

INTERNATIONAL STANDARD

REDLINE VERSION

Reference conditions and procedures for testing industrial and process
measurement transmitters -
Part 2: Specific procedures for pressure transmitters

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Reference conditions and procedures for testing industrial and process measurement transmitters -
Part 2: Specific procedures for pressure transmitters**

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62828-2:2017. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62828-2 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This second edition cancels and replaces the first edition published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) revision according to the latest IEC rules;
- b) comparison with the general part of IEC 62828-1;
- c) additions and more precise definitions in the "Terms and definitions" clause;
- d) correction of the calculation formulas for the measurement error;
- e) more precise formulation of long-term drift;
- f) extension of additional tests;
- g) transfer of the annex "Example of signal current range for a 4 to 20 mA PMT" in IEC 62828-1;
- h) new Annex C "Main characteristics for pressure transmitters".

The text of this International Standard is based on the following documents:

Draft	Report on voting
65B/1308/FDIS	65B/1319/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This International Standard is to be used in conjunction with IEC 62828-1:2026.

A list of all parts in the IEC 62828 series, published under the general title *Reference conditions and procedures for testing industrial and process measurement transmitters*, can be found on the IEC website.

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INTRODUCTION

Most of the current IEC standards on industrial and process measurement transmitters are rather old and were developed having in mind devices based on analogue technologies. Today's digital industrial and process measurement transmitters are quite different from those analogue transmitters: they include more functions and newer interfaces, both towards the computing section (mostly digital electronic) and towards the measuring section (mostly mechanical). Even if some standards dealing with digital process measurement transmitters already exist, they are not sufficient, since some aspects of the performance are not covered by appropriate test methods.

In addition, existing IEC test standards for industrial and process measurement transmitters are spread over many documents, so that for manufacturers and users it is difficult, impractical and time-consuming to identify and select all the standards to be applied to a device measuring a specific process quantity (pressure, temperature, flow, level, etc.).

To help manufacturers and users, it was decided to review, complete and reorganize the relevant IEC standards and to create a more suitable, effective and comprehensive standard series that provides in a systematic way all the necessary specifications and tests required for different industrial and process measurement transmitters.

To solve the issues mentioned above and to provide an added value for the stakeholders, the new standard series on industrial and process measurement transmitters covers the following main aspects:

- applicable normative references;
- specific terms and definitions;
- typical configurations and architectures for the various types of industrial and process measurement transmitters;
- hardware and software aspects;
- interfaces (to the process, to the operator, to the other measurement and control devices);
- physical, mechanical and electrical requirements and relevant tests; clear definition of the test categories: type tests, acceptance tests and routine tests;
- performance (its specification, tests and verification);
- environmental protection, hazardous areas application, functional safety, etc.;
- structure of the technical documentation.

To cover in a systematic way all the topics to be addressed, the IEC 62828 series is organized in several parts. At the moment of the publication of this document, the IEC 62828 series consist of the following parts:

- *IEC 62828-1: General procedures for all types of transmitters;*
- *IEC 62828-2: Specific procedures for pressure transmitters;*
- *IEC 62828-3: Specific procedures for temperature transmitters;*
- *IEC 62828-4: Specific procedures for level transmitters;*
- *IEC 62828-5: Specific procedures for flow transmitters.*

~~In preparing IEC 62828 (all parts), many test procedures were taken, with the necessary improvements, from IEC 61298 (all parts). As IEC 61298 (all parts) is currently applicable to all process measurement and control devices, when IEC 62828 (all parts) is completed, IEC 61298 (all parts) will be revised to harmonise it with IEC 62828 (all parts), taking out from its scope the industrial and process measurement transmitters. During the time when the scope of IEC 61298 (all parts) is being updated, the new IEC 62828 series takes precedence for industrial and process measurement transmitters.~~

1 Scope

This part of IEC 62828 establishes specific procedures for testing pressure process measurement transmitters (PMT) used in measuring and control systems for industrial processes and for machinery ~~control systems~~.

A pressure PMT can feature a remote seal to bring the process variable to the sensing element in the PMT. When the remote seal cannot be separated from the PMT, the complete device is tested.

