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Country Code[1]	Clause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Convener's responses
0001 **ISO 278** **0003** **VNIIM** **0005** **ISO 280**	3	Title	ge	In our opinion, the title of Chapter 3 should be changed because it does not correspond in full to the content of this Chapter.	Possible candidates for the title of Chapter 3:Measurement performance measures Measurement performance	Not accepted. “Measurement quality” is a more widely used and understood term. “Performance” pertains predominantly to only processes but not outcomes.
0002 **ISO 279** **000** **VNIIM**	3		ge	We would recommend to change the order of entries in the chapter starting with general ones. ‘Uncertainty’ in the Draft VIM4 is defined as a parameter. So it can be considered as a certain measure of accuracy. In the Draft VIM4, the term ‘accuracy’ is treated in different senses, including the general sense when the ‘true value’ is not known.	Change the order of entries to begin with accuracy, trueness, precision, errors and to finish with ‘uncertainty’	Not accepted. Measurement uncertainty is discussed first as an entry which is widely used as a quality characteristic of a measurement result.
0006 **ISO 281** **0038** **ISO 289**	3.1		te	measurement uncertainty The term "Parameter" is too limiting.	Please modify NOTE 2 to include asymmetrical distribution and associate measurement uncertainty (it might be necessary to modify accordingly other definitions that could be impacted by this change).	Not accepted. In the VIM4 1CD measurement uncertainty is treated in a quantitative sense only and ‘parameter’ is kept to be consistent with VIM 3 definition and definition given in the GUM. Some clarifications are given in Note 1 to the entry 3.11 and Note 3 to the entry 3.12.
0007 **ISO 282**	3.1		ge	Delete the word ‘uncertainty’ and only keep measurement uncertainty and uncertainty of measurement as synonyms of the term to avoid possible confusion with the general use of the term.	measurement uncertainty uncertainty of measurement uncertainty	Not accepted. In metrology uncertainty relates only to measurement so no confusion is possible. Moreover, the short term “uncertainty” is in agreement with other terms such as “definitional uncertainty”, “uncertainty budget”.
0008 **ISO 283**	3.1		te	The definition of measurement uncertainty does not clearly articulate the applicable meaning for practical metrology	Propose replacing with, “a range of quantity values within which the true value of the measurand is expected to lie, with a specified level of confidence.”	Not accepted. The proposed definition is not in agreement with the definition of “standard uncertainty” which is understood as a standard deviation (not a range) and which is a basic concept and expression for measurement uncertainty propagation.
0009 **NMIJ4**	3.1	D	ed	It is difficult to translate the proposed definition of “uncertainty” into Japanese because the concept of plural does not exist in Japan, thus the word “values” requires more clarification.	parameter characterizing the dispersion of the set of values being attributed to a measurand, based on the information used.(cf. measurement result: set of values being attributed to a measurand together with any other available relevant information)	Not accepted. The expression “dispersion of the set” is misleading.
0010	3.1	definition	ge	Congratulations on removing the redundant ‘non-	no action	

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IUPAC				negative'		
0011 **IUPAC**	3.1	definition	te	'based on information used' unclear – used in a measurement? used for the uncertainty evaluation? used for choosing lunch? does it mean all the information available? all the info available from a particular measurement?	replace with "following measurement" or equivalent	Partially accepted. Some clarifications are s given in Note 2 and Note 6.
0012 **IUPAC**	3.1	definition	te	'parameter' unnecessary	delete 'parameter characterising the'	Not accepted. In the VIM4 1CD measurement uncertainty is treated in a quantitative sense only. 'parameter' is kept to be consistent with the VIM 3 definition and the definition given in the GUM.
0013 **RNMF_FR**	3.1	definition	ed	Note 4 : Why making such a detailed statement while clear definitions are given in 3.4 and 3.5?	To add reference to 3.4 and 3.5 when citing Type A and Type B	Accepted. Note 4 is deleted.
0014 **BelGIM**	3.1	Note 1	ge	We recommend providing a more clear and unambiguous description of the role of true value and the necessity of considering or not considering it when interpreting terms within conception of measurement uncertainty to avoid any different and sometimes contradictory interpretations of the terms. Specifically, the term "true value of a measurand" is avoided in GUM because the word "true" is viewed as redundant.	Note 1 might read as follows: "A way to interpret measurement uncertainty is as indecision or doubt about the measured value to be chosen to represent a measurement result."	Not accepted. Uncertainty is associated with a measurement result but it relates to doubt about a true value of a measurand after making a measurement. The term "true value" is used in GUM-related documents, for example in JCGM102 in defining 'coverage interval' (3.23).
0015 **ILAC**	3.1	Note 1	te	It is very inappropriate that the first note includes the term "true value" as such is never considered for any physical parameters except probably the defining constants of the SI.	Delete "essentially unique true value" from Note 1.	Partially accepted. A true value is kept , it' is used in JCGM104:2009 and in JCGM 102:2011.
0016 **ISO 284** **0019** **EC-092**	3.1	Note 1	ed	Is the word "unique" really needed, i.e., is a true value in itself not always unique?	Consider deleting the word "unique"	Accepted.
0017 **IUPAC**	3.1	Note 1	te	measurement uncertainty is not indecision	delete 'indecision or'	Accepted.
0018 **RNMF_FR**	3.1	Note 1	te	« NOTE 1 A way to interpret measurement uncertainty is as indecision or doubt, either about the essentially unique true value of the measurand that remains after	To remove note 1	Partially accepted. Some rewording is proposed for clarification. Generally speaking 'true value' is accepted for use in JCGM104:2009 and in JCGM 102:2011. .

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				making a measurement, or about the measured value to be chosen to represent a measurement result. »There are two interpretations of the uncertainty in WG1 and WG2 (According to the acceptation or not of true value). It could be difficult for a reader to understand. Globally the note 1 is unprecise, complex and difficult to interpret for an essential definition. The same in 3.12 coverage interval, 3.13 coverage probability		
0020 ISO 285 0023 EC-093	3.1	Note 2	te	Note 2 states that the uncertainty is either positive or zero. The explicit mention of “zero” may give the impression that negligibly small uncertainty can be (simply) replaced by zero.An uncertainty of “zero” is not common and is only possible for very specific cases, for instance, where a measurement function follows a linear approximation, e.g., f =x2 and with x = 0.	Please either avoid the word zero by referring to “non-negative” or explain in Note 2 the boundary conditions for an uncertainty that equals to zero.	Accepted.
0021 IUPAC	3.1	Note 2	te	covariance is a parameter characterising dispersion (including MU) and individual covariances can be negative.	Delete “is either positive or zero. It” to read “The parameter characterizing dispersion may be, for example, …”	Accepted.
0022 IUPAC	3.1	Note 2	ed	‘may’ in inappropriate context	change ‘may’ to ‘can’	Accepted.
0024 ILAC	3.1	Note 3	te	NOTE 3 Measurement uncertainty includes components arising from systematic effects…… Sometimes estimated systematic effects are not corrected for..’ uses ‘systematic effects, where in other parts of VIM4 (e.g. 7.correction, 3.16 trueness, 3.20 bias) this wording is replaced by the less ambiguous ‘systematic error’.	Replace ‘systematic effects’ with ‘systematic errors’ (in two places)	Accepted.
0025 ISO 286 0028 EC-094	3.1	Note 3	te	The term “systematic effect” is not explained in the current version of CD VIM4 and should preferably be replaced by “systematic error” (entry 3.19).To be consistent with entry 3.19, Note 3 to 3.1 could clearly distinguish the following contributions to measurement uncertainty:measurement trueness (i.e., standard uncertainty associated to an unknown systematic effect/error) that takes into consideration uncertainties attributed to quantities of measurement standards;remaining uncertainty of an input or output	Please revise Note 3 accordingly	Accepted.

