

Template for comments and convener's observations

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Country Code ¹	Clause	Paragraph/ Figure/Table	Type of comment ²	Comments	Proposed change	Convener's responses
0001 ILAC	5.1		te	A gauge block is obviously a measurement standard, but it is not the realization of the definition of a quantity e.g. length as that definition is realized by use of a laser interferometer. Probably it would be better to delete the word "definition" as that seems to strict for the definition to be applied broadly.	Delete "the definition of" from the term.	Disagree Empirical quantities are already real entities, and therefore cannot be "realized". Vice versa, definitions are linguistic or conceptual entities, which can be realized. A clarification is also provided in a new Note. Also, the definition remains consistent with the VIM3.
0002 ISO 464	5.1		ge	5.1 [VIM3: 5.1; VIM2: 6.1; VIM1: 6.01] measurement standard This defines measurement standard in general. Entries 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8 and 5.10 provide a definition of each specific or type of measurement standard but shall have common ideas of measurement standard in 5.1. In this sense, EXAMPLE 1 to 8 in 5.1 may lead to misunderstanding by losing generalities of measurement standard.	Remove EXAMPLE 1 to 8 or, otherwise, provide an example representing each term in 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8 and 5.10.	Partly Agreed. Examples were provided for some of the 5.2 -5.10 entries and some examples in 5.1 have been deleted.
0003 IUPAC	5.1	definition	te	Although the definition has appreciable pedigree, it remains hard to understand owing to the almost arcane idea of 'realization of a definition'. The result is that the examples are far more informative than the definition. In addition, it is not clear that a measurement uncertainty is a defining characteristic of a measurement standard. Many pharmaceutical pure reference standards have no associated uncertainty statement but are sufficiently well characterized to be used as calibration materials.	Consider revising along the lines of "device [or system] providing a reference value for a quantity [and associated measurement uncertainty]"(text in [...] optional)	Not agreed. This proposal does not include "the definition of", which would be a major change to the definition.
0004 IUPAC	5.1	definition	ed	unclear on the nature of 'quantity'	Consider revising along the lines of "device [or system] providing a reference value and associated measurement uncertainty for a quantity"	See 0003..
0005 CMI	5.1	Example	ed	The numbering of examples and the following units should be better separated from each other.	Only typographical improvement	Agreed.
0006 ISO 465	5.1	Example 7, Example 8	te	For example 7: It should be made clear that the certified value corresponds to the "concentration" of cortisol. Example 7 and 8 are very similar	Please revise, i.e.: "Set of reference materials of cortisol in human serum with different concentrations, each accompanied with a certified value with measurement uncertainty. EXAMPLE 5 Set of reference solutions of cortisol in human serum having a certified quantity value" Consider deleting either example 7 or example 8 as both provide similar explanations	Agreed. The Example 7 is revised and Example 8 is deleted. See also comment 0002 above.

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0007 IUPAC	5.1	Examples 7, 8	ed	These two examples are essentially identical	Consider removing one of examples 7 and 8	Agreed. See 0006 above.
0008 IEC-IT NC01 0009 ISO 466	5.1	Note 1	te	It is preferable to make use of the generic term "reference material" instead of "certified reference material".	Modify Note as follows: NOTE 1 A measurement standard can be a measuring system, a material measure, or a certified reference material.	Partly agreed.
0010 IUPAC	5.1	Note 2	ed	The vocabulary uses the term 'standard' in the sense of 'norme' in many of the notes	Amend to "This definition is concerned solely with the second meaning"	Agreed. This is what the Note says in the last sentence.
0011 ISO 467	5.1	Note 5	te	Certified reference materials, also called physical artefacts, play a crucial role in realizing the definition of an individual quantity (metrological traceability). VIM4 does not clearly specify whether certified reference materials fall under procedure 2 (i.e., physical phenomenon) or procedure 3 (i.e., material measure).	Please explicitly appreciate "certified reference material"	Agreed. Note 5 has been deleted. See also 0012.
0012 IUPAC	5.1	Note 5	ed	note 5 is unnecessary for understanding or use of the term and there seems to be no fundamental difference between the first two modes of realization given; both involve setting up a standard based on a physical phenomenon	delete note 5	Agreed.
0013 ISO 468	5.1	Note 7	te	Producers of measurement standards (e.g., producers of reference materials operating according to ISO 17034) assess the stability of the relevant properties of a reference material under pre-defined conditions and over a specific time interval. Uncertainties associated to potential instability must be included in the uncertainty of the assigned quantity (reference) value. Acknowledging the above, Note 7 gives a wrong impression that measurement standards are not necessarily stable at the time of use. Instead, a measurement standard is guaranteed to be stable at the user's premises provided its shelf life has not expired and instructions for storage and use are adhered to.	Note 7 should be revised accordingly	Partly agreed. No suggested wording provided, but wording updated to be more neutral.
0014 IUPAC	5.1	Note 7	te	requirement ("must") on use of measurement standards in inappropriate context (note on meaning)In addition, "evaluation of the stated value and its uncertainty"	Reduce to "NOTE 7 The stated value or associated uncertainty of a measurement standard can change	Partially agreed. Re-worded See also 0013.

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				implies a reference measurement at the same time as the standard is used in for calibration, which is almost never practical.	over time, requiring periodic reassessment or, sometimes, reassignment at each time of use."	
0015 IUPAC	5.1	Note 7	ed	The 'relevant quantity' cannot reasonably change – only the value can.	Amend to 'stated value'	Partially agreed. The NOTE is shortened for clarity and to be more general. See also 0013.
0016 IUPAC	5.1	Note 9	ed	Poor wording - "The realization" would be referred to as "the embodiment"	Amend to "The term 'embodiment' is sometimes used for 'realization'"	Agreed.
0017 IUPAC	5.1	Notes 3, 4	ed	These notes say the same thing in different words	merge to one shorter Note; for example, amend Note 3 to "NOTE 3 Measurement standards are used to conserve, reproduce, or disseminate the specified individual quantity, and to calibrate measuring systems, thereby establishing metrological traceability" and delete note 4	Disagreed. Different types of usages are provided.
0018 IUPAC 0019 AU	5.2	definition	ed	unnecessary words 'and used'	delete "and used"	Agreed
0020 IUPAC	5.2	Example 1	ed	unnecessary words 'as is'	delete 'as is'	Agreed
0021 ISO 470	5.2	Example 2	ed	Chorionic gonadotrophin (without "h"?)	Chorionic gonadotropin	Agreed
0022 ILAC	5.3		te	The role of national measurement standards was historically of huge importance. With the re-definition of the SI units, it may be relevant to delete this definition and make that clear also in the introduction.	Delete term. Or at least make a note explaining the changing role of national standards and that metrological traceability in any case should be to the SI and not any national metrology institute.	Not agreed. Concept is commonly used in many economies. Also, has been used since VIM1.
0023 IUPAC	5.4	Example 1	te	Poor example - the action described is carried out many times a day in a routine analytical laboratory and almost never results in a primary standard	Clarify the circumstances in which this would result in a primary standard or delete the example	Not agreed to delete example. This is kept instead of example 3.
0024 ILAC	5.4	Example 2	te	Something is missing. What is a primary standard for pressure? A pressure balance.	Amend what is needed to the example.	Partly agreed. Pressure balance added to text.
0025	5.4	Example 3	te	See comment on 5.4 example 1 – the act of mixing does not generally result in a primary standard	Clarify the circumstances in which this would result in a primary standard or delete the example	See 0023.

