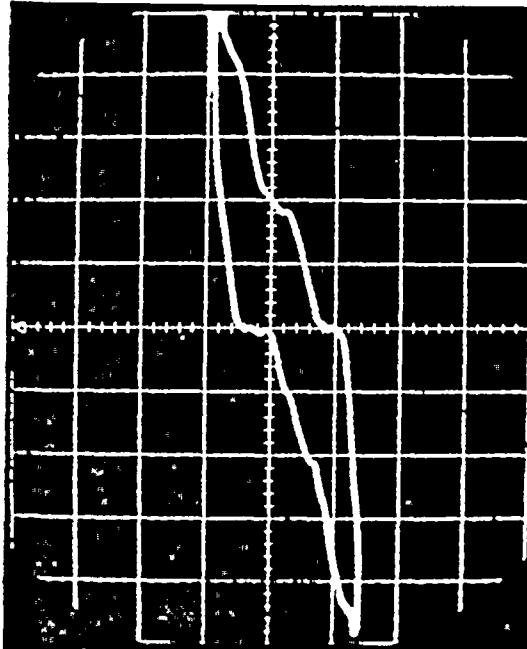
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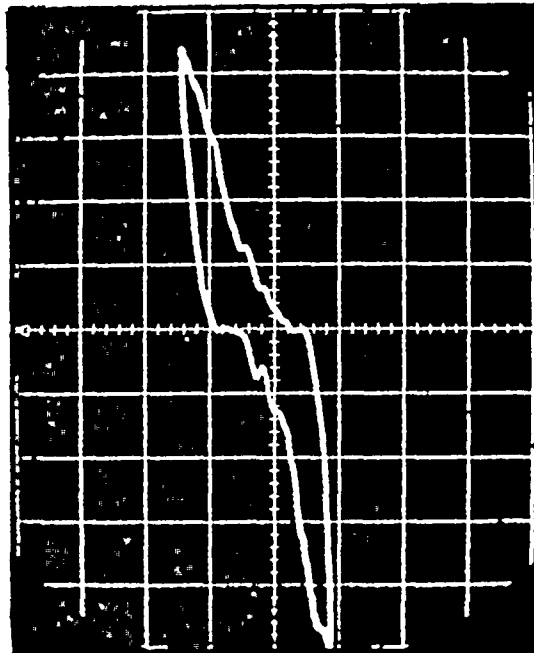
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200°F

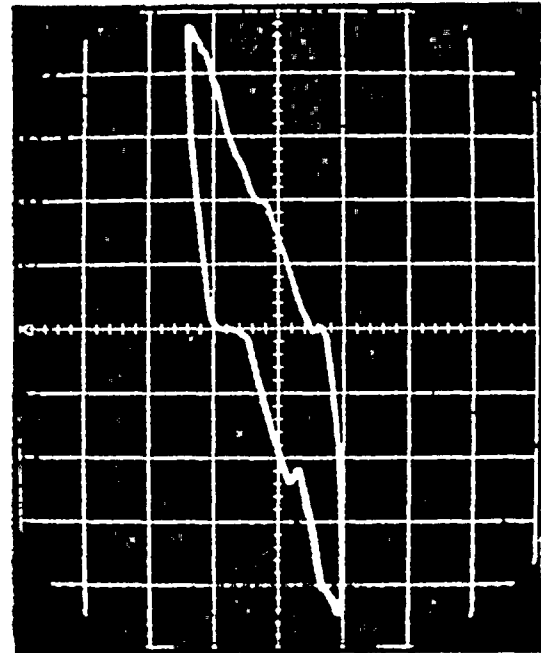
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C