For general test procedures, reference is made to IEC 62828-1, which is applicable to all types of process measurement transmitters.

NOTE In industrial and process applications, to indicate the process measurement transmitters, it is common also to use the terms "industrial transmitters", or "process transmitters".

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62828-1:2026, *Reference conditions and procedures for testing industrial and process measurement transmitters - Part 1: General procedures for all types of transmitters*

IEC 61518, *Mating dimensions between differential pressure (type) measuring instruments and flanged-on shut-off devices up to 413 bar (41,3 MPa)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62828-1 and in IEC 61518 as well as the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1 absolute pressure

p_{abs}
pressure using absolute vacuum as the datum point

~~Note 1 to entry: The CDD code of this entry for Electronic Data Exchange is ABB181.~~

[SOURCE: IEC 61987 #ABB181 in the IEC common data dictionary]

3.2 ambient atmospheric pressure

p_{amb}
pressure exerted by the atmospheric air at a given altitude and temperature

Note 1 to entry: The atmospheric pressure decreases with the altitude by about 10 Pa/m (Pascal per meter).

3.3 differential pressure

Δp

$p_{1,2}$

difference between the two (absolute) pressures that act simultaneously on opposite sides of a membrane or a primary element

~~Note 1 to entry:—The CDD code of this entry for Electronic Data Exchange is ABB995.~~

[SOURCE: IEC 61987 #ABB995 in the IEC common data dictionary]

3.4 gauge pressure

p_g

pressure using atmospheric pressure as the datum point

$$p_g = p_{abs} - p_{amb}$$

Note 1 to entry: Gauge pressure assumes positive values when the absolute pressure is greater than the ambient atmospheric pressure; it assumes negative values when the absolute pressure is less than the ambient atmospheric pressure.

Note 2 to entry: In certain industrial environments, "gauge pressure" ~~may~~ can be referred to as "pressure".

Note 3 to entry: The term "relative pressure" to indicate gauge pressure is obsolete and conceptually wrong, so it should be avoided.

~~Note 4 to entry: The CDD code of this entry for Electronic Data Exchange is ABB182.~~

[SOURCE: IEC 61987 #ABB182 in the IEC common data dictionary]

3.5 line pressure static pressure

pressure applied on both sides of a differential pressure PMT

Note 1 to entry: For differential pressure PMTs, it is an influence factor that is bilateral and does not represent the measurand.

3.6 leakage rate

leakage, permeation and/or diffusion effects of the medium through the PMT and/or its mounting devices over the testing period under static pressure conditions, expressed as normal volume flow rate

~~Note 1 to entry:—The CDD code of this entry for Electronic Data Exchange is ABD632.~~

[SOURCE: IEC 61987 #ABD632 in the IEC common data dictionary]

3.7 measuring range

for pressure PMTs range related to the measurement of absolute and gauge pressure PMTs

Note 1 to entry: For a pressure PMT with variable (adjustable or programmable) span, the measuring range and associated terms are shown in Figure 1.

Note 2 to entry: See also Annex-G in IEC 62828-1:2026 for an example of signal current range of a 4 mA to 20 mA PMT.

Note 3 to entry: The maximum span indicates the measuring range defined by the difference between the upper and lower range limit.

