

OPERATIONS DEPARTMENT SPECIFICATION

CSO-TS-8
January 20, 1980

Superceding
TBS-PT-001
9 August 1968

PRESSURE TRANSDUCER (GENERAL PURPOSE)

APPROVED BY	ORGANIZATION	DATE
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[illegible][illegible]

1.0 SCOPE

1.1 This specification describes a strain gage type pressure transducer for use in measurement of varying pressures encountered during rocket engine & ramjet motor static (ground) testing.

1.2 Conflict. In cases of conflict between this specification and the purchase order, the purchase order shall govern.

1.3 Option 1 units as defined in 3.1.9 may be specified on the purchase order.

2.0 APPLICABLE DOCUMENTS

2.1 The following documents of the latest issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-I-45208	Inspection System Requirements
MIL-C-45662	Calibration System Requirements
MS 33656	Fitting End Standard Dimensions for Flared Tube Connection & Gasket Seal
MS 33649	Bosses, Fluid Connections - Internal Straight Thread

3.0 REQUIREMENTS

3.1 Configuration

3.1.1 Transduction. The transducer shall be of a four active arm wheatstone bridge type, using bonded strain gages. OK

3.1.2 Dimensions. The dimensions are indicated in Figure 2, for Option 1. OK

3.1.3 Connections.

- (a) Mechanical. The transducer shall have either a boss or port per MS 33656-4 or MS 33649-4 respectively. OK
- (b) Electrical. The electrical connection shall be an Amphenol 67-02E14-9P affixed to the transducer. Pin connections are shown in Figure 1. OK

3.1.4 Connector Cavity. The cavity used to mount and/or enclose the shunt correlation, shunt calibration, sensitivity adjusting resistors, and electrical connector shall be readily accessible; potting material such as Silicone grease, tar, beeswax, etc. may be used for water-proofing in this location, however it must flow readily out of the cavity when heated above 150°F. OK

✓ 3.1.5 Marking. An identification plate permanently affixed to the transducer or engraving on the transducer body, shall be provided containing the following information: range, manufacturer, serial number, and CSD Specification Number. u/c

3.1.6 Range. Range will be specified in the purchase order (PSIA or PSIG). The only requirement on a PSIA unit (different than a PSIG unit) is that vacuum may be applied to the sensing diaphragm relative to the external case & the output will meet Paragraph 3.3.5 requirements.

No 0200PSIA
3.1.7 Operating Temperature Range. The transducer shall be usable over the temperature range of -100° to $+250^{\circ}$ F. o/c

3.1.8 Cleaning. The pressure sensing cavity shall be capable of being disassembled for cleaning (ie, removable end-cap). o/c

3.1.9 Option 1 - Option 1 units as requested on the purchase order shall meet the requirements of Figure 2, and shall have provision for sensing-diaphragm replacement in the customers (CSD) laboratory. u/c

3.2 Electrical Characteristics

✓ 3.2.1 Resistance

- 3.5*
- (a) Input: 350 ± 10 ohms, across pins A & B.
 - (b) Output: 350 ± 10 ohms, across pins C & D.
 - (c) Resistive Unbalance: Less than 10 ohms difference between the respective resistances from B to C and B to D.
 - (d) Isolation: Greater than 1,000 Meg-ohms from any pin to case at 100 Volts D.C. o/c

3.2.2 Excitation. Up to 15 volts D.C. operating, and 20 volts D.C. without damage. + 15V MAX.

3.3 Performance

✓ 3.3.1 Sensitivity

- 1.7*
- (a) Nominal Full Scale: $3 \text{ mV/V} \pm 5\%$.
 - (b) Temperature Compensation: $\pm 0.5\%$ of reading/ 100° F from 30° F to 130° F, or better. *.015%*

✓ 3.3.2 Shunt Calibration

- ?*
- (a) Internal Shunt: Built-in resistor wired as shown in Figure 1 to simulate $50 \pm 1\%$ of full scale pressure change; temperature coefficient of this resistor shall be $5 \text{ PPM}/^{\circ}$ F or better. Shorting pins "E" and "F" simulates a pressure change. *o/c*

- (b) External Shunt: Resistors connected across pins "F" and "J" shall simulate pressure as follows:

280.7K ohm	-	10 \pm 0.1% of full scale
112.2K ohm	-	25 \pm 0.25% of full scale
56.0K ohm	-	50 \pm 0.5% of full scale
37.28K ohm	-	75 \pm 0.75% of full scale

Dalle Shunt

- (c) For any excitation between 1 VDC and 15 VDC, the shunt correlation (ie, simulated pressure) shall not vary by more than 0.05% of indicated value.

