Suggestions for electricity topics in MID

from: ad hoc drafting group Annex V:

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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**.

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 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

[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.

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].

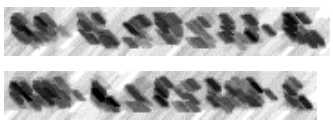
3. Suggested textual changes for Annex I and Annex V

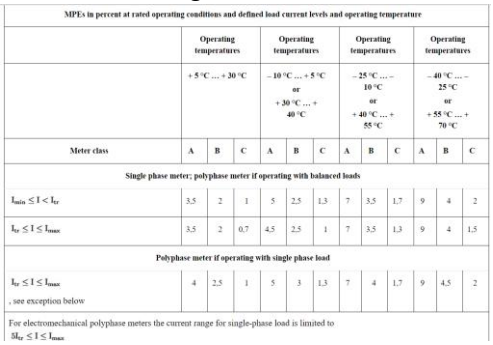
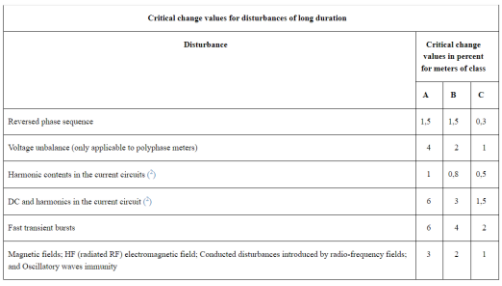
Based on the considerations above, our opinion is that simplifications – often achieved by removing parts of the text from the MID's Annex V – can facilitate the inclusion of important aspects such as DC metering, energy other than active energy, and EV charging applications.

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 active 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

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

		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)*~~  ~~power factor range at least from cosϕ = 0,5 inductive to cosϕ = 0,8 capacitive.~~	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.

	Upper temperature limits above 70 °C may be specified. Lower temperature limits below -40 °C may be specified.	
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: 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.  MPEs in percent at rated operating conditions and defined load current levels and operating temperature 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 … – 25 °C or + 55 °C … + 70 °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 $I_{min} \le I < I_{tr}$: 3,5 2 1 | 5 2,5 1,5 | 7 3,5 1,7 | 9 4 2 $I_{tr} \le I \le I_{max}$: 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 $I_{tr} \le I \le I_{max}$, see exception below: 4 2,5 1 | 5 3 1,5 | 7 4 1,7 | 9 4,5 2 For electromechanical polyphase meters the current range for single-phase load is limited to $5I_{tr} \le I \le I_{max}$ 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.	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: 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.	We suggest to introduce a new accuracy class 'D'. This may prove useful for current high-power and other future applications. See the proposed new Table 2: Proposed changes to Table 2 in point 3 of Annex V (changes highlighted in yellow): 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.
4.2 Effect of disturbances of long duration Table 3: Critical change values for disturbances of long duration  Critical change values for disturbances of long duration Disturbance: Critical change values in percent for meters of class A B C Reversed phase sequence: 1,5 1,5 0,3 Voltage unbalance (only applicable to polyphase meters): 4 2 1 Harmonic contents in the current circuits (*): 1 0,8 0,5 DC and harmonics in the current circuit (*): 6 3 1,5 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	*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**	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.

	- 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.**	
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	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**	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.

(m being the number of measuring elements of the meter, Un in Volts and Imax in Amps).	**product of the number of measuring elements of the meter, the highest voltage within the rated operating conditions, Imax and 0,001 h.**	
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	5.5. Starting	Current phrasing needs adaption to encompass reactive energy.