28 Hz



23 Hz



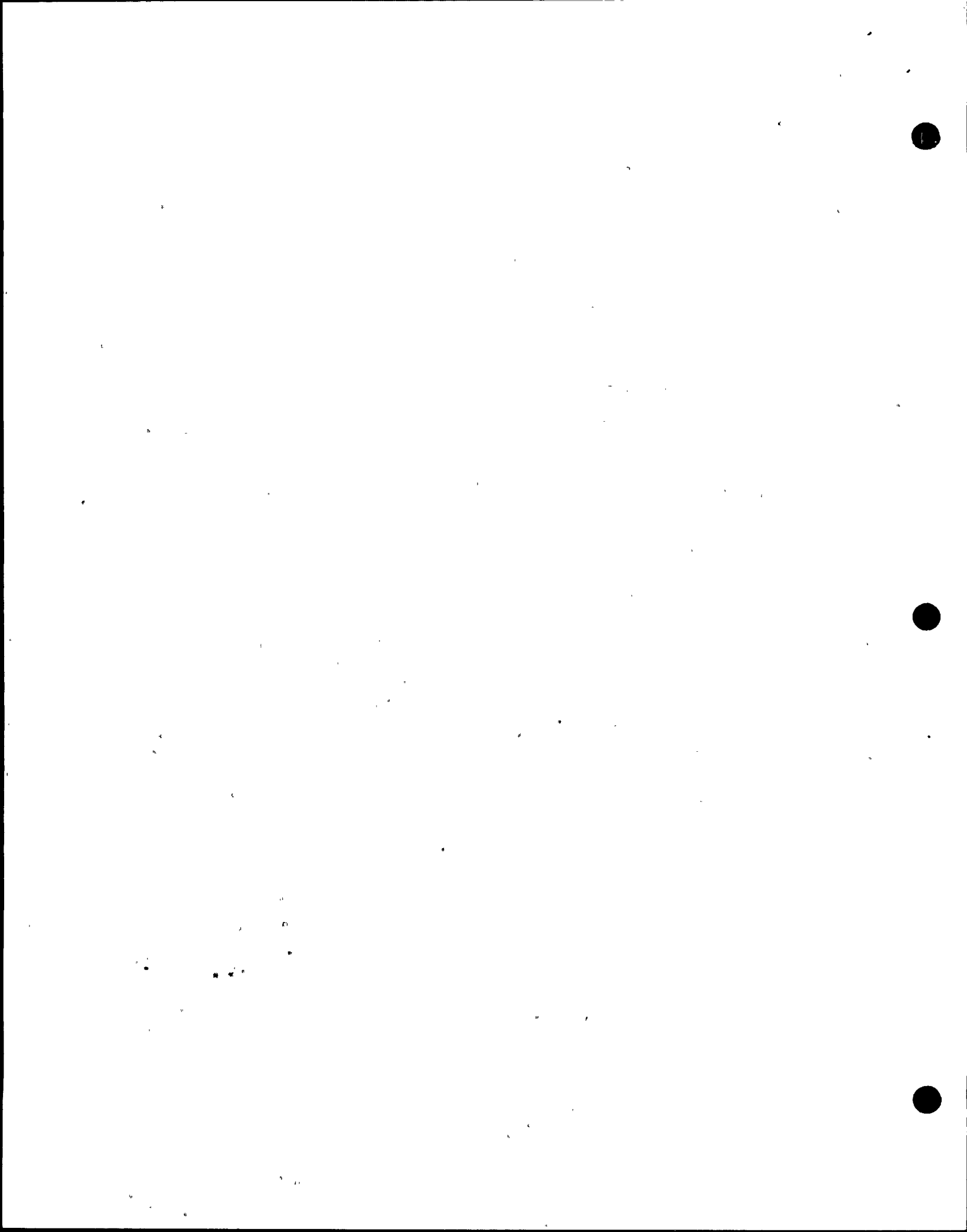
33 Hz

VERTICAL = .05 Inch / DIV.  
 HORIZONTAL = 10,000 Lbs. / DIV.