✓ 3.3.3 Zero Imbalance

.03 changed OK

- (a) Residual zero output: 0 ± 0.02 mV/V at atmospheric pressure applied to the measuring port.
- (b) Temperature compensation: $\pm 1.0\%$ of full scale/100°F from -30°F to 130°F or better.

3.3.4 Creep. The zero imbalance shift after a static pressure application for a period of ten minutes, shall not exceed 0.1% of the applied pressure output within 30 seconds of pressure removal. ✓

✓ 3.3.5 Error Band. Deviations of a plot of output vs. pressure from a straight line due to non-linearity, hysteresis and non-repeatability determine a static error band: This straight line shall herein be defined as the line passing through the zero pressure and 75% of full scale pressure points, where the 75% point is taken during increasing pressure application; for PSIA type units, zero is taken to be zero PSIA.

- (a) Error Band Limits. Each boundary of the error band as defined herein shall not deviate from the straight line defined above by more than $\pm 0.25\%$ of full scale. *OK*

✓ 3.3.6 Non-repeatability and Hysteresis. The combined effects of non-repeatability and hysteresis shall not cause deviations from the initial linearity curve (of increasing pressure application) of more than 0.15% of full scale. *OK*

✓ 3.3.7 Internal Thermal Shock. The results of starting with the unit at an ambient temperature of 70°F to 80°F and quickly filling the pressure cavity with water at 32°F to 35°F, or at 200°F to 212°F shall not cause a zero shift of more than 1.0% of full scale during any time period following the temperature change. *25%*

3.3.8 External Thermal Shock. The results of starting with the unit at an ambient temperature of 70°F to 80°F and quickly immersing it in water at 32°F to 35°F or at 200°F to 212°F (with the pressure cavity entrance plugged) shall not cause zero shift of more than 1% of full scale during any time period following the temperature change.

3.3.9 Over Pressure Limits. The unit shall be capable of withstanding the following respective over-pressure without a zero shift exceeding 0.05% of full scale, nor a sensitivity change of more than .01 millivolts per volt measured at full scale pressure:

- (a) 600% of full scale for a unit whose full scale range is less than 200 PSIA.
- (b) 200% of full scale for a unit whose full scale range is 2000 PSIG to 200 PSIA. *6/6*
- (c) 150% of full scale for a unit whose full scale range is above 2000 PSIG. *OK*

3.3.10 Over Pressure Damage. The unit shall be capable of withstanding the following over-pressures without sustaining permanent damage:

- (a) 1000% of full scale for a unit whose full scale range is less than 200 PSIA.
- (b) 400% of full scale for a unit whose full scale range is 2000 PSIG or less.
- (c) 200% of full scale for a unit whose full scale range is above 2000 PSIG. *OK*

3.4 Shock and Vibration

3.4.1 Output Limit. The unit shall exhibit less than the following respective percent of full scale output per "G" of acceleration with a sinusoidal driving force in any axis, from 0 to 2000 HZ:

- (a) .04% for a unit whose full scale range is 200 PSIG or less.
- (b) .02% for a unit whose full scale range is above 200 PSIG. *.003 7.18/6*

4.0 QUALITY ASSURANCE PROVISIONS

Acceptance testing shall be performed by the vendor as defined below. Data shall be entered directly as read from the instruments, and correction factors noted on the calibration record. Tests defined below are for each bridge.

4.1 Sensitivity. Manufacturer test results are required to show compliance with paragraph 3.3.1.

Test Conditions

- (a) Specimen temperature - Test at 30°, 77°, 130°F (+10°F). *CIR*
- (b) Applied Pressure Repeatability - Shall be within +0.05% of reading. *OK*

- (c) Voltage Readout Accuracy - Shall be within $\pm 0.015\%$ (3 sigma) of reading ± 0.5 micro-volts, or better.
- (d) Input Voltage (Excitation) - No value requirement except voltage sensing shall be accomplished through separate non-current carrying leads attached to the unit at its mating connector, or cable shall be less than 10 feet of #22 AWG (or larger) wire.
- (e) Applied Pressure - 75% of rated full scale or greater.

4.2 Shunt Calibration

- 4.2.1 Internal Shunt. Manufacturer test results are required to show compliance with paragraph 3.3.2.

Test Conditions

Same as 4.1 (a,c,d).

- 4.2.2 External Shunt. Test results are required to show compliance with paragraph 3.3.2.

Test Conditions

Same as 4.1 (a,c,d), plus shunt resistor tolerance is $\pm 0.05\%$.

- 4.3 Zero Imbalance. Test results are required to show compliance with paragraph 3.3.3.

Test Conditions

Same as 4.1 (a,c,d).

- 4.4 Compliance. The contractor shall provide and maintain systems that comply with the requirements of MIL-I-45208 and MIL-C-45662.

