Comment: when making the proposal the changes have been made to stick to this original text to keep them at minimum, as required. In future revisions the restriction to "light" use should be dropped, better accuracy classes added and electromechanical meters finally dropped. On the other hand, reactive meters have been added as their absence is a major barrier to free movement of electrical energy meters across the Single Market. The A,B,C classification has been extended to reactive meters as well. Also the DC meters have been added. A maximum of the proposals by the drafting group have been taken on board.

Red-highlighted text (only in the text on AC electrical energy meters): CZ proposals

Green-highlighted text (only in the text on AC electrical energy meter): proposals of the drafting group

ANNEX V

~~ACTIVE~~ ELECTRICAL ENERGY METERS (MI-003)

The relevant requirements of Annex I, the specific requirements of this Annex and the conformity assessment procedures listed in this Annex, apply to ~~active~~ electrical energy meters, in case of utility measuring instruments intended for residential, commercial and light industrial use.

Note:
Electrical energy meters may be used in combination with external measuring transducers such as instrument transformers with a better accuracy class index, depending upon the measurement technique applied. However, this Annex covers only electrical energy meters but not those external transducers ~~instrument transformers~~.

DEFINITIONS
An active/reactive electrical energy meter is a device which measures the active/reactive electrical energy consumed in a circuit or transferred between circuits.

I	=	the electrical current flowing through the meter;
I_n	=	the specified reference current for which the transducer~~former~~ operated meter has been designed;
I_{st}	=	the lowest declared value of I at which the meter registers active/reactive electrical energy at unity active/reactive power factor (polyphase meters with balanced load);
I_{min}	=	the value of I above which the error lies within maximum permissible errors (MPEs) (polyphase meters with balanced load);
I_{tr}	=	the value of I above which the error lies within the smallest MPE corresponding to the class index of the meter;
I_{max}	=	the maximum value of I for which the error lies within the MPEs;
U	=	the voltage of the electricity supplied to the meter;
U_n	=	the specified reference voltage;
f	=	the frequency of the voltage supplied to the meter;
f_n	=	the specified reference frequency;
PF	=	power factor = cos φ = the cosine of the phase difference φ between I and U.

SPECIFIC REQUIREMENTS

CHAPTER I

AC electrical energy meters

1. Accuracy

The manufacturer shall specify the class index of the meter. The class indices are defined as: Class A, B and C.

2. Rated operating conditions

The manufacturer shall specify the rated operating conditions of the meter; in particular:
the values of f_n, U_n, I_n, I_{st}, I_{min}, I_{tr} and I_{max} that apply to the meter.

For the current values specified, the active electrical energy meter shall satisfy the conditions given in Table 1a;

Table 1a

	Class A	Class B	Class C
For direct-connected meters			
I_{st}	$\leq 0{,}05 \cdot I_{tr}$	$\leq 0{,}04 \cdot I_{tr}$	$\leq 0{,}04 \cdot I_{tr}$
I_{min}	$\leq 0{,}5 \cdot I_{tr}$	$\leq 0{,}5 \cdot I_{tr}$	$\leq 0{,}3 \cdot I_{tr}$
I_{max}	$\geq 50 \cdot I_{tr}$	$\geq 50 \cdot I_{tr}$	$\geq 50 \cdot I_{tr}$
For transformer-operated meters			
I_{st}	$\leq 0{,}06 \cdot I_{tr}$	$\leq 0{,}04 \cdot I_{tr}$	$\leq 0{,}02 \cdot I_{tr}$
I_{min}	$\leq 0{,}4 \cdot I_{tr}$	$\leq 0{,}2 \cdot I_{tr}$ (1)	$\leq 0{,}2 \cdot I_{tr}$
I_n	$= 20 \cdot I_{tr}$	$= 20 \cdot I_{tr}$	$= 20 \cdot I_{tr}$
I_{max}	$\geq 1{,}2 \cdot I_n$	$\geq 1{,}2 \cdot I_n$	$\geq 1{,}2 \cdot I_n$

(1) For Class B electromechanical meters $I_{min} \leq 0{,}4 \cdot I_{tr}$ shall apply.

