Suggestions for electricity topics in MID

from: ad hoc drafting group Annex V:

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Version 2 :: 2023 ~~September~~October 18th

1 Scope

In May 2023, the European Commission (DG GROW) asked WELMEC for thoughts on revising the MID. Regarding electricity topics, the relevant parts of the requests are to provide thoughts about:

- *the set of essential requirements e-vehicle charging stations should meet;*
- *whether the requirements of MID Annex V on electrical energy meters and the corresponding requirements in Annex I should be modified taking into account technological development, new uses and the roll-out of smart meters, and if yes, how.*

A crucial point in the European Commission's (EC) request is that "the essential requirements are technology neutral, future and innovation proof in order to reflect the principles of the New Legislative Framework".

The drafting group on electricity topics was composed in response to the above request. The four members – under their personal title – jointly provide the following considerations and suggestions for modifications to MID Annex ~~I and MID Annex V. On the date of issue of this document, it is submitted to the WELMEC Executive Board and simultaneously circulated to WELMEC WG11 to ask its members for their opinion on this advice from the drafting group. Given the lack of consultation outside of the small drafting team, the~~ ~~**document at hand should not be seen as representing a broad consensus view**~~~~.~~V. After a consultation period of ~2 weeks in WELMEC WG11 and in the broader community (until Oct 9th/13th), this proposal was amended only on editorial aspects, and therefore still **does not represent a consensus view. In Section 3, we do summarise the major points of the feedback received.**

We expect that the outcome of the **Annex I** drafting group proposal will lead to [*a*] a modernisation of point 10.1 to be open up to other ways to indicate the measurement result besides a (local) display or hardcopy; and [*b*] an adaptation of point 11, in combination with the definition of utility, worded such that it applies to EVSE. With this assumption regarding the outcome of the Annex I process, our proposal is restricted to Annex V, and no longer includes suggestions for Annex I that were included in the previous issue of this document, version 1, dated 2023 Sep 18th.

2 Background and introduction

The above assignment starts with electric vehicle charging stations (Electric Vehicle Supply Equipment; EVSE). While the EU Alternative Fuel Infrastructure Regulation (AFIR) will soon be implemented, setting various requirements for EV charging infrastructure, it does not address (or even refer to) metrology aspects. To address EVSE metrology, the EC has realized that an adaption of MID is necessary. Our concrete suggestions in section 3 are in the form of **adaptions** to the existing Annex V of MID – increasing its technology neutrality –, rather than a separate new Annex for electrical energy measurement in EVSE applications alone. The proposed simplifications, in our view, make the Annex V more suitable to a wider range of applications and use cases, including – but certainly not restricted to – EVSE.

~~After identifying points in the current MID that provide friction for the EVSE application, one will find that the majority of these are not in Annex V but in the horizontal essential requirements of Annex I. We therefore also felt compelled to **provide suggestions for changes to Annex I**, which, if followed, would make the MID a less technology specific, more broadly applicable Directive also for non-EVSE applications.~~

The technological changes referred to in the second bullet of the assignment in section 1 are gathered in the EU Energy Directive 2019/944. This directive – among other things – imposes requirements on the functionality of smart metering systems to show 'validated historical consumption' (article 20(a))[1] and on the length of the time slots that consumers can be billed over (article 20(g))[2].

With the time resolution coupled to the network imbalance mitigation, time intervals come down to 15-minute intervals, in practice. The need to show 'validated' historical consumption poses a challenge for the legally controlled registers in the current generation of electricity meters. The sheer amount of data is unpractical to browse through on a typical household meter interface (usually with very small displays and only few buttons) and local storage capacity is often insufficient. We should realize, though, that with the technology available in the modern world, there is **no need to impose that all legally relevant measurement data is necessarily stored inside the meter**.

For **smart metering** aspects of legal metrology[3], the key is how and where to store legally relevant data, how to keep the data legally relevant, and what to include in the conformity assessment. To ensure availability, integrity and authenticity of digitally sealed ('signed') metrological data packets, the **conformity assessment procedure** should (i) focus on the **interface** between metering system and storage system (**not** meaning that the entire internet in between needs to be included), (ii) confirm authenticity of **stored and retrieved data**, and (iii) check that a **compromised data packet** is appropriately flagged. Once this is realized, the MID as it stands is already suitable to smart metering.