CALIBRATION --

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ABNORMAL ENVIRONMENT LOG

P/N 1801112-11

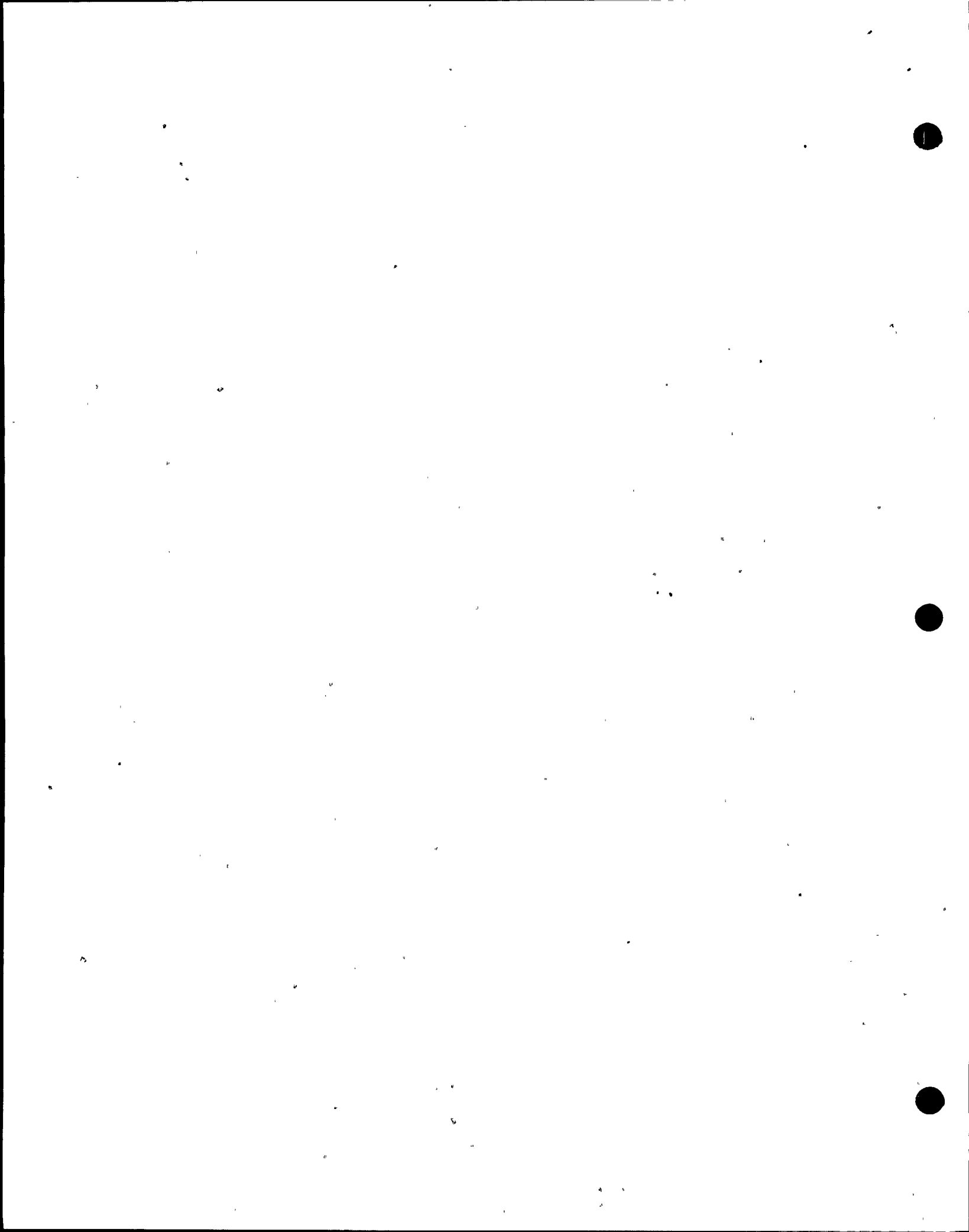
S/N 5192 &  
5193

DATE	TIME	TEMP °F	PRESS PSIG	REMARKS
1-28-80	0600	75	2020	APPLY HEAT
	0630	150	0	ADD WATER
	0700	302	3	VENT AIR
	0730	333	12	START PHASE I (114)
	0745	340	14	350°F max 0-15 min
	0800	338	14	
	0815	335	13	
	0830	338	14	
	0845	345	12	
	0900	351	13	
	0915	353	12	
	0930	352	12	
	0945	350	8	
	1000	348	7	
	1015	332	10	
	1030	342	30	30 min - 45 sec min START PHASE II (114) 310°F max 0-15 min
	1045	345	15	
1100	335	14		
1115	332	14		
1130	322	8		
1145	321	6		
1200	320	5		
1215	320	4		
1230	320	4		
1245	319	4		
1300	319	4		
1315	319	4		
1330	319	5		
1-29-80	1345	319	5	

DATE	TIME	TEMP °F	PRESS PSIG	REMARKS
1-29-80	1400	320	5	
	1415	320	5	
	1430	319	5	
	1445	319	5	
	1500	316	4	
	1515	315	4	
	1530	313	5	
	1545	312	5	
	1600	307	6	RFW
	1615	306	6	
	1630	306	6	START PHASE III (114) 350°F max 0-15 min
	1645	302	5	
	1700	297	6	
	1715	295	7	
	1730	295	8	
	1745	295	8	
	1800	296	7	
	1815	294	9	
	1830	292	8	
	1845	285	6	
1900	282	6		
1915	280	6		
1930	279	5		
1945	278	5		
2000	277	5		
2015	277	5		
2030	276	5		
2045	275	4		
2100	274	4		
2115	273	4		

DATE	TIME	TEMP °F	PRESS PSIG	REMARKS	
1-29-80	2130	278	6		
	2145	282	6		
	2200	278	6		
	2215	273	7		
	2230	268	7		
	2245	264	7		
	2300	262	8		
	2315	260	8		
	2330	251	11		
	2345	251	15	BAR	
	1-29-80	2400	253	15	
	0015	260	15		
	0030	268	14		
	0045	272	11		
0100	277	11			
0115	277	11			
0130	274	12			
0145	268	14			
0200	264	14			
0215	266	14			
0230	270	14			
0245	271	14			
0300	267	13			
0315	266	14			
0330	269	13			
0345	272	13			
0400	273	13			
0415	271	12			
0430	270	12			
1-29-80	0445	271	12		

DATE	TIME	TEMP °F	PRESS PSIG	REMARKS
1-29-80	0500	272	12	
	0515	272	12	
	0530	271	11	
	0545	270	11	
	0600	271	10	
	0615	272	10	
	0630	274	10	
	0645	270	10	
	0700	270	10	
	0715	271	10	
	0730	271	10	RFW
	0745	271	10	
	0800	271	10	
	0815	271	10	
	0830	273	10	
	0845	273	10	
	0	275	11	
	0915	275	11	
	0930	275	11	
	0945	277	11	
	1000	277	11	
	1015	274	10	
	1030	274	10	
	1045	271	10	
1100	270	8		
1115	266	8		
1130	263	7		
1145	259	6		
1200	256	6		
1-29-80	1215	257	6	