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				quantity value after correction of a known systematic error. This will clarify those corrections can, indeed, be imperfect. Following the EC comment on entry 2.17, and to be consistent with entry 3.19, systematic errors are either known or unknown. The term “systematic” effect/error puts ambiguity and should be avoided (i.e., only know systematic errors may be corrected).		
0026 IUPAC	3.1	Note 3	te	The Note implies MU _only_ includes systematic effects	Amend to include random effects. For example (using two Notes to keep each simple)“NOTE 3 Measurement uncertainty includes components arising from both random variation and systematic effects.NOTE xx, Components of measurement uncertainty arising from systematic effects include components associated with corrections and values attributed to quantities of measurement standards.”	Accepted.
0027 IUPAC	3.1	Note 3	te	The treatment of uncorrected systematic effects is difficult and sometimes controversial and this vocabulary should not give seriously incomplete implied guidance on the point	delete “Sometimes estimated systematic effects are not corrected for but, instead, associated measurement uncertainty components are incorporated.”	Not accepted. Note 5 talks about measurement uncertainty components caused by systematic errors. So it’s useful to stress that contributions to MU will be different depending whether estimated systematic errors are corrected or not. No concrete guidance is given, because this issue requires a separate detailed consideration.
0029 ISO 287	3.1	Note 3, Last sentence	ge	The text relating to the inclusion as an uncertainty contributor in preference to applying a correction is vague and ambiguous.	Propose replacing with, “Sometimes, estimated systematic effects are not corrected for but instead are considered as measurement uncertainty contributors”.	Not accepted. Please see also reply to comment 0027.
0030 ISO 288	3.1	Note 4	te	An important difference between type A and type B uncertainties, and which is not explicitly stated in Note 4, is that type A uncertainties are evaluated by statistical means while type B uncertainties are estimated using other than statistical means.	Please consider adding “statistically evaluated” (for type A uncertainties)	Partially accepted. Note 4 is removed and direct reference to the GUM is given.
0031 IUPAC	3.1	Note 4	ed	This presents a specific approach to MU	Consider omitting and referring to JCGM 100 and related guidance for all detail	Accepted. Note 4 is removed and direct reference to the GUM is given.
0032 NPL, UK	3.1	Note 4	te	It is very unusual for Type B uncertainty contributions to arise from standard deviations, and in any event this eventuality is covered by ‘evaluated from probability distributions’.	Remove “can also be characterised by standard deviations” as this is misleading and is also not present as an example in 3.5.	Partially accepted. Note 4 is removed and direct reference to the GUM is given.

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0033 **EC-095**	3.1	Note 4	te	An important difference between type A and type B uncertainties, and which is not explicitly stated in Note 4, is that type A uncertainties are evaluated by statistical means while type B uncertainties are estimated using other than statistical means.	Please consider adding “statistically evaluated” (for type A uncertainties)	Partially accepted. Note 4 is removed and direct deference to the GUM is given.
0034 **BelGIM**	3.1	Note 6	ge	The note is inconsistent with the definition in 2.10. The 2.10 Definition does not explicitly specify the uncertainty to be a part of a measurement result. We would recommend aligning that note and the 2.10 definition with one another. It is also unclear how (in which way) the significant digits should be represented, so it would be helpful to provide an example there.	The note should be amended in accordance with this comment or deleted.	Partially accepted. Rewording of Note 6 is proposed. The order of the notes is changed.
0035 **ILAC**	3.1	Note 6	te	The last sentence relates to reporting issues and significant digits and is far beyond what should be covered in a VIM.	Delete the second sentence in Note 6.	Accepted.
0036 **IUPAC**	3.1	Note 6	te	The statement “only significant digits should be reported” conflicts with both practical requirements (consider automated transmission in software which may require all available digits, or subsequent estimation of dispersion from rounded data) and exceeds the requirements of 17025 and others	Delete “If instead a measurement result is reported as a single measured value, then only significant digits should be reported.”	Accepted.
0037 **RNMF_FR**	3.1	Note 6	te	This note is a very useful addition, making explicit the link between the measurement uncertainty and the measurement result. However, the adverb “generally” seems not necessary? In which circumstances the measurement uncertainty is not part of a measurement result?	To delete “generally” in the note	Not accepted. In some cases a measurement result is reported by a single value. This case is considered in Note 2 to the entry 2.10 (‘measurement result’)
0039 **ISO 290**	3.1	notes	te	Too many notes, and risk of contradiction the many JCGM guides on this topic	replace notes with a reference to JCGM 100	Partially accepted. Note 4 is deleted and direct reference to JCGM100 is given.
0040 **IUPAC**	3.1	notes	te	Are all these notes necessary given that there are currently at least four complete JCGM guides on this topic?	Replace all of the notes with a single note referencing JCGM 100	Partially accepted. Note 4 is deleted.
0041 **ISO 291**	3.1, 3.12	definition	ge	Different wording "based on the information used" in term 3.1 (measurement uncertainty) and "based on the information available" in term 3.12 (coverage interval). Note that in term 2.1 (measurement) and 6.5 (examination of a nominal property), “together with any	Use same wording, for example, "based on the information used".	Accepted.