While business cases are emerging[4] where unit price of energy (e.g., euro per kilowatt-hour) changes depending on the power (electric equivalent of 'flow rate'; e.g. in watt) at which it is delivered, we expect that the traded commodity will continue to be energy, although integrated over smaller time periods than what was traditionally the case. The difference of energy readings is a measure for the power delivered during the time between the two readings. Therefore, it is in our view **not necessary**

[1] Literally, article 20(a) reads:
the smart metering systems shall accurately measure actual electricity consumption and shall be capable of providing to final customers information on actual time of use. Validated historical consumption data shall be made easily and securely available and visualised to final customers on request and at no additional cost. Non-validated near real-time consumption data shall also be made easily and securely available to final customers at no additional cost, through a standardised interface or through remote access, in order to support automated energy efficiency programmes, demand response and other services.

[2] Literally, article 20(g) reads:
smart metering systems shall enable final customers to be metered and settled at the same time resolution as the imbalance settlement period in the national market.

[3] Other legislation, such as the General Data Protection Regulation, deals with how long, where, data is allowed to be stored.

[4] For example, utility distribution companies charging for peak demand (power level); or a charging station allowing each customer to choose between a 'fast' (high power) mode at high energy unit price and a 'slow' (lower power) at a lower energy unit price.

to include power as a new measurand in the scope of MID. Introducing different requirements to serve the same purpose would cause additional implementation costs without benefit. In addition, in our opinion, there are no explicit changes needed in Annex V to facilitate dynamic tariffs, in the assumption that Annex I point 10.1 (indication of measurement result) will be clarified to be less technology specific.

Finally, regarding time. The essential requirements in the current MID already imply that a time window, over which electrical energy is measured and billed, is set accurately; the situation is no different whether the time window is a year, a month, or 15 minutes. Accurate time keeping is easily and universally accessible, so there is no information asymmetry between trading partners. Neither consumer nor supplier nor manufacturer complaints are known. Therefore, we conclude that the current, implicit regulation of time is satisfactory for all affected parties. **Measuring absolute time and the length of time windows does not need to be regulated explicitly** by legal metrology[5].

[5] In fact, the industry has already covered restrictions on time keeping in technical standard EN 62054-21.

3 Summary of feedback on version 1 of this document

[Note: this entire section 3 is new in version 2, but not explicitly marked as such.]

This summary reflects, to the best of our ability, feedback submitted in writing via the WELMEC WG11 consultation and the broader WELMEC consultation, and discussions at the in-person WG11 meeting on October 10th-11th in Bern, Switzerland. For the sake of brevity, this summary includes Annex V specific matters only. Concerns about the general process without impact assessment and cost-benefit analysis are not included.

For a large fraction of changes proposed in our version 1, there is at least one comment in favour and at least one comment against, with varying degrees of detail. We **have not adopted or rejected any comments**; instead, we summarize the major comments – and only the major ones – as follows.

3.1 General

- In favour of proposed changes in Annex I because they **open up opportunities for innovation and technical progress** and are seen as a necessary prerequisite for addressing, among other urgent matters, EVSE metrology in Annex V.
- Against proposed changes of Annex I because **they limit innovation and technical progress** much more than the present Annex I, which achieving the same or lower level of consumer protection.
- Against changes because all practically relevant and urgent problems can be solved by guidance and, if needed, a delegated act.

