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Standard

Specifications and Tests for Strain Gage Pressure Transducers

ISA-S37.3 — Specifications and Tests for Strain Gage Pressure Transducers

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Preface

This preface, as well as all footnotes and annexes, is included for informational purposes and is not part of ISA-S37.3.

This standard has been prepared as a part of the service of ISA, the international society for measurement and control, toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board; ISA; 67 Alexander Drive; P.O. Box 12277; Research Triangle Park, NC 27709; Telephone: (919) 549-8411; Fax: (919) 549-8288; E-mail: standards@isa.org.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards, recommended practices, and technical reports. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavor to introduce SI and acceptable metric units in all new and revised standards to the greatest extent possible. *The Metric Practice Guide*, which has been published by the Institute of Electrical and Electronics Engineers as ANSI/IEEE Std. 268-1992, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

It is the policy of ISA to encourage and welcome the participation of all concerned individuals and interests in the development of ISA standards, recommended practices, and technical reports. Participation in the ISA standards-making process by an individual in no way constitutes endorsement by the employer of that individual, of ISA, or of any of the standards which ISA develops.

The development of this Standard was initiated as the result of a survey conducted by the Survey Committee on Transducers for Aero-Space Testing (8A-RP37) in December 1960. In addition to the strong need for improved and uniform transducer nomenclature and specification terminology, many of the people surveyed also indicated the need for standardization of performance characteristic specifications, test methods, and electrical requirements for certain classes of transducers used in Aero-Space Testing. Accordingly, five subcommittees were established initially, each to deal with one of these classes of transducers. Subcommittee 8A-RP37.3 (Subcommittee on Strain Gage Pressure Transducers, "SCOSGAPT") was organized on May 1, 1961, to prepare a Recommended Practice for strain gage pressure transducers. Six successive drafts were prepared and submitted for review and comments to a large number of people active in aerospace industries and sciences in which strain gage pressure transducers are used. The final document, ISA-RP37.3 (Guide for Specifications and Tests for Strain Gage Pressure Transducers for Aero-Space Testing), was published by ISA in April 1964. It was revised in 1970 and approved as ANSI Standard MC 6.2 in October 1975.

This Standard was prepared under the direction of Paul S. Lederer (Chairman S37.3) by members of SP37 by updating and expanding the previous version of the document and by obtaining extensive reviews of drafts of the Standard by representatives of transducer users and manufacturers as well as agencies of the U.S. Government. The reviewers were selected from a broad cross-section of all industries and sciences in which transducers are applied for measuring purposes.

This Standard is intended as a guide for technical personnel at user facilities as well as by manufacturers' technical and sales personnel whose duties include specifying, calibrating, testing, or showing performance characteristics of potentiometric pressure transducers. By basing users' specifications as well as technical advertising and reference literature on this Standard, or by referencing portions thereof, as applicable, a clear understanding of the users' needs or of the transducers' performance capabilities, and of the methods used for evaluating or proving performance, will be provided. Adhering to the specification outline, terminology and procedures shown will not only result in simple, but also complete specifications; it will also reduce design time, procurement lead time, and labor, as well as material costs. Of major importance will be the reduction of qualification tests resulting from use of a commonly accepted test procedures and uniform data presentation.

The following individuals served on the 1975 SP37.3 Subcommittee:

NAME	COMPANY
P. S. Lederer, Chairman	National Bureau of Standards
J. F. Arbogast	Hercules Powder Company
D. M. Keast	Bolt, Beranek and Newman
D. L. Limbacher	Aerojet-General
H. E. Lockery	Baldwin-Lima-Hamilton
W. R. Myers	Consolidated Electrodynamics

The following individuals served on the ISA Committee SP37, who reaffirmed ISA-S37.3 in 1995:

NAME	COMPANY
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C. Landis	Weed Fiber Optics
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This standard was reaffirmed by the ISA Standards and Practices Board on September 29, 1995.

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R. Dieck	Pratt & Whitney
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K. Lindner	Endress + Hauser GmbH + Company
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R. Reimer	Allen-Bradley Company
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1 Scope

1.1 This Standard covers strain gage pressure transducers, but primarily those used in measurement systems.

1.2 Included among the specific versions of strain gage pressure transducers to which this Standard is applicable are the following:

Absolute Pressure Transducers

Differential Pressure Transducers

Gage Pressure Transducers

Sealed Reference Pressure Transducers

2 Purpose

This Standard establishes the following for strain gage pressure transducers.

2.1 Uniform minimum specifications for design and performance characteristics

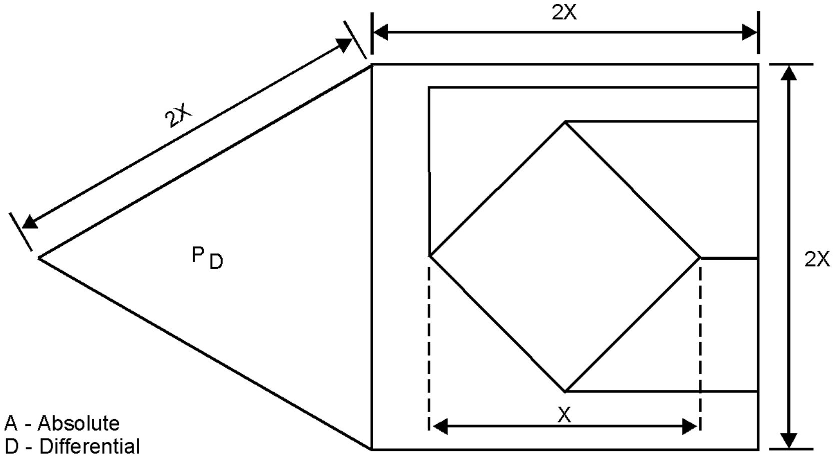
2.2 Uniform acceptance and qualification test methods, including calibration techniques

2.3 Uniform presentation of minimum test data

2.4 A drawing symbol for use in electrical schematics (See note in Section 3.)

3 Drawing symbol

The drawing symbol for measuring a transducer is a square of dimensions 2x by 2x, with an added equilateral triangle, the base of which is the left side of the square. The triangle symbolizes the sensing element. The letter "P" in the triangle designates "pressure" and the subscripts denote the second modifier.



The strain gage is symbolized by a small square, with diagonals x by x, centered in the large square. The diagonals of the small square are drawn perpendicular to the sides of the large squares. Lines from each apex of the small square projected to the right side of the large square represent the electrical leads.

> **NOTE —** This symbol is not ANSI approved at this time. It has been submitted to the ANSI Y 32 Committee on Graphic Symbols for their consideration and approval.

4 Specifications

Terminology used in this document is defined in ISA-S37.1. An *asterisk* appears beside terms defined in S37.1. A double asterisk appears beside additional terms considered applicable to strain gage pressure transducers that are defined in 4.3 of this document.

4.1 Design characteristics

4.1.1 Required mechanical design characteristics

The following mechanical design characteristics shall be listed.

4.1.1.1 Type of pressure sensed

a) Absolute Pressure*
b) Differential Pressure, Unidirectional*
c) Differential Pressure, Bidirectional*
d) Differential Pressure, Sealed Reference**
e) Gage Pressure*

*Defined in ISA-S37.1
**Defined in 4.3

NOTES

1. At present, no provision is made by the SI system of units for abbreviations following the pressure units to indicate the type of pressure, as is done in the U.S. customary system of units; e.g., psia for absolute pressure in psi. In the interim it is recommended that for the SI system, the type of pressure be indicated in this manner: " . . . An absolute pressure of ________Pa." " . . . A differential pressure range of ________ kPa," etc.