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 .	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** Ist.	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 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 $5I_{tr} \leq I \leq I_{max}$																

As indicated in the introduction, we furthermore propose the following changes and/or simplifications to the horizontal Annex I:

Annex I – current text (MID 2014/32/EU)	**Suggestion for change, if any**	**Notes and motivation**
(In definitions list, above point 1 of Annex I.) Utility: A utility is regarded as a supplier of electricity, gas, thermal energy, or water.	*(We refrain from any concrete suggestions, but provide some notes and thoughts in the rightmost column.)*	Since Annex V is not specific to utility applications, the term "utility" is not used (except superfluously in point 7c) and could be removed (or maintained) without any effect as far as Annex V is concerned. To make the MID futureproof it is necessary to reconsider the definitions used. In the energy transition the boundaries of utility and utility measuring instruments become more fluid as users of utility measurement instruments are not necessarily only large-scale energy suppliers or utility companies anymore. Especially for the suppliers of EVSE and the growing potential of bidirectional charging the current definition of utility may be burdensome instead of helpful. If the original definition would be removed, there would no longer be a need to sweep any and all electricity and gas measurements under the utility umbrella. This would affect, of course, other parts of Annex I (8.5, 9.4, 10.5, 11.1.), for which adaptation proposals exist. For other/alternative suggestions on 'utility' matters throughout the remainder of MID (i.e., the instrument specific annexes and including Annex I) we are happy to provide additional input and textual suggestions.
8. Protection against corruption		
8.4. Measurement data, software that is critical for measurement characteristics and metrologically important parameters stored or transmitted shall be adequately protected against accidental or intentional corruption.	*Suggestion of drafting group Annex I:* 8.4. **Each of the following** shall be adequately **secured** and protected **to ensure availability, integrity and authenticity:**	

	● Measurement data **processed, stored or transmitted;** ● Software **stored or transmitted** that is critical for measurement characteristics**;** ● metrologically important parameters stored or transmitted. */////////* *Instead of the above, we (drafting group Annex V electricity) suggest the following alternative:* **Legally relevant** measurement data, software that is critical for measurement characteristics and metrologically important parameters ~~stored or transmitted~~ shall be adequately protected **to ensure availability, integrity and authenticity** ~~against accidental or intentional corruption~~.	Drafting group Annex V is worried that the wording proposed by drafting group Annex I could turn out to be insufficiently technology neutral. This might lead to unintended gaps in the future. Drafting group Annex V proposes an alternative wording that is more technology neutral and future proof, along the lines aiming for performance requirements. It enumerates the information to be protected and specifies that they are to be protected without enumerating under which conditions – they are to be protected *always*. Guidance should be provided by WELMEC guides, ideally horizontal WELMEC guides.
8.5. For utility measuring instruments the display of the total quantity supplied or the displays from which the total quantity supplied can be derived, whole or partial reference to which is the basis for payment, shall not be able to be reset during use.	~~8.5. For utility measuring instruments the display of the total quantity supplied or the displays from which the total quantity supplied can be derived, whole or partial reference to which is the basis for payment, shall not be able to be reset during use.~~ *(Remove)*	See our comments concerning the definition of utility. The requirement is redundant: A reset feature is a feature facilitating fraudulent use (Annex I point 7.1). Therefore, removing this requirement has no impact on Annex V and, most likely, no impact on any other instrument-specific annex.
10. Indication of result		
10.1. Indication of the result shall be by means of a display or hard copy. 10.5. Whether or not a measuring instrument intended for utility measurement purposes can be remotely read it shall in any case be fitted with a metrologically controlled display accessible without tools to the consumer. The reading of this display is the measurement result that serves as the basis for the price to pay.	*Suggestion of drafting group for Annex I with modifications by drafting group for Annex V:* 10.1. A measuring instrument shall: ● be fitted with a metrologically controlled display and/or printer accessible without tools ~~to the consumer~~ **and/or** ● **be capable to present the relevant data on a metrologically controlled**	The suggested changes, combining the current points 10.1 and 10.5, are in support of technology neutrality. It explicitly opens up options for other ways to indicate the measurement result, while staying in control of its authenticity and integrity. Additionally, the suggested change facilitates (remotely) displaying legally relevant measurement results on a website or an app on mobile phone. This is essential to streamline, e.g., dynamic tariffing

