

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

AMENDMENT 1  
AMENDEMENT 1

Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures –

Part 12: Power metering and monitoring devices (PMD)

<https://standards.iteh.ai/catalog/standards/sist/31345d87-6d61-44d4-4065-555555555555>

Sécurité électrique dans les réseaux de distribution basse tension jusqu'à 1 000 V en courant alternatif et 1 500 V en courant continu – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection –

Partie 12: Dispositifs de comptage et de surveillance du réseau électrique (PMD)



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**Part 12: Power metering and monitoring devices (PMD)**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION  
SYSTEMS UP TO 1 000 V AC AND 1 500 V DC –  
EQUIPMENT FOR TESTING, MEASURING OR  
MONITORING OF PROTECTIVE MEASURES –**

**Part 12: Power metering and monitoring devices (PMD)**

**AMENDMENT 1**

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Amendment 1 to IEC 61557-12:2018 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

The text of this amendment is based on the following documents:

FDIS	Report on voting
85/755/FDIS	85/764/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 Amendment 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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications/](http://www.iec.ch/standardsdev/publications/).

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- amended.

## 1 Scope

# iTeh STANDARD PREVIEW

*Replace the existing text of this clause by the following new text:*

This part of IEC 61557 specifies requirements for power metering and monitoring devices (PMD) that measure and monitor the electrical quantities within electrical distribution systems, and optionally other external signals. These requirements also define the performance of PMD in single- and three-phase AC or DC systems having rated voltages up to 1 000 V AC or up to 1 500 V DC.

These devices are fixed or portable. They are intended to be used indoors and/or outdoors.

Power metering and monitoring devices (PMD), as defined in this document, give additional safety information, which aids the verification of the installation and enhances the performance of the distribution systems.

Additionally, this document specifies requirements for measurement functions dedicated to metering and monitoring of electrical parameters called power metering and monitoring function (PMF) which can be embedded in equipment (EPMF) that is not classified as PMD and for which the main function is not power metering and monitoring.

Requirements for power metering and monitoring function (PMF) and additional requirements for equipment embedding power metering and monitoring function (EPMF) are described in Annex H.

The power metering and monitoring devices (PMD) for electrical parameters described in this document are used for general industrial and commercial applications.

The power metering and monitoring devices (PMD) can be associated with sensing devices such as but not limited to instruments transformers compliant to IEC 61869 series of standards or with transducers compliant to IEC 60688.

This document does not address functional safety and cyber security aspects.

This document is not applicable to:

- electricity metering equipment that complies with IEC 62053-21, IEC 62053-22, IEC 62053-23 and IEC 62053-24. Nevertheless, uncertainties defined in this document for active and reactive energy measurement are derived from those defined in IEC 62053 (all parts);
- the measurement and monitoring of electrical parameters defined in IEC 61557-2 to IEC 61557-9 and IEC 61557-13 or in IEC 62020;
- power quality instrument (PQI) according IEC 62586 (all parts);
- devices covered by IEC 60051 (all parts) (direct acting analogue electrical measuring instrument).

NOTE 1 Generally such types of devices are used in the following applications or for the following general needs:

- energy management inside the installation, such as facilitating the implementation of documents such as ISO 50001 and IEC 60364-8-1;
- monitoring and/or measurement of electrical parameters;
- measurement and/or monitoring of the quality of energy inside commercial/industrial installations.

NOTE 2 A measuring and monitoring device of electrical parameters usually consists of several functional modules. All or some of the functional modules are combined in one device. Examples of functional modules are:

- measurement and monitoring of several electrical parameters simultaneously;
- energy measurement and/or monitoring, as well as sometimes compliance with aspects of building regulations;
- alarms functions;
- demand side quality (current and voltage harmonics, over/under voltages, voltage dips and swells, etc.).

NOTE 3 PMD are historically called power meter, power monitor, power monitor device, power energy monitoring device, power analyser, multifunction meter, measuring multifunction equipment, energy meters.

NOTE 4 Metering, measuring and monitoring applications are explained in Annex A.

