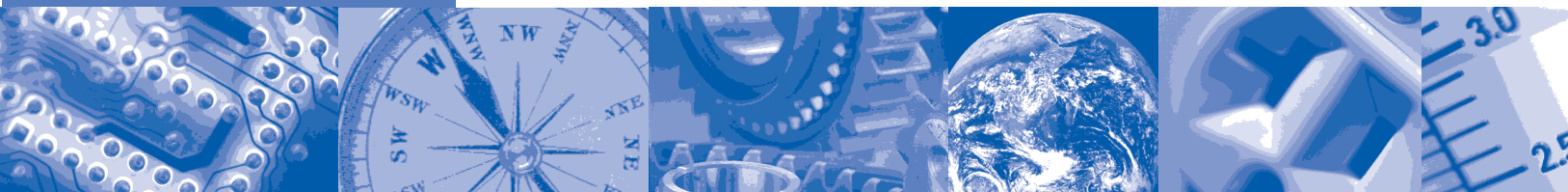


ISA-37.6-1982 (R1995)

Formerly ISA-S37.6-1982 (R1995)



Specifications and Tests for Potentiometric Pressure Transducers



ISA—The Instrumentation,
Systems, and
Automation Society

Reaffirmed 29 September 1995



Documents

Document Sharing Hub

ISA-37.6-1982 (R1995), Specifications and Tests for Potentiometric Pressure Transducers

ISBN 0-87664-380-2

Copyright © 1982 by the Instrument Society of America. All rights reserved. Printed in the United States of America. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), without the prior written permission of the publisher.

ISA
67 Alexander Drive
P.O. Box 12277
Research Triangle Park, North Carolina 27709

Preface

This preface, as well as all footnotes and annexes, is included for information purposes and is not part of ISA-37.6-1982 (R1995).

This standard has been prepared as a part of the service of ISA, the international society for measurement and control, toward the 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-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.

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 procedure and uniform data presentation.

The development of this Standard was initiated as the result of a survey conducted in December, 1960. A total of 240 questionnaires was sent out to transducer users and manufacturers. A strong majority indicated in their replies a need for transducer standardization. As potentiometric pressure transducers were one of the types shown to be most in need of standardization, a project subcommittee, SP37.6, Potentiometric Pressure Transducers, was formed under the cognizance of Committee SP37, Transducers for Aerospace Testing, and a standard was developed and published in 1967. Subsequently, the standard was reviewed extensively, and revised in 1974. The reviewers were selected from a broad cross-section of all industries and sciences in which transducers are applied for measuring purposes.

The following individuals served on the 1969 SP37 committee:

NAME	COMPANY
P. S. Lederer, Chairman	National Bureau of Standards
J. F. Mayo-Wells	National Bureau of Standards
R. R. Bouche	ENDEVCO
H. C. Chandon	Rosemount, Inc.
J. Hilten	National Bureau of Standards
H. N. Norton	Jet Propulsion Laboratory
J. J. Elengo	Revere Corporation of America
O. C. Ingebritsen	NASA/Langley Research Center
R. D. Bronson	Lockheed Electronics Company
J. Z. Inskeep	Jet Propulsion Laboratory

The following individuals served on the ISA Committee SP37, who reaffirmed ISA-S37.5 in 1995:

NAME	COMPANY
E. Iccayan, Chairman	Westinghouse Hanford Co.
J. Weiss	Electric Power Research Inst.
P. Bliss, Deceased	Consultant
M. Brigham	The Supply System
D. Hayes	LA Dept. Water & Power
M. Kopp	Validyne Corp.
C. Landis	Weed Fiber Optics
J. Miller	Rosemount Inc.
A. Mobley	3M Co.
J. Mock	Consultant
D. Norton	McDermott Energy Svces Inc.
H. Norton	Consultant
M. Tavares	Boeing Defense & Space Group
R. Whittier	Endevco
J. Wilson	Consultant

This standard was reaffirmed by the ISA Standards and Practices Board on September 29, 1995.