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IUPAC						
0026 ISO 471	5.4	Eexample 4	ed	Two different spellings of "artefact" (in 5.4) and "artifact" (in 5.4 EXAMPLE 4) were used in this version. It would be better to keep the consistency of spelling throughout a document.	Spell "artifact" and "artefact " in a consistent way.	Agreed
0027 National Institute of Standards (NIS), Egypt	5.4	definition	ge	What is the difference between artefact and artifact in the new and old definitions of primary measurement standard?	By referring to dictionary, we think that artifact is more representative. So, the proposed definition is "measurement standard established using a primary method, or a primary reference procedure, or created as an artifact, chosen by convention."	Not agreed – with "artifact" and not "artefact" The VIM4 is following the British English spelling.
0028 ISO 473 0029 ILAC	5.6		te	A Reference Standard is used to transfer/disseminate metrological traceability	Propose adding the following to the end of the current definition, ".....or at a given location for the purpose of disseminating metrological traceability."	Not agreed. Using "calibration" in the definition already addresses this suggestion.
0030 IUPAC	5.6	definition	ed	definition unnecessarily long and includes non-essential detail	shorten to "measurement standard designated for the calibration of other measurement standards"	Disagree. This usage is kept for historical reason, where the organization/location has a particular relevance.
0031 ISO 472 0032 EC-168	5.6	term	te	Every measurement standard can be used to calibrate other measurement standards; and to refer directly to ISO Guide 98 and to delete Note 4 and 5	Delete this definition	Noted, kept for historical reasons.
0033 ILAC	5.6-5.8		te	The hierarchy of standards is by far historical and depends on the use rather than the nature of the standard. In any case the names for standards are all just basically measurement standards. A working measurement standard in some laboratories are even primary standards and in some cases working standards is a secondary standard and/or travelling standard. In general the use of those terms are obsolete and a slimming of the vocabulary is relevant. The hierarchy of standards have e.g. been reduced to a minimum in ISO/IEC 17025:2017 compared to earlier version.	Remove those terms to be included all 4 to be jointly included as a note for 5.1: "Standards have traditionally been given names according to their use and accommodation, e.g. "reference measurement standard" if the standard is used for calibration of other standards, "working measurement standard" if used for routine calibrations and "travelling measurement standard" when used on site at different locations."	Noted, definitions kept for historical reasons. The proposed Note basically defines these terms anyway, which is not done using Notes in the VIM4.
0034 ISO 474	5.7	term & definition	te	Introducing the term "calibrator" gives the wrong impression that a working standard is intended exclusively for calibration.	Please delete the term "calibrator" Revise the definition as follows: "measurement standard that is used routinely to calibrate or verify	Not Agreed. Prefer wording in VIM4 1CD.

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				Working standards are also used to verify the performance of measuring instruments or measuring systems. Note, in some fields, working standards are also called "transfer standards", e.g., zeta potential transfer standard.	the performance of measuring instruments or measuring systems" Consider adding an additional note for introducing the term "transfer standard"	The adopted definition is actually very close to the one proposed here
0035 IUPAC	5.8	definition	ed	definition unnecessarily long and fails to distinguish the concept from measurement standards that can be transported but are not designed for that purpose	shorten to "measurement standard designed for frequent transport between different locations"	Partially agreed. Definition shortened, and a new Note has been added.
0036 ISO 475 0037 PTB 0038 PTB-OIML	5.9	Example	te	It is not a good idea to use adjustable callipers to compare end standards. Adjustable callipers have an uncertainty with is ten times larger than the uncertainty for end standards.	Change the text to: Electro-mechanical comparator to compare end standards.	Partially agreed. Example has been deleted.
0039 NPL, UK	5.10	Note 3	ed	'Outstanding' is a subjective and non-comparative adjective.	Change text to "...have superior stability compared to those based on material properties."	Agreed
0040 IUPAC	5.10	Note 5	te	note incorrect – this is not the meaning of 'inherent', which only means that the property is always present. It is the word 'reproducible' in the definition that implies constancy.	delete the Note – it is unnecessary as 'inherent' is used in its normal dictionary sense.	Agreed. The Note is deleted.
0041 ILAC	5.11		te	This definition is a combination of a primitive and a well described term and therefore not needed to define.	Delete term.	Agreed. Entry has been deleted.
0042 ISO 476 0043 ISO 477 0044 EC-169	5.11	definition	te	Why is the term "conservation" used instead of the easier understandable "maintenance"? In addition, "conservation" usually means putting things under specific conditions and leaving it alone. Verification definitely is usually not part of conservation, but definitely of "maintenance".(If the authors decide to keep the term, then please insert one or more examples)	The term "conservation" should be replaced by "maintenance". Doing this, the term becomes self-explanatory and could even be scrapped.	Agreed. Entry has been deleted
0045 ILAC	5.12		te	This change in definition relies on the introduction of chapter 6. If that is not introduced rather revert to VIM 3 formulation.	Revert to VIM 3 if chapter 6 is not included.	Chapter 6 will stay. Alignment with REMCO definition is the goal. Also see 0048

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0046 ISO 478	5.12		te	There is one open question to consider, that is, if the word "material" used here is sufficiently defined. Some readers have confused material to mean measurement standards (which makes no sense). This confusion originates from the missing definition of "material". Just recently, (19 April) in a meeting of ISO-CASCO WG57, the "experts" had problems in understanding what is meant by reference material and this was due to the fact that they had problems in understanding what a "material" is in this context.	We propose to add a definition of material or at least make a NOTE to "RM" explaining and delimitating the understanding of "material" with respect to "measurement standard".	Noted. See 0048
0047 ISO 479	5.12		te	Definition reads: "material, sufficiently homogeneous and stable with reference to one or more specified properties, which has been established to be fit for its intended use in measurement or in examination" This definition raises a general requirement regarding homogeneity and stability which might be a completely un-necessary requirement in certain applications. Therefore we propose a re-wording that is purely goal-oriented, making it shorter and clearer.	we propose a re-wording that is purely goal-oriented, making it shorter and clearer: reference material Material, with one or more specified properties, which has been established to be fit for its intended use in a measurement process.	The aim here is to align the VIM definition for RM and CRM with the REMCO definition to the extent possible. See also 0048.
0048 ISO 480	5.12	definition	te	This seems to differ (again) from the REMCO (now TC334) definition	Align with REMCO	Agreed.
0049 ISO 481	5.12	definition and Note 4	te	Revision of the ISO REMCO (replaced by ISO TC 334) definition of reference material to include the separate terms "measurement" and "examination" is yet another example of JCGM/WG2 inserting its narrow view of restricting measurement to quantity values. Regarding NOTE 4, properties of RMs can include ordinal quantity values	Adopt the definition of reference material as given in Guide 30:2015: "material, sufficiently homogeneous and stable with respect to one or more specified properties, which has been established to be fit for its intended use in a measurement process" Reference ISO Guide 30:2015, Reference materials – Selected terms and definitions, definition 2.1.1 NOTE 4: Move NOTE 4 to NOTE 1 position and change text to: Properties of reference materials can be quantities, ordinal quantity values, or nominal properties. Remove NOTE 8	Noted. See 0048
0050 IEC-IT NC02 0051 ISO 482	5.12	Note 1	te	It is very important to clarify that CRMs are a subgroup of RMs (see ISO Guide 30:2015 definition), with additional characteristics (fully explained in the definition of CRM), in order to eliminate the confusion which currently exist, so that many producers and users consider RMs and CRMs as separate entities.	Modify Note as follows: NOTE 1 Reference materials can be certified reference materials or reference materials without a certified property value. is a generic term. The subgroup of RMs, called "certified reference materials" possesses additional characteristics.	Noted. Note1 deleted. However see 0052