3.2 Question of EVSE

- In favour of the proposal to **keep MID limited to 'any device or system with a measurement function'** for active electrical energy (Art. 4(1) MID). This is seen as key to ensuring a high level of consumer protection during the lifetime of the instrument (e.g. allowing cable replacement) while keeping the directive free of application-specific requirements. This approach is being used by a number of countries without problem[6] (for transformer operated meters and also in EVSE). It allows the manufacturer to integrate additional functionality in the product and does not preclude entire EVSE being conformity assessed.
  Support: CH, FI, NO, HU, SE
- Suggesting to adapt the proposed Annex V such that its **requirements unambiguously state that complete measuring systems are covered**, including transfer point and protection and indication of transaction data. It cannot be left to technical standards to fill in requirements that are missing in MID. This approach allows design freedom to manufacturers of EVSE. In addition, certified measuring systems can contain predefined replaceable parts, facilitating easy cable replacement in use. Various member states have already decided, individually, that requirements in the current MID are not sufficient to ensure a high level of consumer protection for EVSE users.[7]
  Support: AT, BE, CZ, FR, ES, DE, NL, SK, TR, CLC TC13 WG03, ChargeUp Europe, FORCE, NMi Certin
- Against the proposal; an instrument specific annex for electrical energy measurement for EVSE is a better option, because the application is so different from other types of measuring electrical energy.
  Support: CZ, DE, ES, SK, NMi Certin

[6] .. whereas others have (are) instated (-ing) national EVSE legislation as current MID requirements are not sufficient.

[7] .. although other member states are convinced that a legislative system based on the current MID is sufficient.

3.3 Question of including measuring instruments for other forms of electrical energy than the active electrical energy (AC and DC) presently covered by Annex V

Note: This point results in the need to revise Annex V points 4 and 5.

- In favour of the proposed changes.
- Generally sympathetic to the idea, but against the proposed changes without impact assessment and cost benefit analysis (mainly because these modifications affect all electrical energy meter, including utility meters).

3.4 New accuracy class index

- In favour of class D or no objection.
- Possibly in favour of a class D, but not of the proposed MPEs.
- Against class D.

3.5 Possibility to specify temperature limits outside of range (−70 to +70 °C)

Those who address our in proposal in their comments, are in favour. Expansion is beneficial to some manufactures and, mostly, users. No impact on those who will not use the possibility.

3.6 Time measurement in or out of scope

With time not being a measurand of its own, some commenters stress that accuracy of measurement of time period shall nevertheless be checked at conformity assessment stage.

3.7 Other major Annex V topics commented on

country / organisation	topic / clause	comment (possibly condensed)
CZ	DC	* suggesting different MPEs for DC (2%, 1%, 0.5%), with separate temperature dependence tables * suggesting tighter MPEs (only B/1%, C/0.5%) for EVSE than for normal AC electr. meter, * restricting EVSE metrology scope to those >50kW
DE, NMi Certin	scope	Regarding proposed changed note in scope section of Annex V below title: In our view, the opening of the description to “representation” of a meter is much too wide. It would be possible to completely outsource the metering technology that is actually to be protected.
DKE (German mirror comm. IEC/CLC)	scope	A critical evaluation is needed to see whether LPIT should be included in the MID
ES	general	Agree that time is easy to measure, but should be considered.
ES	def.	Instead of 'transferred', a specific definition should be given to active, reactive and DC energy. Reactive energy is not transferred.
NMi Certin	2	Retain original text to avoid composite error becoming too broad.
RO	3. MPEs	Add MPEs of 2%, 1%, 0.5% classes to Table 2.
RO	4.2.3	put in accordance the definition of critical change value (expressed in absolute value) with 4.3.1 - half of MPE (expressed in %)
CLC TC13 WG03	term.	Use term ‘ESE-MS’ to delineate the measuring system, and to be open to charging non-stationary electrical devices.
CLC TC13 WG01	4.2	unclear how to determine when a result is or is not valid during a disturbance. Needs to be adapted.
Enedis	4.2	Introduce a new disturbance 'DC ripple' following OIML G22, 2.3.14
		* worry about open interpretation if Table 3 (disturbances) is removed
Enedis	4.2	It has to be carefully checked that “the indication of the measurement result is such that it cannot be interpreted as a valid result” is usable once received by the billing party.
CLC TC13 WG01	4.2	removing harmonics requirements leaves matters too open. Risk of diverging interpretation.
EMH metering	4.2	Worry about open interpretation if Table 3 (disturbances) is removed.
CLC TC13 WG01	4.3	only EM disturbances should be considered in the Directive.
EMH metering	4.3.1	Newly proposed formula leads to unacceptably high errors for wide range meters (AC 58V-240V) operated at 58V.
NMi Certin	4.3.2, 5.1, 5.2, 6	Disagree with removing point 4.3.2, point 5.1, point 5.2, and point 6.
CLC TC13 WG01	5.1	The comments suggests that if the meter operates (below the rated operating voltage), then this would be considered as a disturbance. Either (a) Revised MPE requirements would apply according to 4.2.3 (half of the MPE), which is not realistic in practice; or (b) declare the results as invalid, which would work.
RO, EMH metering	5.3	suggest to keep original text.
CLC TC13 WG01, EMH metering	5.4	“zero current” or “no current” would be better (closer to old text)
CLC TC13 WG01	5.5	if 'product of I and U' is meant as rms, then agreed, otherwise clarification is needed.
EMH metering	5.5	Corresponding to the definition for apparent power, it is better to define startup at a power factor of 1. Apparent power can appear with noise coming from electronic parts on the current.
EMH metering	7/8	Suggesting that DoC also allowed to be delivered electronically.