### 3 Terms, definitions and notations

<https://standards.iteh.ai/catalog/standards/sist/31345d87-6d61-44d4-ab16-c4f4c3d3625/iec-61557-12-2018-amd1-2021>

Add the following new definitions:

#### 3.1.16

##### **power metering and monitoring function**

##### **PMF**

measurement function dedicated to metering and monitoring electrical parameters within electrical distribution systems embedded in an equipment that is not a PMD and complies to another IEC product standard

#### 3.1.17

##### **equipment embedding PMF**

##### **EPMF**

equipment or arrangement of equipment embedding PMF whose main function is not metering and monitoring of electrical parameters

Note 1 to entry: Such equipment are uninterruptible power systems (UPS), static transfer systems (STS), circuit breakers, transfer switching equipment (TSE), switches, disconnectors, switch-disconnectors, fuse-combination units, programmable controllers (PLC), inverter for use in photovoltaic power systems, adjustable speed electrical power drive systems, protection relay, residual current devices (RCDs, RCBOs), residual current monitoring devices (RCM), load-shedding equipment (LSE), bi-directional grid connected power converters.

Add the following new Annex H:

## **Annex H** (normative)

### **Requirements for power metering and monitoring function (PMF) and additional requirements for equipment embedding power metering and monitoring function (EPMF)**

#### **H.1 Scope**

This annex specifies additional requirements and tests for equipment embedding a power metering and monitoring function (EPMF) whose main function is not measurement and its embedded power metering and monitoring function (PMF).

When not otherwise stated in this annex, the core of this document is applied to EPMF or PMF as appropriate when reading “PMD” in the core document.

NOTE The annex follows the same structure as the core document.

#### **H.2 Normative references**

Clause 2 applies.

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In addition, the following standards apply:

IEC 60255 (all parts), *Measuring relays and protection equipment*

<https://standards.iteh.ai/catalog/standards/sist/31345d87-6d61-44d4-ada4-44701d36255c/iec-60255-12-2018-amd1-2021>

IEC 60755, *General safety requirements for residual current operated protective devices*

IEC 60898 (all parts), *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*

IEC 60947-2, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-3, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 60947-6-1, *Low-voltage switchgear and controlgear – Part 6-1: Multiple function equipment – Transfer switching equipment*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-19, *Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports*

IEC 61008 (all parts), *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)*

IEC 61009 (all parts), *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)*

IEC 61131 (all parts), *Programmable controllers*

IEC 61800 (all parts), *Adjustable speed electrical power drive systems*

IEC 62020 (all parts), *Electrical accessories – Residual current monitors (RCMs)*

IEC 62040 (all parts), *Uninterruptible power systems (UPS)*

IEC 62109-2, *Safety of power converters for use in photovoltaic power systems – Part 2: Particular requirements for inverters*

IEC 62310 (all parts), *Static transfer systems (STS)*

IEC 62423, *Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses*

IEC 62909 (all parts), *Bi-directional grid connected power converters*

IEC 62962, *Particular requirements for load-shedding equipment (LSE)*

### H.3 Terms, definitions and notations

Clause 3 applies.

### H.4 Requirements for PMF and additional requirements for EPMF

#### H.4.1 General requirements

The equipment that may embed EPMF shall be chosen in the equipment list defined in Table H.1.

**Table H.1 – List of equipment that may embed EPMF**

Equipment	IEC Standard
Uninterruptible power systems (UPS)	IEC 62040 series
Static transfer systems (STS)	IEC 62310 series
Circuit-breakers	IEC 60947-2, IEC 60898 series
Transfer switching equipment (TSE)	IEC 60947-6-1
Switches, disconnectors, switch-disconnectors and fuse-combination units	IEC 60947-3
Programmable controllers (PLC)	IEC 61131 series
Inverter for use in photovoltaic power systems	IEC 62109-2
Adjustable speed electrical power drive systems	IEC 61800
Protection relay	IEC 60255
Residual current devices (RCD, RCBO)	IEC 61008 series, IEC 61009 series, IEC 62423, IEC 60947-2, IEC 60755 series
Residual current monitoring devices (RCM)	IEC 62020 series
Load-shedding equipment (LSE)	IEC 62962
Bi-directional grid connected power converters	IEC 62909 series

The requirements of 4.2 to 4.12 apply with the modifications specified in this annex.