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0052 ISO 483	5.12	Note 1	ed	NOTE 1 Reference materials can be certified reference materials or reference materials without a certified property value.	Clearer wording: NOTE 1 The term reference materials encompasses both certified reference materials and reference materials without certified values.	Agreed. However deletion of the Note is considered a better solution.
0053 ISO 484	5.12	Note 2	ed	NOTE 2 For a reference material to be used as a measurement standard for calibration purposes it needs to be a certified reference material.	Improve English language	Noted. See 0054
0054 IUPAC	5.12	Note 2	te	Implied requirement ("needs to be") on use of RMs in inappropriate context (note on meaning or use of term)	Delete Note 2 – inappropriate in a vocabulary If retained, amend to "Reference materials used for calibration purposes are usually certified reference materials"	Agreed. However, the Note is moved to 5.14 and wording adjusted.
0055 ISO 485	5.12	Note 3	te	This is confusing, as no specific term nor non-certified RM exists	A "Non-certified" should be added before "Reference material" in this example.	Partially agree about the confusion. However, the term "non-certified" is not defined.
0056 ISO 486	5.12	Note 3	ed	NOTE 3 Reference materials can be used for measurement precision evaluation and quality control. This note can be understood ambiguously. WG to clarify the intention and reword	Add "for" for more clarity to read: NOTE 3 Reference materials can be used for measurement precision evaluation and for quality control. If this is not the intention of the phrase, then NOTE 3 Reference materials can be used for measurement precision evaluation and for measurement precision quality control.	Agreed.
0057 EC-170	5.12	Note 3	te	This is confusing, as no specific term nor non-certified RM exists	A "Non-certified" should be added before "Reference material" in this example.	See 0055.
0058 ISO 487	5.12	Note 6	ed	Any measuring instrument or device can have indications outside the SI. This note does not add specific clarity to the definition. Delete the note	Delete the note.	Not agreed. Note has been clarified. This is similar to the Note in VIM 3.
0059 ISO 488 0062 EC-171	5.12	Note 7	te	An RM can be used for several purposes in a measurement, but not in the same measurement. The scrapping of the "the same" or "given" from the previous version makes the note less understandable.	Add "in a given/in a specific" or similar.	See 0060.
0060 ISO 489	5.12	Note 7	te	"NOTE 7 A given reference material can only be used for one purpose in a measurement, either calibration or quality control, but not both. "This note is detailing on a certain aspect of the application and does not contribute to the definition of the term. Therefore delete.	Delete note.	Agreed.
0061	5.12	Note 7	te	Note untrue. For example, a solid pure reference material can be used for calibration and as a regular	Delete Note 7	Agreed. See 0060.

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IUPAC				check on whether calibration has been correctly carried out, by independently making up a set of calibration solutions and a set of quality control solutions.		
0063 ISO 490	5.12	Note 8	ge	REMCO has recently be transformed into a Technical Committee (TC334)	Name of committee not necessary in the note. Propose to delete the name of the committee.	Agreed,
0064 IUPAC	5.12	Note 8	ed	ISO REMCO has been disbanded	Amend to "ISO TC334" or shorten to "ISO Guide 30, Reference materials – Selected terms and definitions has an analogous definition but uses the term "measurement process" for both measurement and examination"	Noted. See 0063
0065 National Institute of Standards (NIS), Egypt	5.12	Note 7	ed	NOTE 7 in VIM4 is written as "A given reference material can only be used for one purpose in a measurement, either calibration or quality control, but not both."For non-English speaking countries, it is not clear that a measurement gives the same meaning of a given measurement, as mentioned is NOTE6 of VIM3. We think that NOTE6 of VIM3 is clearer.	We propose to add the word "given" to NOTE7 so that it becomes: "A given reference material can only be used for one purpose in a given measurement, either calibration or quality control, but not both."	Noted. See 0060.
0066 ILAC	5.12	Note 7	te	Change "quality control" for "assurance of the validity of the results" which is the term used in ISO/IEC 17025:2017	A given reference material can only be used for one purpose in a measurement, either calibration or assurance of the validity of the results, but not both	Noted. See 0060.
0067 ILAC	5.13		ed	certified reference material reference material, characterized by a metrologically valid approach for one or more specified properties, accompanied by an RM certificate that provides the values of the specified properties, associated uncertainties, and statements of metrological traceability	Undefined acronym (RM). I suggest that it be spelled out in full (reference material)	Agreed.
0068 ISO 491	5.13			The term "RM certificate" is used in 5.13.	Propose to replace "RM certificate" with "CRM certificate".	Not agreed. This wording complies with ISO 17034. The term RM certificate is used in ISO 17034. RMs without certified values have product information sheets.
0069 ILAC 0070 ISO 492	5.13		te	When ISO 17034 was developed there was an extensive discussion concerning this definition. In the end it was decided to replace the term "approach" with the term "procedure". The reason for the change was a widespread feeling that an approach was a "not so detailed methodology described at principle level, and not necessarily documented". The WG decided that this was just not good enough, why the definition in ISO Guide 30 was modified. The WG was of the opinion that the change was an improvement to be included in the next revision of ISO Guide 30.	Change "approach" to "procedure".	Agreed. This complies with ISO 17034. Approach versus procedure.

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0071 KR-OIML	5.13	Note 3	te	I understand that metrology is valid for both quantities and nominal properties. But metrological traceability can be applied for quantities only. The traceability that can be used for nominal properties is called examination traceability.	Removal of NOTE3 so that the definition holds good for quantities only, not nominal properties	Not agreed. Note 3 explains that the definition is taken from ISO Guide 30:2015. We recognize that the Note is still valid although ISO Guide 30 and VIM then do not match perfectly.
0072 IEC-IT NC03 0073 ISO 493	5.13	New Note and Note 2	te	We deem that it is appropriate to add a note from ISO Guide 30:2015 definition of "certified reference material" (clause 2.1.2) and modify Note 2 accordingly.	Add the following notes as first ones: NOTE 1 The concept of value includes a nominal property or a qualitative attribute such as identity or sequence. Uncertainties for such attributes may be expressed as probabilities or levels of confidence. NOTE 12 Metrologically valid approaches for the production and characterization of CRMs are primarily given in ISO 17034, General requirements for the competence of reference material producers. Renumber other notes accordingly.	Disagreed. Current wording is not improved with this proposal.
0074 ISO 494	5.13	Note 1	ed	Copy-Paste effect from an ISO document. This note does not add value to the definition within the VIM	Delete the note.	Not agreed. This is relevant information.
0075 ISO 495	5.13	Note 2	te	In the example it should be make clear that the assigned value is a "certified value".	Please revise as follows : "Human serum with assigned certified value for the substance concentration of [...]."	Agreed.
0076 IUPAC	5.13	Note 2	te	Implied requirement ("Only CRMs can be used") on use of RMs in inappropriate context (note on meaning or use of term)	Amend to "Certified reference materials are often intended for calibration or for assessing measurement trueness"	Agreed. Much better formulation.
0077 ISO 496	5.13	Note 3	ed	In contradiction to the statement, the definition does slightly differ from the definition given in ISO Guide 30:2015, i.e.: "reference material (RM) characterized by a metrologically valid procedure for one or more specified properties, accompanied by an RM certificate that provides the value of the specified property, its associated uncertainty, and a statement of metrological traceability"	Please add the year of publication of the ISO Guide, i.e., ISO Guide 30:2015 Acknowledging the slight differences between the proposed VIM4 definition and the definition given in ISO Guide 30:2015, the note should be revised as follows: "The definition is based on ISO Guide 30:2015 [...]."	Agreed.
0078	5.13	Note 3	te	The last part of Note 3 is likely to mislead the readers into thinking that the modifiers 'metrological' and	This definition is taken from ISO Guide 30, Reference materials – Selected terms and definitions, developed	Noted. The VIM4 definition of 'metrology' has been expanded to incorporate nominal