4 Suggested textual changes for Annex ~~I and Annex~~ V

Based on the considerations ~~above,~~in Section 2, our opinion is that simplifications – often achieved by removing parts of the text from the MID's Annex V – can facilitate the inclusion of important aspects such as DC metering, energy other than active energy, and EV charging applications.

Table 1: proposed changes to Annex V

Annex V – current text **(MID 2014/32/EU)**	**Suggestion for change, if any** marked with **bold lettering** for additions/changes and strikethroughs for deletions	**Notes and motivation**
Title ACTIVE ELECTRICAL ENERGY METERS (MI-003)	Title ~~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 intended for residential, commercial and light industrial use. Note: Electrical energy meters may be used in combination with external instrument transformers, depending upon the measurement technique applied. However, this Annex covers only electrical energy meters but not instrument transformers.	The relevant requirements of Annex I, the specific requirements of this Annex and the conformity assessment procedures listed in this Annex, apply to ~~activeactive~~ electrical energy meters intended for residential, commercial and light industrial use. Note: Electrical energy meters **are** used **with the direct or the indirect measurement technique. When the indirect measurement technique is used, a representation of the energy consumed in the circuit to be measured is applied to the electrical energy meter. This Annex covers only electrical energy meters. It does not cover the external instruments such as instrument transformers used to generate the representation.**	Suggested change makes this point future proof without requiring changes to existing technical solutions. For example, with the new suggestion, not only conventional instrument transformers would be explicitly qualified as being outside of the MID (as is already the case with the current MID), but also connected EVSE cables and modern instrument transformers ("LPIT"), which can be digital. This exclusion achieves two things simultaneously: 1. It prevents such external parts from having to be under metrological seal (which would make maintenance of, e.g., DC EVSE in use unnecessarily burdensome); 2. It leaves the option open for EVSE technical standards to explicitly include hardware up to and including the transfer point as well as compensation parameters in software in the conformity assessment procedures. Current and recent work on prEN 50732 and OIML G22 have in fact done this. For instrument transformers, such standards exist already, for example national Metering Codes (for utilities) and EN 50470-3, subclause 10.5 (for manufacturers).

