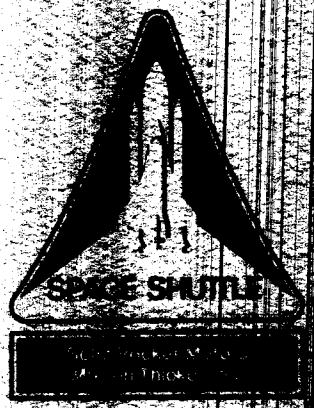
TWR-19248



Teledyne Taber 206-1000 and 2210-3000 Pressure Transducer Proof Test and Burst Test Final Test Report

May 1989

Prepared for

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

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Teledyne Taber 206-1000 and 2210-3000 Pressure Transducer Proof Test and Burst Test Final Test Report

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CONTENTS

Section		Page
1	INTRODUCTION	1
	1.1 TEST ITEM DESCRIPTION	1
2	TEST OBJECTIVES	2
3	SUMMARY, CONCLUSIONS, AND RECOMMENDATION	3
	3.1 SUMMARY	3
	3.2 CONCLUSIONS	3
	3.3 RECOMMENDATION	4
4	INSTRUMENTATION	5
5	PHOTOGRAPHY	6
6	TEST RESULTS AND DISCUSSION	7
	6.1 RANDOM VIBRATION TEST	7
	6.1.1 Introduction	7
	6.1.2 Objective	7
	6.1.3 Results and Discussion	7
	6.2 PRESSURE CALIBRATION	8
	6.2.1 Introduction	8
	6.2.2 Objective	8
	6.2.3 Results and Discussion	8
	6.3 150-PERCENT MAXIMUM PRESSURE TEST	9
	6.3.1 Introduction	9
	6.3.2 Objectives	9
	6.3.3 Results and Discussion	9
	6.4 BURST TEST	9
	6.4.1 Introduction	9
	6.4.2 Objectives	9
	6.4.3 Results and Discussion	14
7	APPLICABLE DOCUMENTS	19

APPENDIXES

Appendix		Page
A	Pressure Calibration After Vibration Test	A-1
B	Pressure Calibration.	B-1
C	Calibration After Maximum Pressure Test	C-1

FIGURES

Figure		Page
1	150-Percent Pressure Transducer Proof Test (Model 206--S/N 870222)	10
2	150-Percent Pressure Transducer Proof Test (Model 206--S/N 848504)	11
3	150-Percent Pressure Transducer Proof Test (Model 2210--S/N 842258)	12
4	150-Percent Pressure Transducer Proof Test (Model 2210--S/N 882181)	13
5	Burst Pressure (Model 206--870222)	15
6	Burst Pressure (Model 206--848504)	16
7	Burst Pressure (Model 2210--842258)	17
8	Burst Pressure (Model 2210--882181)	18

1

INTRODUCTION

The purpose of this test was to verify the range accuracy and structural integrity of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers and to determine if multiple uses have a significant effect on the transducers. Burst pressure for these transducers was also established.

The Teledyne Taber Model 206-1000 pressure transducer is used to measure chamber pressure on full-scale space shuttle solid rocket motors. The Teledyne Taber Model 2210-3000 pressure transducer is used to measure igniter pressure. The Teledyne Taber transducer has very good temperature stability and has been used on all full-scale solid rocket motors, so there is a large data base established using this transducer.

1.1 TEST ITEM DESCRIPTION

Two Teledyne Taber 206-1000 transducers and two 2210-3000 transducers were subjected to all phases of the tests. One transducer of each model number was unused, and the other had multiple uses.

The burst test was conducted in a metal bursting box using a deadweight tester. The vibration test took place at the Morton Thiokol, Inc. vibration facility (T-53). All other testing took place at M-9.

The test item configuration was controlled by WTP-0185 and the applicable documents referenced in that document.

2

TEST OBJECTIVES

The developmental objectives for this test are as follows:

1. Verify that the measurement of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers will be accurate to ±2 percent of full scale.
2. Determine whether repeated uses degrade the performance of the transducers.
3. Verify that pressure calibration remains constant following vibration loading specified in this test plan.
4. Determine if the Teledyne Taber 206-1000 and 2210-3000 remain operational following 150 percent of the maximum operational pressure.
5. Determine transducer bursting pressure at ambient temperature.

3

SUMMARY, CONCLUSIONS, AND RECOMMENDATION

3.1 SUMMARY

Two 206-1000 transducers and two 2210-3000 transducers were subjected to all phases of the tests. One transducer of each model number was new and the other had multiple uses.

All transducers were vibrated in two axis directions for 7g root mean square for 6 min. The 206-1000 transducer was pressurized to 1,000 +50/-0 psig and the 2210-3000 transducer was pressurized to 3,000 ±100 psig during the vibration test.

An 11-point pressure transducer calibration procedure was then completed five times for each transducer. The pressure transducer voltage output was recorded to ±0.0001 V.

The 150-percent maximum pressure test was run; all transducers were functional during and after the test.

A burst test was then conducted at ambient temperature to verify the structural integrity and to determine the burst strength of the Teledyne Taber transducers. The 206-1000 transducers were pressurized to 1,500 psig and the 2210-3000 transducer to 4,500 psig.

3.2 CONCLUSIONS

The following is a one-on-one correlation of development objectives with test results. Detailed results can be found in the sections referenced in parenthesis.

	Objective	Results
1.	Verify that the measurement of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers will be accurate to ±2 percent of full scale.	The measurements of the 206-1000 and 2210-3000 were accurate to ±2 percent full scale. (6.2)

Objective	Results
2. Determine whether repeated uses degrade the performance of the transducers.	Repeated uses do not degrade the performance of the transducers. (6.3, 6.4)
3. Verify that pressure calibration remains constant following vibration loading specified in this test plan.	Pressure calibration remained constant after vibration loading. (6.1)
4. Determine if the Teledyne Taber 206-1000 and 2210-3000 remain operational following 150 percent of the maximum operational pressure.	All transducers remained operational following 150-percent maximum pressure test. (6.3)
5. Determine transducer bursting pressure at ambient temperature.	Determined--See table in Section 6.4.3 for specific values.

3.3 RECOMMENDATION

Burst Test

Cap screw torque on all 206-1000 transducers should be checked in subsequent tests.

4

INSTRUMENTATION

Standard laboratory equipment traceable to NBS was used to support this test. All instrumentation was calibrated in accordance with MIL-STD-45662. All instruments were calibrated and recorded before and after each test. Lab standards were used during pressure calibration tests.

5

PHOTOGRAPHY

Prior to testing, still color photographs were taken of the test item assembly and typical instrumentation. Post-test photographs were required for test documentation.

6

TEST RESULTS AND DISCUSSION

6.1 RANDOM VIBRATION TEST

6.1.1 Introduction

A random vibration test was performed at T-53 to verify the structural integrity of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers. For the random vibration test, the 206-1000 transducer was assembled to the 1U50731-09 configuration, and the 2210-3000 transducer was assembled to the 1U50731-12 configuration.

Each transducer was subjected to random vibration at 7g root mean square for 6 min following the vibration criteria listed below (refer to SE-019-049-2H). The 206-1000 transducer was pressurized to 1,000 +50/-0 psig and the 2210-3000 transducer was pressurized to 3,000 ±100 psig during the vibration test.

20 - 50 Hz at 0.020 g^2/Hz
50 - 150 Hz at +3 dB/oct
150 - 500 Hz at 0.060 g^2/Hz
500 - 2,000 Hz at -6 dB/oct
2,000 Hz at 0.0038 g^2/Hz

The test was performed in the two axis directions (longitudinal and lateral).

Vibration was recorded and verified by T-53 personnel to be within the criteria listed above.

6.1.2 Objective

The vibration test was run to support the following test objective:

Verify that pressure calibration remains constant following vibration loading specified in this test plan.

6.1.3 Results and Discussion

The vibration test verified the structural integrity of the Teledyne Taber transducers. The 206-1000 transducer maintained a pressure of 1,000 psi and

the 2210-3000 transducer maintained a pressure of 3,000 psi during vibration loading with no visible leakage occurring.

The gage was verified to be functional following this test during the 150-percent overpressure test documented in Section 6.3 of this report. Pressure calibration change was negligible after the vibration test (Appendix A).

6.2 PRESSURE CALIBRATION

6.2.1 Introduction

An 11-point pressure transducer calibration procedure was completed five times for each transducer. The pressure transducer voltage output was recorded to ±0.0001 V.

1. Ten Vdc were applied to input of pressure transducer. Pressure transducer voltage output and lab standard pressure were recorded. This was performed before and after 150-percent maximum pressure test.
2. Pressure was increased from 0 to 1,000 psig for the 206-1000 transducer and from 0 to 3,000 psig for the 2210-3000 transducer in 200-psi increments. Lab standard pressure and pressure transducer voltage output were recorded at each 200-psi increment.
3. Pressure was decreased back to 0 psig in 200-psi increments. Lab standard pressure and pressure transducer voltage output was recorded at each 200-psi increment.

6.2.2 Objective

The pressure calibration was run to support the following test objective:

> Verify the measurement of the Teledyne Taber 206-1000 and 2210-3000 pressure transducers will be accurate to ±2 percent of full scale.

6.2.3 Results and Discussion

The Teledyne Taber 206-1000 and 2210-3000 pressure transducers were verified to be accurate to ±2 percent full scale (Appendix B).

6.3 150-PERCENT MAXIMUM PRESSURE TEST

6.3.1 Introduction

Ten-Vdc input was applied to each pressure transducer. Pressure was increased to 1,500 psig for the 206-1000 transducer and 4,500 psig for the 2210-3000 transducer. Pressure transducer voltage output versus time and lab standard pressure versus time were recorded. The pressure calibration test, as outlined in Section 6.2.1, was repeated.

6.3.2 Objectives

The 150-percent maximum pressure test was run to support the following test objectives:

Determine whether repeated uses degrade the performance of the transducers.

Determine if the Teledyne Taber 206-1000 and 2210-3000 remain operational following 150 percent of the maximum operational pressure.

6.3.3 Results and Discussion

All transducers remained functional for the duration of the test; the reading returned to zero following the test (Figures 1 through 4). No leakage was noted. The transducers were recalibrated after the maximum pressure test; the change was negligible (Appendix C).

6.4 BURST TEST

6.4.1 Introduction

All transducers were subjected to this test. A burst test was conducted at ambient temperature to verify the structural integrity and to determine the burst strength of the Teledyne Taber transducers. The transducers were installed in the metal bursting box. The 206-1000 transducers were pressurized to 1,500 psig and the 2210-3000 transducers to 4,500 psig. Pressure was increased in 500-psi increments until burst occurred.