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KRISS				'metrologically' are also used for nominal properties in this Vocabulary.	by ISO/REMCO, where the modifiers "metrological" and "metrologically" are used for both quantities and nominal properties, whereas in this Vocabulary they are only used for quantities.	properties, although we agree that, for now, some unavoidable ambiguity persists here.
0079 ISO 498 0080 KR-OIML	5.14		te	A certified value of a CRM is NOT assigned to the relevant property of the CRM, but measured by a metrologically valid procedure. 'Assigned quantity values' are different in their contextually meaning from 'measured quantity values'. For example, for intrinsic measurement standard, values are assigned by consensus and does not need to be measured with a valid measurement procedure.	Alteration of definition : value, assigned or measured for a property of a certified reference material (CRM) that is accompanied by an uncertainty and a statement of metrological traceability, identified as such in the CRM certificate	Not agreed. The present formulation is not seen to contradict that the value is "measured".
0081 IEC-IT NC04 0082 ISO 497	5.14	definition	te	We deem that it is necessary to expand the definition in order to take examination into account.	Modify definition as follows: value, assigned to a property of a certified reference material (CRM) that is accompanied by an uncertainty and a statement of metrological traceability or examination traceability, identified as such in the CRM certificate	Partially agreed. See new wording.
0083 ISO for the 499	5.14	Note	te	NOTE currently reads: "The value mentioned in the definition of either a value of a quantity or a value of a nominal property." Sounds awkward and could be rephrased. Further, the NOTE does not include ordinal quantity value and it should.	NOTE: Value refers to either a quantity value, ordinal quantity value or nominal property value.	Not agreed. Ordinal properties are considered to be quantities in VIM 4, see 1.30 and 1.31.
0084 IUPAC	5.13	Note 3	ed	ISO REMCO has been disbanded	delete "developed by ISO/REMCO,"	Partially Agreed. TC 334 mentioned also.
0085 National Institute of Standards (NIS), Egypt	5.14	definition	te	In addition to the definition of "certified value of a CRM", a definition of "indicative value of reference material" is highly recommended to be addressed in VIM4 as defined in [ISO guide 80].	Indicative value [ISO Guide 80]: Value of a quantity or property, included in the certificate of a CRM or otherwise supplied, which is provided for information only (i.e., is not certified by RM producer or the certifying body).	Not agreed This goes beyond the scope of the VIM, and should be left for TC 334 documents
0086 ISO 500	5.15	definition	ed	this definition of 'commutability' is much too long, and differs substantially from other definitions in current use	Adopt IFCC description	Agree, new simplified definition based on IFCC definition
0087 IUPAC	5.15	definition	ed	there are no short, good and complete definitions for commutability, but this definition is much longer than most and differs substantially from other definitions in current use	Pending a more succinct form, adopt IFCC description (modified below to use VIM terms and generalise beyond 'clinical samples'): property of a reference material that relates to the closeness of agreement between measured values for the RM and measured values for other relevant	Partially agreed. See 0086:

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					materials when measured by two or more measurement procedures	
0088 IUPAC	5.15	Note 2	te	recommendation on use of RMS in inappropriate context (note on use/meaning of term)	Amend Note 2 to factual statement: "ISO 15193, In vitro diagnostic medical devices – Measurement of quantities in samples of biological origin – Requirements for content and presentation of reference measurement procedures, recommends that if an internationally recognized reference measurement procedure for the measurand exists, it should be included in commutability investigations"	Partially agreed.
0089 IUPAC	5.15	Note 3	te	requirement on use of RMS in inappropriate context (note on use/meaning of term)	Either quote the recommendation or requirement of a particular standard (see comment on 5.15 note 2 for example) or delete the note	Partially agreed, Note has been restricted to clinical chemistry.
0090 IUPAC	5.16	definition	te	the definition is unduly verbose, contains non-essential detail, and could refer to any verified data, published or not note also that the source of data is nearly always known, so 'from an identified source' adds nothing useful (particularly when the main difference between 5.16 and 5.17 is that 5.17 gives this and .	Shorten verified data published for general use in measurement or examination and add "Note: verified data is usually critically evaluated and checked for accuracy" And keep the note on 'accuracy', referring instead to the above note.	Not agreed. The "verified for accuracy" seems important for the definition and should not be a Note.
0091 NPL, UK	5.16	Note	ed	The first part of the note is superfluous.	The note should read simply: "Nowadays 'data' is commonly used in the singular sense, instead of 'datum'."	Not agreed. Kept as in VIM 3.
0092 IUPAC	5.17	definition	ed	'recognized body' is not sufficient for 'standard' (many recognized authorities have no formal role in standardization); the main characteristic is the purpose Note also that a regulatory body	Amend to (for example)reference data issued for the purpose of harmonization by a recognized authority	Not agreed.
0093 ISO 501	5.17	Example 1	te	CODATA does not only recommend values for basic constants, but it also gives values for conversion factors. It is not clear whether the latter also fall under "reference data".	Please clarify	Not agreed. No suggestion provided.
0094 ISO 502	5.18		te	A very abstract definition, difficult to use on daily practices	All necessary operations to compare a measuring instrument or a measuring system of lower order (measurand), with a measuring instrument or a measuring system of higher order (reference measurement standard)	Not agreed. Lower order and higher order are undefined/unclear.
0095 ISO 503	5.18		te	We acknowledge the work on the definition of calibration. If we are right assuming that NOTE 2 is	If our assumption is right, then we propose: NOTE 2 The relation for obtaining a measurement result from an indication may be expressed by a statement,	Agreed.

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				meant to explain "step 2" from the definition, we propose to use the key word "relation" from the definition also in the note to replace the unspecific word "outcome". This would add much clarity. However, if our above assumption should be wrong, then please acknowledge that there still is a lack of clarity which requires further action on making the definition clearer.	calibration function, calibration diagram, calibration curve, or calibration table. In some cases, it may consist of an additive or multiplicative correction of the indication with associated measurement uncertainty.	
0096 ISO 504	5.18		te	The second step is not part of definition of calibration since this does not determine calibration as an operation. After completing calibration of a measuring instrument, for instance, the calibration laboratory does not (necessarily) use the information to establish a relation for obtaining a measurement result from an indication of the instrument, but the user does. Hence, it would be better to put this step in a note showing the purpose of calibration.	Rephrase definition:5.18 [VIM3: 2.39; VIM2: 6.11; VIM1: 6.13]calibration operation performed on a measuring instrument or a measuring system that, under specified conditions establishes a relation between the values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties Replace NOTE 4 with: NOTE 4 The information from calibration is used to establish a relation for obtaining a measurement result from an indication of the calibrated measuring instrument or measuring system.	Disagreed. Two-step definition maintained.
0097 ILAC	5.18	definition	te	The "and" between part 1 and 2 of the definition means that a rather large part of calibration laboratories do no longer perform calibration according to this definition. The huge majority of calibration laboratories exclude step 2. The user of a calibrated instrument has to decide - with or without the help from the calibration laboratory - how it wishes to use calibration results and NOTE 4 does not repair this deficiency in the definition. Moreover, in many cases the main (and only) result of the calibration is measured instrument's error (bias) together with its uncertainty. Then it's upon a user how to handle those results.	Shorten the definition to be: "operation performed on a measuring instrument or a measuring system that establishes a relation between reference values and corresponding instrument indications with associated measurement uncertainties "And then change part 2 of the definition to become a note that will replace NOTE 4:"Note 4: A calibration may include sufficient information to establish a relation for obtaining a measurement result from an indication",	Disagreed. See 0096.
0098 ISO 505	5.18	definition	te	The definition is far too long, and the alleged two-step process is both too restrictive and hard to explain to practitioners.	Shorten to something like "establishment of a relationship between indications and reference values"	Noted. Wording slightly shortened.
0099 ISO 506	5.18	definition	te	A very abstract definition, difficult to use on daily practices.	All necessary operations to compare a measuring instrument or a measuring system of lower order (measurand), with a measuring instrument or a measuring system of higher order (reference measurement standard).	See 0094.
0100 IUPAC	5.18	definition	te	The definition is verbose, to the point that is impossible to substitute usefully. The two-step characterisation is restrictive, non-essential, and also often unrecognisable	Shorten operation performed on a measuring instrument or a measuring system that establishes a relationship between indications and reference values	See 0098.