For the current values specified, the active electrical energy meter shall satisfy at the rated reference conditions the percentage error limits given in Table 1b;

Value of current	**Power factor**	**Acceptable percentage error limits for meters of class index**		
		A	**B**	**C**
$I_{min} \leq I < I_{tr}$	1	± 2,5	± 1,5	± 1,0
$I_{tr} \leq I \leq I_{max}$	0,5 ind... 1... cap 0,8	**± 2,0**	**± 1,0**	**± 0,5**

For the current values specified, the reactive electrical energy meter shall satisfy at the rated reference conditions the percentage error limits given in Table 1c;

Value of current		**sin φ (inductive or capacitive)**	**Acceptable percentage error limits for meters of class**		
for directly connected meters	**for transformer operated meters**		**A (3)**	**B (2)**	**C (1)**
$I_{min} \leq I \leq 0{,}1\ I_n$	$I_{min} \leq I < 0{,}05\ I_n$	1	±4,0	±2,5	±1,5
$0{,}1\ I_n \leq I \leq I_{max}$	$0{,}05\ I_n \leq I \leq I_{max}$	1	**±3,0**	**±2,0**	**±1,0**
$0{,}1\ I_n \leq I < 0{,}2\ I_n$	$0{,}05\ I_n \leq I < 0{,}1\ I_n$	0,5	±4,0	±2,5	±1,5

$0{,}2\ I_n \leq I \leq I_{max}$	$0{,}1\ I_n \leq I \leq I_{max}$	0,5	±3,0	±2,0	±1,0
$0{,}2\ I_n \leq I \leq I_{max}$	$0{,}1\ I_n \leq I \leq I_{max}$	0,25	±4,0	±2,5	±2,0

Comment: the extension of the A,B,C classification to reactive meters would be convenient to manufacturers as the meters can be marked by a joint class only as e.g. active meters of class 2 are usually combined with reactive meters class 3.

~~The voltage, frequency and power factor ranges within which the meter shall satisfy the MPE requirements are specified in Table 2. These ranges shall recognise the typical characteristics of electricity supplied by public distribution systems.~~

The voltage and frequency ranges shall be at least:

$$0{,}9 \cdot U_n \leq U \leq 1{,}1 \cdot U_n$$

$$0{,}98 \cdot f_n \leq f \leq 1{,}02 \cdot f_n$$

power factor range at least:

for active electrical energy meters from cos φ = 0,5 inductive to cos φ = 0,8 capacitive

for reactive electrical energy meters sin φ = 0,5 inductive to sin φ = 0,8 capacitive.

3. MPEs

The effects of the various measurands and influence quantities (a, b, c,...) are evaluated separately, all other measurands and influence quantities being kept relatively constant at their reference values. The error of measurement, that shall not exceed the MPE ~~stated in Table 2,~~ is calculated as:

$$\text{Error of measurement} = \sqrt{(a^2 + b^2 + c^2 + \cdots)}$$

When the meter is operating under rated operating conditions ~~varying load current~~, the percentage errors for active electrical energy meters shall not exceed the MPE limits given in Table 2.

Table 2

MPEs in percent at rated operating conditions and defined load current levels and operating temperature

	Operating temperatures			Operating temperatures			Operating temperatures			Operating temperatures		
	+ 5 °C ... + 30 °C			− 10 °C ... + 5 °C or + 30 °C ... + 40 °C			− 25 °C ... − 10 °C or + 40 °C ... + 55 °C			below − 25 °C or above + 55 °C		
Meter class	A	B	C	A	B	C	A	B	C	A	B	C
Single phase meter; polyphase meter if operating with balanced loads												
$I_{min} \leq I < I_{tr}$	3,5	2	1	5	2,5	1,3	7	3,5	1,7	9	4	2
$I_{tr} \leq I_{max}$	3,5	2	0,7	4,5	2,5	1	7	3,5	1,3	9	4	1,5
Polyphase meter if operating with single phase load												
$I_{tr} \leq I \leq I_{max}$, see exception below	4	2,5	1	5	3	1,3	7	4	1,7	9	4,5	2

For electromechanical polyphase meters the current range for single-phase load is limited to $5I_{tr} \leq I \leq I_{max}$.