6.4.2 Objectives

The burst tests were performed to support the following objectives:

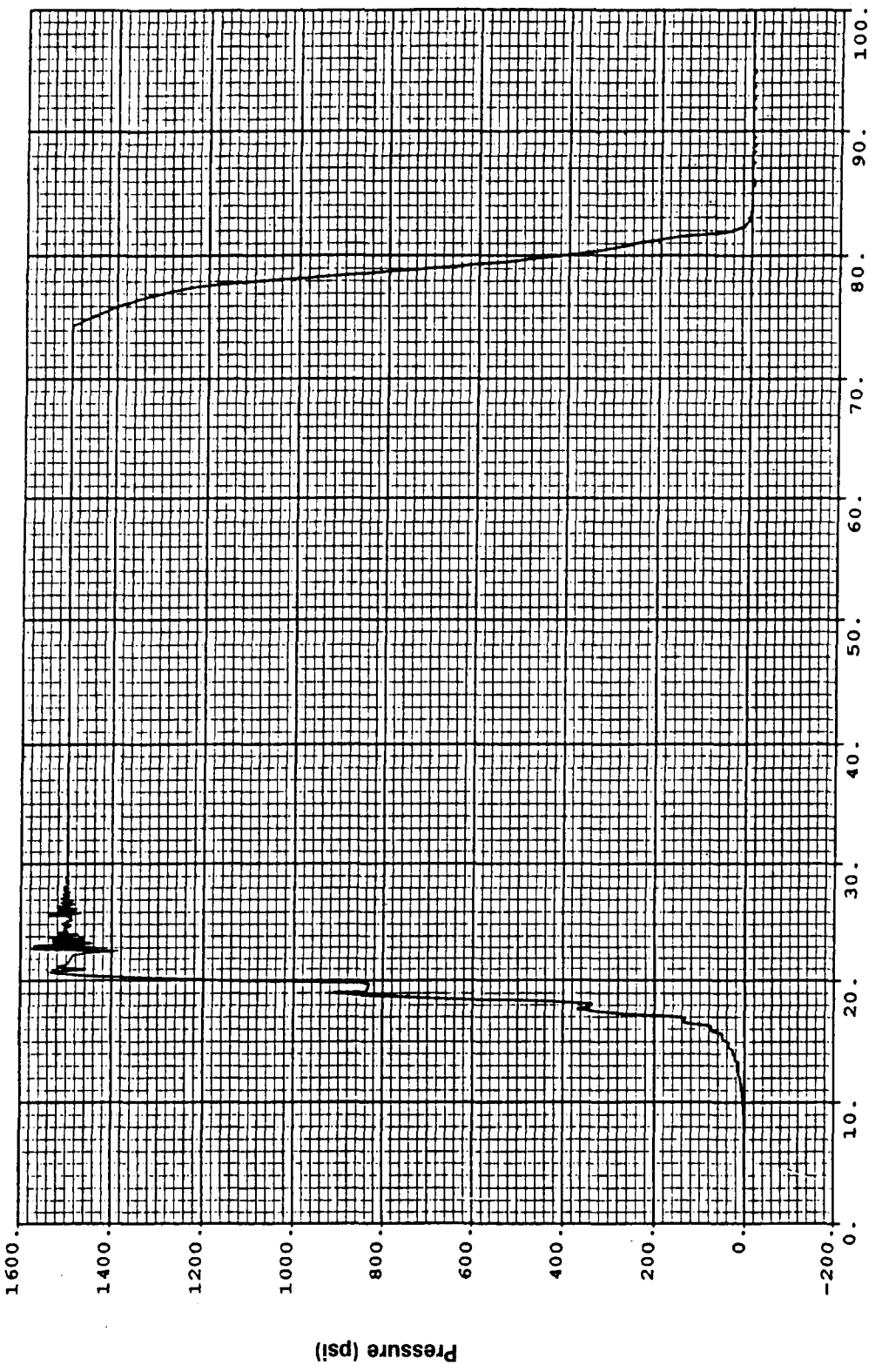

Figure 1. 150-Percent Pressure Transducer Proof Test (Model 206—S/N 870222)

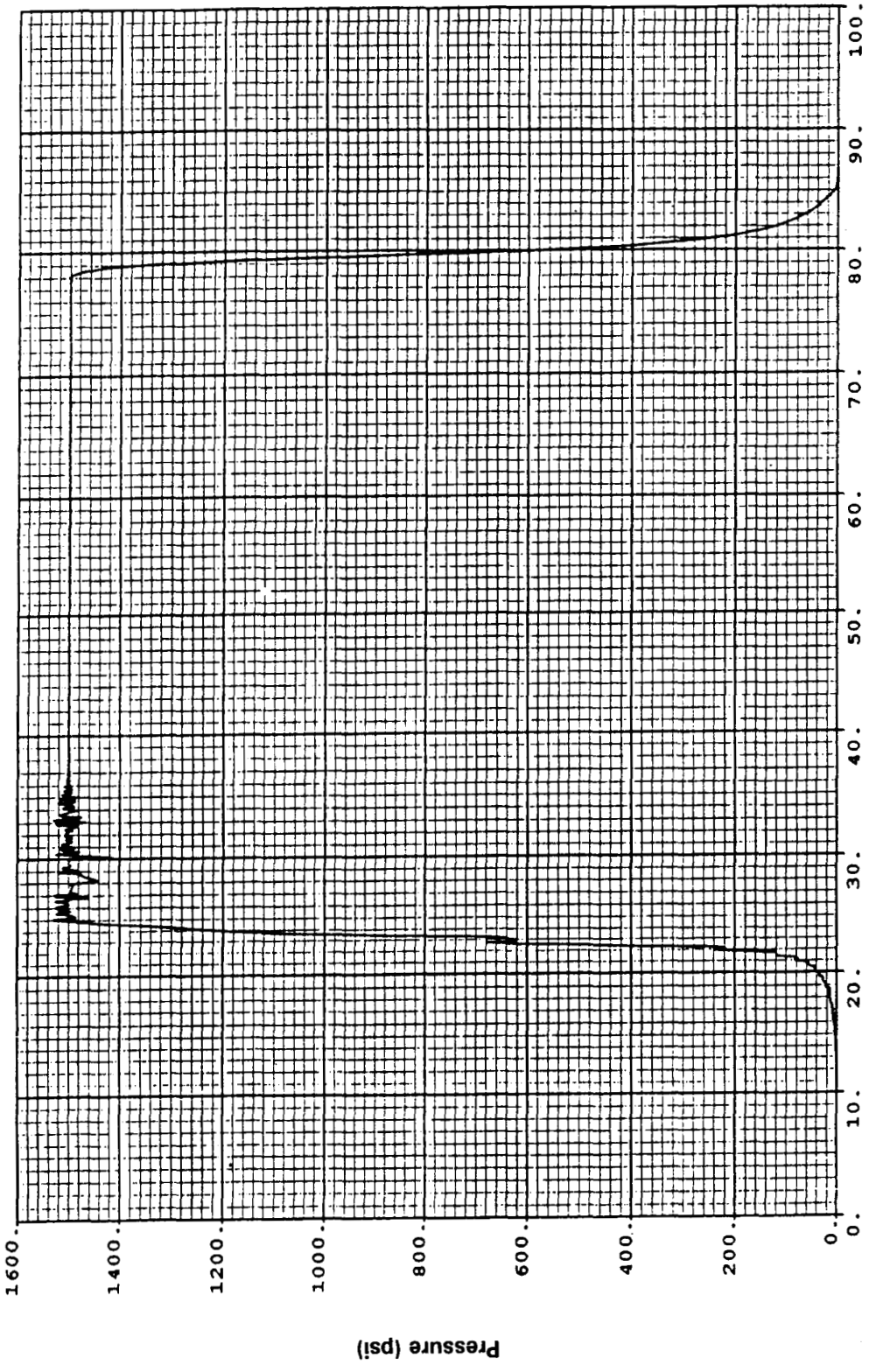

Figure 2. 150-Percent Pressure Transducer Proof Test (Model 206—S/N 848504)

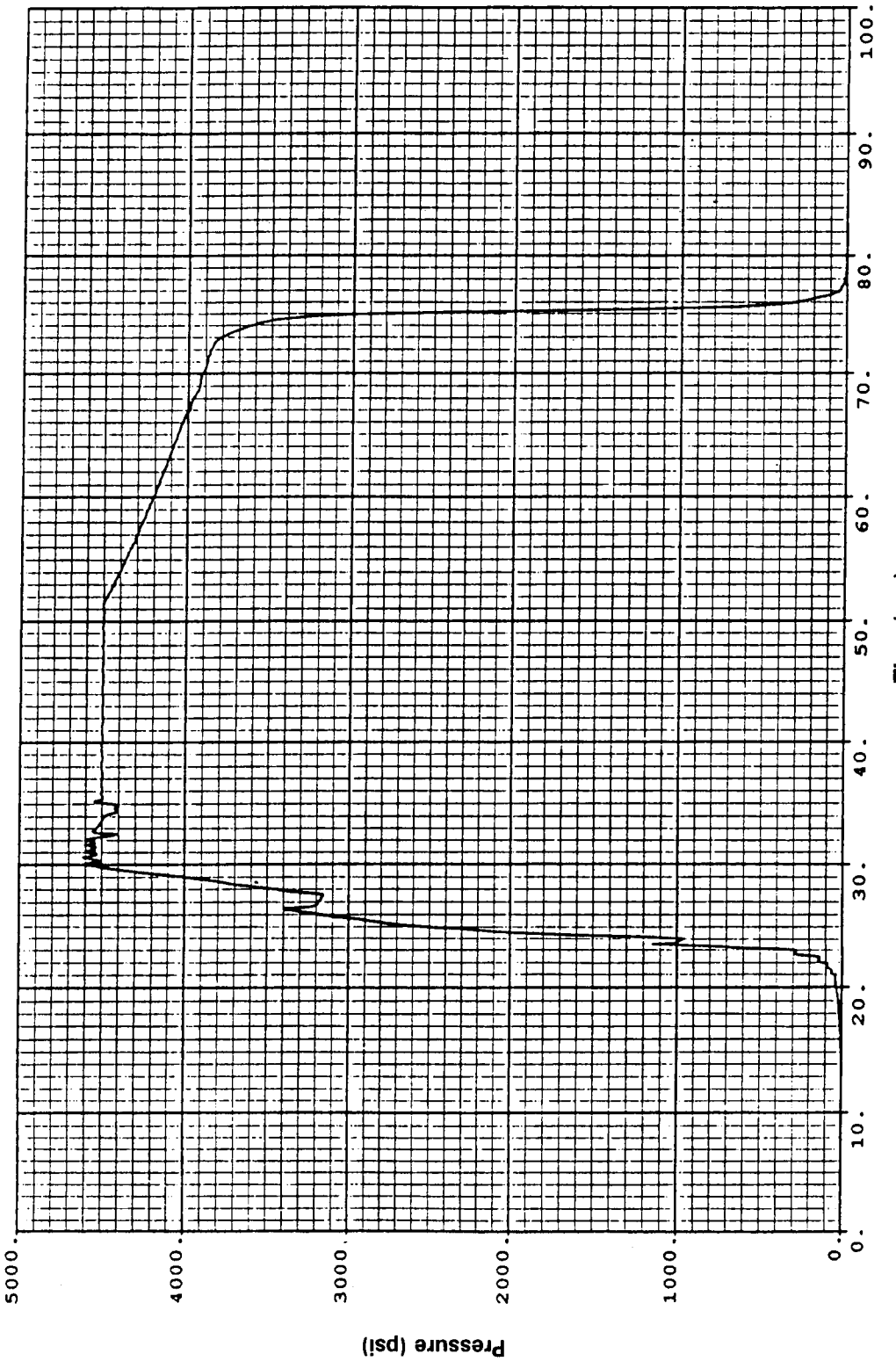

Figure 3. 150-Percent Pressure Transducer Proof Test (Model 2210—S/N 842258)