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				other available relevant information" is also used.		
0042 **ISO 292**	3.1, 3.2, 3.12, 3.13 (and 2.10)	definition	ge	The wording "a measurand" is used in term 2.10 (measurement result), 3.1 (measurement uncertainty) and 3.2 (definitional uncertainty), but "a quantity" is used in term 3.12 (coverage interval) and 3.13 (coverage probability).	Use "measurand" to keep the wording consistent with term 2.10 (measurement result). This does not preclude the use of uncertainty in case of non-direct measurements.	Accepted.
0043 **IUPAC**	3.2	Example 1	te	This is a relatively poor example of the concept. First "which part of the circulation" is unclear. Second, it can be understood as a sampling problem and not one of measurand definition.	Give specific 'parts' of the circulation that could be implied and say what needs to be specified	Accepted. Example 1 is removed
0044 **IUPAC**	3.2	Example 2	te	A poor example because it appears to be a sampling problem and it does not show what would need to be specified in order to eliminate the alleged definitional uncertainty.	Give a specific change in definition that would remove or reduced the definitional uncertainty	Not accepted. Example 2 (now the only Example) illustrates incomplete definition of the measurand that could be significant in cases where high accuracy is required.
0045 **ISO 293** **0047** **EC-096**	3.2	examples	te	The examples have nothing to do with a definitional uncertainty: the glucose in blood plasma is measured and the measurement has a certain uncertainty, independent and regardless when and where the sample was taken. The value this measurement result is compared with depends on the part of the blood circulation, but this is not an uncertainty. The same argument applies to Example 2.	Find proper examples or delete the definition	Partially accepted. Example 1 is removed.
0046 **RNMF_FR**	3.2	examples	ge	Examples very useful, thank you		Noted.
0048 **ISO 294** **0051** **EC-097**	3.2	Note 1	te	See comment on "target uncertainty" (entry 3.10)		Partially accepted. Rewording of the definition and Note1 are provided
0049 **IUPAC**	3.2	Note 1	te	recommendation ('should') in inappropriate context – the recommendation is about measurement practice, not use of the term	change "should be defined" to "is usually defined"	Not accepted. It's a requirement on the definition of the measurand.
0050 **IUPAC**	3.2	Note 1	te	The usual practice is to ensure that definitional uncertainty is negligible, not just 'significantly smaller'	change "is significantly less than the target uncertainty" to "is negligible compared to the target uncertainty"	Accepted.

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0052 **IUPAC**	3.3 (now 3.4)	Note 1	te	unclear that calibration is sufficient to characterise instrument uncertainty as defined here; calibration only covers the uncertainties of any corrections under the conditions of calibration. Issues such as mismatch, operation under field conditions etc are not included in calibration	review the Note and amend for generality	Partially accepted. Rewording is provided.
0053 **IUPAC**	3.3	Note 1	te	an individual instrument uncertainty can not be evaluated in calibrating a measuring system unless the system comprises only one instrument and no preliminary or subsequent operations are needed	delete “or measuring system”	Not accepted. Measuring systems can also be calibrated by calibrating their components, or as a ‘black box’.
0054 **ISO 295** **0055** **EC-098**	3.3	Note 3	te	Instrument specifications are usually wider than the actual performance of an instrument (the specifications is the minimum performance the manufacturer guarantees), hence the instrument specifications overestimate the instrumental uncertainty.	Correct	Accepted. Modification of Note 3 is provided.
0056 **ISO 296** **0057** **EC-099**	3.3 (now 3.4)		te	The authors of CD WD VIM4 are encouraged to revisit the term “instrumental measurement uncertainty”. When measurement uncertainty is estimated through a so-called bottom-up (see GUM) or Type-B evaluation, the measurement model provides the basis of the uncertainties associated to the applicable input quantities. An “instrument” cannot be considered as an input quantity, thus questioning the relevance of the concerned term.It is true that instrumental and design specifications may contribute to the uncertainty of a value of a given input quantity (of a measurement model). However, the given term gives too much ‘weight’ to its typical impact (which is very often negligible).If the authors of VIM4 decide to retain the term, then, at least, the word “measurement” should be ideally deleted as to avoid confusion with the general principle and understanding of the term “measurement uncertainty”. It should also be noted that the term “instrumental uncertainty” is commonly referred to in VIM4 and not “instrumental measurement uncertainty”.	Please consider deleting “instrumental measurement uncertainty” from the vocabulary If kept, please consider deleting “measurement” from the term, i.e., instrumental uncertainty	Not accepted. The term is widely used, sometimes as performance characteristics of a measuring instrument. The word ‘measurement’ can’t be deleted because ‘instrumental uncertainty’ is a part of a measurement uncertainty. Some rewording is provided. It’s true that ‘measuring instrument’ can’t be considered as an input quantity. But indication of a measuring instrument can be considered as an input quantity in a measurement model.
0058 **IUPAC**	3.4 (now 3.5)	Note 2	te	The GUM defines type A and type B, but does not give much information about statistical analysis. The GUM is also already referenced in Note 3	Either delete note 2 OR amend to “The GUM gives additional information about Type A and Type B uncertainty evaluation”	Accepted. Note 2 and 3 are combined.

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0059 **ISO 297** **0060** **EC-100**	3.5 (now 3.6)	2nd example	te	According to ISO Guide 30:2015, the property of the certified reference material must be “specified”. In addition, this information must be provided by the reference material certificate.	Please revise to: associated with the value of a specified property of a certified reference material, as provided by the reference material certificate	Accepted.
0061 **ISO 298**	3.5	definition	te	In contrast to the terms defined in 3.4, the addition of “determined” to modify evaluation, implies that it may be a result (a value), is not necessary.	Deleted “determined”	Accepted.
0062 **IUPAC**	3.5	examples	te	drift is typically characterised by statistical analysis	delete ‘drift’	Not accepted. In this entry the way of drift estimation or prediction is not considered. It’s assumed that this information is given. It can be specified as limits, or functional dependence or in some other ways.
0063 **RNMF_FR**	3.5	examples	ed/te	The expertise in addition with the experience may be sometimes more helpful to get information to infer limits related to a quantity. Bayesian elicitation of prior distributions (what it is about here) is based on expertise, word communally used in the statically community	Suggestion for the last example of the list” obtained from limits inferred through personal experience and expertise”	Accepted.
0064 **ISO 299** **0067** **EC-101**	3.6 (now 3.7)	definition	te	Standard uncertainties are expressed, not specified	Change to.. specified expressed as	Accepted.
0065 **IUPAC**	3.6	definition	ed	Poor choice of word: ‘specification’ only implies a prior choice of format. ‘expressed as’ means the way in which something is actually presented’. It is the latter which is important	Revert to ‘expressed as …’NB: consider also ‘standard deviation expressing MU’ to change the superordinate to SD, allowing more freedom for amendment of MU	Accepted.
0066 **IUPAC**	3.6	definition	te	specification gives a requirement; the correct English word here is ‘expressed’	change to ‘expressed’	Accepted.
0068 **IUPAC**	3.6	term	te	There is no good reason to make the preferred term the longest when the document title and scope are limited to metrology	Take ‘standard uncertainty’ as the preferred term and ‘standard measurement uncertainty’ as a permitted alternative for use when ‘standard	Not accepted. The rule used here is implemented throughout the entire VIM4 CD.