- 4.5 CSD Surveillance. United Technologies Chemical Systems Division, at its option, will maintain surveillance over the vendor's quality control system and acceptance test operations. The cognizant CSD representatives shall have access to those areas of the Vendor's Plant in which this work is being performed under the purchase order referencing this specification.

5.0 PREPARATION FOR DELIVERY

- 5.1 Package for delivery using normal manufacturer practice, with the added condition that each unit shipped shall be individually packaged and protected from other units in the same shipment.

6.0 NOTES

N/A

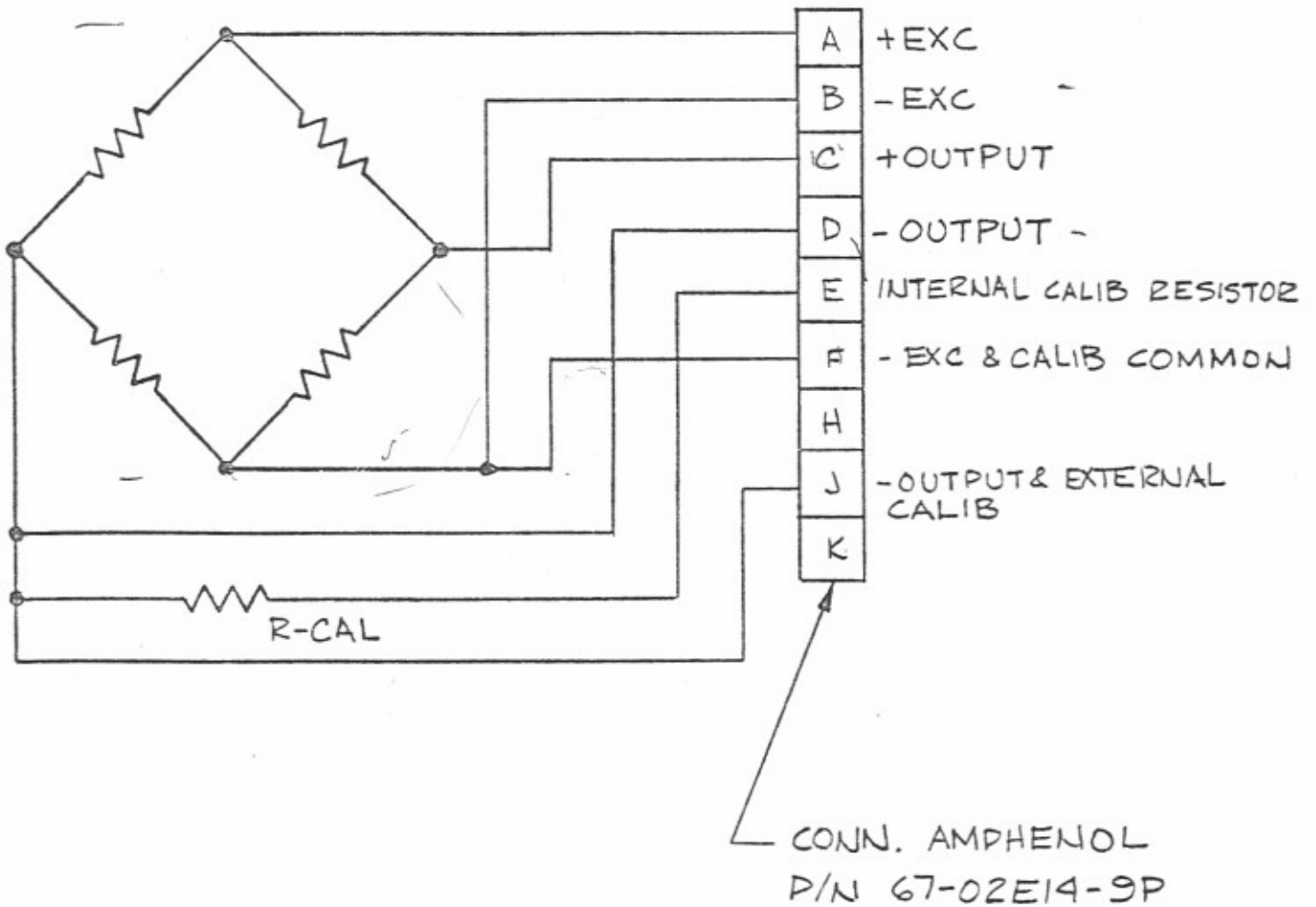


FIGURE 1
(WIRING)