ABNORMAL ENVIRONMENT LOG

P/N 1801112-11

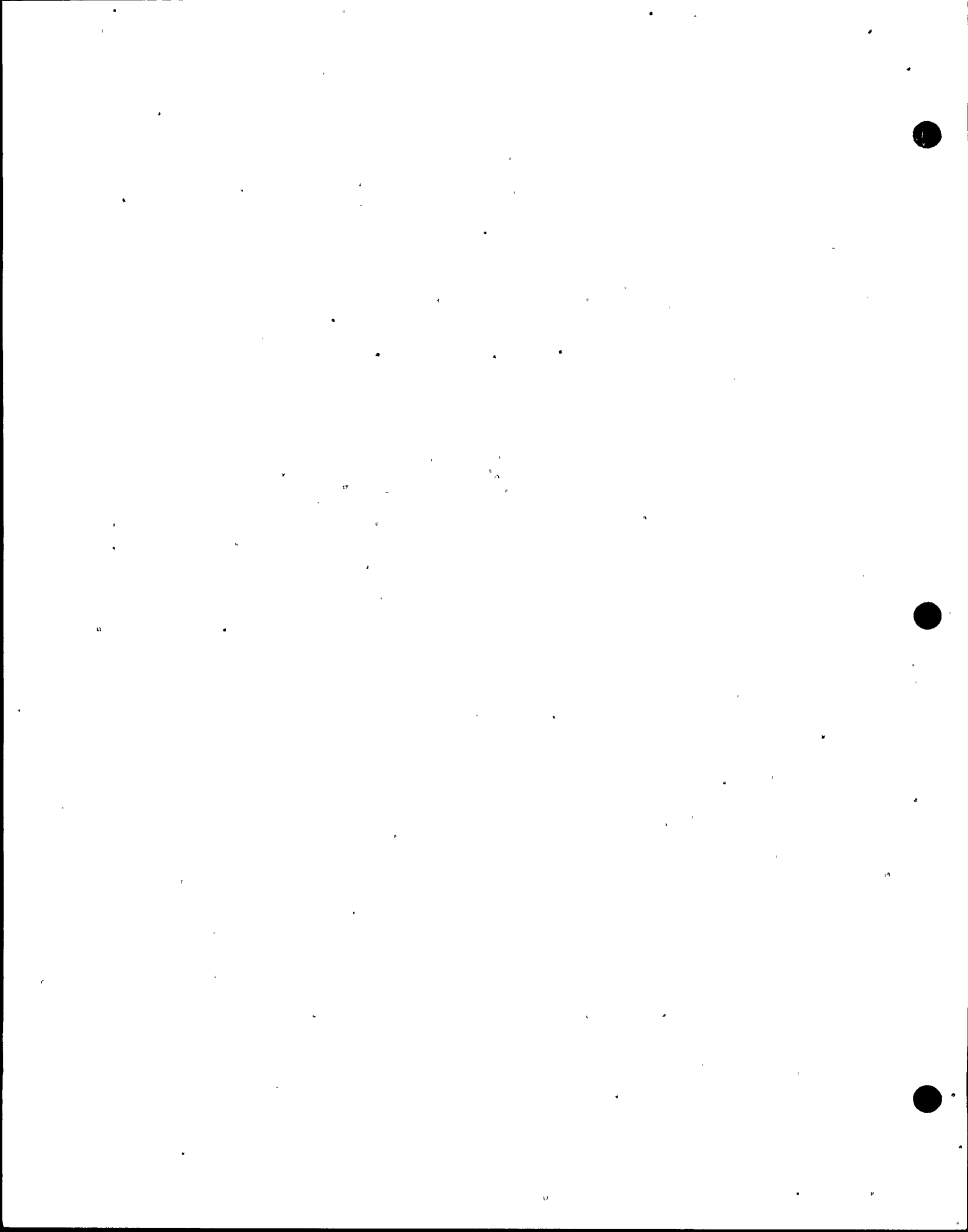
S/N 5192 &  
5193

DATE	TIME	TDP %	PRESS PSIG	REMARKS
1-29-80	1230	258	6	
	1245	259	6	
	1300	257	6	
	1315	261	7	
	1330	261	7	
	1345	263	7	
	1400	268	8	
	1415	270	8	
	1430	269	6	
	1445	264	6	
	1500	264	5	
	1515	265	5	
	1530	265	5	
	1545	262	3	
	1600	257	3	
	1615	257	3	
	1630	252	3	START PHASE IX 2100
	1645	239	0	212 P 0 PSI
	1700	235		
	1715	233		
	1730	228		
	1745	224		
	1800	220		
	1815	215		
	1830	217		
	1845	216		
	1900	215		
	1915	213		
	1930	216		
	1945	215	0	

DATE	TIME	TDP %	PRESS PSIG	REMARKS
1-29-80	2000	213	0	
	2015	213		
	2030	213		
	2045	217		
	2100	214		
	2115	215		
	2130	218		
	2200	221		
	2215	219		
	2230	214		
	2245	213		
	2300	213		
	2315	218		
	2330	214		
	2345	214		REAS
1-30-80	2400	213		
	0015	214		
	0030	213		
	0045	213		
	0100	214		
	0115	214		
	0130	215		
	0145	213		
	0200	215		
	0215	215		
	0230	215		
	0245	214		
	0300	213		
	0315	213		
1-30-80	0330	214	00	