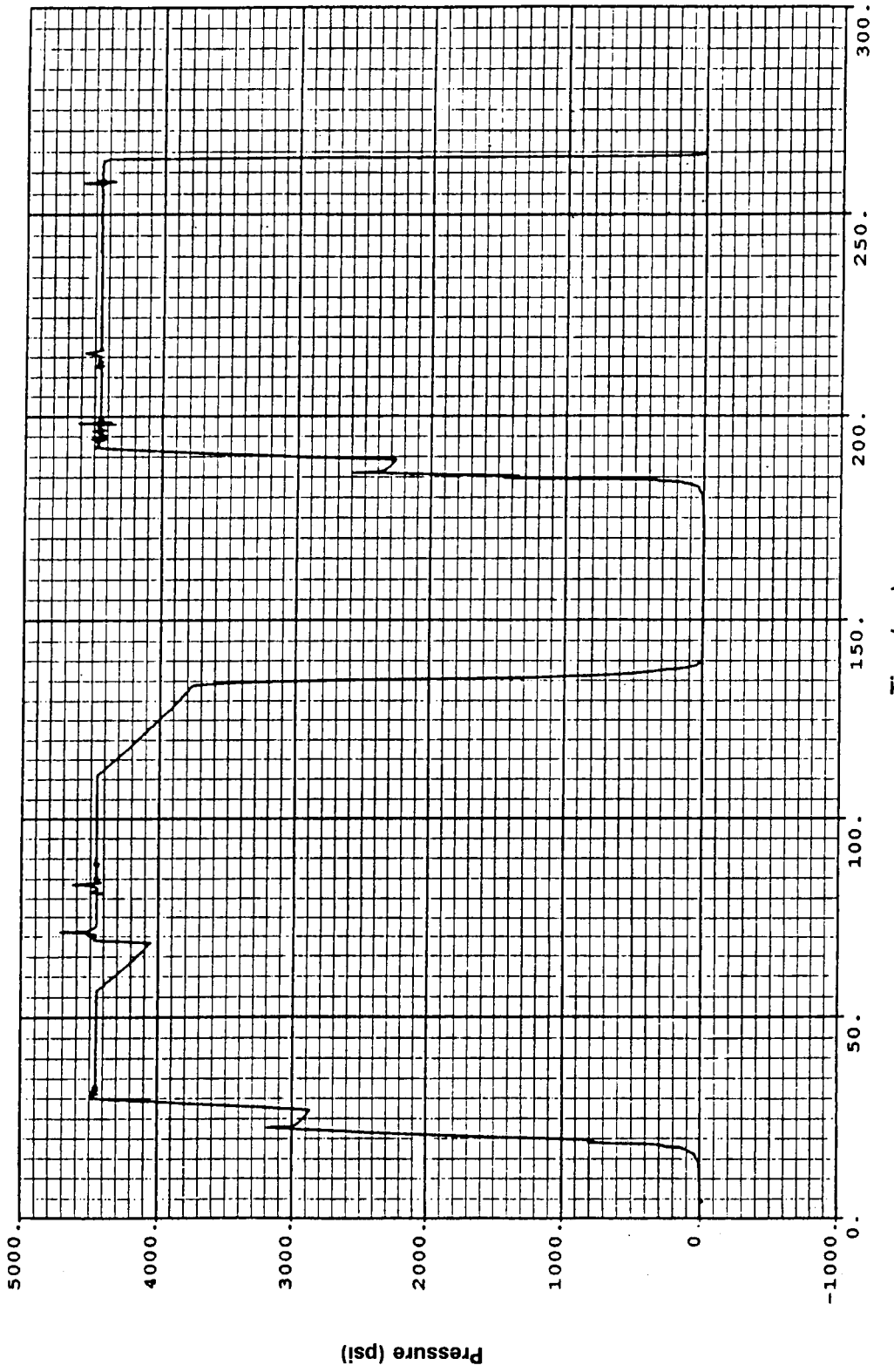

Figure 4. 150-Percent Pressure Transducer Proof Test (Model 2210—S/N 882181)

Determine whether repeated uses degrade the performance of the transducers.

Determine transducer bursting pressure at ambient temperature.

6.4.3 Results and Discussion

The burst pressure traces are shown in Figures 5 through 8. Repeated uses do not degrade the performance of the transducers, as shown by the bursting pressures. Burst test results are listed in the table below.

Burst Test Results

Model No.	S/N	Pressure Rating (psi)	Previous Uses	Burst Pressure (psi)
206-1000	870222	1,000	Multiple	11,259
206-1000	848504	1,000	None	10,577
2210-3000	842258	3,000	Multiple	18,055
2210-3000	882181	3,000	None	18,088

The failure modes are listed below.

2210-3000--The diaphragm ruptured, followed by the electrical connector being blown out of the case.

206-1000--A leak developed between the diaphragm cap and the transducer body joint. No damage was apparent after disassembly.

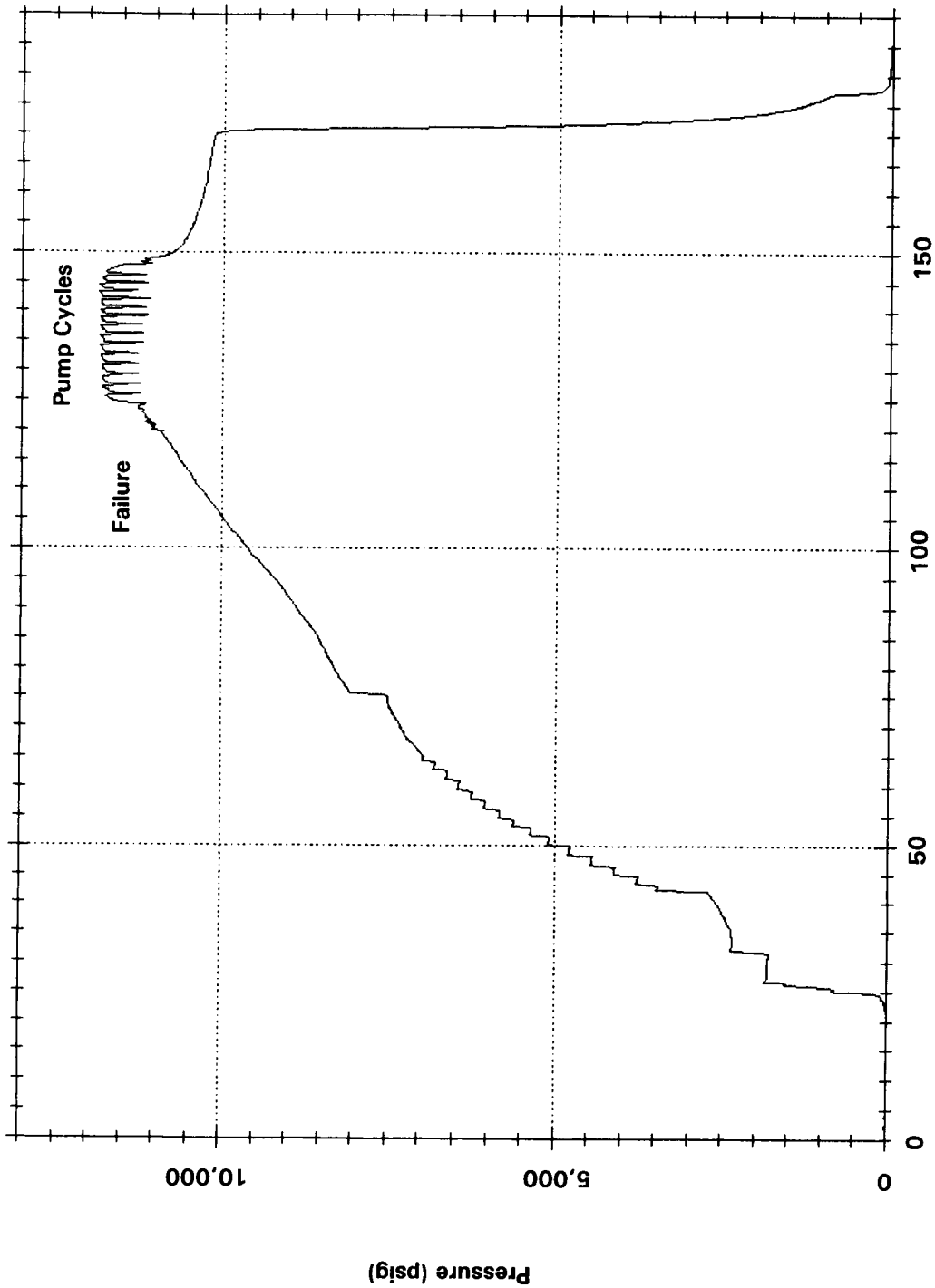

Figure 5. Burst Pressure (Model 206—S/N 870222)