		In our view, standardization groups should be urged to continue to take the inclusive approach.
DEFINITIONS An active electrical energy meter is a device which measures the active electrical energy consumed in a circuit.	DEFINITIONS An ~~active~~ electrical energy meter is a device which measures the ~~active~~ electrical energy ~~consumed in a~~ **transferred between** circuit**s**.	Remove the word "active", to be inclusive to reactive energy. Replace "consumed" by "transferred" to be clearer in the case of small scale producers (households, commerce and light industry), see Directive (EU) 2019/944 and M/541.
2. Rated operating conditions The manufacturer shall specify the rated operating conditions of the meter; in particular: The values of fn, Un, In, Ist, Imin, Itr and Imax that apply to the meter. For the current values specified, the meter shall satisfy the conditions given in Table 1; [Table 1] 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 from cosϕ = 0,5 inductive to cosϕ = 0,8 capacitive.	2. Rated operating conditions The manufacturer shall specify the rated operating conditions of the meter; in particular: The values of fn**,** Un, In, Ist, Imin, Itr and Imax that apply to the meter. For the current values specified, the meter shall satisfy the conditions given in Table 1; [Table 1] The **manufacturer shall specify the operating** ~~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:~~ ~~*(remove formulae)*~~ [illegible] ~~power factor range at least from cosϕ = 0,5 inductive to cosϕ = 0,8 capacitive.~~ **Upper temperature limits above 70 °C may be specified. Lower temperature limits below -40 °C may be specified.**	Changes suggested allow flexibility for meters (devices or systems) to be designed for different purposes and conditions, including DC metering. We suggest removing the last two sentences as they are often redundant and sometimes in contradiction (for transformer-operated meters). Point 7(c) is a better place for this. At present, the upper temperature limit specified by the manufacturer may not exceed 70 °C. Therefore, the users have to make sure the ambient temperature does not exceed 70 °C, requiring impractical technical measures such as active cooling in outdoor applications with solar irradiation. Allowing MID certification at higher (or lower) temperatures (to be declared by the manufacturer) would facilitate the market in finding more efficient technical solutions.
3. MPEs The effects of the various measurands and influence quantities (a, b, c,…) are evaluated separately, all other measurands and	3. MPEs The effects of the various measurands and influence quantities (a, b, c,…) are evaluated separately, all other measurands and	We suggest to introduce a new accuracy class 'D'. This may prove useful for current high-power and other future applications. See the

<table>
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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:

Error of measurement = sqrt[a^2+b^2+c^2 …]

When the meter is operating under varying-load current, the percentage errors shall not exceed the limits given in Table 2.
<table>
<tr><td colspan="13">MPEs in percent at rated operating conditions and defined load current levels and operating temperature</td></tr>
<tr><td></td><td colspan="3">Operating temperatures</td><td colspan="3">Operating temperatures</td><td colspan="3">Operating temperatures</td><td colspan="3">Operating temperatures</td></tr>
<tr><td></td><td colspan="3">+ 5 °C … + 30 °C</td><td colspan="3">– 10 °C … + 5 °C or + 30 °C … + 40 °C</td><td colspan="3">– 25 °C … – 10 °C or + 40 °C … + 55 °C</td><td colspan="3">– 40 °C … – 25 °C or + 55 °C … + 70 °C</td></tr>
<tr><td>Meter class</td><td>A</td><td>B</td><td>C</td><td>A</td><td>B</td><td>C</td><td>A</td><td>B</td><td>C</td><td>A</td><td>B</td><td>C</td></tr>
<tr><td colspan="13">Single phase meter; polyphase meter if operating with balanced loads</td></tr>
<tr><td>$I_{min} \leq I < I_{tr}$</td><td>3,5</td><td>2</td><td>1</td><td>5</td><td>2,5</td><td>1,3</td><td>7</td><td>3,5</td><td>1,7</td><td>9</td><td>4</td><td>2</td></tr>
<tr><td>$I_{tr} \leq I \leq I_{max}$</td><td>3,5</td><td>2</td><td>0,7</td><td>4,5</td><td>2,5</td><td>1</td><td>7</td><td>3,5</td><td>1,3</td><td>9</td><td>4</td><td>1,5</td></tr>
<tr><td colspan="13">Polyphase meter if operating with single phase load</td></tr>
<tr><td>$I_{tr} \leq I \leq I_{max}$
, see exception below</td><td>4</td><td>2,5</td><td>1</td><td>5</td><td>3</td><td>1,3</td><td>7</td><td>4</td><td>1,7</td><td>9</td><td>4,5</td><td>2</td></tr>
<tr><td colspan="13">For electromechanical polyphase meters the current range for single-phase load is limited to $5I_{tr} \leq I \leq I_{max}$</td></tr>
</table>
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.
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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:

Error of measurement = sqrt[a^2+b^2+c^2 …]

When the meter is operating ~~under varying load current~~**within rated operating conditions**, the percentage errors shall not exceed the limits given in Table 2.

[for readability, a proposed version of Table 2 *is shown in full width below this table; additions:* ***new accuracy class D; removed caps of upper and lower temperatures by replacing "-25 °C to -40 °C" by "below -25 °C" and "55 °C to 70 °C" by "above 55 °C").****]*

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.
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proposed new Table 2 below this table.