	remote display accessible without tools and/or ● **be capable to easily present the data via metrologically controlled application software on the device of the user and/or consumer and/or** ● **be capable to easily present the data via a metrologically controlled webpage** The ~~reading of this display is the~~ measurement result **presented by any of the four methods** ~~that~~ serves as the basis for the price to pay. 10.5. *(remove)* ////////////// *Alternative suggestion of drafting group for Annex V:* 10.1: The result **of the measurement shall be indicated.** 10.5. *(remove)*	display, needed to align with the energy directive. In our view (the MID electricity dg), the 'four bullets' options provided by the Annex I dg would be sufficient, but may unintentionally exclude (future) technological solutions that could be equally acceptable. As an alternative, this enumeration could be made a list of examples or moved to WELMEC guides. ////////////// The very short proposed alternative is future proof and open for innovation. Guidance should be provided in harmonised standards or horizontal WELMEC guides.
10.2. The indication of any result shall be clear and unambiguous and accompanied by such marks and inscriptions necessary to inform the user of the significance of the result. Easy reading of the presented result shall be permitted under normal conditions of use. Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.	*Suggestion (possibly superseded by later versions) of drafting group for Annex I with modifications by drafting group for Annex V:* The indication of any result shall be clear, unambiguous, **trustworthy and non-discriminatory**. **The user shall be**~~.. and accompanied by such marks and inscriptions necessary to~~ inform**ed** ~~the user~~ of the significance of the result. ~~Easy reading of the presented result shall be permitted under normal conditions of use.~~ Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.	
10.3. In the case of hard copy the print or record shall also be easily legible and non-erasable.	*Suggestion of drafting group for Annex I with modifications of drafting group for Annex V:*	After a proposed change of points 10.1 and 10.2 is agreed upon, this point 10.3 should be adapted, or in fact removed completely. Reason: if not easily legible, then the

	10.3. In the case of ~~**hard copy a**~~ print-**out,** ~~**record**~~, it shall ~~also~~ be easily legible and non-erasable. *///////* *Alternative:* *(remove 10.3)*	requirements in 10.2 are sufficient; if it is erasable, then it does not meet "trustworthy", as suggested in the adapted version of point 10.2.
10.4. A measuring instrument for direct sales trading transactions shall be designed to present the measurement result to both parties in the transaction when installed as intended. When critical in case of direct sales, any ticket provided to the consumer by an ancillary device not complying with the appropriate requirements of this Directive shall bear appropriate restrictive information.	*(remove)*	This requirement is redundant with points 10.1 and 10.2, so it should be removed.
10.5	*(remove; see above at 10.1)*	
11. Further processing of data to conclude the trading transaction		
11.1. A measuring instrument other than a utility measuring instrument shall record by a durable means the measurement result accompanied by information to identify the particular transaction, when: (a) the measurement is non-repeatable; and (b) the measuring instrument is normally intended for use in the absence of one of the trading parties. 11.2. Additionally, a durable proof of the measurement result and the information to identify the transaction shall be available on request at the time the measurement is concluded.	*Suggestion of drafting group for Annex I with modifications of drafting group for Annex V:* 11. A durable proof ~~**in the form of a print-out or electronic receipt**~~ of the measurement result and the information to identify the transaction shall be available on request at the time the measurement is concluded, when: (a) the measurement is non-repeatable; and (b) the measuring instrument is normally intended for use in the absence of one of the trading parties. ~~In the case of an electronic receipt the measurement result and the information to identify the transaction shall be accompanied by information that enables the consumer to verify the integrity and authenticity with easily available tools.~~	Combine 11.1 and 11.2 to enable the use of an electronic receipt as durable proof of the transaction. A "durable proof" is understood to mean (in the world of today), a print-out, or electronically sealed data indicated somewhere, while it does not exclude future technologies. The sentence proposed by the Annex I drafting group, starting "In the case of .." is really an example, and it is too specific to one technical implementation. Better placed in a WELMEC guide.