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				to practitioners. In support of the difficulty in recognising its applicability to common practice we note that Eurachem were obliged to devote almost an entire page of a guide to an explanation of the rationale for this definition because analytical chemists found it so hard to relate to their daily practice in calibrating instruments.	Add, if desired, a note to the effect that the relationship is generally intended to be used for calculation of new measured values from instrument indications for items being measured. If the two-step characterisation is known to be necessary in some fields of measurement, include the list in the current definition in a note that begins "Calibration can sometimes be thought of as a two step process that..." Better, simplify that to a note to the effect that "Calibration often determines a relation that predicts indications from reference values and then determines the (inverse) relation used to determine measured values from new indications	
0101 IUPAC	5.18	definition	te	The definition does not cover the common usage (eg in mass calibration) whereby the value of a measurement standard (typically a material measure, in the terms of this guide) is established by comparison with one or more measurement standards of smaller uncertainty	Consider separating into definitions with different scope; one for <measuring instrument> and one for <measurement standard>The latter could then be calibration <measurement standard>operation that establishes the value of a measurement standard by comparison with one or more measurement standards with smaller uncertainty	Not agreed.
0102 KRISS	5.18	definition	ge	There is a concern from chemical metrology area, about whether the current definition of calibration also applies to the process of assigning a certified value to a CRM with reference to a so-called primary reference material (PRM), or not. If not, they are afraid that the certified value of a CRM could not have metrological traceability because traceability could only be obtained through unbroken chain of 'calibrations'. Please check this out and add a NOTE or make proper modification on the definition of either calibration or metrological traceability, if needed.	-	Not sure we understand this comment. No proposal is provided.
0103 IUPAC	5.18	Examples	ed	There are no examples to illustrate application of the term and definition	Add Example: Linear regression to determine the relationship between the known values of working standards and the instrument indications in analytical chemistry	Noted. However, proposed example is incomplete as the second step is not addressed.
0104 RNMF_FR	5.18	Note	te	To define/explain in a note « response » et « calibration coeff » it can be added by the note 2	Note 2 : .../... In some cases, a single calibration coefficient may be used over a large range of a given parameter instead of the calibration table, function or diagram. It must be care not to mistaken with the "response", also reported often, which is defined as the invert of the calibration coefficient.	Not agreed. There are so many cases that may be considered that this is beyond the VIM's purpose of providing definitions, Notes and Examples.

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0105 ISO 507	5.18	Note 1	te	While traceability is the frame and the vehicle, through which we obtain quantitative values, it is not the main purpose of a calibration. The main objective of a calibration is providing a quantitative assessment, for practical purposes.	NOTE 1 The main objective of calibration is providing a quantitative assessment, characterizing the measurand against the reference standard.	Not agreed. Present formulation is better, but using "metrological traceability".
0106 Saint Lucia Bureau of Standards (SLBS)	5.18	definition and Note	ge	A Note should be added below the definition of calibration to inform everyone that calibration in itself is not a conformity assessment activity as per Resolution 11 of the 22nd CGPM (2003)	NOTE 6: Calibration is not a conformity assessment activity (Resolution 11 of 22nd CGPM of 2003)	Not agreed. The suggested note is a political resolution.
0107 INRIM	5.18	definition	ed	The separation of the steps 1 and 2 in two bullets has improved significantly the readability. Nonetheless, bullet 1 is still difficult to read, because the (correct) references to the uncertainty break the flow.	Change"1. establishes a relation between the values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and"to"1. establishes a relation between the values provided by measurement standards and corresponding indications, both with their associated measurement uncertainties, and"	Not agreed. References to 'measurement uncertainty' are maintained.
0108 INRIM	5.18	Note 3	te	When a verification is in the context of conformity assessment of measuring instruments or systems (5.25 NOTE 3 and 4), it does not necessarily require prior calibration. This is the case when a measuring instrument performs very differently over the full range of its rated operating conditions (where its MPE holds). In this case, the second step in calibration (correction of the error) may not be possible at all because the measurements in step 1 of calibration are necessarily limited and insufficient to cover the full range of the rated operated conditions. For instance, this occurs for coordinate measuring machines (CMMs) and other complex and reconfigurable measuring instruments for which calibration is recognised to be impossible in general. Nevertheless, the conformity assessment to MPEs is still possible in this cases, as regulated by a procedure defining the MPE. Again, this is the case, for example, of CMMs, to which the series of standards ISO 10360 applies defining procedures and MPEs intended for conformity assessment. Even with the limitation of the adverb "sometimes", stating that the calibration is a "prerequisite for verification" may be confusing and convey the wrong information that a verification requires prior calibration.	Change"... Calibration is sometimes a prerequisite for verification, ..."to"... Calibration is sometimes used for verification, ..."	Partially agreed. Text has been modified.

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0109 ISO 508	5.19	Note 1	te	Note 1 reads: "NOTE 1 A calibration function expresses a functional relation that does not supply a measurement result as it bears no information about the measurement uncertainty. "This statement is not true, since the term "function" is not defined. Other understandings of "function" could very well bear or contain or deliver information about the measurement uncertainty.	We propose to delete Note 1 (preferred). If this is not agreed, please modify text to clarify, reading: "NOTE 1 A (simple) calibration function which only expresses a relation between indications and measured values does not supply measurement results as it does not deliver information about the measurement uncertainty."	Agreed. Note is deleted
0110 IUPAC	5.19	Note 2	ed	Note should be adjusted when simplifying definition (see comments on 5.18)	Delete the first sentence in note 2 after shortening 5.18	Partly Agreed. However Note is deleted as the definition is considered clear and reference anyway goes to the definition of indication.
0111 CMI	5.20	definition	te	It would be recommendable to strengthen the link to 5.19, to intertwine the terms "calibration diagram" and "calibration function". Would it be possible to define that „strip of plane“ as an "envelope of all the calibration functions"?	To emphasize the link to 5.19. Use term "envelope of all the calibration functions" instead of „strip of plane“.	Not agreed. Suggestion not considered clearer.
0112 ISO 509	5.21		te	As "calibration" is now considered as a two-step process (cf. entry 5.18), it should be made clear to which step the calibration hierarchy actually belongs.	Please clarify (in an additional note?)	Not agreed. Both steps apply.
0113 IUPAC	5.21	Note 3	ed	This is a duplicate of Note 1 in 5.22 and does not relate well to 5.21 See also comments on Note 1 of 5.22	Delete Note 3	Not agreed. Note 3 is considered helpful.
0114 ISO 510	5.22		ge	In the 2010 version, a Note was included mentioning a reference to ILAC P10, which seems to have disappeared now (probably linked to the revision of P10): NOTE 7 ILAC considers the elements for confirming metrological traceability to be an unbroken metrological traceability chain to an international measurement standard or a national measurement standard, a documented measurement uncertainty, a documented measurement procedure, accredited technical competence, metrological traceability to the SI, and calibration intervals (see ILAC P-10:2002).However, it seems useful to keep a Note on explaining metrological traceability in the same terms as ISO/IEC 17025	It would be useful to at least add the definition of metrological traceability from the ISO/IEC 17025:2017 version:A.2.Reference to ISO/IEC 17025 Annex A : Metrological traceability is established by considering, and then ensuring, the following: a) the specification of the measurand (quantity to be measured);b) a documented unbroken chain of calibrations going back to stated and appropriate references (appropriate references include national or international standards, and intrinsic standards);c) that measurement uncertainty for each step in the traceability chain is evaluated according to agreed methods; d) that each step of the chain is performed in accordance with appropriate methods, with the measurement results and with associated, recorded measurement uncertainties; e) that the laboratories performing one or more steps in the chain supply evidence for their technical competence. With regard	Not agreed. References to P10 and ISO 17025 may well become circular as VIM should be the reference.