2. For differential pressure transducers, the allowable range of reference pressures shall be listed; e.g., "0 to 1MPa" or "0 to 100 psi."

4.1.1.2 Measured fluids*

The fluids in contact with pressure port(s) shall be listed; e.g., nitric acid, liquid oxygen. Requirements for and limitations on the *isolating element* (if used) shall be listed.

4.1.1.3 Materials in contact with the measured fluid

The materials in contact with the measured fluid shall be listed.

NOTE — For differential pressure transducers, materials in both ports must be considered.

4.1.1.4 Configuration and dimensions

The outline drawing shall show the configuration with dimensions in millimeters (inches). Unless pressure and electrical connections are specified (reference 4.1.1.5 and 4.1.3.4), the outline shall include limiting maximum dimensions for these connections.

4.1.1.5 Pressure connection

The pressure connection(s) shall be indicated on the outline drawing. For threaded fittings, specify: Applicable Military or Industry standards or nominal size, number of threads per millimeter (threads per inch), thread series, and thread class. For hose tube fitting, specify tube size.

4.1.1.6 Mountings and mounting dimensions

Unless the pressure connection serves as a mounting, the outline drawing shall indicate the method of mounting with hole size, centers, and other pertinent dimensions in millimeters (inches), including thread specifications for threaded holes, if used.

4.1.1.7 Mounting effects

The maximum mounting force or torque shall be specified if it will tend to affect transducer performance (reference 4.2.28).

4.1.1.8 Mass

The mass of the transducer shall be specified in grams (ounces).

*Defined in ISA-S37.1

4.1.1.9 Case sealing

If case sealing is necessary, the mechanism and materials used for sealing should be described. The same requirement applies to the electrical connector. The resistance of the sealing materials to cleaning solvents and commonly used measured fluids should be stated.

4.1.1.10 Identification

The following characteristics shall be permanently inscribed on the outside of the transducer case or on a suitable nameplate permanently attached to the case.

a) Nomenclature of transducer (according to ISA-S37.1, Section 3)

b) Name of Manufacturer, (Part number to reflect one controlled configuration), and Serial Number

c) Range* in Pa (psi) and designation of type of pressure (See 4.1.1.1.)

   Maximum excitation*

d) Identification of Measured and Reference Ports* (for differential pressure transducers)

   Reference Pressure Range* (for differential pressure transducers)

e) Identification of Electrical Connections

f) Schematic of Electrical Connections

g) Nominal Bridge Resistance

h) Inscription of the following characteristics is optional:

   1) Sensitivity

   2) Customer Specification or Part Number, or Both

   3) Type of Electrical Connector (if applicable)

   4) Maximum Excitation

   5) Maximum Reference Pressure

   6) Maximum and Minimum Operating Temperature

4.1.1.11 Maximum and minimum operating and fluid temperature*

The maximum and minimum temperature of fluids or environments that can be applied to the transducer and that will not cause permanent calibration shift shall be listed.

4.1.2 Supplemental mechanical design characteristics

Listing of the following mechanical design characteristics is optional.

*Defined in ISA-S37.1

4.1.2.1 Case material

4.1.2.2 Pressure sensing element

a) Diaphragm, flat or corrugated

b) Capsule

c) Bellows

d) Straight Tube

e) Bourdon Tube, plain, spiral, helical, or twisted

f) Liquid-Filled Configuration (Liquid shall be specified.)

4.1.2.3 Type of strain gage used

a) Metallic; bonded or unbonded, wire or foil, deposited thin film

b) Semiconductor; bonded, unbonded, or diffused

4.1.2.4 Location of strain gage

a) Mounted directly on pressure sensing element

b) Mounted on auxiliary member, and activated by pressure sensing element

4.1.2.5 Number of active strain gage elements

a) One

b) Two-arm Bridge

c) Four-arm Bridge

4.1.2.6 Dead volume*

For non-flush mounted transducers, the dead volume shall be given in cubic millimeters (cubic inches). For differential pressure transducers, the volume of both cavities should be listed.

4.1.2.7 Volume change due to full scale pressure

The change in volume of the sensing element due to application of full scale pressure shall be given in cubic millimeters (cubic inches).

4.1.3 Basic electrical design characteristics

The following electrical design characteristics shall be listed. They are applicable at "room conditions" according to the definition given in ISA-S37.1.

4.1.3.1 Excitation *

Expressed as " ________ volts dc" or " ________ volts rms at ________ Hz." (Preferred values are 5, 10, 20, and 28 volts) or " ________ mA dc" or "________ mA rms at ________ Hz."

*Defined in ISA-S37.1

4.1.3.2 Maximum excitation *

Expressed as " ________ volts dc" or " ________ volts rms at ________ Hz" or " ________ mA dc" or " ________ mA rms at ________Hz."

4.1.3.3 Input impedance*

Expressed as " ________ ± ________ ohms at ________ ± ________ Hz." If impedance is resistive, indicate this.

> **NOTE —** Output "open-circuit" for this measurement.

4.1.3.4 Output Impedance*

Expressed as " ________ ± ________ohms at ________ ± ________ Hz." If impedance is resistive, indicate this.

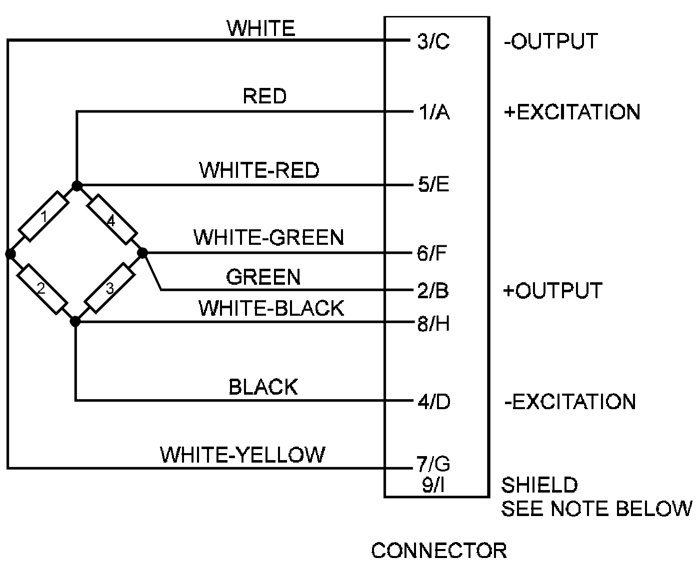
> **NOTE —** If excitation terminals are "short-circuit" for this measurement, this should be indicated.

4.1.3.5 Load impedance*

Performance characteristics values apply only for load impedance values of ________ ohms, minimum or ________ ± ________ ohms.

4.1.3.6 Electrical connections

Whether the electrical termination is by means of a connector or a cable, the pin designations or wire color code shall conform to the following transducer wiring standard promulgated by the Western Regional Strain Gage Committee, as approved September 18, 1957, and revised May 6, 1960.



*Defined in ISA-S37.1

NOTES

1) The output polarities indicated on the above wiring diagram apply when an increasing absolute pressure is applied to the pressure port (sensing end) of an absolute pressure transducer. For differential and gage pressure transducers, the indicated polarities apply when the absolute pressure at measurand port is greater than the absolute pressure at the reference pressure port.

2) The measurand (pressure) port of differential pressure transducers shall be marked "+" or optionally "high" or "meas.," while the reference (pressure) port shall be marked "–" or optionally "low" or "ref."