When a meter operates in different temperature ranges the relevant MPE values shall apply. The meter shall not exploit the MPEs or systematically favour any party.

4. Permissible effect of disturbances

4.1. *General*

As electrical energy meters can also be directly connected to the mains supply and as mains current is also one of the measurands in this case, a special electromagnetic environment is used for electricity meters.

The meter shall comply with the electromagnetic environment E2 and the additional requirements in points 4.2 and 4.3.

The electromagnetic environment and permissible effects reflect the situation that there are disturbances of long duration which shall not affect the accuracy beyond the critical change values and transient disturbances, which may cause a temporary degradation or loss of function or performance but from which the meter shall recover and shall not affect the accuracy beyond the critical change values.

When there is a foreseeable high risk due to lightning or where overhead supply networks are predominant, the metrological characteristics of the meter shall be protected.

4.2. *Effect of disturbances of long duration*

Table 3

Critical change values for disturbances of long duration

Disturbance	Acceptable limits of variation in percent for active/reactive meters of class		
	A	B	C
Reversed phase sequence	1/1,5	0,5/1	0,1/0,5
Voltage unbalance (only applicable to polyphase meters)	4	2/4	1/2
Harmonic contents in the current and voltage circuits – 5th harmonics test (1)	1/1,5	0,8/1	0,5/0,8
DC and harmonics in the current circuit (1)	6	3/6	1,5/3
Fast transient bursts	6	4/6	2/4
Magnetic fields; HF (radiated RF) electromagnetic field; Conducted disturbances introduced by radio-frequency fields; and Oscillatory waves immunity	3	2/3	1/2
Conducted differential mode current disturbances (2 to 150 kHz)	6	4/6	2/4

(1) In the case of electromechanical electricity meters, no critical change values are defined for harmonic contents in the current circuits and for DC and harmonics in the current circuit.

Comment: small corrections and additions (e.g. reactive meters) have been made to the existing table which is surely not the ideal way how to approach it as the list of those disturbances have expanded since the publication of the directive. The alternatives here are: to delete this table altogether or to use formulations proposed by the drafting group or to replace it by complete tables for active/reactive meters used in the corresponding standards (FprEN 50470-3:2022, Table 9, page 13 and Table 10 for active meters and EN/IEC 62053-24:2020, Table 4, page 13 for reactive meters).

4.3. *Effect of disturbances of short duration ~~Permissible effect of transient electromagnetic phenomena~~*

The effect of ~~an electromagnetic~~ **a** disturbance **of short duration** on an electrical energy meter shall be such that during and immediately after a disturbance:

- any output intended for testing the accuracy of the meter does not produce pulses or signals corresponding to an energy of more than the critical change value,

  and in reasonable time after the disturbance the meter shall:

- recover to operate within the MPE limits, and
- have all measurement functions safeguarded, and
- allow recovery of all measurement data present prior to the disturbance, and
- not indicate a change in the registered energy of more than the critical change value.

The critical change value is the product of the number of measuring elements of the meter, the highest voltage within the rated operating conditions, I_{max} and 0,001 h.

~~The effect of an electromagnetic disturbance on an electrical energy meter shall be such that during and immediately after a disturbance:~~

— ~~any output intended for testing the accuracy of the meter does not produce pulses or signals corresponding to an energy of more than the critical change value,~~

~~and in reasonable time after the disturbance the meter shall:~~

— ~~recover to operate within the MPE limits, and~~

— ~~have all measurement functions safeguarded, and~~

— ~~allow recovery of all measurement data present prior to the disturbance, and~~

— ~~not indicate a change in the registered energy of more than the critical change value.~~

~~The critical change value in kWh is~~ $\cancel{m \cdot U_n \cdot I_{max} \cdot 10^{-6}}$