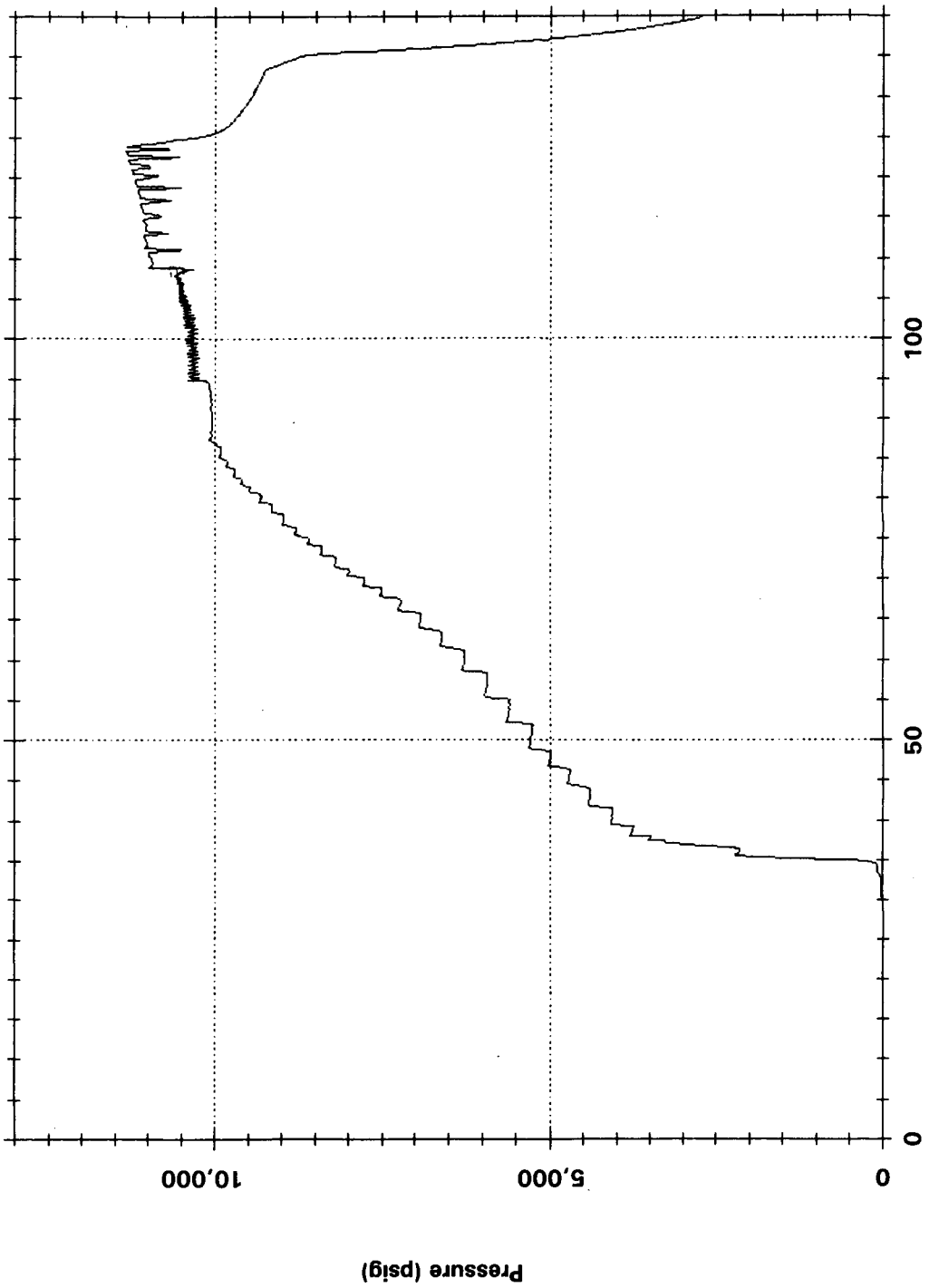

Figure 6. Burst Pressure (Model 206—S/N 848504)

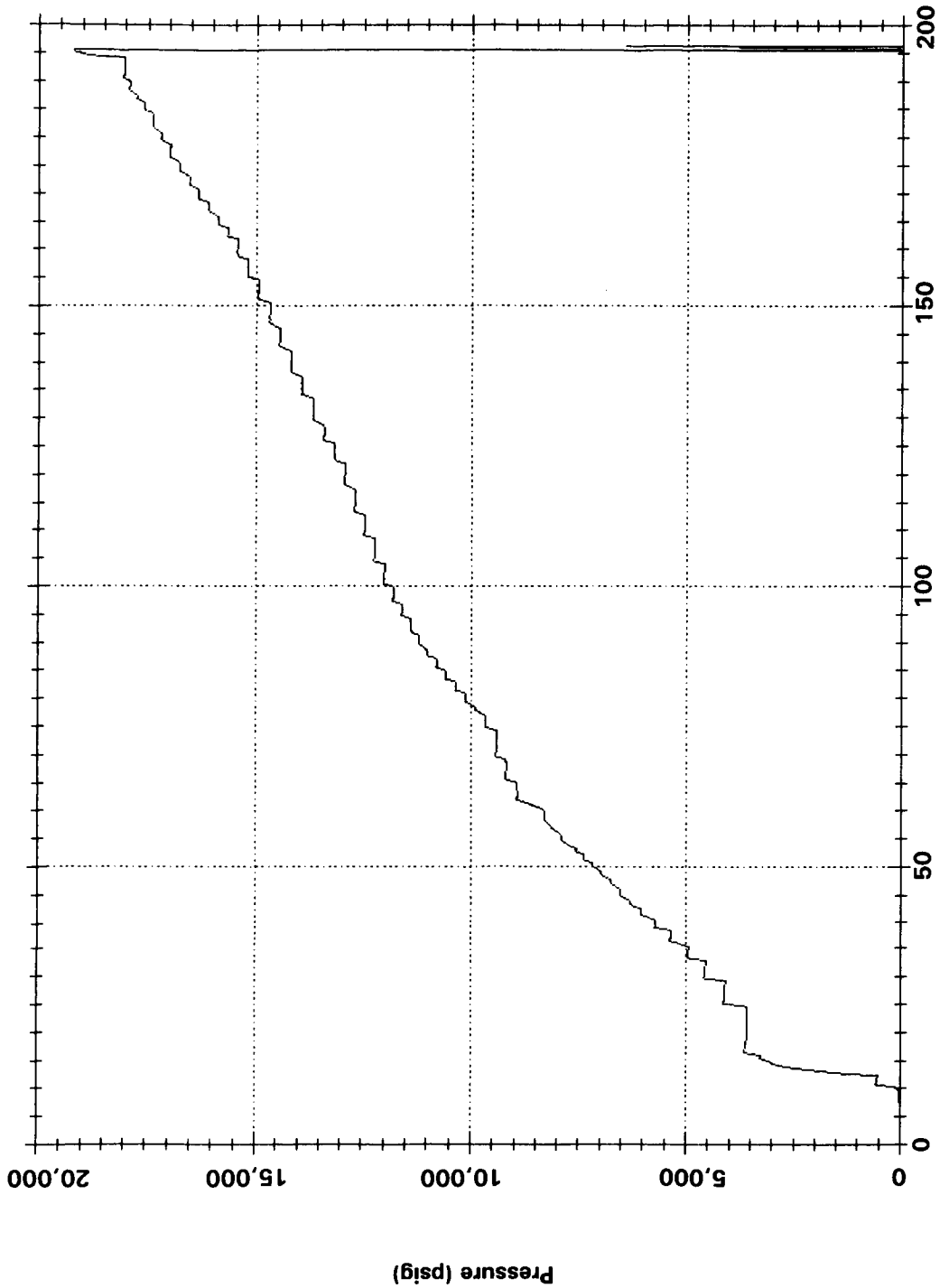

Figure 7. Burst Pressure (Model 2210—S/N 842258)

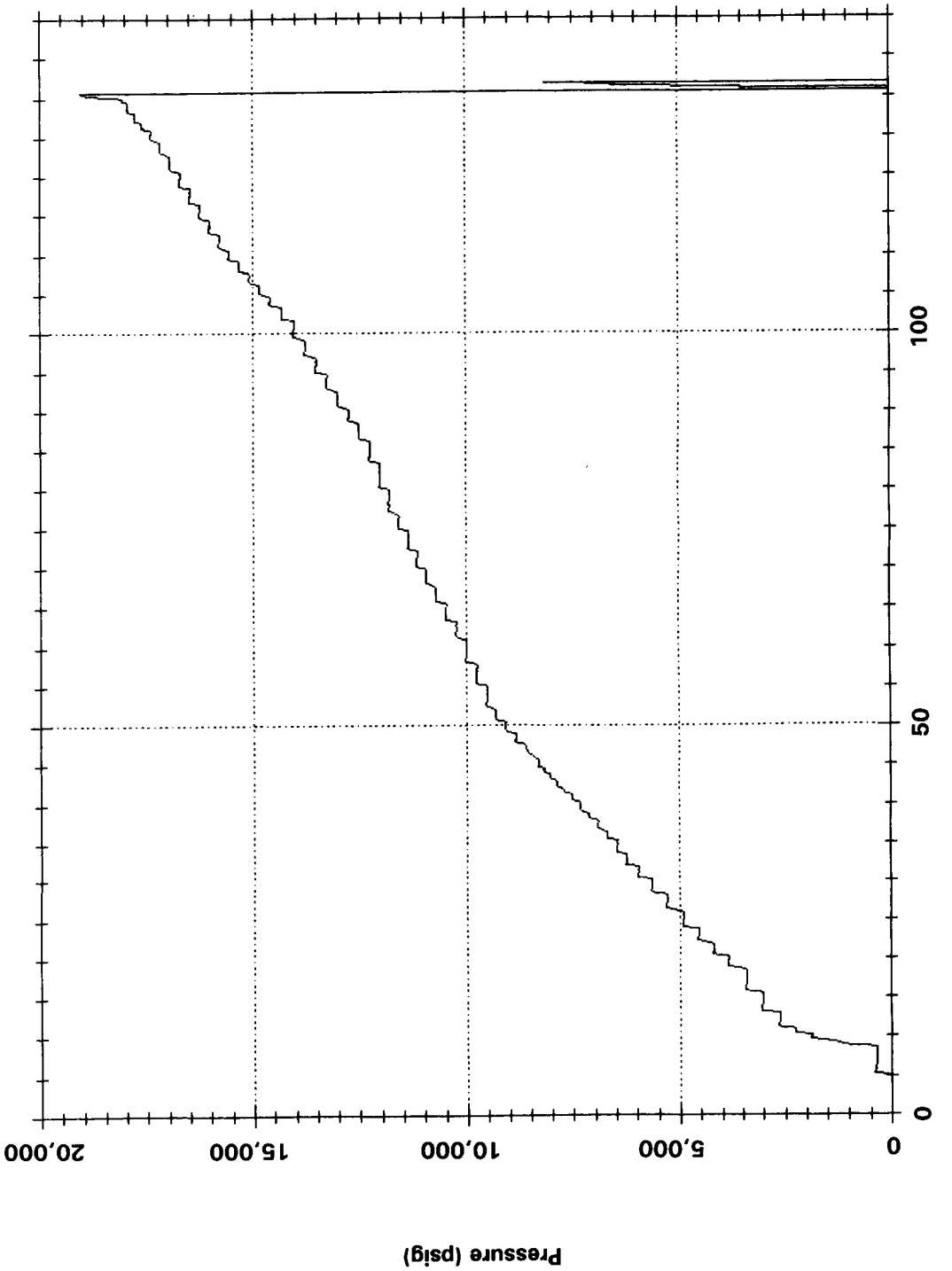

Figure 8. Burst Pressure (Model 2210—S/N 882181)

7

APPLICABLE DOCUMENTS

WTP-0185	Teledyne Taber 206-1000 and 2210-3000 Pressure Transducer Proof Test and Burst Test Final Test Report
MIL-STD-45662	Calibration Systems Requirements
SE-019-049-2H	Solid Rocket Booster Vibration, Acoustic and Shock Design and Test Criteria
1U50731	Transducer Bolt Assembly

Appendix A

Pressure Calibration After Vibration Test

TRANSDUCER CALIBRATION WORKSHEET

ASCENDING

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MANUFACTURER	MODEL	SERIAL NO.	RANGE
TABER	2210	882181	3000
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	15 FEB 89	10.00 VDC	16856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24930
LOADING TECH.	RECORDING TECH.	COMPUTING TECH.	READ OUT
16783	16783		
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1		
2		
3		
4		
5		
6		

APPLIED LOAD %	PSI	MV OUTPUT				AVERAGE	% OF F.S.	LIN	HYS
Z OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	0	0000	0000	0000	0000	0000			
20	200	2.008	2.006	2.009	2.010	2.010			
40	400	4.018	4.017	4.017	4.019	4.018			
60	600	6.028	6.026	6.025	6.030	6.027			
80	800	8.035	8.034	8.034	8.037	8.030			
100	1000	10.038	10.039	10.038	10.041	10.042			
80	1200	12.043	12.039	12.045	12.043	12.046			
60	1400	14.050	14.047	14.045	14.050	14.046			
40	1600	16.051	16.048	16.047	16.047	16.047			
20	1800	18.030	18.043	18.043	18.050	18.038			
0	2000	20.035	20.040	20.041	20.044	20.039			
−20	2200	22.026	22.030	22.028	22.030	22.034			
−40	2400	23.960	24.013	24.018	24.021	24.018			
−60	2600	26.024	26.018	26.012	26.005	26.004			
−80	2800	27.987	27.997	27.993	27.991	28.004			
−100	3000	29.984	29.978	29.991	29.983	29.980			
−80									
−60									
−40									
−20									
−0									
Z OUT									