3) The bridge elements shall be arranged so that functions producing positive output will cause increasing resistance in arms 1 and 3 of the bridge.

4) For shielded transducers, pins 5, 7, and 9 shall be shield terminals for 4, 6, and 8 wire systems respectively.

5) Position of any internal compensation network should be indicated.

4.1.3.7 Insulation resistance*

Expressed as " ________ megohms at ________ volts dc between all terminals in parallel and the transducer case, at a temperature of ________ ± ________°C(°F)."

4.1.4 Supplemental electrical design characteristics

Listing of the following electrical design characteristic is optional.

4.1.4.1 Shunt calibration resistor

Expressed as " ________ ohms for ________% of full scale output." See 4.3.

NOTE — The terminals across which this resistor is to be placed shall be specified, if the resistor is used.

4.2 Performance characteristics

The pertinent performance characteristics of strain gage pressure transducers should be tabulated in the order shown. Unless otherwise specified, they apply at "room conditions" as defined in ISA-S37.1; Temperature: 25 ± 10°C (77 ± 18°F); Relative Humidity: 90% maximum; Barometric Pressure: 73 ± 7 cm of Hg (29 ± 3 inches of Hg) and after an adequate warm-up period (see 4.2.13).

Terminology used here is defined in either ISA-S37.1 or 4.3 of this document. An asterisk appears beside the paragraph number of those terms defined in S37.1.

4.2.1 Range*

Usually expressed as " ________ to ________ Pa (psia, psig)" or " ± ________ Pa (psid)" or "zero to ________ Pa (psid.)"

NOTE — Equivalent pressure units in the SI system are expressed in Pascals.

*Defined in S37.1

1 psi = 6894.8 Pa

10kPa = 1.4504 psi

4.2.2 End points*

Expressed as " ________ ± ________ mV and ________ ± ________ mV at ________ volts (milliamps) excitation."

4.2.3 Full-scale output *

Expressed as "________ ± ________mV per volt (milliamp) excitation into specified load impedance" or " ________ ± ________mV at ________ volts (milliamp) excitation into specified load impedance."

> **NOTE —** If 4.2.2 and 4.2.3 are used to specify performance characteristics, the tolerance in 4.2.3 may be omitted.

Alternately, the following may be specified (4.2.3 - 4.2.6):

Full-scale output is expressed with tolerance (see 4.2.3 note).

4.2.4 Zero measurand output*

Expressed as "________ ± ________ mV."

4.2.5 Zero shift*

Expressed as "± ________% of full scale output over a period of ________ minutes (hours, days, etc.)"

4.2.6 Sensitivity shift*

Expressed as "± ________% over a period of ________ minutes (hours, days, etc.)"

4.2.7 Linearity*

Expressed as "________ linearity within ± ________% of full scale output."

> **NOTE —** The type of linearity specified shall be one of the types defined in ISA-S37.1; namely, end point, independent, least squares, terminal, or theoretical slope.

4.2.8 Hysteresis*

Expressed as " ________ % of full scale output." Alternately, 4.2.7 and 4.2.8 may be combined as follows.

4.2.9 Hysteresis and Linearity

Expressed as "combined hysteresis and ________ linearity within ± ________% of full scale output."

> **NOTE —** The type of linearity shall be stated.

*Defined in ISA-S37.1

4.2.10 Repeatability*

Expressed as "within ________ % of full scale output over a period of ________ minutes (hours, days, months)." Alternately, 4.2.7, 4.2.8, and 4.2.10 may be combined as follows.

4.2.11 Static error band*

Expressed as "± ________% of full scale output as referred to ________ ."

> **NOTE —** The type of reference line or curve shall be stated. When an end point line is specified, the tolerances for the end points should be stated separately. When a "best straight" or terminal line or theoretical slope is specified, the static error band should also include the zero measurand output, zero shift, and sensitivity shift.

4.2.12 Creep*

Expressed as "________ minutes for subsequent shifts in output not to exceed ________% of full scale output."

4.2.13 Warm-up period*

Expressed as "________ minutes for subsequent shifts in sensitivity and zero balance not to exceed ________% of full scale output."

4.2.14 Reference pressure effect*

Expressed as "change in zero balance not to exceed ________% of full scale for a reference pressure change of ________ Pa (psi). Sensitivity change shall not exceed ________% of full scale for a reference pressure change of ________ Pa (psi)." Alternately expressed as "operation at reference pressures from ________ Pa (psia) to ________ Pa (psia) not to cause output readings that will exceed the specified error band."

4.2.15 Frequency response* (amplitude)

Expressed as "within ± ________% from zero to ________ Hz."

> **NOTE —** Frequency response should be referred to a frequency within the specified frequency range, preferably zero, and to a specific measurand value. Mounting conditions and measured fluid should be specified.

4.2.16 Phase shift

Expressed as either "phase shift linear within ± ________% from zero to ________ Hz, reaching ________ degrees at ________ Hz" or "phase shift less than ________ degrees between zero and ________ Hz."

Alternately 4.2.15 and 4.2.16 may be replaced by the following.

4.2.17 Resonant frequency*

Expressed in "hertz" or "kilohertz."

> **NOTE —** If a number of resonances exist, all frequencies should be listed. The lowest resonance frequency must be listed.

*Defined in ISA-S37.1

4.2.18 Damping ratio*

Expressed as " ________% of critical damping."

> **NOTE —** For any other than a second order single-degree-of-freedom system, damping ratio is not defined; and ringing period, rise time, and overshoot should be stated.

4.2.19 Ringing period*

Expressed as " ________milliseconds."

4.2.20 Overshoot*

Expressed as " ________% of applied pressure."

For transducers with relatively high damping and little overshoot, 4.2.17, 4.2.18, 4.2.19, and 4.2.20 may be replaced by 4.2.21.

4.2.21 Rise time*

Expressed as " ________ milliseconds (microseconds) for response to rise from 10% to 90% for an applied pressure step function of ________ Pa (psi)."

> **NOTE —** Existing test equipment generates ramp functions rather than step functions. Care must be taken to ensure that the rise time of the generated ramp function is one-third or less of the anticipated rise time of the transducer under test.

4.2.22 Proof pressure*

Expressed as "application of ________% of full scale for ________minutes will not cause changes in transducer performance beyond the specified tolerances."

4.2.23 Burst pressure rating*

Expressed as " ________ Pa (psia, psig) (or psid) applied ________ times for a period of ________ minutes each to ________." (Sensing element or case; specify.)

4.2.24 Operating temperature range

Expressed, as "temperatures from ________°C(°F) to ________°C(°F) will not cause thermal sensitivity shift of more than ________% or thermal zero shift of more than ________% of full scale."

Or, alternately, the following may be specified.

4.2.25 Thermal sensitivity shift*

Expressed as " ________% per °C(°F) temperature change over a temperature range from ________°C(°F) to ________ °C(°F)."

4.2.26 Thermal zero shift*

Expressed as " ________% of full scale output per °C(°F) temperature change over a temperature range from ________°C(°F) to ________°C(°F)."

Alternately, 4.2.24, 4.2.25, or 4.2.26 may be specified by the following.

*Defined in ISA-S37.1

4.2.27 Temperature error*

Expressed as " ________% full scale output at ________ Pa (psi) for a temperature change from ________°C(°F) to ________°C(°F)."

4.2.28 Temperature error band*

Expressed as "within ± ________% of full scale output from the straight line establishing static error band, over temperature range from ________°C(°F) to ________°C(°F)."