DATE	TIME	TDP %	PRESS PSIG	REMARKS
1-30-80	0345	213	0	
	0400	215		
	0415	213		
	0430	213		
	0445	213		
	0500	214		
	0515	213		
	0530	215		
	0545	214		
	0600	215		
	0615	213		
	0630	215		
	0645	215		
	0700	213		
	0715	213		
	0730	212		
	0745	212		
	0800			
	0815			
	0830			
	0845			
	0900			
	0915			
	0930			
	1000			
	1015			
	1030			
	1045			
1-30-80	1100			
	1115	212	0 PSI	

DATE	TIME	TDP %	PRESS PSIG	REMARKS
1-30-80	1130	212	0	
	1145			
	1200			
	1215			
	1230			
	1245			
	1300			
	1315			
	1330			
	1345			
	1400			
	1415			
	1430			
	1445			
	1500			
	1515			
	1530			
	1545			
	1600			
	1615			
	1630	212	0	END OF TEST EPA



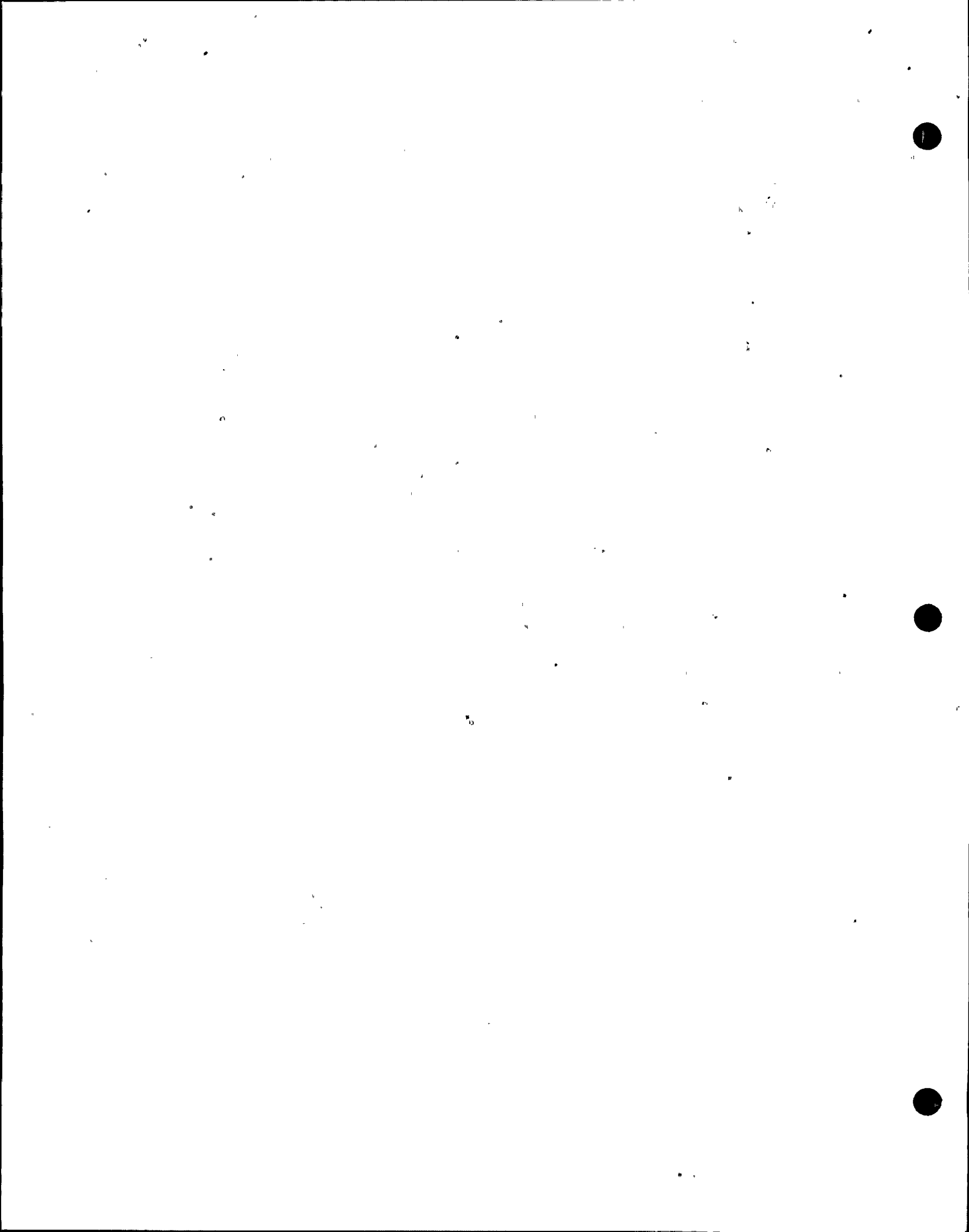
APPENDIX 1

INITIAL FUNCTIONAL TEST DATA SHEETS  
AND MATERIAL TRACEABILITY RECORD,  
I.T. 534 PAGES 4, 5 and 5A  
TOTAL OF 6 PAGES

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Final Inspection Check List



PSCo 1801112

Shock Arrestor

Ref. paragraphs refer to paragraphs from this procedure, I.T. 534


Part No. 1801112-11 Serial No. 5192  
PSCo P.O. No. 32704 Date 1-22-80  
Shop Order No. 1-1925-0438 Customer Bergen Paterson

I. Visual Examination (para. 5.1)

- (a) Dimensional..... 
- (b) Workmanship..... 