~~(m being the number of measuring elements of the meter,~~ $\cancel{U_n}$ ~~in Volts and~~ $\cancel{I_{max}}$ ~~in Amps).~~

~~4.3.2. For overcurrent the critical change value is 1,5 %.~~

~~**5. Suitability**~~

~~5.1. Below the rated operating voltage the positive error of the meter shall not exceed 10 %.~~

Comment: If the voltage is high enough for the meter to be operational, then it is covered by 4.2 (if we change it to generalised form or use the complete tables from the standards). If it is not operational anymore, it will not be measuring at all.

~~5.2. The display of the total energy shall have a sufficient number of digits to ensure that when the meter is operated for 4 000 hours at full load (~~$\cancel{I = I_{max}, U = U_n}$ ~~and PF = 1) the indication does not return to its initial value and shall not be able to be reset during use.~~

~~5.3. In the event of loss of electricity in the circuit, the amounts of electrical energy measured shall remain available for reading during a period of at least 4 months.~~

5.4. *Running with no load*

When the voltage is applied with**out any significant** ~~no~~ current flowing in the current circuit ~~(current circuit shall be open circuit)~~, the meter shall not register any energy.

~~When the voltage is applied with no current flowing in the current circuit (current circuit shall be open circuit), the meter shall not register energy at any voltage between 0,8 · U_n and 1,1 U_n.~~

5.5. *Starting*

The meter shall start and continue to register at U_n, PF = 1 (polyphase meter with balanced loads) and a current which is equal to I_{st}.

Starting current I_{st} relation to I_{tr} for active meters is in Table 4.

Table 4

Meters for	**Meters of class index**			**Power factor**
	A	**B**	**C**	
Direct connection	$\leq 0{,}05\ I_{tr}$	$\leq 0{,}04\ I_{tr}$	$\leq 0{,}04\ I_{tr}$	1
Transformer operated	$\leq 0{,}06\ I_{tr}$	$\leq 0{,}04\ I_{tr}$	$\leq 0{,}02\ I_{tr}$	1

Starting current I_{st} relation to I_n for reactive meters is in Table 5.

Table 5

Meters for	**Starting current I_{st}**			**sin φ (inductive or capacitive)**
	class A	**class B**	**class C**	
Direct connection	0,01 I_n	0,005 I_n	0.004 I_n	1
Connection through current transformers	0,005 I_n	0,003 I_n	0,002 I_n	1

~~6. Units~~

~~The electrical energy measured shall be displayed in kilowatt-hours or in megawatt-hours.~~

Comment: Annex I point 9.7 is sufficient (and better, because it is more future proof).

7. Putting utility electrical energy meters into use

(a) Where a Member State imposes measurement of residential use, it shall allow such measurement to be performed by means of any Class A meter. For specified purposes the Member State is authorised to require any Class B meter.

(b) Where a Member State imposes measurement of commercial and/or light industrial use, it shall allow such measurement to be performed by any Class B meter. For specified purposes the Member State is authorised to require any Class C meter.

(c) The Member State shall ensure that the user, when installing the meters, determines the foreseen and foreseeable practical working conditions, namely the rated operating conditions, so that the meters accurately measure the actual consumption of final customers and are suitable for their use.

Comment: in art. 7c) a merger of the proposal by the drafting group and the Electricity Directive, par. 22, 1 is made..

Harmonized standards:

- *Active electrical energy meters: (Fpr)EN 50470-3:2022, EN 50470-2: 2006 + A1:2018*
- *Reactive electrical energy meters: EN IEC 62053-24:2020*

CHAPTER II

DC electrical energy meters

DEFINITIONS:

DC energy, DC active energy - time integral of DC power

DC energy meter - instrument intended to measure DC (active) energy

transitional current I_{tr} - value of the current at, and above which, up to I_{max} full accuracy requirements of this chapter apply

minimum measurable quantity MMQ - minimum amount of energy for which the requirements of this document are met by an energy meter

SPECIFIC REQUIREMENTS

1. Accuracy

The manufacturer shall specify the class index of the meter. The class indices are defined as: Class A, B and C.