4.2.29 Temperature gradient error*

Expressed as "less than ± ________% of full scale output during a period of ________ minutes while subjected to a step function temperature change from ________°C(°F) to ________°C(°F), applied to ________ (specify particular part) of the transducer."

4.2.30 Acceleration error*

Expressed as "less than ± ________% of full scale output per g along ________ axis at steady acceleration level of ________ g."

> **NOTE —** The error should be listed for each of the three axes or for the axis with the largest error.

Alternately 4.2.30 may be replaced by 4.2.31.

4.2.31 Acceleration error band*

Expressed as "within ± ________% of full scale output for steady accelerations up to ________ g along ________ axis." See 4.2.30 note.

4.2.32 Vibration error*

Expressed as "less than ± ________% of full scale output per g along ________ axis at vibration level of ________ g peak over a frequency range from ________ Hz to ________ Hz."

> **NOTE —** The error should be listed either for each of the three axes or for the axis with the largest error.

Alternately 4.2.32 may be replaced by 4.2.33.

4.2.33 Vibration error band*

Expressed as "within ± ________% of full scale output for vibration level of ________ g peak over a frequency range from ________ Hz to ________ Hz along ________ axis." See 4.2.32 note.

4.2.34 Life, cycling*

Expressed as " ________ full scale output pressure cycles (applied at a rate of ________ Hz) over which the transducer shall operate without change in characteristics beyond their specified tolerances."

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*Defined in ISA-S37.1

4.2.35 Mounting error*

Expressed as "within ± ________% of full scale output," or, "within the static error band," under specified conditions of mounting force or torque.

4.2.36 Other environmental conditions

Other pertinent environmental conditions that shall not change transducer performance beyond specified limits should be listed; examples follow:

a) Shock – Triaxial

b) High-Level Acoustic Excitation

c) Humidity

d) Salt Atmosphere

e) Nuclear Radiation

f) Magnetic Fields

g) Solar (or other) Heat Radiation

h) Sand and Dust

i) Altitude

j) Temperature Shock

4.2.37 Storage life

Expressed as "Transducer can be exposed to Specified Environmental Storage Condition for ________days (months, years) without changing the following performance characteristics beyond their specified tolerances."

> **NOTE —** Environmental storage conditions shall be described in detail. Pertinent performance characteristics (examples: sensitivity, zero shift) shall be specified.

4.3 Additional terminology

4.3.1 phase shift: the amount of time by which the output of a transducer lags a sinusoidally varying measurand.

> **NOTE —** Expressed as fraction of a cycle of the frequency, usually in degrees.

4.3.2 sealed reference differential pressure transducer: transducer which measures pressure difference between unknown pressure and pressure of fluid in an integral sealed reference chamber.

4.3.3 shunt calibration resistor: a shunt resistor which, when placed across a specified element of the electrical circuit of the transducer, will electrically simulate a specified percentage of the transducer full scale output at room conditions.

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*Defined in ISA-S37.1

4.4 Tabulated characteristics versus test requirements

This table is intended for use as a quick reference for design and performance characteristics and for tests of their proper verification as contained in this Standard.

		Design Characteristic		Verified During	
Characteristic	Paragraph	Basic	Supplemental	Individual Acceptance Test	Qualification Test
Type of Pressure Sensed	4.1.1.1	x		No Test	Special Test
Measured Fluids	4.1.1.2	x			
Materials in Contact with Measured Fluid	4.1.1.3		x		Special Test
Configuration, Dimensions, Mounting Pressure Connection	4.1.1.4 through 4.1.1.6	x		5.2.1	
Mounting Force or Torque	4.1.1.7	x			6.5
Weight	4.1.1.8	x			6.2
Case Sealing	4.1.1.9	x			5.2.1
Identification	4.1.1.10	x		5.2.1	
Case Material	4.1.2.1				5.2.1
Pressure Sensing Element	4.1.2.2		x		
Type of Strain Gage Used	4.1.2.3				5.2.1
Location of Strain Gage	4.1.2.4		x		5.2.1
Number of Active Strain Gage Elements	4.1.2.5		x		
Dead Volume	4.1.2.6		x		6.3
Volume Change Due to Full Scale Pressure	4.1.2.7		x		6.4
Maximum and Minimum Operation and Fluid Temperature	4.1.1.11	x	x		
Excitation	4.1.3.1	x		5.2.6	
Input Impedance	4.1.3.3	x		5.2.11	
Output Impedance	4.1.3.4	x		5.2.11	
Load Impedance	4.1.3.5				
Electrical Connections	4.1.3.6	x		5.2.10	
Insulation Resistance	4.1.3.7				
Shunt Calibration Resistor	4.1.4.1	x	5.2.4	5.2.5 (partially)	6.7
Range	4.2.1	x		5.2.3	
End Point	4.2.2	x		5.2.3	
Full-Scale Output	4.2.3	x		5.2.3	
Zero Measurand Output	4.2.4	x		5.2.3	
Zero Shift	4.2.5	x		5.2.4	
Sensitivity Shift	4.2.6	x		5.2.4	
Linearity	4.2.7	x		5.2.3	
Hysteresis	4.2.8	x		5.2.3	
Hysteresis and Linearity	4.2.9	x		5.2.3	
Repeatability	4.2.10	x		5.2.3	
Static Error Band	4.2.11	x		5.2.3	6.2
Creep	4.2.12	x		5.2.5	
Warm-up Period	4.2.13				5.2.6
Reference Pressure Error	4.2.14			5.2.7, 5.2.8	
Frequency Response (Amplitude)	4.2.15				6.6
Phase Shift	4.2.16				6.6
Resonant Frequency	4.2.17	x			6.6
Damping Ratio	4.2.18	x			6.6
Ringing Period	4.2.19	x			6.6

		Design Characteristic		Verified During	
Characteristic	**Paragraph**	**Basic**	**Supplemental**	**Individual Acceptance Test**	**Qualification Test**
Overshoot	4.2.20	x			6.6
Rise Time	4.2.21	x		5.2.9	
Proof Pressure	4.2.22	x			6.13
Burst Pressure Rating	4.2.23	x			6.7
Operating Temperature Range	4.2.24	x			6.7
Thermal Sensitivity Shift	4.2.25	x			6.7
Thermal Zero Shift	4.2.26	x			6.7
Temperature Error	4.2.27				
Temperature Error Band	4.2.28	x			6.7
Temperature Gradient Error	4.2.29				
Acceleration Error	4.2.30				6.8
Acceleration Error Band	4.2.31				6.8
Vibration Error	4.2.32	x			6.9
Vibration Error Band	4.2.33	x			6.9
Cycling Life	4.2.34				6.10
Mounting Error	4.2.35				6.5
Other Environmental Conditions	4.2.36				6.11
Storage Life	4.2.37				6.12

5 Individual acceptance tests and calibrations

5.1 Basic equipment necessary to perform individual acceptance tests and calibration of strain gage pressure transducers

The basic equipment for acceptance tests and calibrations consists of a source of pressure, a source of electrical excitation for the strain gages, and a device which measures the electrical output of the transducer. The combined errors or uncertainties of the calibration system comprising these three components should be sufficiently smaller than the permissible tolerance of the transducer performance characteristic under evaluation to result in meaningful values. (Department of Defense practice commonly uses a four-to-one ratio in calibration hierarchy.) The traceability to national standards for this measuring system should be well known.

5.1.1 Source of pressure

A pressure medium similar to the one which the transducer is intended to measure should be used for testing. The accuracy of the pressure source should be at least five times greater than the permissible tolerance of the transducer performance characteristic under evaluation. The range of the instrument supplying or monitoring the calibration pressure should be selected to provide the necessary accuracy to 125 percent of the full scale range of the transducer.