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					uncertainty' would be ambiguous	
0069 **ISO 300** **0070** **ISO 301**	3.7 (now 3.8)	definition	te	Why does this differ from the definition given in the GUM?	Use the GUM definition	Not accepted. The proposed definition is wider than the definition in the GUM. It allows calculation of combined measurement uncertainty using the law of uncertainty propagation or by MMC or other tools.
0071 **ISO 302** **0073** **EC-102**	3.7	definition	te	The combined standard measurement uncertainty corresponds to a level of confidence of approximately 68 %. As a result, also the word "standard" can be considered superfluous. The definition emphasises that the different input quantities are associated with the "input quantities in a measurement model". It should be noted that measurement uncertainties can also be estimated from data obtained during a validation study. In this case, there is no "mathematical relation among all input quantities" (see entry 2.12). In that case, typical uncertainty contributions relate to repeatability, intermediate precision, trueness and reproducibility; the measurement uncertainty may also be affected by uncertainties from other (environmental) factors that are not related to the actual measurement process. Those uncertainties should also be included in the uncertainty budget.	Please consider the alternative term "combined uncertainty" Please revise the definition or add a note to entry to explain that a mathematical relation among all input quantities does not always exist.	Not accepted. Level of confidence of approximately 68% is true only in case of normal distribution. In GUM-6:2020 measurement model is treated in broad sense including statistical models mentioned in the comment.
0072 **IUPAC**	3.7	definition	te	unclear why this needs to differ from the definition given in the GUM	use the GUM definition	Not accepted. The proposed definition is wider than the definition in the GUM. It allows calculation of combined measurement uncertainty using the law of uncertainty propagation or by MMC or other tools.
0074 **ISO 303**	3.7	Note	ed	Two different spellings of "modelling" (in 3.7) and "odelling" (in 5.28 NOTE 2) were used in this version. It would be better to keep the consistency of spelling throughout a document.	Spell "modelling" and "odelling" in a consistent way.	Accepted.
0075 **IUPAC**	3.7	Note	ed	reference to random variables is specific to a particular modelling framework; the GUM is more general and refers to correlation among input quantities, not variables.In addition, the 'must' here is an implied requirement imposed on practice, not use of term	Amend to use GUM wording and remove implied requirement; e.g."Where the input quantities are correlated, the combined standard uncertainty also includes correlation or covariance terms. See the GUM, entry 2.3.4	Not accepted. The correlation among input quantities is taken into account when random variables used for modelling input quantities are defined.

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0076 ISO 304	3.8 (now 3.9)	2nd line	ed	For consistency, add other wording under "relative standard measurement uncertainty" as in 3.7.	--> relative standard uncertainty	Accepted.
0077 ISO 305	3.8	definition	te	Relative standard deviation is not defined for negative mean values.	Omit the 'absolute value' and restrict to positive values.	Not accepted. The definition corresponds to the VIM3 definition. There are no sound reasons to change it.
0078 IUPAC	3.8	definition	ed	'absolute value of the measured value' is potentially confusing	consider 'unsigned measured value'	Not accepted. The definition corresponds to the VIM3 definition. There are no sound reasons to change it.
0079 IUPAC	3.8	definition	ed	'absolute value of the measured value' is potentially confusing (does it mean "absolute (value of the measured value)" or "(absolute value) of the measured value"	consider 'modulus of the measured value'	Not accepted. The definition corresponds to the VIM3 definition. There are no sound reasons to change it.
0080 IUPAC	3.8	definition	te	in ISO 3534, relative standard deviation is not defined for negative mean values, for good reason – if a negative value is possible, the quantity is not on a ratio scale and the meaning of a relative standard deviation is very unclear. the same is true of 'relative standard uncertainty' on an interval scale.	Omit the 'absolute value/modulus' and restrict to positive values; for example consider the ISO 3534 restriction to positive values; eg include <positive measured value> or add a Note to say that a relative standard deviation is not usually applicable for negative measured values	Not accepted. The definition corresponds to the VIM3 definition.
0081 ISO 306	3.8	Note	te	Add a Note: In general, relative uncertainty is not inappropriate for the measured value of an indication error.	Add a Note: In general, relative uncertainty is not inappropriate for the measured value of an indication error.	Not accepted. Indication error is not mentioned in the VIM.
0082 MIRS-OIML	3.8		ge	Unlike the terms 3.6 and 3.7, the term 3.8 does not have stated its shorter version omitting word 'measurement', i.e. relative standard uncertainty.	3. 8 Relative standard measurement uncertainty relative standard uncertainty	Accepted.
0083 ISO 307	3.9 (now 3.10)	Note	te	The revised note states that the uncertainty budget should specify "any coverage factor if expanded uncertainty is considered". This statement gives, in my opinion the wrong, impression that a coverage factor is only applicable when calculating an expanded uncertainty at a confidence level of approximately 95 %, 99 %, etc. However, an uncertainty budget is only complete if also the coverage factors of the individual standard uncertainties are given. These standard uncertainties represent one standard deviation, or k = 1.	Please consider the following revision:"[…] type of evaluation of measurement uncertainty, and coverage factors associated to standard and expanded uncertainties."	Partially accepted. Rewording of the Note is provided.

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0084 IUPAC	3.9	Note	te	recommendation ('should') in inappropriate context	Amend to "A comprehensive uncertainty budget specifies …"	Partially accepted.
0085 IUPAC	3.9	Note	ed	degrees of freedom are specific to a small number of plausible distributions and if the distribution is specified in full, degrees of freedom are not required	amend to read "type of applied probability distributions, any relevant parameters of those distributions (including degrees of freedom), " Alternatively preface the list with "where relevant"	Accepted. Rewording of the Note is provided.
0086 RNMF_FR	3.9	Note	te	1-Degrees of freedom are well defined for Type A evaluation component, but not for type B.2-Except, in key comparisons, the degree of freedom are no more used in an uncertainty budget	See next proposal	Partially accepted. Rewording of the note is provided. ~~proposed~~
0087 RNMF_FR	3.9	Note	ge/te	Comment linked to the one for 2.12. The note gives a highly restrictive approach to the uncertainty budget. Clearly it refers to a first order approach of the calculation with a linear development of the model. But in this case only sensitivity factors are needed, and not the explicit complete model. Many ways can be used to get them, and it would be a pity to limit the use of such a budget to the only cases where an explicit model is available.	Change to Note An uncertainty budget should specify, as far as available, the measurement model, estimates…	Partially accepted. Rewording of the note is provided. In the GUM a measurement model is considered in a broad sense, see also JCGM GUM-6:2020
0088 EC-103	3.9	Note	te	The revised note states that the uncertainty budget should specify "any coverage factor if expanded uncertainty is considered".This statement gives, in my opinion the wrong, impression that a coverage factor is only applicable when calculating an expanded uncertainty at a confidence level of approximately 95 %, 99 %, etc. However, an uncertainty budget is only complete if also the coverage factors of the individual standard uncertainties are given. These standard uncertainties represent one standard deviation, or k = 1.	Please consider the following revision:"[…] type of evaluation of measurement uncertainty, and coverage factors associated to standard and expanded uncertainties."	Not accepted. Proposed clarification is redundant.
0089 IUPAC	3.10 (now 3.3)	Note	te	i) recommendation ('should') on measurement practice in inappropriate context ii) not needed as a generally similar statement is made under 'definitional uncertainty'iii) target uncertainty is not dependent on any uncertainty component, including definitional uncertainty – the note suggests that the target uncertainty must reflect a particular uncertainty component when the correct course of action would be the converse – the definitional uncertainty must be	delete the Note	Accepted.