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					to demonstrating metrological traceability, it would also be useful to make a reference to Annex A.3 of ISO/IEC 17025:2017 and ILAC P10 (could be in a Note as was the case in the previous version)	
0115 ISO 511	5.22		ge	In line with the introductory sentence to 3 and with ISO/IEC 17025 it is not required to repeat the definitions of ISO Guide 99.	Delete 3.14 and 3.15.	Not agreed. Don't understand this proposal in this context.
0116 ISO 512	5.22		te	The definition for metrological traceability originates from the GUM and refers specifically to 'Calibration'. The publication of ILAC P10 recognizes the role of CRM in providing Metrological Traceability	Consider a revised definition, or if not possible at this time, then add as part of the definition reference to CRMs as being a suitable of ensuring metrological traceability. This should be done in the definition not only in an accompanying note. "Note 8 to entry: Certified values of certified reference materials from reference material producers conforming to ISO 17034 provide metrological traceability."	Not agreed. This definition does not originate with the GUM. How evidence of metrological traceability is demonstrated or provided is outside the scope of the VIM.
0117 ISO 513	5.22	definition	ed	Excludes metrological traceability acquired through adjustment against a reference artefact – a process which is excluded from 'calibration'	revert to 'comparisons' instead of 'calibrations'	Not agreed. Comparisons was not used in VIM3.
0118 ISO 514	5.22	Note 1	te	Note 1 should provide a clear understanding of the different types of metrological references. The proposed revision is very elaborate and somehow dilutes the actual underlying information. Also, to me, it is unclear what is meant with: "However, sometimes the reference is thought of as the realization itself, that is, a quantity." If to be kept, please insert an example?	Keep VIM3 Note 1	Not agreed. The new Note 1 elaborates considerably on the VIM3 Note 1, and provides examples. See also 0120-
0119 IUPAC	5.22	Note 1	ed	This is a very confused note. The guide defines a unit as a quantity, but this Note says that a unit and a quantity are different possible ways of considering 'reference'. The note then says that the reference can be a procedure (itself unclear) but finishes by saying that the quantity acting as reference must have a value and measurement uncertainty. Procedures have neither.	Delete Note 1 If desired, just include a short note to the effect that NOTE 1 The reference mentioned in this definition is usually a measurement unit or a quantity with a reference value and measurement uncertainty	Not Agreed. See 0120.
0120 VNIIM	5.22	Note 1	te	The application of reference measurement procedures for providing metrological traceability is important not only for ordinal quantities, but for multi-dimensional quantities that are used in medicine, chemistry and other fields that are comparatively new for measurement science.	NOTE 1 The reference mentioned in this definition is sometimes thought of in different ways. Probably most commonly, the reference is considered to be the definition of a unit, through its practical realization (for example, a realization of the definition of a unit of the SI; "traceable to the SI"). However, sometimes the reference is thought of as the realization itself, that is, a quantity. The reference could also be any	Agreed. "or primary reference measurement procedure" is added to the Note.

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					measurement standard for a quantity of the same kind (for example, a length standard used in a machine shop for measuring lengths) or primary reference measurement procedure. In the case of ordinal quantities, the reference is typically a measurement procedure (for example, a procedure for using a hardness measurement machine to obtain values of Rockwell C hardness). The quantity that is the reference or is carried by the reference must have a reference value and a measurement uncertainty.	
0121 VNIIM	5.22	Note 1	te	The application of reference measurement procedures for providing metrological traceability is important not only for ordinal quantities, but for multi-dimensional quantities that are used in medicine, chemistry and other fields that are comparatively new for measurement science.	NOTE 1 The reference mentioned in this definition is sometimes thought of in different ways. Probably most commonly, the reference is considered to be the definition of a unit, through its practical realization (for example, a realization of the definition of a unit of the SI; "traceable to the SI"). However, sometimes the reference is thought of as the realization itself, that is, a quantity. The reference could also be any measurement standard for a quantity of the same kind (for example, a length standard used in a machine shop for measuring lengths) or primary reference measurement procedure. In the case of ordinal quantities, the reference is typically a measurement procedure (for example, a procedure for using a hardness measurement machine to obtain values of Rockwell C hardness). The quantity that is the reference or is carried by the reference must have a reference value and a measurement uncertainty.	Se 0120.
0122 ISO 515	5.22	Note 3	ge	Is it correct to have a "must" in a Note to entry?		Agreed. Change "must" with "will normally"
0123 ISO 516	5.22	Note 4 Last sentence	ge	The sentence implies that the effort applied to the establishment of metrological traceability is proportional to its influence on the final measurement result. This leaves it up to subjective choice. Any measurand calculated from input quantities for which there is no sound metrological traceability in place, is technically invalid.	Please clarify that it is best practice to establish the metrological traceability of all input quantities, especially the input quantities that provide imported traceability to the measurement result. The metrological traceability may not be required to be established at the highest level of accuracy if the uncertainty contribution from the input quantity is small.	Partially agreed. The current text already aligns well with these proposals.
0124 ILAC	5.22	Note 6	te	This reference to ILAC P10 is partly historic and based on national standards no longer relevant and is not seen needed anymore.	Delete NOTE 6	Agreed

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0125 ISO 517	5.22	Note 7	ed	Although ISO 9000:2015 has "item" as an alternative, the main term is "object". In addition, a draft IUPAC recommendation has suggested 'object traceability' to distinguish the concept from 'metrological traceability'	"...of an item object..."	Agreed. /object is added at the end of first sentence.
0126 ISO 518	5.23	definition	te	Very few measurements have a traceability chain (i.e., linear sequence), as most measurements have more than one input quantity.	The term "traceability web" or "traceability network" (or equivalent) should therefore replace (or at least complement) the "traceability chain".	Not agreed. There is a separate traceability chain for each measurement result. This is not wording met among the broad scientific community.
0127 EC-172	5.23	definition	te	Very few measurements have a traceability chain, as most measurements have more than one input quantity.	The term "traceability web" (or equivalent) should therefore replace the "traceability chain".	Not agreed. See 0126.
0128 VNIIM 0129 VNIIM	5.23	Note 1	te	A measurement procedure applied to obtain measurement result using calibrated measuring instrument should be mentioned when defining 'metrological traceability chain'	NOTE 1 A metrological traceability chain is defined through a calibration hierarchy and validated measurement procedure.	Not agreed. There may be many different procedures. Therefore the Note is kept as it is, as adding more words could cause more confusion.
0130 ILAC	5.25	Example 1	te	This example is not as general as example 2 and 3.	Change order so that example 1 becomes example 3.	Not agreed
0131 ISO 519	5.25	Example 1	te	A "reference material" is known to be homogeneous. However, its homogeneity has been assessed during the homogeneity study, which was an intrinsic part of the production process of the reference material. Therefore, there is little added value of confirming or verifying (retrospectively?) whether a "reference material" is homogeneous. The example would be, however, correct when referring to "candidate" reference material.	Please correct as follows: "Confirmation that a given candidate reference material is sufficiently homogeneous and stable with respect to one or more specified properties"	Not agreed. The words "as claimed" seem to cover this concern.
0132 ISO 520	5.25	Example 2	te	Performance properties are usually understood as being related to measuring instruments or measuring systems. On the other hand, "legal requirements" are often seen as the result of a "measurement procedure" and not of a "measuring system".	Please revise, i.e.: Ex. 2a: "Confirmation that performance properties of a measuring system are achieved" Ex. 2b: "Confirmation that measured values of a quantity or measurand agree with legal requirements."	Not agreed. The present wording does include both 2a and 2b suggested.
0133 ILAC	5.25	Note	ge/te	The fulfillment of ISO 17025 requires laboratories to calibrate equipment e.g. when metrological traceability of reported results needs to be established. In addition to that the suitability of equipment needs to be verified to conform to specified requirements prior to its placement into service. A clarification within the VIM	Change note 5 as follows Verification of a measuring instrument should not be confused with its calibration. The objective evidence required for the verification can be provided e.g. by a statement of conformity resulting from a measurement result of a test or a calibration. Not every verification is a validation.	Partially agreed. However last word suggested should be "calibration" not "validation".