The source of calibration pressure may be either continuously variable over the range of the instrument or may be provided in discrete steps as long as the steps can be programmed in such a manner that the transition from one pressure to the next during calibration is accomplished without creating a hysteresis error in the measurement due to overshoot.

EXAMPLES OF PRESSURE SOURCES / MONITORING EQUIPMENT

MERCURY MANOMETER (Pressure Indicating Device)

Typical ranges

100 kPa (about 30 in. Hg)	Accuracy ± 0.02% Full Scale
200 kPa (about 60 in. Hg)	Accuracy ± 0.02% Full Scale
340 kPa (about 100 in. Hg)	Accuracy ± 0.01% Full Scale

AIR PISTON (Pressure Source)

Typical ranges

About 2 to 10 kPa (0.3 to 1.5 psi)	Accuracy ± 0.15% of Reading
About 10 to 350 kPa (1.5 to 50 psi)	Accuracy ± 0.015% of Reading
About 100 kPa to 1 MPa (15 to 150 psi)	Accuracy ± 0.025% of Reading
About 100 kPa to 3.5 MPa (1 to 500 psi)	Accuracy ± 0.025% of Reading

PRECISION DIAL GAGE (Pressure Indicating Device)

Typical ranges

0 to 30 kPa (about 0 to 120 H_2O)	Accuracy ± 0.1% Full Scale
0 to 100 kPa (about 0 to 30 in. Hg)	Accuracy ± 0.1% Full Scale
0 to 100 kPa (about 0 to 100 psi)	Accuracy ± 0.1% Full Scale
0 to 700 MPa (about 0 to 10,000 psi)	Accuracy ± 0.1% Full Scale

NOTE — Pressure indicating devices generally require a supply of dry gas; e.g., dehumidified air, or nitrogen, or helium, required for reasons of safety.

OIL PISTON GAGE (Pressure Source)

Typical ranges

About 40 kPa to 30 MPa (6 to 4000 psi)	Accuracy ± 0.01% of Reading
About 400 kPa to 300 MPa (60 to 40,000 psi)	Accuracy ± 0.01% of Reading
About 14 MPa to 700 MPa (2000 to 100,000 psi)	Error in Piston Area Less Than ± 0.009%
About 30 MPa to 1400 MPa (4000 to 200,000 psi)	Error in Piston Area Less Than ± 0.012%

5.1.2 Stable source of excitation of accurately known amplitude

Commonly used sources of dc excitation are chemical batteries such as dry cells and storage batteries, or line-powered, electronically regulated, power supplies. A stable, low distortion, audio oscillator may be used to furnish ac excitation.

5.1.3 Read-out instrument

Examples of suitable devices are as follows.

MANUALLY BALANCED POTENTIOMETER

Typical ranges

0 to 0.01111 volt, ± (0.008% of reading + 0.5 microvolt)
0 to 0.1111 volt, ± (0.006% of reading + 1 microvolt)
0 to 1.111 volt, ± (0.004% of reading + 10 microvolts)
0 to 11.11 volts, ± (0.006% of reading + 100 microvolts)

SELF-BALANCING POTENTIOMETER

Typical ranges

0 to 6 millivolts, limit of error ± 0.3%
0 to 100 millivolts, limit of error ± 0.3%

DIGITAL ELECTRONIC VOLTMETER/RATIO METER

Typical accuracy

± 0.01% of reading + 1 digit (4 digits display)
± 0.005% of reading + 1 digit (5 digits display)

AC RMS DIFFERENTIAL METER

Typical accuracy

± 0.05% 10 Hz to 50 kHz
± 0.1% Hz to 10 kHz

NOTE — The input impedance of the readout instrument must comply with the value of load impedance specified. Unless otherwise stated, adjustments and compensation of the transducer apply with the specified load impedance across the output terminals.

5.2 Calibration and test procedures

Results obtained during the calibration and test procedures should be recorded on data sheets like the sample data sheet in Section 7. These procedures shall be performed under "room conditions" as defined in ISA-S37.1 unless otherwise indicated.

NOTE — The defining paragraph under Design Characteristics (4.1) and Performance Characteristics (4.2) is listed beside each of the parameters sought in the following paragraphs.

5.2.1 The transducer shall be inspected visually for mechanical defects, poor finish, and improper identification markings. The electrical connector shall also be inspected.

5.2.2 The transducer shall be connected to the pressure source and secured with the recommended force or torque. The excitation source and readout instrument shall also be connected to the transducer and turned on. Adequate warm-up time for test equipment shall be allowed before tests are conducted. The pressure source, connecting tubing, and transducer system shall have passed a prior test for leaks, which would cause calibration errors.

5.2.3 Two or more complete calibration cycles shall be run consecutively. At least eleven data points shall be obtained per cycle using both ascending and descending directions. Excitation amplitude shall be monitored as required. (Time duration of calibration cycle to be stated.)

From the data obtained during these tests, the following characteristics should be determined:

a) End points	4.2.2
b) Full-scale output	4.2.3
c) Zero measured output	4.2.4
d) Linearity	4.2.7
e) Hysteresis	4.2.8
f) Hysteresis and linearity	4.2.9
g) Repeatability	4.2.10
h) Static error band	4.2.11

5.2.4 Repeated calibration cycles over a specified period of time should establish the following characteristics for this period of time:

a) Zero shift	4.2.5
b) Sensitivity shift	4.2.6

NOTE — These tests may be abbreviated cycles with fewer data points than required in 5.2.3.

5.2.5 Application of full scale pressure to the transducer during a specified short period of time and measurement of changes in output at constant excitation during this time should establish

a) Creep	4.2.12

NOTE — Rate of change of pressure should be as high as possible without resonant excitation of transducer.

5.2.6 By measuring zero balance and sensitivity over a period of time (one hour should suffice), starting with the application of excitation to the transducer, the following characteristic should be determined:

a) Warm-up period	4.2.13

NOTE — It is desirable to test for these effects separately establishing the warm-up change of zero balance first.

5.2.7 From the application of the same pressure to both sides of the transducer sensing element over a range of pressures up to the maximum expected reference pressure and subsequent calibration cycles, the following should be established:

a) Reference pressure effect (zero measurand output)	4.2.14

NOTE — This test does not apply to absolute or fixed reference pressure transducers.

5.2.8 Application of the maximum expected reference pressure, only to the low port of a differential pressure transducer, and a pressure equal to the sum of the maximum expected reference pressure and the full scale pressure to the high port shall establish

a) Reference pressure effect (sensitivity)	4.2.14

NOTE — Reference pressure effect on zero balance must be taken into account.

5.2.9 After application of the specified proof pressure a specified number of times, and in the specified direction for differential pressure transducers, at least one complete calibration cycle shall be performed to establish that the performance characteristics of the transducer are still within specifications.

a) Proof pressure	4.2.22

5.2.10 Measure the insulation resistance between all terminals, or leads connected in parallel, and the case of the transducer, with a megohm meter or similar acceptable device, using a potential of 50 volts dc, unless otherwise specified. The temperature at which the insulation resistance is measured shall be specified.

a) Insulation resistance	4.1.3.7

5.2.11 A wheatstone bridge (for dc) or impedance bridge shall be used to measure

a) Input impedance	4.1.3.3
b) Output impedance	4.1.3.4

6 Qualification test procedures

Qualification tests shall be performed as applicable using the test forms for Section 7 as required. Upon completion of all testing, the form of Figure 6 shall be used to summarize all testing.