NAME	COMPANY
M. Widmeyer, Vice President	Washington Public Power Supply System
H. Baumann	H. D. Baumann & Associates, Inc.
D. Bishop	Chevron USA Production Company
P. Brett	Honeywell, Inc.
W. Calder III	Foxboro Company
H. Dammeyer	Phoenix Industries, Inc.
R. Dieck	Pratt & Whitney

NAME**COMPANY**

H. Hopkins	Utility Products of Arizona
A. Iverson	Lyondell Petrochemical Company
K. Lindner	Endress + Hauser GmbH + Company
T. McAviney	Metro Wastewater Reclamation District
A. McCauley, Jr.	Chagrin Valley Controls, Inc.
G. McFarland	Honeywell Industrial Automation and Controls
J. Mock	Consultant
E. Montgomery	Fluor Daniel, Inc.
D. Rapley	Rapley Engineering Services
R. Reimer	Allen-Bradley Company
R. Webb	Pacific Gas & Electric Company
W. Weidman	Consultant
J. Weiss	Electric Power Research Institute
J. Whetstone	National Institute of Standards & Technology
C. Williams	Eastman Kodak Company
G. Wood	Graeme Wood Consulting
M. Zielinski	Fisher•Rosemount

Contents

1 Scope	9
2 Purpose	9
3 Drawing symbol	9
4 Specification characteristics	10
4.1 Design characteristics	10
4.2 Performance characteristics	15
4.3 Additional terminology	19
4.4 Tabulated characteristics versus test requirements	21
5 Individual acceptance tests and calibrations	22
5.1 Basic equipment	22
5.2 Calibration and test procedures	24
6 Qualification test procedures	26
6.1 Initial performance tests (Figure 2)	26
6.2 Resolution test (Figure 6)	26
6.3 Weight test (Figure 6)	27
6.4 Dead volume test (Figure 6)	27
6.5 Volume change test (Figure 6)	27
6.6 Mounting test (Figure 6)	27
6.7 Loading test (Figure 6)	27
6.8 Dynamic response test (Figure 4a or 4b as applicable)	27
6.9 Temperature tests	28
6.10 Acceleration test (Figure 5)	29
6.11 Vibration test (Figure 5)	29
6.12 Tests for other environments (Figure 3)	30
6.13 Life test (Figure 3)	30
6.14 Burst pressure test (Figure 6)	30
7 Test report forms	30
Annex A — References	39

Figures

1 — Potentiometric pressure transducer individual acceptance test and calibration record	31
2 — Potentiometric pressure transducer initial performance test	32
3 — Potentiometric pressure transducer environmental test record	33
4a— Potentiometric pressure transducer dynamic response tests	34
4b— Potentiometric pressure transducer dynamic response tests (Sinusoidal Method).....	35
5 — Potentiometric pressure transducer acceleration/vibration test record.....	36
6 — Transducer test report potentiometric pressure transducer	37
7 — Potentiometric pressure transducer individual acceptance test and calibration record (Static Error Band Calibration)	38

1 Scope

1.1 This Standard covers potentiometric pressure transducers, primarily those used in measuring systems.

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

- Absolute Pressure Transducers
- Differential Pressure Transducers
- Gage Pressure Transducers

1.3 Technology used in this document is defined in ISA-S37.1. Additional terms considered applicable to potentiometric pressure transducers are defined in 4.3 of this document. An asterisk appears after those terms defined in S37.1. A double asterisk appears after those terms defined in 4.3.