DESCENDING

TRANSDUCER CALIBRATION WORKSHEET

MANUFACTURER	MODEL	SERIAL NO.	RANGE
TABER	2210	882181	3000
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	15 FEB 89	10.00 VDC	16856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24930
LOADING TECH.	RECORDING TECH.	COMPUTING TECH.	READ OUT
16783	16783		
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1		
2		
3		
4		
5		
6		

APPLIED LOAD %	PSI	MV OUTPUT				AVERAGE	% OF F.S.	LIN	HYS
Z OUT	input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	3000	29.984	29.979	29.991	29.983	29.980			
20	2800	28.027	27.996	28.005	27.995	28.002			
40	2600	26.032	26.025	26.024	26.022	26.024			
60	2400	23.973	24.030	24.037	24.029	24.031			
80	2200	22.043	22.046	22.047	22.045	22.037			
100	2000	20.043	20.053	20.053	20.050	20.054			
80	1800	18.052	18.059	18.056	18.061	18.054			
60	1600	16.058	16.059	16.059	16.062	16.059			
40	1400	14.043	14.061	14.058	14.062	14.059			
20	1200	12.054	12.056	12.055	12.060	12.055			
0	1000	10.053	10.052	10.051	10.057	10.053			
−20	800	8.047	8.046	8.046	8.049	8.047			
−40	600	6.040	6.036	6.037	6.041	6.037			
−60	400	4.029	4.027	4.028	4.029	4.026			
−80	200	2.018	2.014	2.104	2.016	2.013			
−100	0	.0000	.0000	.0000	.0003	.0001			
−80									
−60									
−40									
−20									
−0									
Z OUT									

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OF POOR QUALITY

TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER
MODEL#: 206
SERIAL#: 848504
RANGE: 1000 PSIG
DATE: 16 FEB 89
SL#: N/A
READOUT: 24930
MODE: POS
REF STD: 16856
SHUNTS: 3 MV/V
INS.RES.: 10K MEG OHMS

3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
ZERO= 0.000	0.000		
#1 = 7.528	7.528	25.08	25.01
#2 = 15.055	15.055	50.15	50.06
#3 = 22.581	22.581	75.22	75.15
#4 = 30.103	30.103	100.28	100.27

TEMP.DEG.F = 75
EXCITATION = 9.9994 V.DC
SENSITIVITY = 3.002 MV/V
POT OUT = 0.2720 MV
CONVERSION FACTOR = 3.33133453

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.001	0.000	0.000	0.000	0.000	0.00	
20%=	6.012	6.016	6.015	6.014	6.014	20.03	
40%=	12.030	12.034	12.031	12.032	12.031	40.08	
60%=	18.039	18.041	18.047	18.042	18.042	60.10	
80%=	24.042	24.040	24.039	24.040	24.040	80.09	
100%=	30.025	30.023	30.007	30.018	30.018	100.00	
80%=	24.069	24.060	24.061	24.063	24.063	80.16	0.07
60%=	18.059	18.051	18.060	18.057	18.056	60.15	0.05
40%=	12.041	12.043	12.045	12.043	12.043	40.12	0.04
20%=	6.018	6.019	6.017	6.018	6.018	20.05	0.02
0%=	0.000	0.001	-0.002	0.000	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.858E-03 B=.301404 C= -1.149E-05
RR= .999999838

TCC 17776 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER	206	848504	16 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	9.9994	3.002 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.01	100%=	100.00	80%=	0.07
#2 =	50.06	80%=	80.09	60%=	0.05
#3 =	75.15	60%=	60.10	40%=	0.04
#4 =	100.27	40%=	40.08	20%=	0.02
		20%=	20.03	0%=	0.00

TRANSDUCER WORKSHEET I AP 28 A1

		3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MFG.:	TABER	ZERO=	0.000	0.000	
MODEL#:	206	#1 =	7.526	25.08	25.01
SERIAL#:	848504	#2 =	15.053	50.16	50.07
RANGE:	1000 PSIG	#3 =	22.578	75.23	75.16
DATE:	16 FEB 89	#4 =	30.102	100.31	100.29
SL#:	N/A				
READOUT:	24930	TEMP.DEG.F = 75			
MODE:	POS	EXCITATION = 9.9992 V.DC			
REF.STD:	16856	SENSITIVITY = 3.001 MV/V			
SHUNTS:	3 MV/V	POT OUT = 0.2770 MV			
INS.RES.	>10K MEG OHMS	CONVERSION FACTOR = 3.33218558			

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.001	0.000	0.000	0.000	0.00	
20%=	6.011	6.014	6.016	6.014	6.013	20.04	
40%=	12.029	12.028	12.026	12.028	12.027	40.08	
60%=	18.034	18.029	18.037	18.033	18.033	60.09	
80%=	24.035	24.043	24.042	24.040	24.040	80.10	
100%=	29.998	30.017	30.017	30.011	30.010	100.00	
80%=	24.055	24.061	24.055	24.057	24.057	80.16	0.06
60%=	18.057	18.060	18.054	18.057	18.057	60.17	0.08
40%=	12.039	12.036	12.036	12.037	12.037	40.11	0.03
20%=	6.018	6.015	6.019	6.017	6.017	20.05	0.01
0%=	0.000	-0.002	0.001	0.000	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.572E-03 B=.301278 C= -1.084E-05
RR= .999999714

TCC 17776 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER	206	848504	16 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	9.9992	3.001 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.01	100%=	100.00	80%=	0.06
#2 =	50.07	80%=	80.10	60%=	0.08
#3 =	75.16	60%=	60.09	40%=	0.03
#4 =	100.29	40%=	40.08	20%=	0.01
		20%=	20.04	0%=	0.00

TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER
MODEL#: 206
SERIAL#: 870222
RANGE: 1000 PSIG
DATE: 16 FEB 89
SL#: N/A
READOUT: 24412
MODE: POS
REF.STD: 16856
SHUNTS: 3 MV/V
INS.RES. >10K MEG OHMS

3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
ZERO= 0.000	0.000		
#1 = 7.513	7.513	25.04	25.02
#2 = 15.024	15.024	50.08	50.04
#3 = 22.536	22.536	75.12	75.09
#4 = 30.049	30.049	100.16	100.15

TEMP.DEG.F = 75
EXCITATION = 10.0015 V.DC
SENSITIVITY = 3.000 MV/V
POT OUT = 0.3260 MV
CONVERSION FACTOR = 3.33333333

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	6.002	6.003	6.003	6.003	6.003	20.01	
40%=	12.007	12.007	12.009	12.008	12.008	40.03	
60%=	18.011	18.008	18.014	18.011	18.011	60.04	
80%=	24.011	24.021	24.017	24.016	24.016	80.05	
100%=	29.996	29.997	30.007	30.000	30.000	100.00	
80%=	24.030	24.032	24.028	24.030	24.030	80.10	0.05
60%=	18.026	18.031	18.030	18.029	18.029	60.10	0.06
40%=	12.014	12.015	12.014	12.014	12.014	40.05	0.02
20%=	6.002	6.004	6.005	6.004	6.004	20.01	0.00
0%=	-0.002	0.000	-0.002	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-2.465E-03 B=.300481 C= -4.19E-06
RR= .999999865

TCC 17776 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER	206	870222	16 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	10.0015	3.000 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.02	100%=	100.00	80%=	0.05
#2 =	50.04	80%=	80.05	60%=	0.06
#3 =	75.09	60%=	60.04	40%=	0.02
#4 =	100.15	40%=	40.03	20%=	0.00
		20%=	20.01	0%=	0.00

TRANSDUCER WORKSHEET I AP 28 A1

MFG.: TABER
MODEL#: 206
SERIAL#: 870222
RANGE: 1000 PSIG
DATE: 16 FEB 89
SL#: N/A
READOUT: 24412
MODE: A/POS
REF STD: 76856
SHUNTS: 3 MV/V
INS.RES.>10K MEG OHMS

3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
ZERO= 0.000	0.000		
#1 = 7.513	7.513	25.04	25.02
#2 = 15.024	15.024	50.06	50.04
#3 = 22.538	22.538	75.10	75.08
#4 = 30.051	30.051	100.14	100.14

TEMP.DEG.F = 75
EXCITATION = 10.0017 V.DC
SENSITIVITY = 3.000 MV/V
POT OUT = 0.3130 MV
CONVERSION FACTOR = 3.33233364

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	6.003	6.006	6.005	6.005	6.005	20.01	
40%=	12.009	12.014	12.010	12.011	12.011	40.02	
60%=	18.014	18.013	18.020	18.016	18.016	60.03	
80%=	24.014	24.014	24.013	24.014	24.014	80.02	
100%=	30.007	30.017	30.003	30.009	30.009	100.00	
80%=	24.040	24.033	24.029	24.034	24.034	80.09	0.07
60%=	18.027	18.027	18.034	18.029	18.029	60.08	0.05
40%=	12.015	12.019	12.021	12.018	12.018	40.05	0.03
20%=	6.006	6.006	6.006	6.006	6.006	20.01	0.00
0%=	0.000	0.000	-0.002	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-1.239E-03 B=.300466 C= -3.58E-06
RR= .999999981

TCC 17776 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER	206	870222	16 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	10.0017	3.000 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.02	100%=	100.00	80%=	0.07
#2 =	50.04	80%=	80.02	60%=	0.05
#3 =	75.08	60%=	60.03	40%=	0.03
#4 =	100.14	40%=	40.02	20%=	0.00
		20%=	20.01	0%=	0.00

TRANSDUCER CALIBRATION WORKSHEET

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MANUFACTURER	MODEL	SERIAL NO.	RANGE
TABER	2210	842258	3000
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	15 FEB 89	10.00 VDC	16856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24412
LOADING TECH.	RECORDING TECH.	COMPUTING TECH.	READ OUT
16783	16783		
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1		
2		
3		
4		
5		
6		

APPLIED LOAD %	PSI	MV OUTPUT				AVERAGE	% OF F.S.	LIN	HYS
Z OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	0	.0000	.0000	.0000	.0000	.0000			
20	200	2.018	2.018	2.017	2.018	2.021			
40	400	4.040	4.043	4.038	4.038	4.041			
60	600	6.061	6.062	6.058	6.060	6.061			
80	800	8.081	8.082	8.079	8.080	8.075			
100	1000	10.101	10.102	10.099	10.098	10.103			
80	1200	12.116	12.118	12.117	12.115	12.120			
60	1400	14.134	14.132	14.130	14.135	14.131			
40	1600	16.145	16.143	16.144	16.142	16.140			
20	1800	18.150	18.152	18.157	18.160	18.155			
0	2000	20.160	20.168	20.165	20.162	20.160			
−20	2200	22.170	22.170	22.168	22.167	22.167			
−40	2400	24.160	24.163	24.173	24.165	24.168			
−60	2600	26.158	26.180	26.178	26.176	26.180			
−80	2800	28.170	28.176	28.173	28.171	28.172			
−100	3000	30.170	30.180	30.178	30.172	30.180			
−80									
−60									
−40									
−20									
−0									
Z OUT									

DESCENDING

TRANSDUCER CALIBRATION WORKSHEET

MANUFACTURER	MODEL	SERIAL NO.	RANGE	STEPS	SHUNTS	% OF F.S.
TABER	2210	842258	3000	1		
CHANNEL	CALIBRATION DATE 15 FEB 89	EXCITATION 10.00 VDC	LOADING INSTRUMENT 16856	2		
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD 24412	3		
LOADING TECH. 16783	RECORDING TECH. 16783	COMPUTING TECH.	READ OUT	4		
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.	5		
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INSP.						