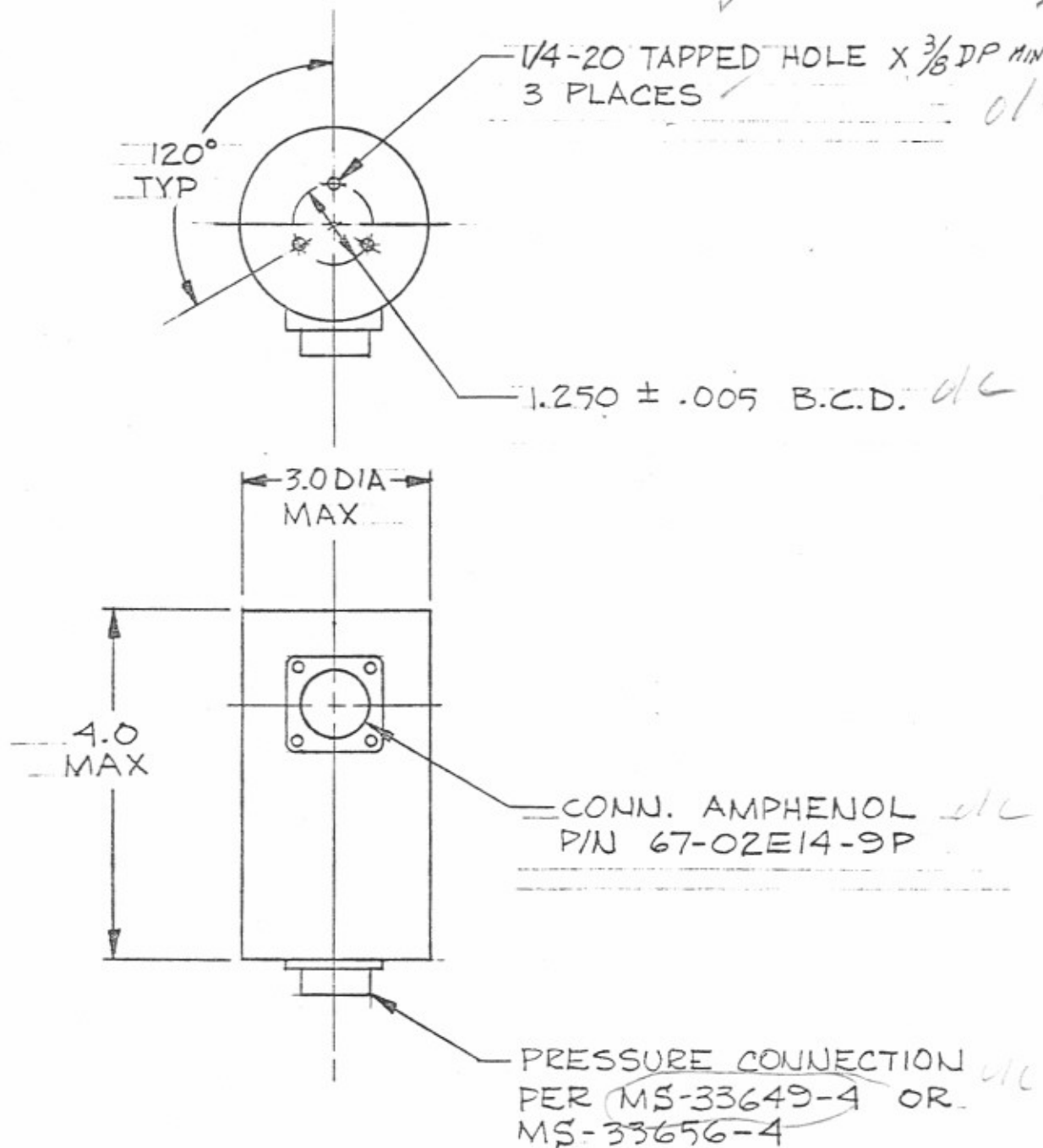


FIGURE 2

OPTION 1 CONFIGURATION

11/20/89

Deviations from Std. Spec.

130002

(NEW IS 130087)

① OTR - 100 to +250°F

② Insulation Resistance - 1K Megohms at 100 VDC

③ Shunt - Internal - $50 \pm 1\%$

Shunt - External	10 +/-	.10 % F.S.
	25 +/-	.25 % F.S.
	50 +/-	.50 % F.S.
	75 +/-	.75 % F.S.

④ Static Error Band $\pm .30\%$ for Linearity, hysteresis, and non repeatability, from a line drawn through increasing zero and 75% points.

⑤ Combined hysteresis and non-repeatability $\pm .25\%$

Exemptions to CSD-TS-3 dated 1-20-80

Change Paragraph:

- Change paragraph 3.2.2 to read max voltage 15 VDC
- Change paragraph 3.3.1b to read from -30°F to +170°F
- Change paragraph 3.3.3A to read 0 ± 0.03 mV/V
- Change paragraph 3.3.3B to read from -30°F to +170°F
- Change paragraph 3.3.5A to read $\pm .3\%$ F.S.
- Change paragraph 3.3.6 to read 0.25% F.S.
- Change paragraph 4.1a to read at -30°, 70°, +170°F