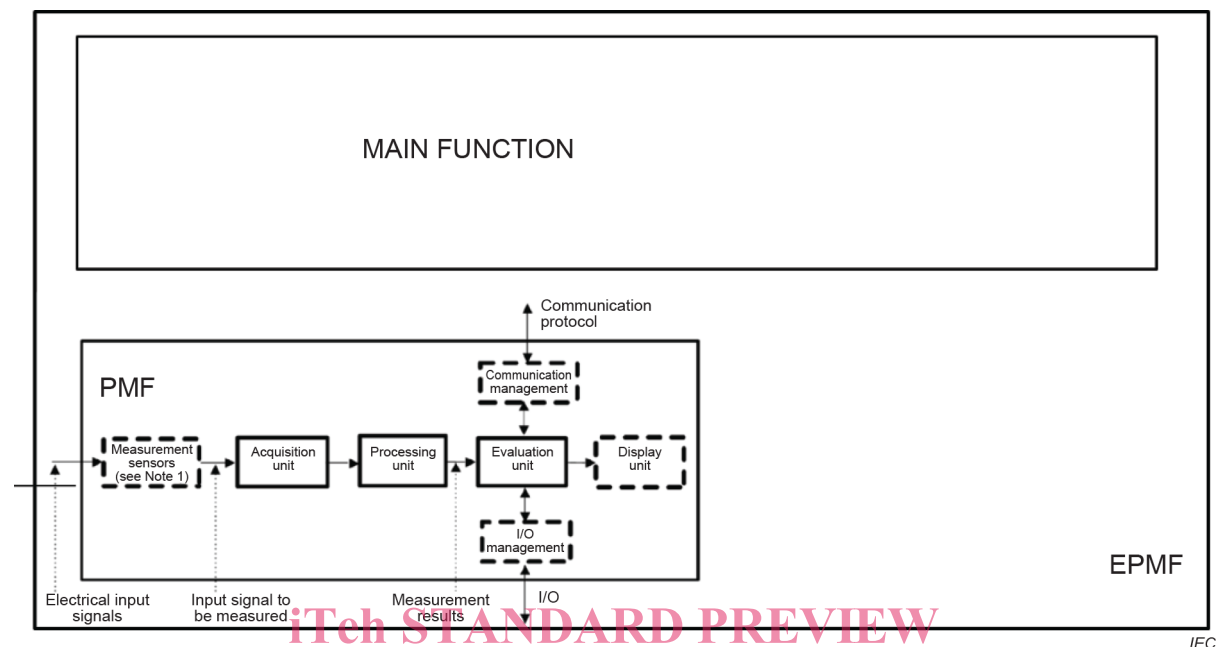
#### H.4.2 EPMF general architecture

This subclause provides information about a possible implementation of a PMF in an EPMF.



Figure H.1 shows the common organization of an EPMF including its main function and PMF.

Organization of the measurement chain of EPMF: the electrical quantity can be measured either directly or via voltage and/or current sensors (see also H.4.4).



NOTE 1 It is not necessary that the parts in the dotted lines be included in PMF.

NOTE 2 I/O are analog and/or digital signals with alarms.

NOTE 3 Communications may be ensured by the EPMF or by the PMF part.

Figure H.1 – Example of architecture of EPMF

### H.4.3 Classification of PMF

4.3 applies to PMF classified according to Table H.2.

Table H.2 – Functional classification of PMF with minimal required functions

Functionalities symbol <sup>a</sup>	PMF type <sup>b</sup>		
	PMF-I Energy efficiency	PMF-II Basic power monitoring	PMF-III Advanced power monitoring /network performance
$P$		■	■
$Q$		■	■
$S$		■	■
$E_a$	■	■	■
$E_r$		■	■
$E_{ap}$			■
$f$		■	■
$I$		■	■
$I_N$			■
$U$ and/or $V$		■	■

Functionalities symbol <sup>a</sup>	PMF type <sup>b</sup>		
	PMF-I Energy efficiency	PMF-II Basic power monitoring	PMF-III Advanced power monitoring /network performance
<i>PF</i>		■	■
<i>THD<sub>u</sub></i> and/or <i>THD<sub>v</sub></i> and/or <i>THD-R<sub>u</sub></i> and/or <i>THD-R<sub>v</sub></i>			■
<i>THD<sub>i</sub></i> and/or <i>THD-R<sub>i</sub></i>			■

<sup>a</sup> Only total quantities are mandatory.

<sup>b</sup> For PMF other than PMF-I, PMF-II and PMF-III, called PMF-x, other combinations of functions are allowed and shall be specified by the manufacturer.