APPLIED LOAD %	PSI	MV OUTPUT				~~AVERAGE~~	% OF F.S.	LIN	HYS
Z OUT	input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	3000	30.170	30.180	30.178	30.172	30.180			
20	2800	28.142	28.185	28.180	28.176	28.180			
40	2600	26.177	26.196	26.189	26.184	26.186			
60	2400	24.170	24.196	24.196	24.183	24.187			
80	2200	22.143	22.195	22.193	22.191	22.196			
100	2000	20.113	20.190	20.188	20.190	20.189			
80	1800	18.160	18.185	18.181	18.184	18.181			
60	1600	16.167	16.171	16.173	16.171	16.169			
40	1400	14.155	14.159	14.155	14.161	14.161			
20	1200	12.136	12.143	12.141	12.146	12.142			
0	1000	10.126	10.125	10.122	10.128	10.126			
−20	800	8.110	8.105	8.104	8.108	8.107			
−40	600	6.085	6.084	6.082	6.086	6.083			
−60	400	4.062	4.062	4.060	4.063	4.060			
−80	200	2.035	2.034	2.031	2.033	2.032			
−100	0	.0006	.0005	.0003	.0004	.0004			
−80									
−60									
−40									
−20									
−0									
Z OUT									

Appendix B

Pressure Calibration

TRANSDUCER CALIBRATION WORKSHEET *Ascending*

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MANUFACTURER	MODEL	SERIAL NO.	RANGE
Taber	2210	882181	0 - 3000 #
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	17 Feb 89	10.000VDC	16851
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24412
LOADING TECH. TCC 16783 STOS	RECORDING TECH. TCC 16783 STOS	COMPUTING TECH.	READ OUT
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1	7.526	
2	15.053	
3	22.582	
4	30.109	
5		
6		

APPLIED LOAD %						AVERAGE	% OF F.S.	LIN	HYS
Z OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	0	0.000	0.000	0.000	0.000	0.000			
20	200	2.011	2.009	2.007	2.013	2.012			
40	400	4.025	4.026	4.027	4.028	4.031			
60	600	6.044	6.044	6.045	6.047	6.039			
80	800	8.062	8.061	8.063	8.060	8.065			
100	1000	10.077	10.074	10.080	10.081	10.081			
80	1200	12.092	12.089	12.096	12.089	12.093			
60	1400	14.102	14.100	14.107	14.103	14.108			
40	1600	16.114	16.111	16.113	16.119	16.114			
20	1800	18.122	18.118	18.125	18.128	18.115			
0	2000	20.128	20.126	20.128	20.130	20.129			
-20	2200	22.131	22.130	22.133	22.133	22.125			
-40	2400	24.133	24.129	24.131	24.136	24.125			
-60	2600	26.132	26.127	26.130	26.135	26.123			
-80	2800	28.133	28.129	28.127	28.132	28.128			
-100	3000	30.127	30.117	30.121	30.122	30.126			
-80									
-60									
-40									
-20									
-0									
Z OUT									

TRANSDUCER CALIBRATION WORKSHEET

Decending

MANUFACTURER	MODEL	SERIAL NO.	RANGE
Taber	2210	882181	0-3000#
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	17 Feb 89	10.00VDC	16,856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24412
LOADING TECH. Tec 16783 STOS	RECORDING TECH. Tec 16783 STOS	COMPUTING TECH.	READ OUT
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1	7.526	
2	15.053	
3	22.582	
4	30.109	
5		
6		

APPLIED LOAD %						~~AVERAGE~~	% OF F.S.	LIN	HYS
Z OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	3000	30.127	30.117	30.121	30.122	30.126			
20	2800	28.130	28.125	28.136	28.134	28.130			
40	2600	26.128	26.132	26.145	26.147	26.140			
60	2400	24.135	24.142	24.150	24.152	24.137			
80	2200	22.140	22.138	22.153	22.146	22.135			
100	2000	20.145	20.148	20.150	20.151	20.147			
80	1800	18.155	18.146	18.146	18.148	18.152			
60	1600	16.145	16.137	16.142	16.140	16.145			
40	1400	14.134	14.124	14.133	14.130	14.135			
20	1200	12.127	12.119	12.120	12.119	12.123			
0	1000	10.107	10.109	10.104	10.106	10.109			
-20	800	8.096	8.089	8.092	8.088	8.092			
-40	600	6.074	6.070	6.070	6.068	6.072			
-60	400	4.053	4.051	4.049	4.047	4.050			
-80	200	2.034	2.029	2.026	2.027	2.030			
-100	0	0.007	0.002	0.003	0.001	0.004			
-80									
-60									
-40									
-20									
-0									
Z OUT									

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TRANSDUCER CALIBRATION WORKSHEET

Ascending

MANUFACTURER	MODEL	SERIAL NO.	RANGE
Taber	2210	8122558	0-3000 #
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	17 Feb 89	10.000VDC	16856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD 24467 ~~24472~~
LOADING TECH. TCC 16783 STDS	RECORDING TECH. TCC 16783 STDS	COMPUTING TECH.	READ OUT
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1	7.521	
2	15.046	
3	22.567	
4	30.086	
5		
6		

APPLIED LOAD %						AVERAGE	% OF F.S.	LIN	HYS
Z OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	0	0.000	0.000	0.000	0.000	0.000			
20	200	2.001	2.000	2.005	2.003	2005 =			
40	400	4.005	4.005	4.010	4.006	4.008			
60	600	6.009	6.008	6.012	6.012	6.009			
80	800	8.013	8.009	8.010	8.011	8.012			
100	1000	10.013	10.011	10.014	10.015	10.015			
80	1200	12.011	12.010	12.014	12.010	12.015			
60	1400	14.009	14.007	14.012	14.014	14.012			
40	1600	16.007	16001	16.006	16.009	16.006			
20	1800	18.001	17.996	18.005	18.004	18.000			
0	2000	19.995	19.990	19.996	19.994	19.994			
-20	2200	21.983	21.984	21.983	21.981	21.978			
-40	2400	23.975	23.970	23.969	23.971	23.965			
-60	2600	25.953	25.948	25.950	25.955	25.945			
-80	2800	27.943	27.938	27.941	27.939	27.930			
-100	3000	29.920	29.912	29.918	29.920	29.917			
-80									
-60									
-40									
-20									
-0									
Z OUT									

TRANSDUCER CALIBRATION WORKSHEET Decending

MANUFACTURER	MODEL	SERIAL NO.	RANGE
Tc ber	2210	842258	0-3000#
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	17 Feb 89	10.000VDC	16 856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24467
LOADING TECH. TCC 16783 STDS	RECORDING TECH. TCC 16783 STDS	COMPUTING TECH.	READ OUT
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1	7.521	
2	15.046	
3	22.567	
4	30.086	
5		
6		

APPLIED LOAD %						AVERAGE	% OF F.S.	LIN	HYS
Z OUT	Input	Run 1	Run 2	Run 3	Run 4	Run 5			
0	3000	29.920	29.912	29.918	29.920	29.917			
20	2800	27.925	27.920	27.930	27.941	27.932			
40	2600	25.960	25.955	25.960	25.962	25.953			
60	2400	~~23.987~~ 23.967	23.973	23.980	23.979	23.968			
80	2200	21.987	21.985	21.993	21.992	21.995			
100	2000	20.010	20.004	20.008	20.005	20.005			
80	1800	18.015	18.011	18.015	18.016	18.012			
60	1600	16.022	16.015	16.023	16.022	16.018			
40	1400	14.026	14.018	14.027	14.027	14.023			
20	1200	12.031	12.024	12.030	12.027	12.033			
0	1000	10.026	10.028	10.029	10.029	10.031			
-20	800	8.030	8.025	8.024	8.023	8.033			
-40	600	6.023	6.022	6.024	6.017	6.024			
-60	400	4.018	4.015	4.016	4.016	4.016			
-80	200	2.009	2.009	2.008	2.007	2.011			
-100	0	0.003	0.003	0.001	0.002	0.002			
-80									
-60									
-40									
-20									
-0									
Z OUT									

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN	
MODEL#:	206	ZERO=	0.001	0.000		
SERIAL#:	848504	#1 =	7.524	7.523	25.07	25.04
RANGE:	1000 PSIG	#2 =	15.049	15.048	50.15	50.09
DATE:	17 FEB 89	#3 =	22.572	22.571	75.23	75.17
SL#:	N/A	#4 =	30.094	30.093	100.30	100.28
READOUT:	24930	TEMP.DEG.F = 73				
MODE/#'S:	POS	EXCITATION = 9.9965 V.DC				
REF.STD:	16856	SENSITIVITY = 3.001 MV/V				
SHUNTS:	3 MV/V	POT OUT = 0.3060 MV				
INS.RES.:	>10K MEG OHMS	CONVERSION FACTOR = 3.33292598				

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	6.003	6.001	6.001	6.002	6.002	20.00	
40%=	12.013	12.014	12.009	12.012	12.012	40.04	
60%=	18.029	18.030	18.025	18.028	18.028	60.09	
80%=	24.029	24.027	24.023	24.026	24.026	80.08	
100%=	30.007	30.001	30.003	30.004	30.004	100.00	
80%=	24.043	24.042	24.051	24.045	24.045	80.14	0.06
60%=	18.048	18.046	18.046	18.047	18.047	60.15	0.06
40%=	12.035	12.032	12.028	12.032	12.032	40.10	0.06
20%=	6.009	6.003	6.008	6.007	6.007	20.02	0.02
0%=	0.000	-0.003	-0.002	-0.002	-0.002	-0.01	-0.01

Y=A+BX+CX^2 A=-5.89299999E-03 B=.300912 C= -7.58E-06

RR= .999999567

TCC 16783 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TCC 16952 STDS

TABER	206	848504	17 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL

1000 PSIG	N/A	POS	9.9965	3.001	3
RANGE	SL # / MODE		EXCITATION V.DC.	MV/V SENS./	MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.04	100%=	100.00	80%=	0.06
#2 =	50.09	80%=	80.08	60%=	0.06
#3 =	75.17	60%=	60.09	40%=	0.06
#4 =	100.28	40%=	40.04	20%=	0.02
		20%=	20.00	0%=	-0.01