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				reduced to meet target uncertainty		
0090 **RNMF_FR**	3.10	Note	te	“Significantly” to be deleted. “Should” to be replace by “shall”	To modify the note as follows:“The target uncertainty of a given measurement shall be greater than the definitional uncertainty of the measurand”	Partially accepted. The Note has been removed.
0091 **ILAC** **0092** **ISO 309**	3.10	notes	te	The term “target measurement uncertainty” is widely applicable to various measurement and testing activities and as such could perhaps have additional notes to clarify or contextualise the definition in these scenarios	Propose adding notes as follows:“Note 2: The target measurement uncertainty should ideally be at least four times smaller than the test tolerance limits.”“Note 3: The desired target measurement uncertainty should be defined prior to performing the measurements since it has a bearing on the selection of appropriate measuring equipment.”“Note 4: Defining the target measurement uncertainty beforehand is critical to metrology activities such as participation in Proficiency Testing or Validation of Methods.”	Not accepted. Proposed recommendations are beyond the scope of the VIM and can be given only in particular documents relating to decision making and testing.
0093 **ISO 308** **0094** **EC-104**	3.10		te	As defined “target uncertainty” is the “measurement uncertainty specified as an upper limit and decided on the basis of the intended use of measurement results”. The use of “target” leads to the interpretation that a laboratory, while estimating the MU associated with a measured value, should get an estimated MU close to the target uncertainty. However, this estimated value should be interpreted (correctly) as the maximum limit of MU, which can be used, at that level, to be judged as fit for the purpose. Example: a reproducibility standard deviation, SR (estimated following ISO 5725-2) may be considered as an “upper limit” for MU. This SR includes de variability of several (competent) laboratories following the same measurement procedure. It is expected a single laboratory to estimate its MU lower than this value.	Replace “Target uncertainty” by “Uncertainty limit”.	Not accepted. Target uncertainty is usually not evaluated as a measurement uncertainty and it is specified as an upper limit.. But this term is widely applicable in practice and it’s useful to have a short term for the concept. Rewording of the entry is provided.
0095 **INRIM**	3.10target measurement uncertainty	term	te	Two comments are jointly reported here because the proposed change is the same for both.1. The uncertainty expresses the degree of ignorance on a quantity. It is subjective, depending on the amount of available information, the larger the amount the smaller the uncertainty. Given any amount, the uncertainty cannot be “augmented”. The importance of such value is clear in practice. However, it is not an uncertainty according to the definition 3.1.2. The world “target” is usually associated with either centring something (e.g. when aiming with a weapon) or to an achievement (e.g.	Consider renaming the term and its definition:3.10 target measurement uncertainty ceiling measurement uncertainty value specified as an upper limit to the measurement uncertainty and decided on the basis of the intended use of measurement results NOTE The target uncertainty ceiling of a given measurement should be significantly greater than the definitional uncertainty of the measurand.	Not accepted. Target uncertainty is usually not evaluated as a measurement uncertainty and it is specified as an upper limit.. This term is widely applicable in practice and it’s useful to have a short term for the concept. Rewording of the entry is provided.

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				the yearly sells). In the former case, the acceptable deviation of the actual value to the target is either positive or negative, in the latter it is usually positive. In the case of the target uncertainty, the acceptable deviation is negative. This may confuse, particularly it may convey the wrong idea that the best possible actual uncertainty coincides exactly with the target, whereas it only needs to be smaller.		
0096 ILAC	3.11	definition	ed	In the definition of “expanded measurement uncertainty”, it is recommended to use “coverage factor” instead of “factor” and to revise Note 1 accordingly.	product of a combined standard uncertainty and a coverage factor greater than one NOTE 1 The coverage factor depends upon the type of probability distribution of the output quantity in a measurement model and the selected coverage probability. Expanded uncertainties …	Not accepted. The rationale is to keep a separate entry for ‘coverage factor’ as in VIM3.
0097 ISO 310 0100 EC-105	3.11	definition	ed	The CD VIM4 considers “combined standard measurement uncertainty” as main term and “combined standard uncertainty” as acceptable synonym. Definitions should refer to the main terms rather than to synonyms	Please keep VIM3 definition	Accepted. See also comment 0098.
0098 IUPAC	3.11	definition	te	expanded uncertainty applies to input quantity uncertainties and not just to combined standard uncertainties	delete “combined”	Accepted.
0099 IUPAC	3.11	definition	te	is there any reason that this can not be defined with reference to ‘coverage factor’?	replace ‘factor greater than one’ with ‘coverage factor’ and move the substance of note 1’s to 3.14	Not accepted. The rationale is to keep a separate entry for ‘coverage factor’ as in VIM3.
0101 IUPAC	3.11	Note 1	te	expanded uncertainty applies to input quantities	delete “output”	Accepted
0102 IUPAC	3.11	Note 1	te	the distribution of an input or output quantity is not the same as the distribution used to describe its uncertainty (eg distribution of height of adults in the US)	amend to “probability distribution used to describe the measurement uncertainty in a quantity …”	Partially accepted. Rewording of Note 1 is provided.
0103 RNMF_FR	3.11	Note 1	ge	The sentence “Expanded uncertainties are meaningful only for symmetric distributions” is a very useful addition. Thank you.		Noted.
0104 BelGIM	3.12	definition	ge	It should be indicated what specific value of a quantity, e.g., a "measured value (of a quantity)", or what specific quantity, e.g., a "measurand" or a "quantity being measured", are intended in the Definition. In other terms, the value or quantity the coverage interval relates to should be described more clearly in the definition, otherwise the definition would appear incomplete and	The definition might read as follows: "interval containing the measured value with a stated probability, based on the information available."	Accepted. Rewording is provided.