In addition to the proposed changes in the middle column, some clarification is needed on the interpretation of ‘temperature’, which in the case of EVSE could be interpreted as ambient temperature just outside an integrated meter (inside the EVSE), or ambient outside the EVSE enclosure. This topic should be covered in a WELMEC guide, in our view.
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<td>
4.2 Effect of disturbances of long duration Table 3: Critical change values for disturbances of long duration
<table>
<tr><td colspan="4">Critical change values for disturbances of long duration</td></tr>
<tr><td>Disturbance</td><td colspan="3">Critical change values in percent for meters of class</td></tr>
<tr><td></td><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Reversed phase sequence</td><td>1,5</td><td>1,5</td><td>0,3</td></tr>
<tr><td>Voltage unbalance (only applicable to polyphase meters)</td><td>4</td><td>2</td><td>1</td></tr>
<tr><td>Harmonic contents in the current circuits (*)</td><td>1</td><td>0,8</td><td>0,5</td></tr>
<tr><td>DC and harmonics in the current circuit (*)</td><td>6</td><td>3</td><td>1,5</td></tr>
<tr><td>Fast transient bursts</td><td>6</td><td>4</td><td>2</td></tr>
<tr><td>Magnetic fields; HF (radiated RF) electromagnetic field; Conducted disturbances introduced by radio-frequency fields; and Oscillatory waves immunity</td><td>3</td><td>2</td><td>1</td></tr>
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Remove Table 3.

**4.2.1. The effect of a disturbance of long duration on an electricity meter shall be such that:
- the change in the measurement result is no greater than the critical change value as defined in point 4.2.3, or
- the indication of the measurement result is such that it cannot be interpreted as a valid result, such as a momentary variation that cannot be interpreted, memorised or transmitted as a measuring result.**

**4.2.2. After undergoing a disturbance, the electricity meter shall:
- recover to operate within MPE, and
- have all measurement functions safeguarded, and
- allow recovery of all measurement data present just before the disturbance.**

4.2.3. The critical change value is the quantity corresponding to half of the magnitude of the MPE.
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Removing the overly specific content of Table 3 makes this point robust for future developments, independent of technology.

It takes away, among other things, the problem that DC cannot be a disturbance if it can also be defined as a valid rated operating condition.

The text proposed here to replace Table 3 has been inspired by the gas meter requirements, Annex IV point 3.1.
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4.3. Permissible effect of transient electromagnetic phenomena	4.3. ~~Permissible~~ **E**ffect of **disturbances of short duration**~~ transient electromagnetic phenomena~~	*Replace it with, e.g., fixed absolute error (independent of MPE), like in Point 3.1 of Annex IV gas meters.* The phrasing of the titles of point 4.2 and point 4.3 should be such that there is no possibility of an unintended gap. The present phrasing excludes disturbances of short duration that are not electromagnetic phenomena, which is not intended.
4.3.1. 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 m*Un*Imax*1e-6 (m being the number of measuring elements of the meter, Un in Volts and Imax in Amps).	4.3.1. 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 in kWh is m*Un*Imax*1e-6~~ ~~(m being the number of measuring elements of the meter, Un in Volts and Imax in Amps).~~**The critical change value is the product of the number of measuring elements of the meter, the highest voltage within the rated operating conditions, Imax and 0,001 h.**	The formula for the critical change value is rephrased to cover the case of meter for wide voltage ranges, as commonly used for EV charging applications.
4.3.2. For overcurrent the critical change value is 1,5 %.	(remove)	If overcurrent is transient, a relative error is meaningless and 4.3.1 is sufficient.