6.1 Initial performance tests (Figure 1)

Following a thorough inspection of the transducers, the tests and procedures of Section 5 shall be run to establish reference performance during increasing (and decreasing) steps of 0, 20, 40, 60, 80, and 100 percent of range as a minimum (percent of span for bidirectional transducers).

6.2 Weight test

The transducer shall be weighed on an appropriate balance or scale. The following shall be established:

a) Weight 4.1.1.8

6.3 Dead volume test (Figure 6)

The pressure cavity shall be filled (both cavities for a differential transducer) with a measurable, non-corrosive fluid (under a vacuum if necessary), and the contents poured into a graduate. The following shall be established:

a) Dead volume 4.1.2.6

6.4 Volume change test (Figure 6)

A fluid pressure system shall be connected to the transducer, a parallel pressure gage, and a graduated reservoir. (Provisions shall be made for isolating the transducer when filled.) The pressure system shall be evacuated and filled with fluid, the valve to the transducer closed, the valve opened and the following shall be determined:

a) Volume change due to full scale pressure 4.1.2.7

6.5 Mounting test

The mounting of the actual installation shall be duplicated as closely as possible following specific instructions and one calibration run performed. The following shall be established:

a) Mounting error 4.2.35

b) Mounting force or torque 4.1.1.7

6.6 Dynamic response test

The dynamic response characteristics of pressure transducers may be established either with transient-stimulation devices, or with sinusoidal pressure generators.

6.6.1 Transient excitation method

A positive step-function of pressure may be generated in gases with a shock-tube or a quick-opening valve. A hydraulic quick-opening valve is used to generate a positive pressure step function in a liquid medium. A burst diaphragm generator produces a negative pressure step in a gas medium. In all cases, the rise time of the generated step function shall be sufficiently short to shock-excite all resonances in the transducer under test. It shall also be one-third or less of the anticipated rise time of the transducer under test.

Since the tubing used to mechanically connect the transducer to the test setup will drastically affect the dynamic characteristics, it is recommended that the shortest possible tubing be installed, and that its length and diameter be stated along with the test results. Alternately the tubing used shall duplicate as closely as possible the actual installation, if this condition were specified instead of the characteristics of the transducer alone.

By applying step functions of pressure at room conditions within the full scale range of the transducer, and analyzing the electronic or electro-optical recording of the transducer output, the following can be determined: (see appropriate notes).

a) Frequency response amplitude	4.2.15
b) Phase shift	4.2.16
c) Resonant frequency	4.2.17
d) Damping ratio	4.2.18
e) Ringing period	4.2.19
f) Overshoot	4.2.20
g) Rise time	4.2.21

6.6.2 Sinusoidal stimulation method

Generators are now available that produce sinusoidal pressures in liquids or gases. They are generally limited to frequencies below several kilohertz and peak dynamic pressures below 10 MPa (roughly 1500 psi). These devices operate either on a piston-phone principle (such as the system used for the calibration of microphones) or by modulating fluid flow through an orifice (as exemplified by a siren).

By applying a sinusoidal pressure waveform of varying frequency and of constant and specified amplitude, the following can be obtained directly:

a) Frequency response (amplitude)	4.2.15
b) Phase shift	4.2.16

If within the frequency range covered, the following can be established from the frequency response:

a) Resonant frequency or resonances	4.2.17
b) Damping ratio	4.2.18

6.7 Temperature tests

6.7.1 Steady state temperature test

The transducer shall be placed in a suitable temperature chamber. After allowing adequate stabilization time at a specified temperature, one or more calibration cycles shall be performed. This procedure shall be repeated at an adequate number of temperatures within the operating temperature range of the transducer, but at least at upper and lower limits of the operating temperature range. These tests should establish the following characteristics:

a) Thermal sensitivity shift 4.2.25

b) Thermal zero shift 4.2.26

c) Temperature error 4.2.27

d) Temperature error band 4.2.28

These tests will also establish

a) Operating temperature range 4.2.24

6.7.2 Thermal Transient Test

For a flush-mounted pressure transducer, only the sensing end of the transducer is inserted rapidly from "room conditions" into a measurand fluid, which is maintained at a specified temperature above or below "room conditions." And at "room" pressure the output shall be observed over a specified period of time starting from the moment of insertion.

For a cavity-type pressure transducer, fluid at a specified temperature above or below "room conditions" may be applied rapidly through the pressure port to the sensing element. The output shall be observed over the specified period of time.

NOTE — The type of fluid shall be specified.

These tests should establish

a) Temperature gradient error 4.2.29

6.8 Acceleration test

Place the transducer on a centrifuge, apply specified acceleration along specified axes and measure changes in output. The following should be established:

a) Acceleration error 4.2.30

b) Alternately, acceleration error band 4.2.31

6.9 Vibration test

Vibrate the transducer along specified axes at desired acceleration amplitudes, and over the specified frequency range with an electromagnetic or hydraulic shaker, and observe or record the transducer output by means of oscilloscopes or high speed recorders. The following should be established:

a) Vibration error 4.2.32

b) Alternately, vibration error band 4.2.33

6.10 Life test

After applying the specified number of full range excursions of measurand, at least one complete calibration cycle shall be performed to establish minimum value of

a) Cycling life 4.2.34

6.11 Effects of other environments

Expose transducer to other specified environmental conditions followed in each case by at least one complete calibration cycle to test ability of transducer to perform satisfactorily after each exposure (see 4.2.36).

NOTE — In some cases, calibrations may be performed while transducer is subjected to the environment.

6.12 Storage life test

After storing the transducer under specified conditions (temperature, humidity, etc.) for the specified period of time, at least one complete calibration cycle shall be performed to establish

a) Storage life 4.2.37

6.13 Burst pressure test

The transducer shall be connected to a suitable test setup with adequate protection for equipment and personnel. The pressure shall be increased to the specified number of times and durations. The following shall be established:

a) Burst pressure rating 4.2.23

NOTE — If specified, burst pressure may also be applied to the inside of the case by first puncturing the sensing element.

7 Test report forms

7.1 The test report forms listed are recommended for use during the testing of strain gage pressure transducers.

7.2 When using the forms, all pertinent information shall be inserted in its proper place. On some forms, blank space has been provided for additional tests. Where the test is prolonged, more than one form may be required.

7.3 Individual acceptance tests and calibrations (Figure 1) used during acceptance testing of Section 5 may also be used for initial performance tests of 6.1.