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				ambiguous.		
0105 **ISO 311**	3.12	definition	te	This is not sufficiently clear. 'value' could be a true value or a measured value. The probability could also be an estimate, an exact (or theoretical) value, or an exact proportion of an (estimated) distribution, and 'information available' implies more than the information actually used.	amend or add notes to clarify whether this is intended to be a statistic or an observed (pair of) value(s)	Accepted. Rewording is provided. Clarification relating to the probability distribution is given in Note 1 to the entry 3.11.
0106 **ISO 312**	3.12	definition	ge	the definition should reflect the measurement or measurement result, and match with the definition of term 2.10 (measurement result) and 3.1 (uncertainty).	interval, the values in which being attributed to a measurand, containing the value of the measurand with a stated probability, based on the information available (or used)	Accepted. Rewording is provided.
0107 **IUPAC**	3.12	definition	te	This is regrettably a minefield (only partly inherited from VIM 3). 'the value' is unclear; is it a true value or a measured value? is the probability exact, intended, or estimated? is the 'information available' different from the 'information used' in the uncertainty definition?	change to "interval containing a specified proportion of the distribution of values attributable to the measurand [based on the measured value and measurement uncertainty]"or similar, with explanatory notes (eg 'the 'specified proportion' is often interpreted as a probability, typically chosen as 95%, that the true value is within the interval')	Partially accepted. Please see comment 0106. Rewording is provided.
0108 **BelGIM**	3.12	Note 4	ge	We recommend providing a more clear and unambiguous description of the role of true value and the necessity of considering or not considering it when interpreting terms within conception of measurement uncertainty to avoid any different and sometimes contradictory interpretations of the terms. Specifically, the term "true value of a measurand" is avoided in GUM because the word "true" is viewed as redundant. See also comments to note 1 in 3.1.	The note should be deleted.	Not accepted. A true value is kept , as it's used in the GUM-related documents : JCGM104:2009 and JCGM 102:2011 .
0109 **RNMF_FR**	3.12	notes	ed	Note 5 should become note 1, as all other notes refer also to specific sections of the GUM	Reorder Notes : Note 5 becomes note 1	Not accepted. For consistency, the Note citing the source is given as the last Note.
0110 **BelGIM**	3.13	definition	ge	It should be indicated what specific value of a quantity, e.g., a "measured value (of a quantity)", or what specific quantity, e.g., a "measurand" or a "quantity being measured", are intended in the definition. In other terms, the value or quantity the coverage interval relates to should be described more clearly in the definition, otherwise the definition would appear incomplete and ambiguous.	The definition might read as follows: "probability that the measured value is contained within a specified coverage interval".	Not accepted. Rewording of entries 3.12 and 3.13 is provided.
0111 **IUPAC**	3.13	definition	te	the probability referred to is unknowable because the [true] value of a quantity is unknowable [though it can be estimated from theory or from simulations in which	either change to "probability associated with a coverage interval" or amend to "intended" or remove the definition	Not accepted. Some clarification is given in Note 1 to the entry 3.11 'expanded measurement uncertainty' where kind of

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				simulated true values are generated]		probability distribution is specified as attributed to the quantity in a measurement model.
0112 **IUPAC**	3.13	definition	te	in statistics, 'coverage probability' is the actual probability associated with an interval generating procedure (See The Oxford Dictionary of Statistical Terms, OUP (2003). ISBN 0-19-920613-9) and that can be quite different from the intended probability or level of confidence.	add a Note to this effect	Not accepted. The comment is correct but beyond the scope of the document.
0114 **BelGIM**	3.13	Note 2	ge	We recommend providing a more clear and unambiguous description of the role of true value and the necessity of considering or not considering it when interpreting terms within conception of measurement uncertainty to avoid any different and sometimes contradictory interpretations of the terms. Specifically, the term "true value of a measurand" is avoided in GUM because the word "true" is viewed as redundant. See also comments to note 1 in 3.1 and comments to note 4 in 3.12.	The note should be deleted.	Partially accepted. Rewording of entries 3.12 and 3.13 is provided. A true value is kept , since it's used in the GUM-related documents : JCGM104:2009 and JCGM 102:2011.
0113 **IUPAC**	3.14	Note 2	ed	symbolized' technically accurate but unusual in this context	consider "denoted by"	Not accepted. Formulation from VIM3 is kept.
0115 **ISO 313** **0116** **EC-106**	3.14	definition	te	Standard uncertainties correspond to one standard deviation or a coverage factor k = 1.Definitions should preferably refer to the main terms defined in the vocabulary and not to possible alternative or synonyms.	Please add a note to explain a coverage factor equal to one.	Not accepted. Considering k=1 is redundant and not consistent with the definition of expanded uncertainty where k>1 is considered.
0117 **ISO 315**	3.15		te	Measurement accuracy is defined in VIM 4 as difference between a measured value and a reference value rather than a true quantity value (VIM 3). This change increases the consistency with other parts (e.g. measurement trueness) and adopts an operational point of view. However, common understanding of measurement accuracy is rather in line with the point of view of VIM 3.The draft proposes to change the definition of accuracy (now 3.15, 2.13 in VIM3) by replacing the term "true value" by "reference value". The concept of a true value that is given as a natural constant in contrast to a reference value that could be a man-made convention is of high importance in	Keep VIM 3 definition	Not accepted. Reference value is used for providing self consistency of the CD VIM4. Detailed explanation of this modification is given in Significant changes" Annex to the Vocabulary. Some rewording of Note 1 is suggested for clarification.

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				fundamental metrology. This concerns all measurements related to properties of the constituents of matter in atomic, molecular and nuclear physics. The definition of the SI unit of time is based on the concept of an unperturbed atomic transition frequency, which is a true value. The uncertainty analysis of primary frequency standards is principally concerned with possible deviations of the realization from the true value, i.e. with accuracy in the sense as defined in VIM3. In the proposed VIM4 the true value becomes a subcategory of the wider class of reference values and its importance for the definition of accuracy is diminished. In the interest of maintaining a steady, concerted and consistent use of vocabulary in the metrological community, the definition of accuracy from VIM3 should be maintained.		
0118 **ISO 316** **0139** **IEC-DE 33**	3.15		ed	(only if the German technical comment on 3.15 is not accepted)In Note 2, the spaces between the current numbers “1)”, “2)”, and “3” and the following texts are not equal. The space after “2)” is larger.Maybe that this is a result of text formatting (grouped style “justification”) but should be avoided.	Unify the spaces throughout the document, possibly different for the several kinds of items.	Accepted
0119 **ISO 317**	3.15		ed	(only if the German technical comment on 3.15 is not accepted)In Note 4, the concept “measurement error” is not emphasized by blue ink.	Emphasize the words “measurement error” by using blue ink. Check all concepts of the index.	Accepted.
0120 **ISO 318** **0122** **MB IMEKO-107**	3.15		te	Text: measurement accuracy accuracy closeness of agreement between a measured value and a reference value of a measurand	Are the three undersigned terms valid for all their instances if considered as quantities? The expression “reference value of a measurand” is not defined, because the term “measurand” (2.3) does not make any reference to values, and, being the “intended” one, its value is only estimated. Thus any “reference value of a measurand” can only be set by convention, differently from 1.24.The “reference value” is usually called the “true value” (1.22) or a “conventional value” (1.23): none can be attributed to a “measurand”, only to a measured or to a stipulated value of a quantity.	There is no suggestion Measured value of a quantity and reference value of a quantity are defined. [1.24 and 2.11]., Measurand is a quantity. So both values can be attributed to a measurand.
0121 **ISO 319**	3.15		te	The definition of accuracy has and still does base on the concept of “closeness”: We find this a little risky	WG kindly asked to discuss: Replace “closeness “Define “closeness ”Revise Note 1 in the light of the above	Accepted. The concept of closeness is clarified in Note 1 (previous Note 2) which was reworded.