#### H.4.4 Structure of EPMF

4.4 applies to EPMF with the following modification.

Depending on the EPMF, the electrical quantity can be measured either directly or via voltage and/or current sensors as shown in Table H.3.

**Table H.3 – Structure of EPMF**  
(standards.iteh.ai)

		Current measurement	
		Sensor operated EPMF (current sensors out of EPMF) →EPMF Sx	Direct connected EPMF (current sensors in EPMF) →EPMF Dx
Voltage measurement	Direct connected EPMF (voltage sensors in EPMF) →EPMF xD	EPMF SD (Semi-direct insertion)	EPMF DD (Direct insertion)
	Sensor operated EPMF (voltage sensors out of EPMF) →EPMF xS	EPMF SS (Indirect insertion)	EPMF DS (Semi-direct insertion)

#### H.4.5 List of applicable performance classes for PMF

4.5 applies.

#### H.4.6 Operating and reference conditions

##### H.4.6.1 Reference conditions

4.6.1 applies for performance class tests of the PMF. For other tests, reference test conditions of the EPMF standard apply.

##### H.4.6.2 Rated operating conditions

If rated operating conditions are not defined by the standard of the equipment where PMF is embedded, 4.6.2 applies.

NOTE Rated operating conditions may be also called environmental conditions (or similar wording) in other standards.

#### H.4.7 Start-up conditions for EPMF

4.7 applies.

#### H.4.8 Requirements for PMF

All PMF embedded in an EPMF and covered by this document shall comply with the requirements of this document given in 4.8 with the following modifications or additions.

Subclause 4.8 describes a list of functions. Depending on the purpose of the measurement, all or a subset of the functions listed shall be measured by the PMF.

The starting current and the specified measuring range of current shall be chosen according to the structure of EPMF given in Table H.3 and Table H.4.

**Table H.4 – Value of current according to the type of EPMF**

Structure of EPMF	Starting current and specified measuring range of current identical to
EPMF Dx	PMD Dx
EPMF Sx	PMD Sx

In reference conditions, signals are sinusoidal, so in this case the power factor =  $\cos \phi$ , see Table 11.

For EMC influence quantities:

- If EMC requirements are covered by the standard of the equipment where PMF is embedded, EMC levels and test conditions defined in the EPMF standard apply;
- If EMC requirements are not covered by the standard of the equipment where PMF is embedded, 4.8 applies.

For temperature influence quantities, the influence range is based on the rated operating range according to H.4.6.2.

#### H.4.9 General mechanical requirements

If mechanical requirements are not defined by the standard of the equipment where PMF is embedded, 4.9 applies.

#### H.4.10 Safety requirements

An equipment safety standard required by the EPMF type shall apply. If safety requirements are not defined by the product standard of equipment where PMF is embedded, 4.10 applies.

In addition, a risk assessment of the PMF shall be done. In case of doubt, IEC 61010-2-30 or any relevant safety standard shall apply.

#### H.4.11 EMC requirements

If EMC requirements are not defined by the standard of the equipment where PMF is embedded, 4.11 applies.

#### H.4.12 Inputs and/or outputs

If inputs and/or outputs requirements are not defined by the standard of the equipment where PMF is embedded, 4.12 applies.

## H.5 Marking and operating instructions

### H.5.1 General

If marking and operating instructions requirements are not covered by the standard of the equipment where PMF is embedded, 5.1 applies.

### H.5.2 Marking

At minimum if relevant, symbol 14 according to IEC 61010-1 shall be marked on the EPMF.

### H.5.3 Operating, installation and maintenance instructions

#### H.5.3.1 General

If operating, installation and maintenance instructions requirements are not covered by the standard of the equipment where PMF is embedded, 5.3.1 applies.

In addition, the following requirements apply:

#### H.5.3.2 General characteristics

5.3.2 applies.

#### H.5.3.3 Essential characteristics

##### H.5.3.3.1 Characteristics of EPMF

The characteristics of the EPMF shall be specified in a table as specified in Table H.5 with the following items:

- a) power quality assessment function (if any);
- b) classification of the PMF and the EPMF according to H.4.3 and H.4.4;
- c) temperature of the EPMF according to H.4.6.2;
- d) humidity and altitude conditions of the EPMF according to H.4.6.2;
- e) active power or active energy function (if existing) performance class according to 4.8.2 and H.4.6.2.