Vendor's Part No.	STRAIN GAGE PRESSURE TRANSDUCER INDIVIDUAL ACCEPTANCE TESTS & CALIBRATIONS	Customer's Part No.
Test Facility		Serial No.
Ambient Conditions Temperature ______ °C (°F) Pressure ______ mm Hg Humidity ______ %	☐ Functional Test ☐ ______ Proof Cycle ☐ ______ Test ☐ Calibration	Vendor Range ______ TO ______ Pa (psi) ______

1. Visual: Mechanical ☐ Finish ☐ Nameplate ☐ Electr. Conn ☐
2. Electrical: Input Impedance ______ ohms, Output Impedance ______ ohms, Ins Res. ______ M Ω at ______ V dc
3. Calibration and Proof Pressure Test at ______ V at ______ Hz Excitation, after ______ minutes warm-up time
4. Load Impedance ______ ohms or ______ mA Excitation

Pressure Pa (psi)	Theoretical Output (mV)	Output (mV) - Run 1 Test Time: Minutes		Output (mV) - Run 2 Test Time: Minutes		Overload Output (mV)	Output (mV) - Run 3 Test Time: Minutes		Maximum Error (mV)	
		Increase	Decrease	Increase	Decrease		Increase	Decrease	+ –	–
						not applicable				
Proof Rev.		not applicable				- - - -		not applicable		

STATIC ERROR BAND: + ______ %, – ______ % FSO (Allowed: ± ______ %FSO),

Referred to ______________________________

______________________________ Linearity

______ LINEARITY: + ______ , – ______ %FSO (Allowed: ______ %FSO)

HYSTERESIS: ______ % FSO (Allowed: ______ % FSO) REPEATABILITY: ______ % FSO (Allowed: ______ %FSO)

ZERO-MEASURAND OUTPUT: ______ %FSO (Allowed ______ %FSO) CREEP: ______ % FSO over ______ minutes (Allowed: ______ %FSO)

ZERO SHIFT: ______ % FSO over a period of ______ (number) ______ (units) (Allowed: ______ %FSO)

SENSITIVITY SHIFT: ______ % over a period of ______ (number) ______ (units) (Allowed: ______ %FSO)

END POINTS: ______ and ______ mV (All'd: ______ and ______ mV) BI-DIR, ONLY: ZERO-PSI PT. ______ mV (All'd. ______ mV)

FULL SCALE OUTPUT (Run 2): ______ mV (Allowed: ______ mV) PROOF PRESSURE (after Run 2): ______ % Range for ______ minutes

△P Only: REFERENCE PRESSURE (during Run 2 and Proof Pressure Test) : ______ (Pa) psia; ZERO-OUTPUT (after Proof Pressure Test) ______ mV)

△P Only: REVERSE △P (after Proof Pressure ______ % Range for ______ Minutes, ZERO-OUTPUT: ______ mV)

Equipment Used:	Defects noted or Comments

BY: ______ DATE: ______ APPROVED BY: ______

Note:

Figure 1 — Strain Gage Pressure Transducer Individual Acceptance Tests & Calibrations

a) Environmental test record (Figure 2) used to record temperature, maximum temperature, life and other environmental tests.

VENDOR'S PART NO.	TEST FACILITY	CUSTOMER'S PART NO.
VENDOR	**STRAIN GAGE PRESSURE TRANSDUCER**	SERIAL NO.
REPORT NO.	**ENVIRONMENTAL TEST RECORD**	CUSTOMER
TYPE OF TEST		RANGE _____ TO _____ Pa (psi) _____

Excitation _____ volts at _____ Hz, or _____ mA Warmup Time _____ Minutes	☐ Before ☐ During ☐ After	Type of Environment _____ For temperature tests, temperature measured at _____	Level _____

Pressure	Theoretical	mV (Run 1)		mV (Run 2)		Overload	mV (Run 3)		Maximum Error mV	
Pa(psi)	(mV)	Increase	Decrease	Increase	Decrease	mV	Increase	Decrease	+	–
	(Pos. Proof)									
	(Neg. Proof)									

Error Band: + _____ % – _____ %FSO (Referred To _____) Allowed: ± _____ %FSO

Proof Pressure _____ % Rated Range for _____ Minutes

Ins. Resistance: _____ megohms At _____ Vdc

For Diff. Press. Transducers Only:

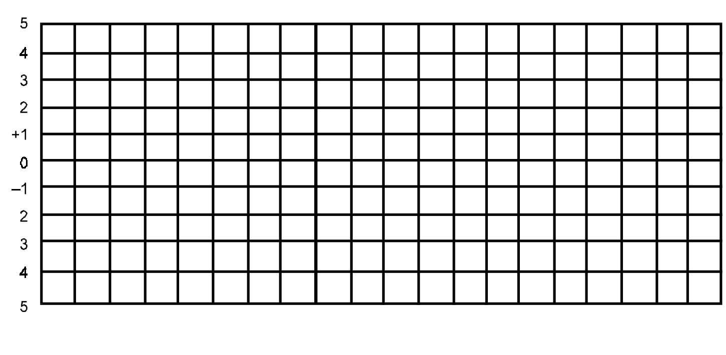
Neg. Proof Pressure _____ %Rated Range for _____ Minutes

Zero Shift: _____ %FSO

Sensitivity Shift: _____ %

Ref. Press., Run 2 : _____ Pa(psia)

Comments: _____



Tested By. _____ Date Test Started: _____ Date Test Finished: _____

Approved By: _____ Title:

Approved By: _____ Title:

Figure 2 — Strain Gage Pressure Transducer Environmental Test Record

b) Dynamic response tests (Figure 3 or Figure 4) used for recording test results of frequency response, resonant frequencies, damping ratio and ringing period. (Note—use 3 or 4 as applicable.)

Transducer Type	DYNAMIC RESPONSE TESTS OF STRAIN GAGE PRESSURE TRANSDUCER	Purchase Order No.
Range		Serial No.
Vendor & Model No.		Part No.

1. Visual Inspection:
   Mechanical: ________ Finish: ________ Nameplate: ________ Connections: ________

2. Electrical: Load Impedance ________ ohms
   Input Impedance: ________ ohms, Output Impedance: ________ ohms, Insulation Resistance ________ mΩ
   Excitation ________ volts or ________ mA at ________ Hz at ________ volts

3. Ambient Conditions: Temperature ________ °C(°F); Pressure ________ cm Hg; Humidity; ________ %

4. Dynamic Response
   Step Function Generator : ________ Shock Tube, Dry Air : ________
   Mounting Location: End : ________ Side: ________

Shock No.	Initial Pressure		Shock Velocity	Step Pressure	Pronounced Resonances, Hz			Ringing Period / Rise Time
	Hi	Low						

ATTACH OSCILLOSCOPE PHOTOGRAPHS OF TRANSDUCER RESPONSES

Amplitude Scale ________ **SHOCK 1** Time Scale ________	Amplitude Scale ________ **SHOCK 3** Time Scale ________
Amplitude Scale ________ **SHOCK 2** Time Scale ________	Amplitude Scale ________ **SHOCK 4** Time Scale ________

BY: ________ APPROVED: ________

Figure 3 — Dynamic Response Tests of Strain Gage Pressure Transducer

VENDOR'S PART NO.	TEST FACILITY	CUSTOMER'S PART NO.
VENDOR	**STRAIN GAGE PRESSURE TRANSDUCER**	SERIAL NO.
REPORT NO.	**DYNAMIC RESPONSE TESTS**	CUSTOMER
TYPE OF TEST	**(SINUSOIDAL METHOD)**	RANGE ______To________(Pa) psi ________

Ambient Conditions: Temperature ____________ °C(°F); Pressure ____________ cm Hg; ________________ Humidity ____________ %

Dynamic Response:

Excitation (volts or ma) ______________ at ____________ Hz; Load Impedance ________________________________ ohms

Sinusoidal Generator ______________________________ ; Test Fluid ________________________________

Mounting Configuration ____

Reference Transducer ____

Test Temperature ________ °C(°F); Quiescent Static Pressure ________________________ Pa(psi) ____________

Sinusoidal pressure ________ Pa(psi) peak; Port excited: ________________________________