II. Final Functional Tests

- (A)(E) (a) Breakaway Friction Force (500 lbs. max.)  
(para. 6.1).....Actual 425
- (G) (b) Lost Motion (.040 max.)(para. 6.2).....Actual .034
- (H) (c) Acceleration/Load Test (.59 sec. min.)(para. 6.3)....  
Actual Time  
Extending 1.99  
Retracting 1.83

Inspector *Tony Vergara*  
Stamp  Date 1-22-80

ADDENDUM

Final Inspection Check List

PSCo 1801112

Shock Arrestor

Ref. paragraphs refer to paragraphs from this procedure, I.T. 534

Part No. 1801112-11 Serial No. 5193

PSCo P.O. No. 32704 Date 1-22-80

Shop Order No. 11925-0438 Customer Bergen Paterson

I. Visual Examination (para. 5.1)

(a) Dimensional..... 

(b) Workmanship..... 

II. Final Functional Tests

(A)(E) (a) Breakaway Friction Force (500 lbs. max.)  
(para. 6.1).....Actual 4 F5

(G) (b) Lost Motion (.040 max.)(para. 6.2).....Actual .030

(H) (c) Acceleration/Load Test (.59 sec. min.)(para. 6.3)....

Actual Time

Extending 1.54

Retracting 1.52

Inspector *[Signature]*

Stamp  Date 1-22-80

(B)