		If overcurrent is of long duration, 4.3.2 doesn't apply (4.2 does).
5.Suitability		
5.1. Below the rated operating voltage the positive error of the meter shall not exceed 10 %.	(remove)	The requirement is redundant: 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). 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 ($I = I_{max}$, $U = U_n$ and PF = 1) the indication does not return to its initial value and shall not be able to be reset during use.	(remove)	The requirement is redundant: More than one overflow during the billing period is a violation of the MPEs. Harmonised standards should (and do) define useful technical specifications. The present point 5.2 is not future proof since it is based on an assumption of the billing period (at the time, one year). A reset feature is a feature facilitating fraudulent use (Annex I point 7.1). NB: No change to the current harmonised standard is needed.
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.	(remove)	The requirement is redundant: If any loss of electricity causes a reset, this is a feature facilitating fraudulent use (Annex I point 7.1). Technical details of this nature are best left to harmonised standards. NB: No change to the current harmonised standard is needed. Requirement of 4 months also follows from 2 (b) Article 21 directive 2019/944, i.e., 11520 records on 15 min interval). Thoughts: ● *In practice, nowadays if you require 4 months, a*

		manufacturer will give you 10 years. ● *Assuming that the wording and/or interpretation of horizontal requirements in Annex I is adapted such that storage capacity is legally allowed to be provided outside of the measuring instrument (under seal, e.g. with an electronic seal), then there is no problem with (costly and unreliable) internal storage capacity.* *As a result, point 5.3 of Annex V (measurement results available for at least 4 months) does not pose any actual restrictions. It could (should?) be removed.*
5.4. Running with no load 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 .	5.4. 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 energy ~~at any voltage between 0,8 · U_n and 1,1 U_n~~.	The current wording contains technical details for testing and assumptions about the rated operating range that are not true in all applications any more. The proposed wording leaves the specification of technical details for testing to harmonised standards and adapts the requirements such that it refers to the rated operating conditions specified by the manufacturer (point 2 Annex V). NB: No change of the current harmonised standard is needed.
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} .	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~~ **a rate of change of energy** equal to **the product of the smallest voltage within the rated operating conditions and** I_{st}.	Current phrasing needs adaption to encompass reactive energy. The proposed new text would not constitute a change for current metering hardware, while simultaneously opening options to cover all electrical energies and all technologies.

6. Units The electrical energy measured shall be displayed in kilowatt-hours or in megawatt-hours.	(remove)	Annex I point 9.~~6~~7 is sufficient (and better, because it is more future proof). NB: No change to the current harmonised standard is needed.
7. Putting 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 current range be determined by the utility or the person legally designated for installing the meter, so that the meter is appropriate for the accurate measurement of consumption that is foreseen or foreseeable.	Rephrase 7(c): The Member State shall ensure that ~~the current range be determined by the utility or the person legally designated for installing the meter~~ **the user determines the foreseen and foreseeable practical working conditions, namely the rated operating conditions**, so that the meter is ~~appropriate for the accurate measurement of consumption that is foreseen or foreseeable~~ **suitable for its use**. *(user :: any legal or natural person who determines the use of the measuring device, regardless of ownership)*	Public EVSE fall under 'commercial use', in our view, for which the current MID specifies class B already. No change needed. Regarding rephrased 7c: The "practical working conditions" (cf Annex I point 7.2) link the suitability for the intended use (manufacturer's responsibility) and the practical use (user's responsibility). Only this link gives practical relevance to Annex I point 7. In our view, it could be left to the user (e.g., distribution company, or CPO) to decide if a reactive energy meter should have the same or a lower accuracy class than for active energy. The text in this point of Annex V needs no further adjustment to accommodate this.

Table 2: Proposed changes to Table 2 in point 3 of Annex V (changes highlighted in yellow):

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**				**~~– 40 °C …~~ below – 25 °C or above +55 °C ~~… + 70 °C~~**			
Meter class	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Single phase meter; polyphase meter if operating with balanced loads																
$I_{min} \leq I < I_{tr}$	3,5	2	1	0,4	5	2,5	1,3	0,6	7	3,5	1,7	0,8	9	4	2	1,0
$I_{tr} \leq I \leq I_{max}$	3,5	2	0,7	0,3	4,5	2,5	1	0,4	7	3,5	1,3	0,5	9	4	1,5	0,7
Polyphase meter if operating with single phase load																
$I_{tr} \leq I \leq I_{max}$, see exception below	4	2,5	1	0,3	5	3	1,3	0,4	7	4	1,7	0,5	9	4,5	2	0,7
For electromechanical polyphase meters the current range for single-phase load is limited to $5I_{tr} \leq I \leq I_{max}$																