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#:	206	ZERO=	0.000	0.000	
SERIAL#:	848504	#1 =	7.523	7.523	25.08 25.03
RANGE:	1000 PSIG	#2 =	15.046	15.046	50.16 50.09
DATE:	17 FEB 89	#3 =	22.570	22.570	75.24 75.18
SL#:	N/A	#4 =	-30.091	30.091	100.31 100.30
READOUT:	24930	TEMP.DEG.F = 73			
MODE:	POS	EXCITATION = 9.9968 V.DC			
REF.STD:	16856	SENSITIVITY = 3.001 MV/V			
SHUNTS:	3 MV/V	POT OUT = 0.3060 MV			
INS.RES.>10K	MEG OHMS	CONVERSION FACTOR = 3.33362966			

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	6.001	6.000	6.002	6.001	6.001	20.01	
40%=	12.016	12.019	12.014	12.016	12.016	40.06	
60%=	18.026	18.021	18.025	18.024	18.024	60.09	
80%=	24.019	24.013	24.023	24.018	24.018	80.07	
100%=	29.998	29.998	29.996	29.997	29.997	100.00	
80%=	24.032	24.034	24.036	24.034	24.034	80.12	0.05
60%=	18.044	18.042	18.039	18.042	18.042	60.14	0.05
40%=	12.027	12.024	12.026	12.026	12.026	40.09	0.03
20%=	6.005	6.009	6.008	6.007	6.007	20.03	0.02
0%=	0.000	0.000	-0.002	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-5.358E-03 B=.300932 C= -8.67E-06

RR= .999999733

TCC 16783 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TABER	206	848504	17 FEB 89	TCC 16962 STDS
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL	
1000 PSIG	N/A	POS	9.9968	3.001 3
RANGE	SL # / MODE		EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.03	100%=	100.00	80%=	0.05
#2 =	50.09	80%=	80.07	60%=	0.05
#3 =	75.18	60%=	60.09	40%=	0.03
#4 =	100.30	40%=	40.06	20%=	0.02
		20%=	20.01	0%=	0.00

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#:	206	ZERO=	0.000	0.000	
SERIAL#:	870222	#1 =	7.512	7.512	25.04	25.04
RANGE:	1000 PSIG	#2 =	15.023	15.023	50.07	50.07
DATE:	17 FEB 89	#3 =	22.535	22.535	75.11	75.10
SL#:	N/A	#4 =	30.047	30.047	100.15	100.13
READOUT:	24412	TEMP.DEG.F = 73				
MODE:	POS	EXCITATION = 10.0000 V.DC				
REF.STD:	16856	SENSITIVITY = 3.000 MV/V				
SHUNTS:	3 MV/V	POT.OUT = 0.3450 MV				
INS.RES.	>10K MEG OHMS	CONVERSION FACTOR = 3.33303707				

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	5.995	5.992	5.996	5.994	5.994	19.98	
40%=	11.998	11.995	11.997	11.997	11.997	39.99	
60%=	18.006	18.010	18.004	18.007	18.007	60.02	
80%=	24.015	24.012	24.010	24.012	24.012	80.03	
100%=	30.003	30.001	30.004	30.003	30.003	100.00	
80%=	24.021	24.018	24.025	24.021	24.021	80.06	0.03
60%=	18.017	18.021	18.017	18.018	18.018	60.06	0.04
40%=	12.014	12.010	12.012	12.012	12.012	40.04	0.05
20%=	5.998	5.991	5.996	5.995	5.995	19.98	0.00
0%=	0.000	-0.003	-0.002	-0.002	-0.002	-0.01	-0.01

Y=A+BX+CX^2 A=-3.81E-03 B=.30014 C= -3E-07

RR= .999999785

TCC 16783 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TCC 16962 STDS

TABER	206	870222	17 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	10.0000	3.000 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.04	100%=	100.00	80%=	0.03
#2 =	50.07	80%=	80.03	60%=	0.04
#3 =	75.10	60%=	60.02	40%=	0.05
#4 =	100.13	40%=	39.99	20%=	0.00
		20%=	19.98	0%=	-0.01

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TRANSDUCER WORKSHEET I AP 28 A1

MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#:	206	ZERO=	0.000	0.000	
SERIAL#:	870222	#1 =	7.510	7.510	25.04 25.03
RANGE:	1000 PSIG	#2 =	15.021	15.021	50.07 50.07
DATE:	17 FEB 89	#3 =	22.533	22.533	75.12 75.11
SL#:	N/A	#4 =	30.044	-30.044	100.15 100.15
READOUT:	24412	TEMP.DEG.F = 73			
MODE:	POS	EXCITATION = 10.0003 V.DC			
REF.STD:	16856	SENSITIVITY = 3.000 MV/V			
SHUNTS:	3 MV/V	POT OUT = 0.3440 MV			
INS.RES.	>10K MEG OHMS	CONVERSION FACTOR = 3.33359261			

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.001	0.000	0.000	0.000	0.00	
20%=	5.992	5.994	5.993	5.993	5.993	19.98	
40%=	12.000	12.006	12.000	12.002	12.002	40.01	
60%=	18.002	18.004	18.004	18.003	18.003	60.01	
80%=	24.003	24.000	24.008	24.004	24.003	80.02	
100%=	29.997	29.998	29.999	29.998	29.998	100.00	
80%=	24.014	24.014	24.013	24.014	24.013	80.05	0.03
60%=	18.017	18.023	18.019	18.020	18.019	60.07	0.06
40%=	12.009	12.006	12.009	12.008	12.008	40.03	0.02
20%=	5.994	5.997	5.991	5.994	5.994	19.98	0.00
0%=	-0.002	0.000	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.393E-03 B=.300148 C= -1.18E-06

RR= .999999894

TCC 16783 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TCC 16962 STDS

TABER	206	870222	17 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	10.0003	3.000 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.03	100%=	100.00	80%=	0.03
#2 =	50.07	80%=	80.02	60%=	0.06
#3 =	75.11	60%=	60.01	40%=	0.02
#4 =	100.15	40%=	40.01	20%=	0.00
		20%=	19.98	0%=	0.00

Appendix C

Calibration After Maximum Pressure Test

TRANSDUCER CALIBRATION WORKSHEET ASCENDING

MANUFACTURER	MODEL	SERIAL NO.	RANGE
TABER	2210	882181	0 - 3000 #
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	19 FEB 89	10.000 VDC	16856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24412
LOADING TECH. 16962 STDS	RECORDING TECH. STDS	COMPUTING TECH.	READ OUT
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1	7.526	
2	15.052	
3	22.575	
4	30.094	
5		
6		

APPLIED LOAD %						~~AVERAGE~~	% OF F.S.	LIN	HYS
Z OUT	INPUT	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5			
0	0	0.000	-0.001	0.000	0.000	0.000			
20	200	2.000	2.002	2.002	2.001	2.002			
40	400	4.007	4.006	4.007	4.008	4.009			
60	600	6.011	6.011	6.010	6.010	6.013			
80	800	8.015	8.012	8.014	8.017	8.016			
100	1000	10.016	10.017	10.017	10.018	10.018			
80	1200	12.020	12.017	12.017	12.018	12.018			
60	1400	14.017	14.015	14.016	14.016	14.017			
40	1600	16.014	16.015	16.013	16.015	16.014			
20	1800	18.011	18.008	17.992	18.009	18.009			
0	2000	20.004	20.002	20.000	20.003	20.002			
-20	2200	21.995	21.994	21.989	21.994	21.991			
-40	2400	23.982	23.982	23.975	23.983	23.980			
-60	2600	25.971	25.964	25.956	25.968	25.967			
-80	2800	27.953	27.936	27.951	27.950	27.950			
-100	3000	29.936	29.929	29.931	29.932	29.934			
-80									
-60									
-40									
-20									
-0									
Z OUT									

FORM TC NO. 768

TRANSDUCER CALIBRATION WORKSHEET DESCENDING

MANUFACTURER	MODEL	SERIAL NO.	RANGE	STEPS	SHUNTS	% OF F.S.
TABER	2210	882181	0-3000 #	1		
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT	2		
	19 FEB 89	10.000 VDC	16856			
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD	3		
			24412			
LOADING TECH. TCC 16962 STDS	RECORDING TECH. 16962 STDS	COMPUTING TECH.	READ OUT	4		
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.	-5		
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR	6		
☐ RECEIVING INSP.						

APPLIED LOAD %						~~AVERAGE~~	% OF F.S.	LIN	HYS
Z OUT	INPUT	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5			
0	3000	29.935	29.930	29.932	29.933	29.933			
20	2800	27.958	27.953	27.954	27.955	27.954			
40	2600	25.976	25.969	25.972	25.975	25.974			
60	2400	23.992	23.984	23.986	23.990	23.990			
80	2200	22.006	22.000	22.000	22.004	22.004			
100	2000	20.009	19.999	20.011	20.014	20.013			
80	1800	18.021	18.018	18.019	18.022	18.022			
60	1600	16.029	16.027	16.025	16.029	16.028			
40	1400	14.028	14.025	14.028	14.032	14.031			
20	1200	12.032	12.029	12.034	12.033	12.033			
0	1000	10.026	10.027	10.030	10.031	10.032			
-20	800	8.029	8.026	8.028	8.029	8.029			
-40	600	6.027	6.020	6.026	6.024	6.024			
-60	400	4.016	4.015	4.016	4.017	4.018			
-80	200	2.008	2.007	2.006	2.009	2.009			
-100	0	0.001	0.000	0.000	0.000	0.000			
-80									
-60									
-40									
-20									
-0									
Z OUT									

FORM TC NO. 768

TRANSDUCER CALIBRATION WORKSHEET ASCENDING

MANUFACTURER	MODEL	SERIAL NO.	RANGE
TABER	2210	842258	0-3000 #
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	19 FEB 89	10.000 VDC	16856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24467
LOADING TECH. 16062 STDS	RECORDING TECH. 16062	COMPUTING TECH.	READ OUT
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1	7.586	
2	15.097	
3	22.627	
4	30.156	
5		
6		

APPLIED LOAD %						~~AVERAGE~~	% OF F.S.	LIN	HYS
Z OUT	INPUT	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5			
0	0	0.000	0.000	0.000	0.000	0.000			
20	200	2.016	2.014	2.013	2.012	2.013			
40	400	4.032	4.027	4.029	4.029	4.031			
60	600	6.049	6.046	6.045	6.045	6.047			
80	800	8.065	8.057	8.061	8.063	8.062			
100	1000	10.079	10.077	10.075	10.076	10.076			
80	1200	12.096	12.088	12.088	12.090	12.091			
60	1400	14.105	14.099	14.100	14.098	14.102			
40	1600	16.117	16.113	16.111	16.111	16.112			
20	1800	18.126	18.117	18.105	18.116	18.117			
0	2000	20.130	20.121	20.117	20.121	20.123			
−20	2200	22.134	22.127	22.123	22.125	22.124			
−40	2400	24.134	24.126	24.123	24.126	24.124			
−60	2600	26.134	26.123	26.125	26.124	26.123			
−80	2800	28.128	28.103	28.121	28.118	28.118			
−100	3000	30.122	30.111	30.110	30.111	30.111			
−80									
−60									
−40									
−20									
−0									
Z OUT									

FORM TC NO. 768

TRANSDUCER CALIBRATION WORKSHEET DESCENDING

MANUFACTURER	MODEL	SERIAL NO.	RANGE
TABER	2210	842268	0-3000#
CHANNEL	CALIBRATION DATE	EXCITATION	LOADING INSTRUMENT
	19 FEB 89	10.000 VDC	16856
BAROMETER	MEGOHMS TO GROUND	BATTERY	STANDARD
			24467
LOADING TECH. 16962 STDS	RECORDING TECH. 16962 STDS	COMPUTING TECH.	READ OUT
☐ DOUBLE SHUNT	SENSITIVITY MV/V	COMPRESSION F.S.	AVERAGE F.S.
☐ SINGLE SHUNT	SHUNT MODULE MV/V	TENSION F.S.	CONVERSION FACTOR
☐ RECEIVING INSP.			