ASME SECTION III, DIVISION I  
 SUBSECTION NF








MATERIALS TRACEABILITY TABULATION

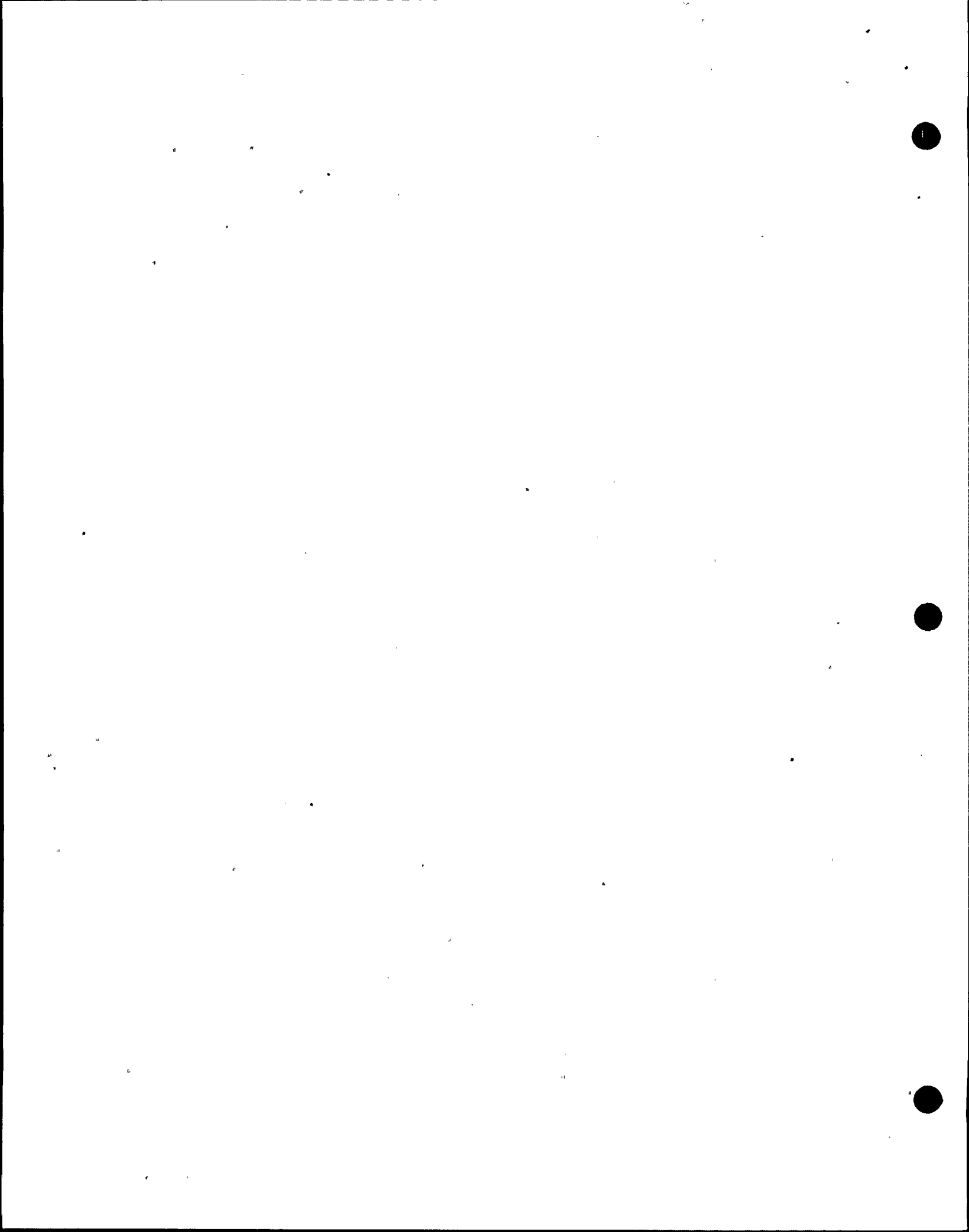
PSCO P/N 180112-11

Serial No. 5192

Owner/Agent Bergen-Paterson

Date 1-22-80

Part No.	Description	Material Code Number	Stamp
1801506	Nut, Adapter	N1067	
1801480	Tube, Transition	NA	
1801529	Shell, Torque Carrier	N1227 A	
1801474	Shell, Inertia Mass	N1317	
1801470	Hub, Torque Carrier	N1333	
1801458	Capstan	N1342	
1801457	Cylinder, Support	N1039	↑
1801456	Cylinder, Telescoping	N1481	
1801453	Housing	N1493	↓
1801451	Nut, End Cap	N1296	
1801450	End Cap (For 1801506 End Cap Assy.)	N1474	
1801407	Hub, Inertia Mass	N1215	
(D) 1801467	Key, Capstan	N1219C	
1801464	Key, Anti-Rotation	N1141-C	
(F) 1801635	Inertia Mass	NA	
(S) 1801465	Gear, Planetary	N993-C	



ASME SECTION III, DIVISION I  
SUBSECTION NF

MATERIALS TRACEABILITY TABULATION

PSCO P/N 1P01112-11

Serial No. 5192

Owner/Agent Bergen-Pater

Date 1-22-80

Part No.	Description	Material Code Number	Stamp
J 1801466	Gear, Ring	A2 N1274A	
J 1801471	Gear, Pinion	N1276	

ASME SECTION III, DIVISION I  
SUBSECTION NF

MATERIALS TRACEABILITY TABULATION

PSCO P/N 1F0112-11

Serial No. 5193

Owner/Agent Bergen-Paterson

Date 1-22-80

Part No.	Description	Material Code Number	Stamp
1801506	Nut, Adapter	N1067	PS G-30 228
1801480	Tube, Transition	NA	PS G-30 228
1801529	Shell, Torque Carrier	N1227 A	PS G-30 228
1801474	Shell, Inertia Mass	N1317	PS G-30 228
1801470	Hub, Torque Carrier	N1333	PS G-30 228
1801458	Capstan	N1342	PS G-30 228
1801457	Cylinder, Support	N1039	↑
1801456	Cylinder, Telescoping	N1481	
1801453	Housing	N1493	
1801451	Nut, End Cap	N1296	
1801450	End Cap (For 1801506 End Cap Assy.)	N1474	
1801407	Hub, Inertia Mass	N1215	
1801467	Key, Capstan	N1219C	
1801464	Key, Anti-Rotation	N1141C	
1801635	Inertia Mass	NA	↓
1801465	Gear, Planetary	N993-C	PS G-30 228

ASME SECTION III, DIVISION I  
SUBSECTION NF

MATERIALS TRACEABILITY TABULATION

PSCO P/N 180112-11

Serial No. 5193

Owner/Agent Bergen-Paterson

Date 1-22-80

Part No.	Description	Material Code Number	Stamp
Ⓟ 1801466	Gear, Ring	N1274A	PSCO DUPLICATE
Ⓟ 1801471	Gear, Pinion	N1276	PSCO 222