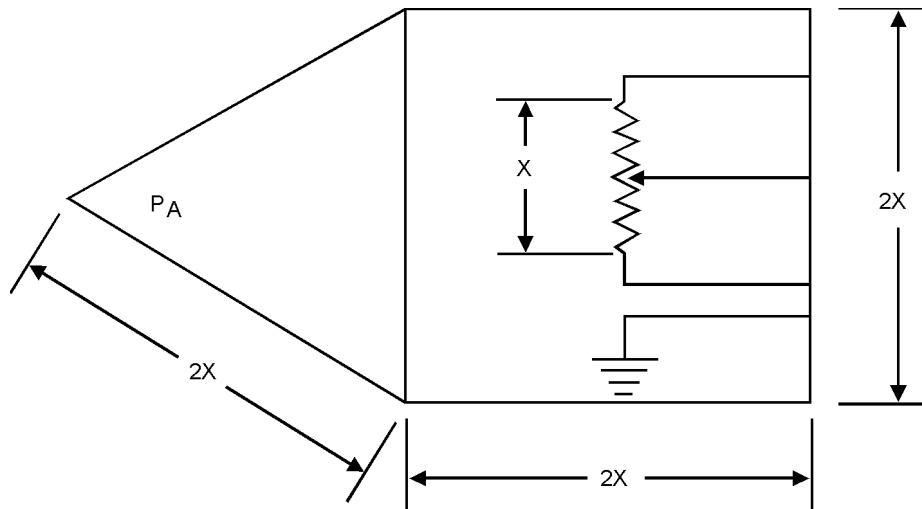
2 Purpose

This Standard establishes the following for potentiometric 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

3 Drawing symbol

3.1 The drawing symbol for a potentiometric pressure transducer is a square with an added equilateral triangle, the base of which is the left side of the square. The letter "P" in the triangle designates "pressure" and the subscripts denote the second modifier (the illustration shows an absolute pressure transducer, as symbolized by "P_A").



Subscripts

- A = Absolute
- D = Differential
- G = Gage
- S = Sealed Reference Differential (see 4.3)

3.2 The potentiometer is symbolized by a variable resistance of length x . The lines from it and to ground represent the electrical leads or terminations.

4 Specification characteristics

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

- Absolute Pressure*
- Differential Pressure, Unidirectional*
- Differential Pressure, Bidirectional*
- Differential Pressure, Sealed Reference**
- 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 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.

4.1.1.4 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.

4.1.1.5 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 Mounting effects

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

4.1.1.7 Mass

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

4.1.1.8 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.

4.1.1.9 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 Section 3 of ISA-S37.1)

*Defined in ISA-S37.1

- 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) Transduction element resistance* (Potentiometric Element)
- e) Identification of Measured and Reference Ports* (for differential pressure transducers)
- f) Reference Pressure Range* (for differential pressure transducers)
- g) Identification of Electrical Connections
- h) Inscription of the following characteristics is optional:
 - i) Customer Specification or Part Number or both
 - j) Type of Electrical Connector and Mating Connector (if applicable)
 - k) Operating Temperature Range**
 - l) Proof Pressure*

NOTE — Identification of Pressure Ports may be abbreviated MEAS & REF.

4.1.2 Supplemental mechanical design characteristics

Listing of the following mechanical design characteristics is optional.

4.1.2.1 Case material

Where applicable, state the surrounding environmental condition requirement or compatibility.

4.1.2.2 Sensing element

The sensing element type shall be specified; e.g.,

- a) diaphragm (flat or corrugated)*;
- b) capsule*;
- c) bellows*; and
- d) bourdon tube* - "C" or "U" shaped, spiral, helical, or twisted.

NOTE — Where used, an isolating element with transfer fluid shall be detailed as to composition.

4.1.2.3 Damping fluid

Where used, the type, composition, temperature characteristics, and compatibility with transducer components shall be specified.

*Defined in ISA-S37.1

**Defined in 4.3

4.1.2.4 Number of potentiometric elements** or taps**

Where more than one potentiometric transducer element or a tapped element is required, they shall be specified.

4.1.2.5 Dead volume

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

4.1.2.6 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).

4.1.2.7 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.

4.1.2.8 Gage vent (port)

In gage pressure transducers where the transduction element is exposed to ambient atmosphere, the allowable types and concentrations of atmospheric contaminant shall be specified.

4.1.2.9 Maximum and minimum temperatures

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

NOTE — Exposure time shall be specified, if relevant.

4.1.3 Required electrical design characteristics

The following electrical design characteristics shall be listed. All are applicable at Room Conditions.*

4.1.3.1 Excitation*

Expressed as "____volts (mA) DC" or "____volts (mA) AC rms at ____ Hz."

4.1.3.2 Maximum excitation

Expressed as "____volts (mA) DC" or "____volts (mA) AC rms at ____ Hz."

4.1.3.3 Transduction element resistance*

Expressed as "____ ± ____ohms."

4.1.3.4 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.

*Defined in ISA-S37.1

**Defined in 4.3