Table 6 - Acceptable relative error limits in per cent at reference conditions

Value of current	**Acceptable relative error limits in per cent for meters of class index**		
	A	**B**	**C**
$I_{min} \leq I < I_{tr}$	±2,5	±1,5	±1,0
$I_{tr} \leq I \leq I_{max}$	±2,0	±1,0	±0,5

2. Rated operating conditions

The manufacturer shall specify the rated operating conditions of the meter; in particular: the values of U_n, I_n, I_{st}, I_{min}, I_{tr}, I_{max} and MMQ if needed that apply to the meter.

Table 7 - Acceptable limits of relative error variation in per cent due to influence quantities

Influence quantity	**Value of current**	**Acceptable limits of relative error variation in per cent for meters of class index**		
		A	**B**	**C**
Temperature variation				
5 °C to 30 °C	$I_{min} \leq I \leq I_{max}$	±1,8	±0,9	±0,5
−10 °C to 5 °C 30 °C to 40 °C	$I_{min} \leq I \leq I_{max}$	±3,3	±1,6	±1,0
−25 °C to −10 °C 40 °C to 55 °C	$I_{min} \leq I \leq I_{max}$	±4,8	±2,4	±1,4
below −25 °C above +55 °C	$I_{min} \leq I \leq I_{max}$	±6,3	±3,1	±1,9

Voltage variation ±10 %	$I_{min} \leq I \leq I_{max}$	±1,0	±0,7	±0,2

3. MPEs

The effects of the various measurands and influence quantities (a, b, c,…) are evaluated separately, all other measurands and influence quantities being kept relatively constant at their reference values. The error of measurement, that shall not exceed the MPE is calculated as:

$$\text{Error of measurement} = \sqrt{(a^2 + b^2 + c^2 + \cdots)}$$

When the meter is operating under rated operating conditions the percentage errors shall not exceed the MPE limits given in Table 8.

Table 8

Value of current	Operating temperature range											
	5 °C to 30 °C			−10 °C to 5 °C or 30 °C to 40 °C			−25 °C to −10 °C or 40 °C to 55 °C			below −25 °C or above +55 °C		
	Meter class index											
	A	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
Meters for two-wire connection, meters for three-wire connection with balanced loads												
$I_{min} \leq I < I_{tr}$	3,5	2,0	1,0	5,0	2,5	1,3	7,0	3,5	1,7	9,0	4,0	2,0
$I_{tr} \leq I \leq I_{max}$	3,5	2,0	0,7	4,5	2,5	1,0	7,0	3,5	1,3	9,0	4,0	1,5
Meters for three-wire connection, measuring a single-sided load, but with balanced voltage supplied to the voltage circuits												
$I_{tr} \leq I \leq I_{max}$	4,0	2,5	1,0	5,0	3,0	1,3	7,0	4,0	1,7	9,0	4,5	2,0

When a meter operates in different temperature ranges the relevant MPE values shall apply. The meter shall not exploit the MPEs or systematically favour any party.

When an MMQ is specified no error limit is specified for energies below the MMQ. The relative error shall not exceed the limits specified for the relevant class indexes in Table 8 when the meter is operated under reference conditions at Un and Imax and an energy corresponding to the MMQ is measured..

4. Permissible effect of disturbances

4.1 *General*

The meter shall comply with the electromagnetic environment E1 and the additional requirements in points 4.2 and 4.3.

The electromagnetic environment and permissible effects reflect the situation that there are disturbances of long duration which shall not affect the accuracy beyond the critical change values and transient disturbances, which may cause a temporary degradation or loss of function or performance but from which the meter shall recover and shall not affect the accuracy beyond the critical change values.