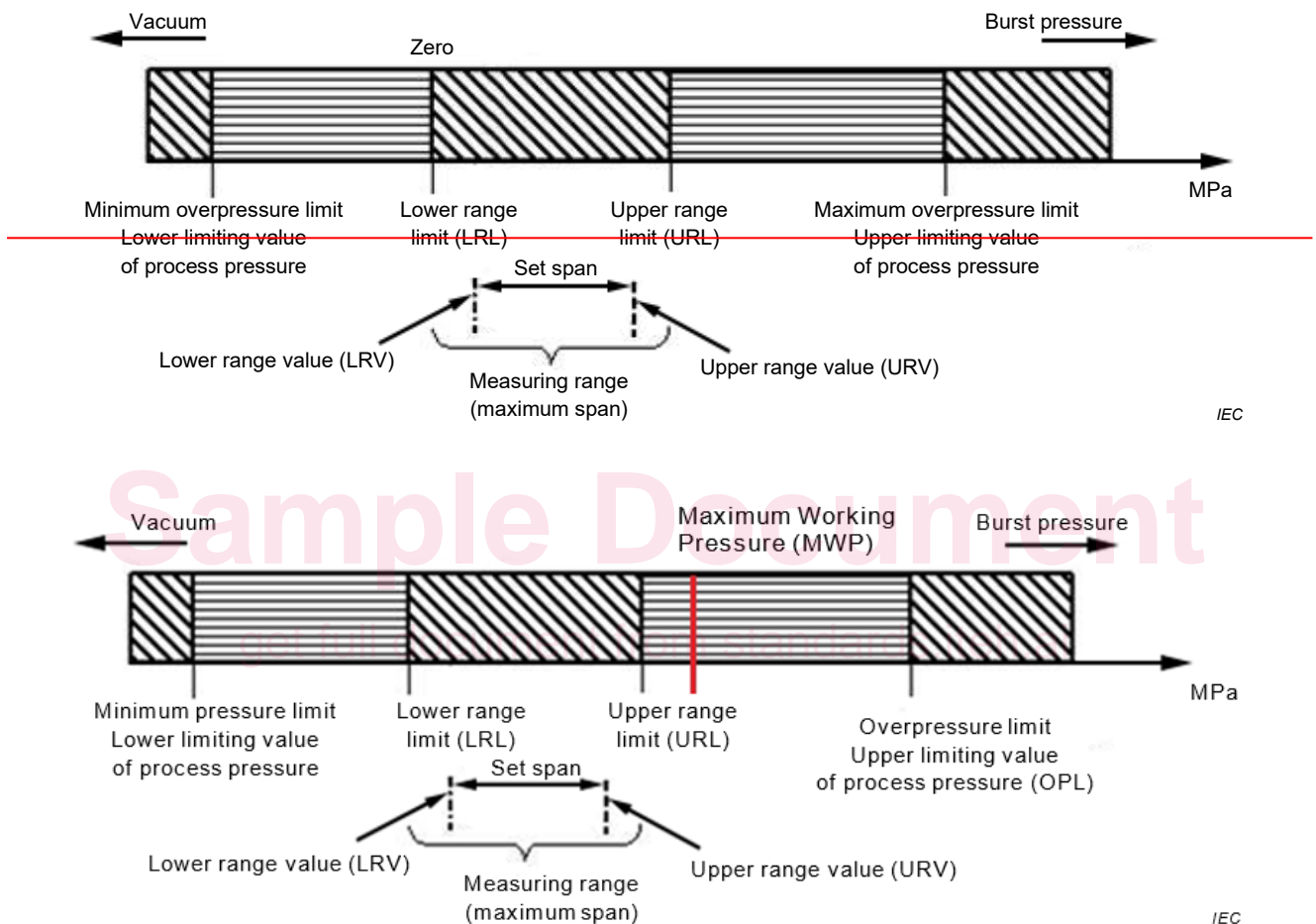


Figure 1 – Measuring range and associated properties of a pressure PMT

3.8 set span

difference between the upper and lower range value of pressure to which a pressure measurement instrument is adjusted

[SOURCE: IEC 61987 #ABB570 in the IEC common data dictionary]

3.9 Maximum Working Pressure MWP

highest pressure a device can be continuously exposed to during operation

Note 1 to entry: Maximum Working Pressure (MWP) is equal to the upper range limit (URL), if not otherwise specified in the product documentation.

3.10**overpressure limit****OPL****proof pressure**

multiple of ~~indicated range~~ Maximum Working Pressure with which the device ~~may~~ can be temporarily subjected to pressure without permanent damage and without change of the guaranteed metrological properties after returning to the measuring range

Note 1 to entry: The output signal at the overpressure limit is sometimes unreliable and/or not predictable. ~~The specification applies to the maximum permitted medium temperature.~~

Note 2 to entry: After returning to the measuring range, the guaranteed metrological properties shall remain unchanged.