The sequence of function symbols shall be the following, see Table H.5:

**Table H.5 – EPMF specification form**

Type of characteristic	Examples of possible characteristic value	Other complementary characteristics
Classification of PMF according to H.4.3	PMF-I or PMF-II or PMF-III or PMF-x	
Classification of EPMF according to H.4.4	SD or DS or DD or SS	
Temperature	K40 or K55 or K70 or Kx or specified range for EPMF	
Humidity + altitude	Blank or extended values or specified range for EPMF	
Active power or active energy function (if function available) performance class	0,1 or 0,2 or 0,5 or 1 or 2	

It is strongly recommended that all items be listed, and only existing ones be specified.

### **H.5.3.3.2 Characteristics of functions**

The characteristics of PMF shall be specified in a table as specified in Table 46 with the following items:

- a) function symbols as defined in Table 46;
- b) function performance class according to this document;
- c) measuring range for the specified performance class;
- d) other complementary characteristics.

## **H.6 Tests**

### **H.6.1 General**

The tests of Clause 6 apply and shall be performed on EPMF with the following modifications or additions.

Except otherwise stated, tests of Clause H.6 apply with the EPMF wired and set under normal conditions of use.

Reference tests conditions of H.4.6.1 apply.

### **H.6.2 Type tests of EPMF**

#### **H.6.2.1 General**

Type tests shall be executed to check the compliance with the requirements of Clause H.4 and Clause H.5.

#### **H.6.2.2 Tests of intrinsic uncertainty**

As a general principle, each line of the intrinsic uncertainty tables in Clause 4 with conditions defined in H.4.6 to H.4.8 shall be associated to a test with the minimum test points and acceptance criterion given in 6.2.2.

#### **H.6.2.3 Tests of variation of uncertainty with influence quantities**

As a general principle, each line of the uncertainty with influence quantities tables in Clause 4 with conditions defined in H.4.6 to H.4.8 shall be associated to a test with the minimum test points and acceptance criterion given in 6.2.3.

#### **H.6.2.4 Test of temperature influence**

6.2.4 applies with environmental conditions defined in H.4.6.

#### **H.6.2.5 Active power**

6.2.5 applies.

#### **H.6.2.6 Apparent power**

6.2.6 applies.

#### **H.6.2.7 Power factor**

6.2.7 applies.

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#### **H.6.2.8 Common mode voltage rejection test**

No requirement.

#### **H.6.2.9 Frequency**

6.2.9 applies.

#### **H.6.2.10 Measurement of voltage harmonics and $THD_u$**

6.2.10 applies.

#### **H.6.2.11 Measurement of current harmonics and $THD_i$**

6.2.11 applies.

#### **H.6.2.12 Dips and swells**

6.2.12 applies.

#### **H.6.2.13 Voltage interruptions**

6.2.13 applies.

#### **H.6.2.14 Outputs tests**

If output tests are not covered by the standard of the equipment where PMF is embedded, 6.2.14 applies.

#### **H.6.2.15 Climatic tests**

Climatic tests of the standard of the equipment where PMF is embedded apply if defined.

After an appropriate recovering time, the PMF shall show no change of the information and shall operate within its specifications.

If climatic tests are not defined by the standard of the equipment where PMF is embedded, 6.2.15 applies but with temperatures based on environmental conditions defined in the product standard of the EPMF.

#### **H.6.2.16 EMC tests**

If EMC tests are not defined by the standard of the equipment where PMF is embedded, 6.2.16 applies taking into consideration levels and tests conditions as defined in H.4.11. In this case, performance criteria apply to the PMF only.

#### **H.6.2.17 Start-up tests**

6.2.17 applies.

#### **H.6.2.18 Gapless measurement test**

6.2.18 applies.

#### **H.6.2.19 Safety tests**

If safety tests are not defined by the standard of the equipment where PMF is embedded, 6.2.19 applies.

### **H.6.3 Routine tests of EPMF**

#### **H.6.3.1 Protective bonding test**

If routine tests for safety aspects are not defined by the standard of the equipment where PMF is embedded, 6.3.1 applies.

#### **H.6.3.2 Dielectric strength test**

If routine tests for safety aspects are not defined by the standard of the equipment where PMF is embedded, 6.3.2 applies.

#### **H.6.3.3 Uncertainty test**

6.3.3 applies.

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