4.2 Critical change values for disturbances of long duration

Table 9

Disturbance	Acceptable limits of variation in percent for DC meters of class		
	A	B	C
Severe voltage variation	3	2,1	0,6

Voltage unbalance (only applicable to 3-wire connection)	4	2	1
Fast transient bursts	6	4	2
Magnetic fields; HF (radiated RF) electromagnetic field; Conducted disturbances introduced by radio-frequency fields; and Oscillatory waves immunity	3	2	1
Conducted differential mode current disturbances (2 to 150 kHz)	6	4	2
Self-heating	1	0,7	0,5
Dry heat test, cold test, damp heat cyclic test	1	0,5	0,25

4.3 *Effect of disturbances of short duration*

The effect of a disturbance of short duration on an electrical energy meter shall be such that during and immediately after a disturbance:

- any output intended for testing the accuracy of the meter does not produce pulses or signals corresponding to an energy of more than the critical change value,

  and in reasonable time after the disturbance the meter shall:

- recover to operate within the MPE limits, and
- have all measurement functions safeguarded, and
- allow recovery of all measurement data present prior to the disturbance, and
- not indicate a change in the registered energy of more than the critical change value.

The critical change value is the product of the highest voltage within the rated operating conditions, I_{max} and 0,001 h.

5. **Suitability**

Starting current I_{st} relation to I_{tr} is shown in Table 10 below.

Table 10 — Starting current

Meters for	**Starting current I_{st}**		
	Class A	**Class B**	**Class C**
Direct connection	≤ 0,05 I_{tr}	≤ 0,04 I_{tr}	≤ 0,04 I_{tr}

Harmonized standard: EN 50470-4:2023

CONFORMITY ASSESSMENT
The conformity assessment procedures referred to in Article 17 that the manufacturer can choose between are: B + F or B + D or H1.

ANNEX X

ELECTRICITY SUPPLY EQUIPMENT MEASURING SYSTEMS (MI-00x)

The relevant requirements of Annex I, the specific requirements of this Annex and the conformity assessment procedures listed in this Annex, apply to electricity supply equipment measuring systems.

DEFINITIONS:

Electricity Supply Equipment Measuring System (ESE-MS) - a system in public use that includes all relevant legal metrological functions related to the point of one directional or bidirectional transfer of electrical energy between supply equipment (e.g. charging stations for electromobility) and non-stationary electrical equipment (e.g. EV) with power over 50 kW.

Comment: an updated definition from the Ad-hoc WG on Charging Infrastructure with red-highlighted changes.

ESE-MS with separately type approved meter – ESE-MS for which the basic metrology is provided by a separately type approved meter which has been tested for compliance with a recognised metering standard with equal or more stringent requirements.

Note: For ESE-MS with embedded metrology, the metrology is an integral part of the ESE-MS. In this case, separate type approval of the embedded metering functionality is not required, since it will be tested as part of the ESE-MS type approval process.

current, I - value of the electrical current flowing to or from the ESE-MS through the connection point. For AC ESE-MS, the value is the RMS value of the current. For DC ESE-MS, the value is the average value of the current.

starting current, I_{st} - lowest value of current specified at which the ESE-MS must register electrical energy at unity power factor and, for poly-phase ESE-MS, with balanced load.

minimum current, I_{min} - lowest value of current at which the ESE-MS is specified to meet the accuracy requirements of this Annex.

transitional current, I_{tr} - value of current at and above which the ESE-MS is specified to lie within the smallest maximum permissible error corresponding to the accuracy class of the ESE-MS.

maximum current, I_{max} - highest value of current at which the ESE-MS is specified by the manufacturer to meet the accuracy requirements of this Annex.

voltage, U -

For AC: RMS value of the electrical voltage supplied to or from the non-stationary electrical equipment at the connection point

For DC: value of voltage supplied to of from the non-stationary electrical equipment at the connection point

nominal voltage, U_{nom} - voltage specified by the manufacturer for normal operation of an AC ESE-MS. An ESE-MS may have multiple U_{nom}.

Note: A DC ESE-MS has no single nominal voltage, but rather a range of voltages from U_{min} to U_{max}.

nominal output frequency, f_{nom} - frequency of the voltage (and current) specified by the manufacturer for the outpower of the ESE-MS.