~~Note 3 to entry: The CDD code of this entry for Electronic Data Exchange is ABC027.~~

[SOURCE: IEC 61987 #ABC027 in the IEC common data dictionary]

3.11**minimum pressure limit**

pressure at which the device is permitted to be subjected without permanent damage and without change of the guaranteed metrological properties after returning to the measuring range

3.12**pressure**

force per unit area applied in a direction perpendicular to a surface

Note 1 to entry: The SI unit for pressure is the Pascal (Pa), equal to one Newton per square metre (N/m^2 or $\text{kg m}^{-1} \text{s}^{-2}$).

Note 2 to entry: In Annex A, a table shows the relationship between the SI unit and other units, often used for process measurement transmitter applications.

Note 3 to entry: For the purpose of this document, a simplified definition could be accepted as follows: Ratio of orthogonal component of the force per unit area ~~to that unit area~~.

3.13**fixed scale pressure transmitter**

pressure transmitter with fixed measuring range set by the manufacturer

3.14**variable scale pressure transmitter**

pressure transmitter with an adjustable measuring range (turndown ratio)

3.15**burst pressure**

maximum pressure that can be applied to the instrument without physically damaging the internal sensing component and potentially compromising device integrity

Note 1 to entry: Above the burst pressure the device function and integrity is no longer guaranteed.

3.16

vacuum

state of a fluid whose pressure is less than atmospheric pressure

3.17

diaphragm seal **remote seal**

functional component that transfers the pressure to be measured to the PMT by hydraulic path and decouples the PMT from influence factors stemming from the process

Note 1 to entry: A remote seal is connected to the transmitter by a capillary; the diaphragm seal is usually an integral part of the transmitter.

Note 2 to entry: The primary purpose of using diaphragm/remote seals is to protect the sensing element against high process temperatures or aggressive media.

Note 3 to entry: A diaphragm made of suitable material is responsible for the separation of the measured fluids/gases and transmitter. A fluid adapted to the measurement task is responsible for the transfer of the pressure to the measuring element.

Note 4 to entry: The diaphragm seal is included in the treatment of the total measurement error (e.g. temperature influence, step response time, vacuum stability, etc.).

3.18

manifold

pipe fitting or similar device, such as a flanged joint, that connects multiple inputs or outputs, allowing differential pressure PMTs to connect to the process

3.19

pressure transmitter

transmitter that outputs a signal representative of a pressure

3.20

destructive range

pressure range in which permanent changes occur to the metrological properties of the pressure sensor and in which the transducer/transmitter can also be mechanically damaged

Note 1 to entry: It begins at the upper limit of the overload range.

3.21

upper range limit

URL

full scale

FS

upper range limit is the highest value of pressure that a device can be adjusted to measure within its specified accuracy limits

[SOURCE: IEC 61987 #ABB212 in the IEC common data dictionary]

3.22

lower range limit

LRL

lowest value of pressure that the device can be adjusted to measure within the specified accuracy limits

[SOURCE: IEC 61987 #ABB214 in the IEC common data dictionary]

3.23**turndown ratio****turndown**

ratio of the maximum span to the set span

Note 1 to entry: $\text{Turndown (TD)} = \text{URL}/|\text{URV} - \text{LRV}|$

[SOURCE: IEC 61987-13:2016, 3.2.3, modified – The second preferred term has been added as well as the Note to entry.]

4 General description of the device and overview

The general description outlined in Clause 4 of IEC 62828-1:2017/2026 is applicable.

For the scope of this document, see a more detailed description of the functional blocks of an intelligent pressure PMT in Annex B.

5 Reference test conditions

To verify the influence of external quantities on accuracy as well as the mechanical and electrical conditions which a device can withstand and still work within specification, Clause 5 of IEC 62828-1:2017/2026 applies, both for standard reference test conditions and for operating reference test conditions.

6 Test procedures**6.1 General**

Clause 6 of IEC 62828-1:2017/2026 shall apply, with the following additional specifications.