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				entry for "verification" could be helpful for laboratories to distinguish between these activities. Therefore we suggest to extend the note 5 in section 5.25 as follows.		
0134 ILAC	5.25	Note 5	te	Note is not correct. Is it verifications in legal metrology? In such case revise or delete Note.	Change validation at the end to calibration. Change NOTE 5 to be: "Verification in legal metrology should not be confused with calibration. Not every verification is a calibration.	Agreed. However parts of suggestion in 0133 are also added.
0135 ILAC	5.25		te	The definitions of verification in other standards such as ISO 17000:2020 and ISO 17029:2019 are not considered relevant for metrology.	Add a note: "NOTE: The definitions of verification in other standards such as ISO 17000:2020 and ISO 17029:2019 are not considered relevant for metrology."	Partially agreed. A new Note is added with a slightly modified formulation.
0136 ISO 521	5.25		te	ISO/IEC 17029 includes a definition of verification where the meaning is expanded also to cover situations where the object is not an item. To limit application of the term to items only seems unnecessary and counterproductive.	Apply the definition provided in ISO/IEC 17029:2019; "confirmation of a claim, through the provision of objective evidence, that specified requirements have been fulfilled".	Not agreed. See 0135. VIM is the basic reference for metrology. Claims are further not defined here.
0137 ISO 522	5.25 and 5.26		te	The definitions of verification and validation are not sufficiently clear to distinguish between the two terms.	Suggest to add to the definition of verification: "provision of objective evidence that a given item fulfils specified requirements at a specific point in time" Suggest to add to the definition of validation: "verification, where the specified requirements are adequate for an intended use until such time as there is a change in the item"	Not agreed. These definitions are implemented widely and have been constant for years. It would be problematic to make editorial changes at this stage.
0138 ISO 523	5.25 and 5.26		te	These two definitions remain highly problematic. Partially because their individual roles within the metrology world are grossly misunderstood and thus incorrectly implemented. Fundamentally, both "Verification" and "Validation" are concerned with the evaluation to ensure the desired output is achieved. Whilst this is not clear in the VIM4 definitions, it is implied. For example if an instrument's accuracy is verified to ensure it is within some specifications, clearly the intended outcome is to ensure that it is fit for its intended use – oh, but that is the definition of validation, not verification. On the other hand it could be argued that in this case, being within accuracy specification would mean that the desired specified requirements have been fulfilled – oh but that is "verification". So	Propose making the distinction of the two not on "fulfilling requirements" or being adequate for intended use, but rather on the timing of the activity. Therefore, before any system or process, measurement or otherwise, has to be evaluated to ensure it meets its design objectives, it has to be "validated". This is essentially a once off exercise unless something in the system or process changes. This is where "verification" comes in. The system or process is "verified" to ensure the design requirement continue to be met and is thus a scheduled ongoing activity. So, A measurement or test procedure would need to be "validated" once, to ensure it generates technically valid measurement results, but thereafter, as long as nothing changes, no further "validation" should be necessary. The instruments controlled by the validated procedure however have the potential to change over time (stability or drift) and hence have to	Not agreed. See 0137.

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				which has been performed on the instrument, a "verification" or a "validation"?	be regularly "verified" to ensure they continue to meet their design requirements (as they are required in the validated procedure). "Validation does not to be a scheduled activity and is sporadically conducted as the need arises. "Verification" however must be a scheduled activity.	
0139 ISO 524	5.25		te	5.25 [VIM3: 2.44]verification provision of objective evidence that a given item fulfils specified requirements Consider using the definition of verification from ISO 9000:2015 Quality management systems — Fundamentals and vocabulary ; or ISO/IEC 17000:2020 Conformity assessment — Vocabulary and general principles Here is the one from ISO 9000:2015:3.8.12verificationconfirmation, through the provision of objective evidence (3.8.3), that specified requirements (3.6.4) have been fulfilled Note 1 to entry: The objective evidence needed for a verification can be the result of an inspection (3.11.7) or of other forms of determination (3.11.1) such as performing alternative calculations or reviewing documents (3.8.5).Note 2 to entry: The activities carried out for verification are sometimes called a qualification process (3.4.1).Note 3 to entry: The word "verified" is used to designate the corresponding status.Here is the one from ISO/IEC 17000:2020:6.6verificationconfirmation of truthfulness through the provision of objective evidence that specified requirements (5.1) have been fulfilledNote 1 to entry: Verification can be applied to claims to confirm the information declared with the claim regarding events that have already occurred or results that have already been obtained.	Consider using the definition of verification used in ISO 9000:2015 or ISO/IEC 17000:2020.	Not agreed. See also 0135 and 0136.
0140 ISO 469	5.3	definition	ge	The given terms differ only slightly from the term "measurement standard" (5.1) and the definitions should only explain the additional words "international" or "national". Explanations beyond these words should be captured in the definition given in 5.1.	For 5.2: Keep VIM3 definition For 5.3: revise as follows: "measurement standard recognized by national authority to serve in a state or economy as the basis for assigning values to other measurement standards for the kind of quantity concerned"	Not agreed. This is about 5.3 and not 5.23. See earlier comments.
0141 ILAC	5.26		te	This definition is often seen as more fundamental than a verification (see eg. ISO/IEC 17025 and ISO 15189).	Consider adding a NOTE to replace the example: "validation may include verification that e.g.	Partially agreed. The suggested NOTE is more general than the example and

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Country Code ¹	Clause	Paragraph/ Figure/Table	Type of comment ²	Comments	Proposed change	Convener's responses
				It is not clear if the example is helpful. It is restricted to a very narrow discipline.	robustness, selectivity and specificity of a measurement method fulfils specified requirements"	expanded to fit ISO/IEC 17025:2017 language.
0142 ISO 525	5.26		te	In chemical and physical test laboratories, validation is commonly associated to the process that is used to demonstrate the suitability of an analytical method for an intended purpose.	Please insert a note to establish a clear link with "method validation"	Agreed. See 0141. Method validation specified in the NOTE.
0143 ISO 526	5.26	definition	te	This is an unhelpful description; in particular, validation ensures that a process will operate correctly, not just that it has.	revert to earlier form of definition like provision of objective evidence that a process or system will fulfil requirements for a given intended use	Not agreed. Definition is unchanged from VIM 3.
0144 ISO 527	5.26	definition	ed/te	The "where" is strange and should be replaced by a "that". In addition, "validation" usually also involves quantification of the precision, trueness and accuracy of a measurement system.	Correct	Not agreed. Definition is unchanged from VIM 3.
0145 IUPAC	5.26	definition	te	the definition is trite but unhelpful, not least because 'verification' often meets the 'intended use' requirement. Further, in practical use validation demonstrates the general applicability of something and, more importantly, is prospective in the sense that it assures that a process will operate correctly rather than (as with verification) that it has operated correctly. Finally, one rarely validates an 'item' (typically assumed to be a physical object); usually, one validates a procedure or a process.	change to provision of objective evidence that a process or system will fulfil requirements for a given intended use If desired, add notes that explain the key differences between validation and verification (eg intended use rather than product specification; typically used in the sense of a prospective check rather than a retrospective check)	Not agreed. Note 2 elaborates what an "item" may be. See 0137 and 0141.
0146 EC-173	5.26	definition	ed/te	The "where" is strange and should be replaced by a "that". In addition, "validation" usually also involves quantification of the precision, trueness and accuracy of a measurement system.	Correct	See 0144
0147 IUPAC	5.26	Notes	ed	it would be useful to note some particularly common uses of 'validation'	Add Note: IUPAC and ICH use the term "method validation" to refer to the process of demonstrating that a particular measurement procedure will perform as required for a given substance, concentration range and type(s) of test item	Partially agreed. see 0141 and the Note added.
0148 ILAC	5.26		te	The definitions of validation in other standards such as ISO 17000:2020 and ISO 17029:2019 are not considered relevant for metrology.	Add a note: "NOTE: The definitions of validation in other standards such as ISO 17000:2020 and ISO 17029:2019 are not considered relevant for metrology."	Partially agreed. A Note is added with a slightly modified formulation.