Note 1: For AC ESE-MS, the frequency of the power supplied to the ESE-MS and the power the ESE-MS supplies to the non-stationary electrical equipment are the same.

Note 2: For DC ESE-MS, f_{nom} is 0 Hz.

Connection point - point at which one non-stationary electrical equipment is connected to the fixed installation.

Note: If the output cable is a fixed part of the charging system, this point is defined as the connector at the end of the cable. Otherwise, the connection point is defined as the point of the charging system at which the cable is plugged in.

energy, active, E_a - instantaneous active power integrated over time

$$E_a = \int_0^T p(t)dt,$$

where E_a is the active energy
T is the total duration of the power delivery in a transaction
t is time
$p(t)$ is instantaneous power

base maximum permissible error (BMPE) - extreme values of the error (of indication) of an ESE-MS when the current is varied (AC and DC ESE-MS) and voltage (DC ESE-MS) within the intervals given by the rated operating conditions, and when the ESE-MS is otherwise operated at reference conditions.

minimum measured quantity, MMQ - minimum quantity of energy delivered in a transaction for which the manufacturer specifies that the ESE-MS will meet the BMPE of the ESE-MS's accuracy class.

certified output cable – an exchangeable output cable type firmly assigned to a given type of an ESE-MS or types of ESE-MSs tested together with the corresponding types of ESE-MS or ESE-MSs for compliance with the requirements of this Annex.

+ other definitions from OIML G22 as needed

SPECIFIC REQUIREMENTS

1. Accuracy

1.1 The manufacturer shall specify the rated operating conditions of the meter; in particular: the values of I_{max}, I_{st}, I_{min}, I_{tr}, U_{nom} that apply to the ESE-MS.

1.2 The manufacturer shall specify the class index of the ESE-MS. The class indices are defined as: Class B and C.

Table 1 – **Base maximum permissible errors -** acceptable relative error limits in per cent when the current is varied (AC and DC ESE-MS) and voltage (DC ESE-MS) within the intervals given by the rated operating conditions, and when the ESE-MS is otherwise operated at reference conditions.

Table 1

Quantity		**Base maximum permissible errors (%) for class**	
Current, I	**Power factor**	**B (1 %)**	**C (0.5 %)**
$I_{st} \leq I < I_{min}$	> 0.9	±15	±10
$I_{min} \leq I < I_{tr}$	> 0.9	±1.5	±1.0
$I_{tr} \leq I \leq I_{max}$	> 0.9	±1.0	±0.5

The given accuracy classes of an ESE-MS can be used exclusively in the full operational range of the ESE-MS or can be combined for different power ranges of the energy delivery.
Comment: in OIML G22 the accuracy class index A is also proposed. Out of sort of political reasons the accuracy classes of ESE-MS should be as close as possible to the accuracy class of fuel

dispensers of 0,5% if electricity charging should be a viable alternative for fuels also from the metrological point of view. Moreover, regulation is proposed for high-power ESE-MS only where better accuracy classes fit much better. Also with an assumed technological progress in foreseeable future it is proposed not to use the worst accuracy class.

1.3 ESE-MS without separately type approved meter shall be tested at least at the following current points: MMQ, I_{min}, I_{tr}, 50% I_{max}, I_{max}.

Comment: this arrangement might not be used much in practice but from the viewpoint of technological independence such an option should be available (nota bene that here we are talking about tests for type examination only). ***It has to be pointed out that in this case the provision of Annex I, art. 7.6 is applicable so that the manufacturer has to provide a communication tool for the notified body to be able to control the ESE-MS under test as required.***

1.4 In case of ESE-MS with separately type approved meter no such test under 1.3 shall be made, however the active energy delivered at the connection point shall satisfy the base MPEs given above as specified by the manufacturer.