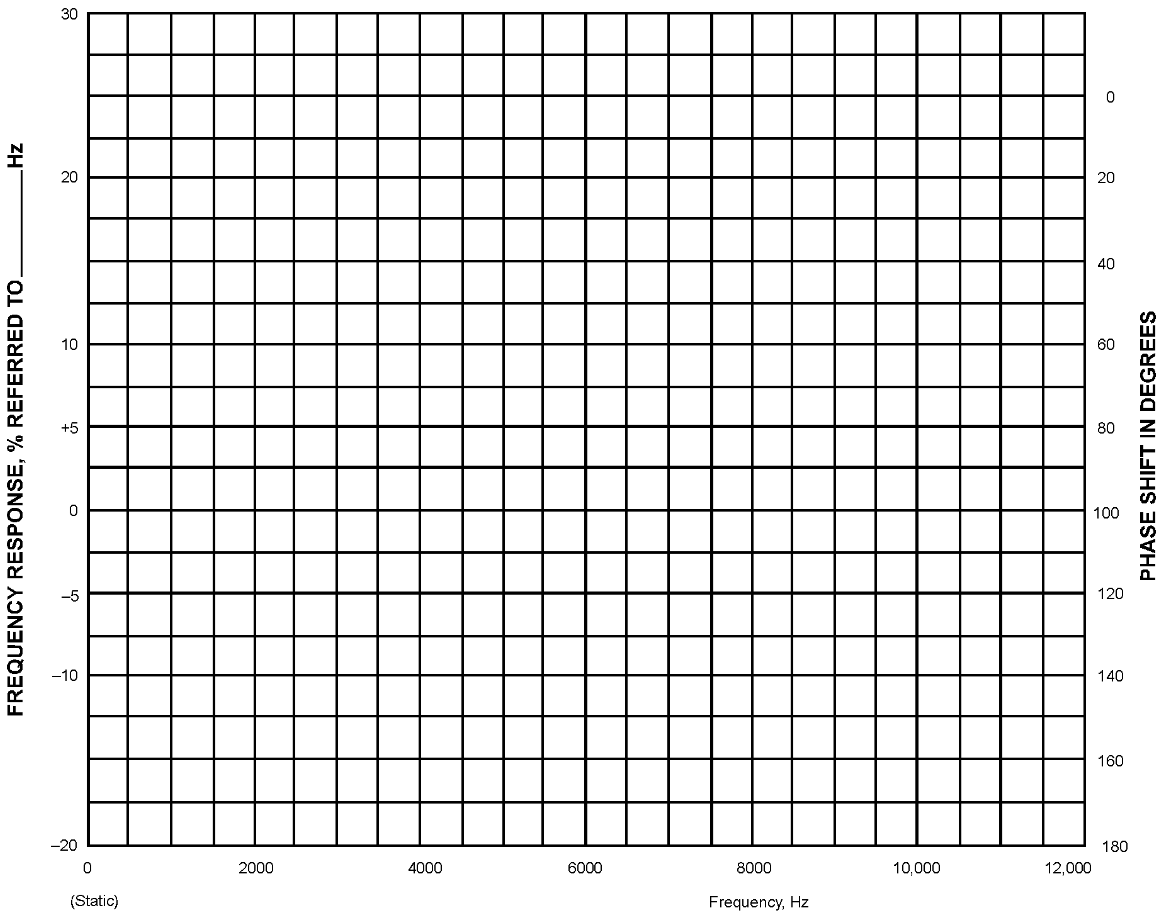


Figure 4 — Strain Gage Pressure Transducer Dynamic Response Tests (Sinusoidal Method)

c) Acceleration/vibration test record (Figure 5) used to record acceleration and vibration test results.

VENDOR'S PART NO.	TEST FACILITY	CUSTOMER'S PART NO.
VENDOR	**STRAIN GAGE PRESSURE TRANSDUCER**	SERIAL NO.
REPORT NO.	**ACCELERATION/VIBRATION TEST RECORD**	CUSTOMER
TYPE OF TEST		RANGE ______ TO ______ Pa (psi) ______

SKETCH OF TRANSDUCER SHOWING AXIS ORIENTATION:

ACCELERATION TEST

AXIS	+X	–X	+Y	–Y	+Z	–Z
Output Before Accel. mV						
Applied Accel. (G)						
Output During Accel. mV						
Accel. Error mV						

Excitation ______ V(mA) AT ______ Hz, Load Impedance ______ ohms

Comments

Pressure Level Used: ______ Pa(psi) ______

Max. Accel. Error: + ______, – ______ %FSO

Pre-Accel. Static Error Band: + ______, – ______ %FSO

Accel. Error Band: + ______, – ______ %FSO

(Allowed Accel. Error Band ± ______ %FSO

Tested By: ______ (Technician)

______ (Test Engineer)

Date: ______ Approved By: ______

Witnessed By: ______ (______)

Witnessed By: ______ (______)

VIBRATION TEST

AXIS	X			Y			Z		
Pressure Level Used	____ Pa(psi)			____ Pa(psi)			____ Pa(psi)		
Output Before Vib.	mV			mV			mV		
Vibration Error	Freq. (Hz)	Error		Freq. (Hz)	Error		Freq. (Hz)	Error	
		Pol.	mV		Pol.	mV		Pol.	mV

Max. Vib. Error: + ______ - ______ %FSO

Pre-Vib. Static Error Band: + ______, - ______ %FSO

Vib. Error Band: + ______, - ______ %FSO

(Allowed Vib. Error Band ± ______ %FSO)

Tested By: ______ (Technician)

______ (Test Engineer)

Date: ______ Approved By: ______

Witnessed By: ______ (______)

Witnessed By: ______ (______)

EXCITATION ______ V(mA) at ______ Hz

LOAD IMPEDANCE ______ OHMS

COMMENTS

Figure 5 — Strain Gage Pressure Transducer Acceleration/Vibration Test Record

d) Test summary (Figure 6) used to compile the results of all testing.

VENDOR'S PART NO.	TEST FACILITY	CUSTOMER'S PART NO.
VENDOR		SERIAL NO.
REPORT NO.	**TRANSDUCER TEST REPORT**	CUSTOMER
TYPE OF TEST	**STRAIN GAGE PRESSURE TRANSDUCER**	RANGE ______ TO __________ Pa(psi) ________

SUMMARY OF RESULTS:

☐ Error
☐ Error Band

Test	Tested Per Proced. No. or Test Waived Per	Par.No.	Pass	Fail					
				Error	Electr.	Mech.	See Comments	+ %FSO	–% FSO
Initial P.T. (Performance Test)									
Weight								____________	_________
Dead Volume								____________ Cu.	________
Vol. Change over Press. Range								____________ Cu.	________
Mounting									
Frequency Response								Flat (+__%): ____ To ____ Hz	
Phase Shift								deg. deg.	at Hz at Hz
Resonant Frequencies								Hz Hz	Hz Hz
Overshoot									
Time Constant								____ msec., ____ %Ovs.	
Low Temp. __________________ °C(°F)									
P.T. After Low Temp.									
High Temp. + __________________ °C (°F)									
Add'l. Temp. __________________ °C(°F)									
P.T. After High Temp.									
________________ g Vibration									
P.T. After ____________ g Vibration									
Acceleration									
P.T. After Accel.									
Thermal Gradient Error									
Life									
Burst Pressure									

Tested By: ________________________________ Date Test Started: ________________ Date Test Finished: ____________

Approved By: ________________________________ Approved By: ________________________________

Title: Title:

Figure 6 — Transducer Test Report Strain Gage Transducer Summary of Results

Annex A — References

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

B88.1-1971	A Guide for the Dynamic Calibration of Pressure Transducers, ASME August, 1972.
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ISA-S37.1-1982	Electrical Transducer Nomenclature and Terminology
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ISA Transducer Compendium, 2nd Edition, Part I, "Pressure, Flow and Level," Plenum Press, New York, 1969.

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