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				because this key concept remains undefined. We propose to keep discussing if this problematic term can be substituted by something else. Note 1 does not add clarity, although it claims to do so.		
0123 **BelGIM**	3.15	definition	ge	The definition proposed is too narrow. It can be applied only to cases where the quality of measurements is evaluated in terms of their error, which quantifies closeness between a measured value and a reference value by the difference between these values. However, nowadays measurement accuracy has become a broader and more abstract concept relating to the quality of measurements in a general case, and implying such characteristics as trueness, repeatability, reproducibility in a more specific case. Since recently, an increasingly common expression of accuracy is "measurement uncertainty". The use of such different approaches to consideration and understanding of accuracy, depending on the measuring situations and objects being measured, is shown in note 2 of the entry.	The definition might read as follows: "accuracy is an abstract concept that characterizes the quality of measurements."	Not accepted. Quality of measurement is a more general concept. In Chapter 3 the concept of quality is used for measurement accuracy and measurement uncertainty. At the same time the current definition of accuracy is in agreement with such concepts as measurement precision and measurement trueness. Note 1 is a rewording for clarification.
0124 **ISO 321**	3.15	definition	te	Definition incorrect. Accuracy must refer to a true value, not a reference value; otherwise, the 'closeness' is a single known value	Revert to the 2008 definition and notes	Not accepted. Reference value is used for providing self-consistency of the CD VIM4. Detailed explanation of this modification is given in Significant changes" Annex to the Vocabulary . Some rewording of Note 1 is provided for clarification. Reporting of measurement accuracy is sometimes specified along with the useof true value.
0125 **ISO 322** **0129** **EC-108**	3.15	definition	te	Change from true value to reference value. The change is incorrect: The reference value itself may be very inaccurate, especially if it was determined by an inaccurate reference measurement procedure.	The link to the true value should be re-established.	Not accepted. Reference value is used for providing self-consistency of the CD VIM4. Detailed explanation of this modification is given in . Significant changes" Annex to the Vocabulary Some rewording of Note 1 is provided for clarification.
0126 **IUPAC**	3.15	definition	te	Although the definition is similar to that of ISO 3534, it is easy to read as defining a single error.	consider 'measured values'	Not accepted. The concept is applied to each measured value so single form is kept.
0127 **IUPAC**	3.15	definition	te	Definition fundamentally incorrect. The correct usage refers to the true value; otherwise the 'closeness' is known immediately to within measurement uncertainty	Revert to the previous (2008) or earlier definition and notes	Not accepted. Reference value is used for providing self-consistency of the CD VIM4. Detailed explanation of this modification is given in . Significant changes" Annex to the Vocabulary Some rewording of Note 1 is provided for clarification. Cases of reporting of measurement accuracy are considered.

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0128 IUPAC	3.15	definition	ed	If there are genuinely different uses for different contexts, as the Notes imply, the definition should be separated into context-specific terms and definitions	provide separate definitions for<single result><set of results><measuring instrument>	Partially accepted. Rewording of Note 1 is provided.
0130 ISO 325	3.15	Note	ed	The close parenthesis at the end of the sentence in "NOTE 2 1)" is redundant.	Delete the close parenthesis at the end of the sentence.	Accepted.
0131 BelGIM	3.15	Note 1	ge	Accuracy should not be considered to be a quantity that can be evaluated. Previous editions of VIM (VIM2 and VIM3) always considered accuracy to be a qualitative concept. Some specific quantitative measures may be used to express accuracy numerically: laboratory bias, bias of the measurement method, repeatability standard deviation, reproducibility standard deviation, repeatability limit, reproducibility limit, standard uncertainty, expanded uncertainty, etc.	The definition might read as follows: “The accuracy of measurements is a qualitative characteristic. Some specific quantitative measures may be used to express accuracy numerically: laboratory bias, bias of the measurement method, repeatability standard deviation, reproducibility standard deviation, repeatability limit, reproducibility limit, standard uncertainty, expanded uncertainty, etc."	Not accepted. Accuracy can be interpreted both qualitatively and qualitatively. Detailed explanation of this modification is given in Significant changes" Annex to the Vocabulary . Note 1 was reworded.
0132 ISO 326 0134 ISO 328 0136 VNIIM	3.15	Note 1	ge	It has long been established that accuracy is a qualitative concept and two separate measures, the estimated standard deviation and the bias (which are also mentioned in Note 2, point 1), cannot be rigorously combined to give a single-number index of accuracy. For this reason accuracy cannot be considered to be a quantity that can be evaluated.	Note 1 should be deleted	Partially accepted. Note 1 is deleted, but some aspects are kept in new Note 1.
0133 ISO 327 0135 EC-109	3.15	Note 1	te	Note 1a If accuracy is the property of a measurement result, how can a measurement procedure have an accuracy?	This note should be changed to “typical results obtained by a measurement procedure” (note: the argument is the same as for the uncertainty of a measurement procedure).	Partially accepted. Some explanation is given in Note 1 which was reworded.
0137 BelGIM	3.15	Note 2	ge	The accuracy for a measuring instrument or a measuring system can be characterized not only by their accuracy class but also by other metrological characteristics, such as, for example, the maximum permissible error, repeatability, resolution, sensitivity, etc.	Item 2 might read as follows:" a measuring instrument or a measuring system. In this case accuracy is generally known and is being reported quantitatively, such as, for example, in terms of accuracy class, maximum permissible error, repeatability, resolution, sensitivity and etc. Sometimes "accuracy" is used to the resolution of a measuring instrument (for example, a weighing instrument), which is not recommended though."	Partially accepted. Note 1 was reworded. But repeatability, resolution and etc. we’re not included in the list because they are particular performance characteristics of measuring instruments which are not considered in this entry.
0138 BelGIM	3.15	Note 2	ge	The third sentence in item 3 ("While accuracy and measurement uncertainty are not the same, sometimes accuracy is reported in terms of measurement uncertainty and sometimes measurement uncertainty is	Item 3 might read as follows: "A single measured value or a set of measured values. Measurement uncertainty can be evaluated in either of these cases."	Partially accepted. Rewording of Item 3 is provided.