Note: *For DC systems it is anticipated that an electric vehicle may be used as the test load. Under that circumstance, testing at the load presented by the vehicle shall be sufficient.*

1.5 The manufacturer can alternatively use output cables certified by a notified body by way of a test certificate to allow for an expedient exchange of damaged cables. The entire measuring instrument inclusive the output cable shall always satisfy the given accuracy class. The cable has to be properly marked and securely connected to the ESE-MS, the exchange to be made by the manufacturer or its authorized representative without any test.

Comment: it is a relatively urgent situation occurring in practice, however its correct legal formulation might be a challenge (to be left to the EC legal service).

1.6 The meter shall not exploit the MPEs or systematically favour any party.

2. Effect of influence quantities

The temperature coefficient of the ESE-MS shall fulfil the requirements of Table 2 when the ESE-MS is otherwise operated at reference conditions.

Table 2 – Limits for temperature coefficient of error

Influence quantity	B (1 %)	C (0.5 %)
Temperature coefficient, *c*, over any interval of the temperature range, which is not less than 15 K and not greater than 23 K, for current $I_{tr} \leq I \leq I_{max}$	±0.05	±0.03

When the load current is held constant at a point within the rated operating range with the EVSE otherwise operated at reference conditions, and when any single influence quantity is varied from its value at reference conditions to its extreme values defined in Table 3, the variation of error shall be such that the additional percentage error is within the corresponding limit of error shift stated in Table 3.

DC ESE-MS – Table 3:

Table 3

Influence quantity	Value	Current	Maximum permissible error shift (%) for ESE-MS of class	
			B (1 %)	C (0.5 %)

Self-heating	Continuous current at I_{max}	I_{max}	±0.5	±0.25
Conducted disturbances, low frequency	2 kHz–150 kHz	$I_{tr} \leq I \leq I_{max}$	±2.0	±2.0
Continuous (DC) magnetic induction of external origin	200 mT at 30 mm from core surface	$I_{tr} \leq I \leq I_{max}$	±1.5	±0.75
Magnetic field (AC, power frequency) of external origin	400 A/m	$I_{tr} \leq I \leq I_{max}$	±1.3	±0.5
Radiated, RF, electromagnetic fields	f = 80MHz–6000 MHz, Field strength ≤ 10 V/m	$I_{tr} \leq I \leq I_{max}$	±2	±1
Conducted disturbances, induced by radio frequency fields	f = 0.15MHz–80 MHz, Amplitude ≤ 10 V	$I_{tr} \leq I \leq I_{max}$	±2	±1
Operation of ancillary devices	Ancillary devices operated with $I = I_{tr}$ and I_{max}	$I_{tr} \leq I \leq I_{max}$	±0.3	±0.15

AC ESE-MS - the same items as in Table 3 + the items in Table 4:

Table 4

Influence quantity	**Value**	**Current**	**Maximum permissible error shift (%) for ESE-MS of class**	
			B (1 %)	**C (0.5 %)**
Voltage variation	0.9 × U_{nom} to 1.1 × highest U_{nom}	$I_{tr} \leq I \leq I_{max}$	±0.7	±0.2
Frequency variation of mains	Each f_{nom} ± 2 %	$I_{tr} \leq I \leq I_{max}$	±0.5	±0.2
Harmonics in voltage and current circuits	d < 5 % I d < 10 % U	$I_{tr} \leq I \leq I_{max}$	±0.6	±0.3
Reversed phase sequence (AC 3-phase only)	Any two phases interchanged	$I_{tr} \leq I \leq I_{max}$	±1.5	±0.1

3. Disturbances

In the presence of disturbances the legally relevant data shall not be incorrect or the shift in the accuracy measurements shall not exceed 1.0 BMPE even if the ESE-MS appears to function correctly. Ceasing to function is not a critical fault. If a disturbance interrupts a transaction, then either: (a) the transaction must be cancelled or (b) when the disturbance is removed, the transaction must be completed correctly.

Harmonized standards/documents: future OIML Recommendation based on OIML G 22, prEN

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CONFORMITY ASSESSMENT

The conformity assessment procedures referred to in Article 17 that the manufacturer can choose between are: B + F or B + D, H1 or G.