STEPS	SHUNTS	% OF F.S.
1		
2		
3		
4		
5		
6		

APPLIED LOAD %						~~AVERAGE~~	% OF F.S.	LIN	HYS
Z OUT	INPUT	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5			
0	3000	30.124	30.111	30.112	30.111	30.111			
20	2800	28.135	28.122	28.125	28.124	28.123			
40	2600	26.145	26.130	26.132	26.134	26.132			
60	2400	24.146	24.134	24.137	24.137	24.139			
80	2200	22.151	22.139	22.140	22.141	22.143			
100	2000	20.142	20.129	20.139	20.140	20.140			
80	1800	18.144	18.132	18.136	18.137	18.139			
60	1600	16.141	16.132	16.130	16.132	16.133			
40	1400	14.127	14.118	14.120	14.123	14.123			
20	1200	12.121	12.109	12.114	12.111	12.113			
0	1000	10.101	10.095	10.099	10.099	10.100			
−20	800	8.092	8.083	8.085	8.083	8.084			
−40	600	6.078	6.063	6.070	6.067	6.065			
−60	400	4.053	4.045	4.047	4.045	4.047			
−80	200	2.023	2.023	2.025	2.024	2.024			
−100	0	0.012	0.002	0.003	0.000	0.001			
−80									
−60									
−40									
−20									
−0									
Z OUT									

FORM TC NO. 768

MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#:	206	ZERO=	0.000	0.000	
SERIAL#:	870222	#1 =	7.512	7.512	25.03 25.04
RANGE:	1000 PSIG	#2 =	15.024	15.024	50.07 50.07
DATE:	19 FEB 89	#3 =	22.537	22.537	75.11 75.10
SL#:	N/A	#4 =	30.049	30.049	100.14 100.13
READOUT:	24412	TEMP.DEG.F = 73			
MODE:	POS	EXCITATION = 10.0017 V.DC			
REF.STD:	16856	SENSITIVITY = 3.000 MV/V			
SHUNTS:	3 MV/V	POT OUT = 0.3400 MV			
INS.RES.>10K	MEG OHMS	CONVERSION FACTOR = 3.33262978			

LOAD	RUN 1/4	RUN 2/5	RUN 3/6	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	5.988	5.995	5.998	5.994	5.994	19.97	
40%=	12.002	11.999	12.002	12.001	12.001	39.99	
60%=	18.004	18.011	18.004	18.006	18.006	60.01	
80%=	24.012	24.010	24.019	24.014	24.014	80.03	
100%=	30.008	30.010	30.001	30.006	30.006	100.00	
80%=	24.022	24.024	24.029	24.025	24.025	80.07	0.04
60%=	18.028	18.029	18.018	18.025	18.025	60.07	0.06
40%=	12.010	12.017	12.007	12.011	12.011	40.03	0.04
20%=	5.998	5.996	5.999	5.998	5.998	19.99	0.02
0%=	-0.004	0.000	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.727E-03 B=.30016 C= -2.3E-07
RR= .99999984

TCC 16962 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TCC 16962 STDS

TABER	206	870222	19 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	10.0017	3.000 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.04	100%=	100.00	80%=	0.04
#2 =	50.07	80%=	80.03	60%=	0.06
#3 =	75.10	60%=	60.01	40%=	0.04
#4 =	100.13	40%=	39.99	20%=	0.02
		20%=	19.97	0%=	0.00

TRANSDUCER CALIBRATION REPORT

MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#:	206	ZERO=	0.000	0.000	
SERIAL#:	870222	#1 =	7.512	7.512	25.04	25.03
RANGE:	1000 PSIG	#2 =	15.025	15.025	50.08	50.06
DATE:	19 FEB 89	#3 =	22.537	22.537	75.11	75.10
SL#:	N/A	#4 =	30.050	30.050	100.15	100.14
READOUT:	24412	TEMP.DEG.F = 73				
MODE:	POS	EXCITATION = 10.0016 V.DC				
REF.STD:	16856	SENSITIVITY = 3.000 MV/V				
SHUNTS:	3 MV/V	POT OUT = 0.3390 MV				
INS.RES.>10K	MEG OHMS	CONVERSION FACTOR = 3.33288895				

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.001	0.000	0.000	0.00	
20%=	5.997	5.997	5.997	5.997	5.997	19.99	
40%=	11.998	11.999	12.008	12.002	12.001	40.00	
60%=	18.007	18.012	18.016	18.012	18.011	60.03	
80%=	24.007	24.016	24.016	24.013	24.013	80.03	
100%=	30.008	30.009	29.996	30.004	30.004	100.00	
80%=	24.037	24.028	24.032	24.032	24.032	80.10	0.07
60%=	18.030	18.028	18.024	18.027	18.027	60.08	0.05
40%=	12.012	12.007	12.020	12.013	12.013	40.04	0.04
20%=	6.003	5.999	6.006	6.003	6.002	20.01	0.02
0%=	0.000	-0.003	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-3.62E-03 B=.30029 C= -1.79E-06
RR= .999999841

TCC 16962 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TCC 16962 STDS

TABER	206	870222	19 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	10.0016	3.000 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.03	100%=	100.00	80%=	0.07
#2 =	50.06	80%=	80.03	60%=	0.05
#3 =	75.10	60%=	60.03	40%=	0.04
#4 =	100.14	40%=	40.00	20%=	0.02
		20%=	19.99	0%=	0.00

TRANSDUCER CALIBRATION REPORT

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MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#:	206	ZERO=	0.000	0.000	
SERIAL#:	848504	#1 =	7.523	7.523	25.07	25.02
RANGE:	1000 PSIG	#2 =	15.049	15.049	50.16	50.07
DATE:	19 FEB 89	#3 =	22.574	22.574	75.23	75.17
SL#:	N/A	#4 =	30.096	30.096	100.30	100.29
READOUT:	24412	TEMP.DEG.F = 73			
MODE:	POS	EXCITATION = 9.9980 V.DC			
REF.STD:	16856	SENSITIVITY = 3.001 MV/V			
SHUNTS:	3 MV/V	POT OUT = 0.3000 MV			
INS.RES.>10K	MEG OHMS	CONVERSION FACTOR = 3.33281489			

LOAD	RUN 1	RUN 2	RUN 3	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	6.005	6.006	6.003	6.005	6.005	20.01	
40%=	12.015	12.017	12.029	12.020	12.020	40.06	
60%=	18.027	18.032	18.038	18.032	18.032	60.10	
80%=	24.023	24.031	24.033	24.029	24.029	80.08	
100%=	30.006	30.008	30.000	30.005	30.005	100.00	
80%=	24.060	24.050	24.050	24.053	24.053	80.17	0.09
60%=	18.054	18.051	18.047	18.051	18.051	60.16	0.06
40%=	12.029	12.025	12.038	12.031	12.031	40.10	0.04
20%=	6.012	6.008	6.016	6.012	6.012	20.04	0.03
0%=	0.000	-0.004	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-5.727E-03 B=.301141 C= -9.87E-06
RR= .999999658

TCC 16962 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TCC 5592 STDS

TABER	206	848504	19 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL

1000 PSIG	N/A POS	9.9980	3.001 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.02	100%=	100.00	80%=	0.09
#2 =	50.07	80%=	80.08	60%=	0.06
#3 =	75.17	60%=	60.10	40%=	0.04
#4 =	100.29	40%=	40.06	20%=	0.03
		20%=	20.01	0%=	0.00

TRANSDUCER CALIBRATION REPORT

ORIGINAL PAGE IS
OF POOR QUALITY

MFG.:	TABER	3 MV/V SHUNTS	-ZERO	%F.S.	SH/LIN
MODEL#:	206	ZERO=	0.000	0.000	
SERIAL#:	~~870222~~ 848504	#1 =	7.525	7.525	25.08 25.04
RANGE:	1000 PSIG	#2 =	15.050	15.050	50.15 50.09
DATE:	19 FEB 89	#3 =	22.576	22.576	75.23 75.17
SL#:	N/A	#4 =	30.098	30.098	100.30 100.28
READOUT:	24412	TEMP.DEG.F = 73			
MODE:	POS	EXCITATION = 9.9981 V.DC			
REF.STD:	16856	SENSITIVITY = 3.001 MV/V			
SHUNTS:	3 MV/V	POT OUT = 0.2990 MV			
INS.RES.>10K	MEG OHMS	CONVERSION FACTOR = 3.33237065			

LOAD	RUN 1 4	RUN 2 5	RUN 3 6	AVERAGE	AVE-ZERO	% F.S.	HYSTERESIS
0%=	0.000	0.000	0.000	0.000	0.000	0.00	
20%=	6.001	6.001	6.006	6.003	6.003	20.00	
40%=	12.017	12.017	12.020	12.018	12.018	40.05	
60%=	18.024	18.034	18.027	18.028	18.028	60.08	
80%=	24.030	24.028	24.039	24.032	24.032	80.08	
100%=	30.008	30.013	30.005	30.009	30.009	100.00	
80%=	24.040	24.043	24.055	24.046	24.046	80.13	0.05
60%=	18.054	18.055	18.045	18.051	18.051	60.15	0.07
40%=	12.031	12.034	12.028	12.031	12.031	40.09	0.04
20%=	6.009	6.005	6.013	6.009	6.009	20.02	0.02
0%=	-0.002	-0.002	0.000	-0.001	-0.001	0.00	0.00

Y=A+BX+CX^2 A=-5.727E-03 B=.300993 C= -7.91E-06
RR= .999999615

TCC 16962 STDS

CALIBRATING TECHNICIAN'S STAMP

TRANSDUCER CALIBRATION REPORT

TCC 16962 STDS

TABER	206	870222	19 FEB 89
MANUFACTURER	MODEL #	SERIAL #	DATE/APPROVAL
1000 PSIG	N/A POS	9.9981	3.001 3
RANGE	SL # / MODE	EXCITATION V.DC.	MV/V SENS./ MV/V SHUNT MOD.

ELECTRICAL SIMULATION		LINEARITY		HYSTERESIS	
#1 =	25.04	100%=	100.00	80%=	0.05
#2 =	50.09	80%=	80.08	60%=	0.07
#3 =	75.17	60%=	60.08	40%=	0.04
#4 =	100.28	40%=	40.05	20%=	0.02
		20%=	20.00	0%=	0.00

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