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0149 ISO 528	5.26		te	ISO/IEC 17029 includes a definition of validation where the meaning is expanded also to cover situations where the object is not an item. To limit application of the term to items only seems unnecessary and counterproductive. Although the meaning of the two definitions are otherwise the same, the definition in ISO/IEC 17029 also has the added advantage that it more succinctly identifies the temporal distinction between verification and validation.	Apply the definition provided in ISO/IEC 17029:2019; "confirmation of a claim (3.1), through the provision of objective evidence, that the requirements for a specific intended future use or application have been fulfilled".	Not agreed. See 0135.
0150 ISO 529	5.26		te	<p>5.26 [VIM3: 2.45]validation verification, where the specified requirements are adequate for an intended use EXAMPLE A measurement procedure, ordinarily used for the measurement of mass concentration of nitrogen in water, may be validated also for measurement of mass concentration of nitrogen in human serum.</p> <p>Consider using the definition of verification from ISO 9000:2015 Quality management systems — Fundamentals and vocabulary: or ISO/IEC 17000:2020 Conformity assessment — Vocabulary and general principles</p> <p>Here is the one from ISO 9000:2015: 3.8.13 validationconfirmation, through the provision of objective evidence (3.8.3), that the requirements (3.6.4) for a specific intended use or application have been fulfilled</p> <p>Note 1 to entry: The objective evidence needed for a validation is the result of a test (3.11.8) or other form of determination (3.11.1) such as performing alternative calculations or reviewing documents (3.8.5).Note 2 to entry: The word "validated" is used to designate the corresponding status. Note 3 to entry: The use conditions for validation can be real or simulated. Here is the one from ISO/IEC</p> <p>17000:2020:6.5validationconfirmation of plausibility for a specific intended use or application through the provision of objective evidence that specified requirements (5.1) have been fulfilled Note 1 to entry: Validation can be applied to claims to confirm the</p>	Consider using the definition of validation used in ISO 9000:2015 or ISO/IEC 17000:2020.	Not agreed. See 0135.

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				information declared with the claim regarding an intended future use.		
0151 IUPAC	5.27	definition	te	'kind' is not defined and neither is 'quantities of a given kind'		Accepted.
0152 ISO 530	5.27	Note 1	ed	Note 1 is unnecessarily verbose and a step back from the old version.	Retain the old version	Don't understand what is intended here.
0153 ISO 531	5.27	Note 1	ed	Note 1 is unnecessarily verbose and a step back from the old version. If the authors decide to keep the proposed revision, additional clarification is required to allow a correct understanding of the following statement: "However, sometimes the reference is thought of as the realization itself, that is, a quantity."	Retain the old version (VIM3)	See 0152.
0154 IUPAC	5.27	Note 1	ed	this note is a further duplicate of the confused Note 1 in 5.22 it is not at all necessary to repeat it here as the idea of 'reference' is already covered elsewhere.	Delete Note 1	Agreed.
0155 EC-174	5.27	Note 1	ed	Note 1 is unnecessarily verbose and a step back from the old version.	Retain the old version	See 0152 and 0154.
0156 ISO 532 0157 ILAC	5.27 and 5.28		te	Common practice amongst metrology laboratories (calibration laboratories) is to use the term "Measurement Equivalence" to include both "Metrological comparability of measurement results" and Metrological compatibility of measurement results". And yet "Measurement Equivalence" is not formally defined in the VIM 4.	Propose including or at least contextualising "Measurement Equivalence" in the VIM 4. Particularly because this is the common objective of participation in proficiency testing which could have the objective of either "Metrological comparability of the measurement results" or "Metrological compatibility of measurement results" or perhaps even a combination of the two. The objective of PT is always to give an indication of Measurement Equivalence between participant laboratories.	Disagree. No definition for "measurement equivalence" has been provided. See new Note 2 for 'metrological compatibility'.
0158 ISO 533 0160 EC-175	5.28	definition	te	A maximum multiple must be given, otherwise all results are compatible (e.g., if one chooses a multiple of 2.4673*10E25).	Specify a maximum multiple	Not agreed. This is not appropriate for a vocabulary. Note 1 addresses this issue somewhat. However, see 0157
0159 IUPAC	5.28	definition	ed	the definition is unnecessarily verbose	replace with "property of a set of measurement results that agree within their measurement uncertainties" optionally with a note to the effect that "agreement of measurement results within their measurement uncertainties is usually determined by	Agreed in principle, but proposal is considered incomplete.

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					comparing the absolute difference between each pair of measured values with the uncertainty of each difference"	
0161 ILAC	5.28	Note 1	te	The second part of the first sentence ("as it represents the criterion for deciding whether two measurement results refer to the same measurand or not") could be more likely related to measurement comparability, not compatibility. Suggestion is to remove it.	NOTE 1 Metrological compatibility of measurement results replaces what was traditionally termed "staying within the error", as it represents the criterion for deciding whether two measurement results refer to the same measurand or not.	Not agreed. Note 1 is maintained from the VIM3.
0162 PT/ IPQ	5.28	Note 2	ed	Although already written in this way in VIM3, it seems that, in English, the smaller / greater for quantities is more correct than lower / higher	Replace: "...the standard uncertainty of their difference is equal to the root mean square sum of their standard uncertainties, while it is lower for positive covariance or higher for negative covariance." By: "...the standard uncertainty of their difference is equal to the root mean square sum of their standard uncertainties, while it is smaller for positive covariance or greater for negative covariance."	Note has been removed.
0163 ISO 534	5.xx	New item	te	The concept "check standard" is widely used and documented extensively e.g. by NIST: http://www.itl.nist.gov/div898/handbook/mpc/section1/mpc12.htm and: https://www.nist.gov/publications/using-check-standard-data-simplify-uncertainty-estimates https://www.nist.gov/publications/verifying-measurement-uncertainty-using-control-chart-dynamic-control-limits-0 or in OIML R111-1 in annex D: https://www.oiml.org/en/files/pdf_r/r111-1-e04.pdf#page=71 We therefore think it be appropriate to include concept this in the VIM Furthermore, the concept that we describe here in the proposed NOTES, is already described analogically in the VIM4 draft notes for "Reference Materials". In this light, it appears well justified to define the parallelism that exists for the measurement standards, too.	Proposal for a wording of the new definition: check standard "Measurement standard used to monitor or control a measurement process "NOTE 1 Check standards can be used for measurement precision evaluation and for quality control .NOTE 2 Check standard with a calibrated value can be used for measurement trueness evaluation and quality control	Partly agreed. See Note 2 in 5.7 ('working measurement standard').

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