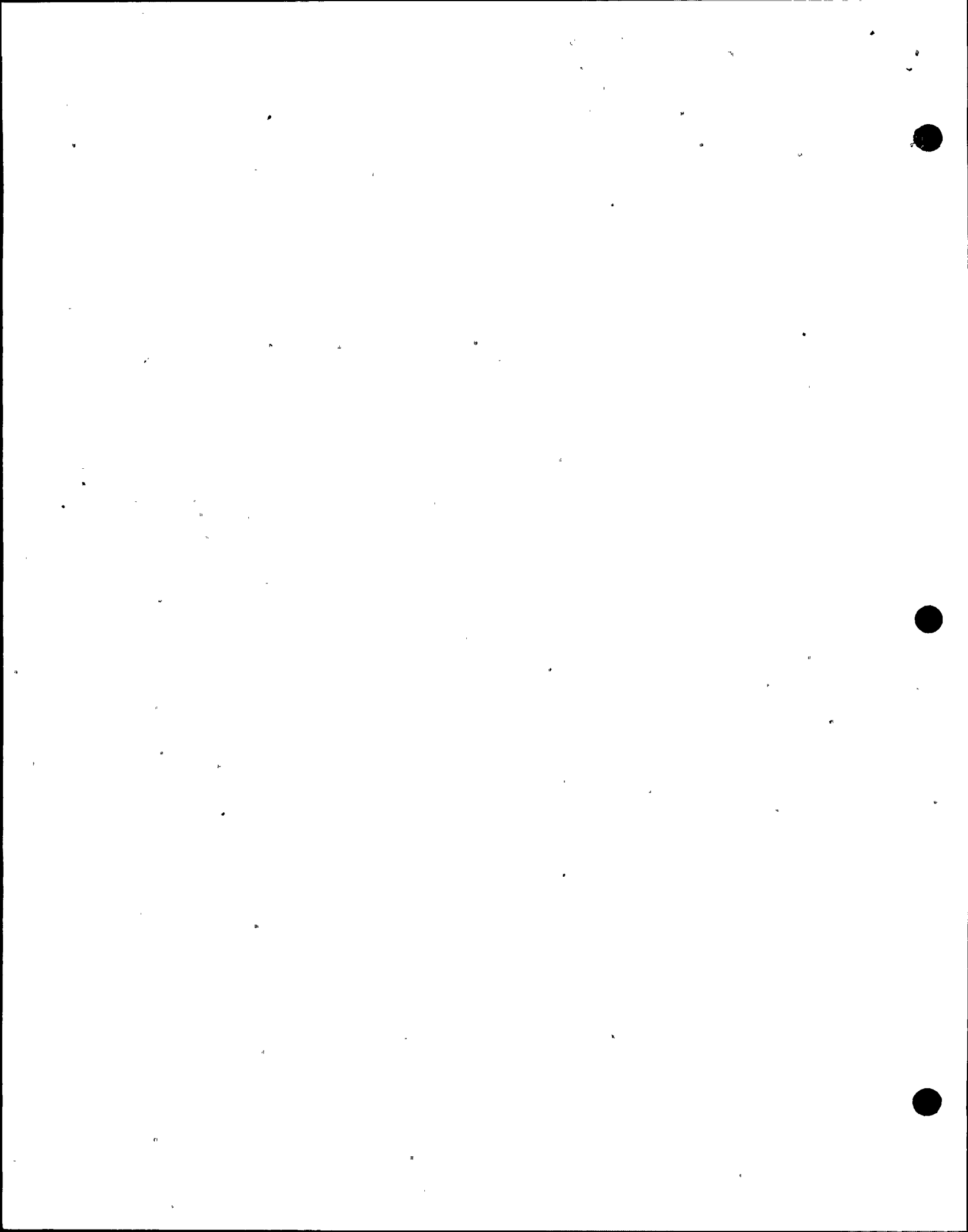


APPENDIX 2

SPRING RATE CALCULATIONS

**PACIFIC SCIENTIFIC • KIN-TECH DIVISION**

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APPENDIX 2

PSA - 35

SPRING RATE CALCULATIONS

AVERAGE ALLOWABLE RATE =  $600 - 60 = 540 \times 10^3$  Lbs/Inch

S/N	Temp OF	Freq. Hz	Peak-Peak Load Lbs.	Dynamic Displ. Inch	Lost Motion Inch	Spring Rate $1 \times 10^3$ lbs/Inch
5192	75	8	97000	.108	.037	1366
		18	98000	.110	.025	1153
AVERAGE =						1260 x $10^3$ Lbs/Inch
5193	75	8	88000	.090	.032	1517
		18	98000	.102	.021	1210
AVERAGE =						1364 x $10^3$ Lbs/Inch

SAMPLE CALCULATION

$$\text{Dynamic Spring Rate} = \frac{97000 \text{ lbs.}}{(.108 - .037 \text{ inch})} = 1366 \times 10^3 \text{ Lbs/Inch}$$

PACIFIC SCIENTIFIC • KIN-TECH DIVISION

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**1.0** PURPOSE

1.1 To assure compliance of production units of the Shock Arrestor Assembly with referenced drawings.

**2.0** SCOPE

2.1 This test establishes both visual and functional characteristics which could be expected to vary through dimensional variation or improper assembly and adjustment.

**3.0** REFERENCE DOCUMENTS

3.1 PSCo Drawing 1801112

**4.0** EQUIPMENT

4.1 1801 TF-2 Universal Shock Arrestor Tester

4.2 .0001 Dial Indicator

**5.0** INDIVIDUAL TESTS**5.1** Examination of Product

5.1.1 Each unit shall be subjected to a dimensional examination to determine compliance with applicable final assembly drawing.

5.1.2 Each unit shall be visually inspected to assure completeness of assembly, freedom from burrs and sharp edges, alignment of parts, security of fasteners, and dimensional integrity.

5.1.3 Units shall be visually inspected for general appearance of plating, painting, freedom from nicks and damage of finishes.

5.1.4 Units shall be inspected to assure the accuracy and legibility of marking and identification.

**6.0** FINAL FUNCTIONAL TESTS**(E)** **6.1** Breakaway Friction Force (500 lbs. max.)

**(A)(E)** 6.1.1 The unit shall extend and retract when subjected to a maximum force of 500 lbs. Unit shall be installed in the 1801 TF-2 Test Fixture and the starting force in both the extension and retraction modes measured at three places.

Measurements shall be taken at the approximate mid position and approximately .5 inch from both extreme positions. Load measured shall not exceed 500 lbs.

**(E)**