An example of schematic test set-up with ~~an optional HART[†] digital output is shown in Figure 3~~ analogue or digital output signal is shown in Figure 2. A more detailed diagram showing an intelligent PMT model is found in Annex B, Figure B.1.

[†] ~~HART[®] is the trade name of a communication protocol specified by FieldComm Group. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.~~

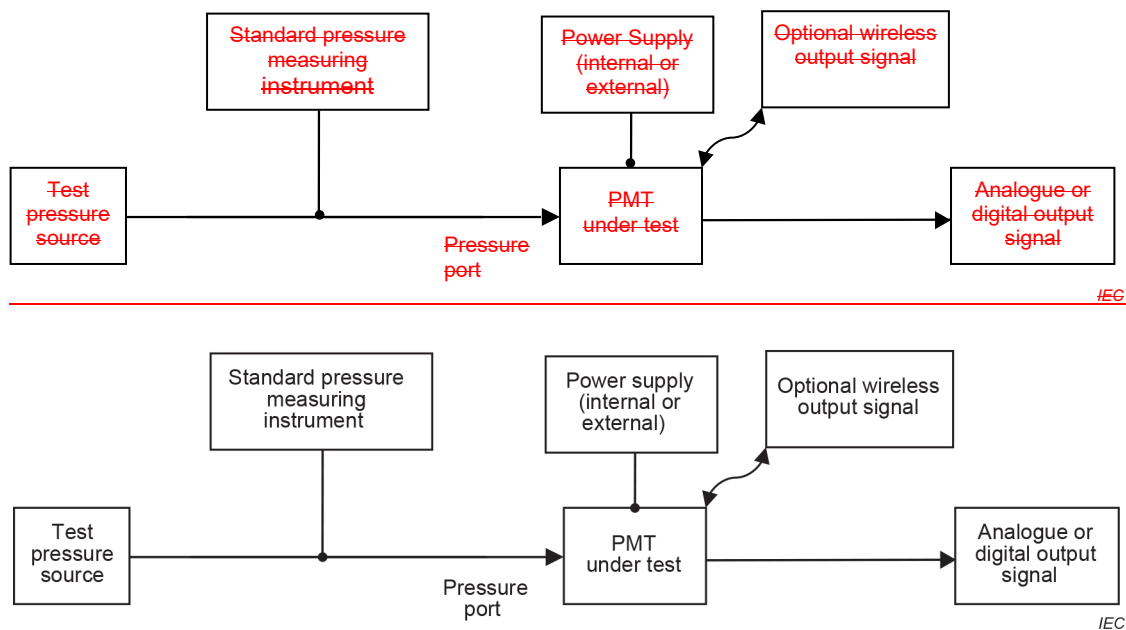


Figure 2 – Schematic example of a test set-up for pressure PMT

The test pressure source and the standard pressure measuring instrument could be the same, as for example for the application of pressure calibrators or pressure balances, namely also dead weight calibrators.

Usually, the power supply is necessary except for wireless PMTs working with internal battery. For batteries, the voltage tolerance listed in Table 5 of IEC 62828-1:2026 shall be fulfilled, meaning the battery needs an adequate charging state for performance tests.

The optional digital output signal is provided for smart and Intelligent PMTs and is detected by handheld or PC communicator.

Usually, for differential pressure PMTs, the pressure is generated in the high-pressure port with the low pressure port open to the atmospheric pressure.

Analogue and digital output signals are ~~mutually exclusive, unless HART® is in use~~ commonly mutually exclusive. For reference, in Annex A, Table A.1 contains the conversion between several pressure units.

6.2 Tests at standard and operating reference test conditions

6.2.1 General

For the majority of the tests, 6.2-4 and 6.3 of IEC 62828-1:2017/2026 apply. In particular, see:

- Annex B in IEC 62828-1:2017/2026 for the summary of the tests at the standard reference conditions;
- Annex C in IEC 62828-1:2017/2026 for the summary of the tests at the operating reference conditions.

In addition, the specific tests in ~~6.2.1~~ 6.2.2 to 6.2.7 apply to pressure PMTs.