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				reported in terms of accuracy.") seems to be not well understandable and needs an explanation and/or an example to be provided. Specifically for the case described in the item, an evaluation of uncertainty (standard and/or expanded) can be performed.		
0140 **ISO 329** **0144** **EC-110**	3.15	Note 2	te	Note 2 a: Many instruments do not have accuracy classes (e.g., ICP-MS, GC….)	Delete Note 2a	Partially accepted. Rewording of Note 1 is providedfor clarification.
0141 **ISO 330**	3.15	Note 2	ed	The close parenthesis at the end of the sentence in "NOTE 2 1)" is redundant.	Delete the close parenthesis at the end of the sentence.	Accepted.
0142 **ISO 331**	3.15	Note 2	ed	(only if the German technical comment on 3.15 is not accepted)In NOTE 2, the spaces between the current numbers “1)”, “2)”, and “3” and the following texts are not equal. The space after “2)” is larger.Maybe that this is a result of text formatting (grouped style “justification”) but should be avoided.	Unify the spaces throughout the document, possibly different for the several kinds of items.	Accepted.
0143 **RNMF_FR**	3.15	Note 2	ed	It is confusing to write that sometimes accuracy is reported in terms of measurement uncertainty and sometimes measurement uncertainty is reported in terms of accuracy. What is implicit here is that one should not use “accuracy” if no known value to compare to is available… The sentence is ambiguous, but the idea is important.	To remove Note 2.3)	Partially accepted. Rewording of Note 1 is provided for clarification.
0145 **IUPAC**	3.15	Note 2	te	‘Accuracy’ is not known. What is known is an estimate of trueness and an estimate of precision Note that these can also describe the operation of a measuring instrument.	Amend first sentence of this note to“The accuracy of standard measurement procedures is sometimes described in terms of trueness and precision.	Partially accepted. Rewording of Note 1 is provided for clarification. Detailed explanation of this modification is given in Significant changes" Annex to the Vocabulary.
0146 **IUPAC**	3.15	Note 2	te	The note confuses ‘measurement accuracy’ and ‘accuracy class’. In general use, an accurate instrument returns results that are close to the true value. This is almost identical to the ‘closeness of agreement’ concept except that it relates to results returned by the instrument. Accuracy class places a limit on error (among other features), and consequently is a related but different concept.	define ‘measurement accuracy’ <measuring instrument> as closeness of agreement between measured values returned by a measuring instrument and the corresponding true values	Partially accepted, Rewording of Note 1 item 2 is provided for clarification. Reference value is used instead of true value to provide consistency with the entry ‘measurement error’.

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0147 **ISO 314** **0148** **ISO 332** **0150** **VNIIM**	3.15	Note 2		The second sentence: While accuracy and measurement uncertainty are not the same… deliberately downplays the distinction between these two concepts, measurement accuracy and measurement uncertainty. This state of affairs is unacceptable.	The sentence indicated in the comment should be deleted	Partially accepted. Rewording is provided. In CD VIM4 'measurement uncertainty' is considered quantitatively so it can be used for expression of a measurement accuracy.
0149 **IUPAC**	3.15	Note 2	te	a true value can not be a reference value because, being unknown, it cannot be used.	correct the definition and remove note 2 point 3)	Not accepted. In the current draft the concept of 'a reference value' includes 'a true value'.
0151 **ISO 333**	3.15	Note 3	te	Note 3 says, "Accuracy can be interpreted as the combination of measurement trueness and measurement precision" We think, the concept of accuracy should be consistent with the concept of a measurement result which is usually "reported as a single measured value and a measurement unc"rtainty" whichh in turn are parameters expressing trueness and uncertainty. Consequently, accuracy should be allowed to be interpreted as a combination of measurement trueness and measurement uncertainty (while not forbidding using trueness and precision). We therefore suggest to use the word"ng "disper"ion" which is also used in the definition of measurement uncertainty.	Replace the first sentence of Note 3 to read Note 3: Accuracy can be interpreted as the combination of measurement trueness and a parameter describing the dispersion of the measured values.	Not accepted. Accuracy cannot be interpreted as combination of trueness and uncertainty, because calculation of uncertainty implies using information about trueness and precision both.
0152 **IEC-DE 34**	3.15	Note 4	ed / ge	The concept "measurement error" is not emphasized by blue ink.	Emphasize the words "measurement error" by using blue ink. Check all concepts of the index.	Accepted.
0153 **ISO 334**	3.15	Note 4	ed	(only if the German technical comment on 3.15 is not accepted)In NOTE 4, the concept "measurement error" is not emphasized by blue ink.	Emphasize the words "measurement error" by using blue ink. Check all concepts of the index.	Accepted.
0154 **ISO 335**	3.15	Note 1	te	Note1 contains a "however, …" clause. Nevertheless, this clause is linguistically unlogical since the the two phrases connected with "however" do not contrast.	Delete note 1	Partially accepted. Note 1 is deleted, but some aspects are kept in new Note 1.
0155 **ILAC** **0156** **ISO 324**	3.15	notes	te	In practical measurement and testing activities, "measurement accuracy" of the measurement instrument/system performing the measurements is a critical selection requirement. Often the "Test Accuracy Ratio" is used as the starting point to select	Propose adding a note as follows:"Note 5: The "measurement accuracy" of an instrument is often defined by its accuracy specification limits, provided conformance to these specification limits has been verified through calibration."	Partially accepted. Calibration and verification are mentioned in the corrected Note 1 Item 2.

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				appropriately “accurate” measuring instruments. The current Notes do not describe this use of the term, “measurement accuracy”.		
0157 **IUPAC**	3.15	notes	te	Previous versions have identified accuracy as a qualitative concept. General usage does not appear to have changed.	Revert to the previous (2008) or earlier definition and notes	Not accepted. Reference value is used for providing self-consistency of the CD VIM4 namely consistency of the entries ‘measurement accuracy’ and ‘measurement error’. Some rewording of Note 1 is providedfor clarification.
0158 **ISO 323** **0159** **PTB** **0160** **PTB-OIML**	3.15	definition	te	Measurement accuracy is defined in VIM 4 as difference between a measured value and a reference value rather than a true quantity value (VIM 3). This change increases the consistency with other parts (e.g. measurement trueness) and adopts an operational point of view. However, common understanding of measurement accuracy is rather in line with the point of view of VIM 3.The draft proposes to change the definition of accuracy (now 3.15, 2.13 in VIM3) by replacing the term "true value" by "reference value". The concept of a true value that is given as a natural constant in contrast to a reference value that could be a man-made convention is of high importance in fundamental metrology. This concerns all measurements related to properties of the constituents of matter in atomic, molecular and nuclear physics. The definition of the SI unit of time is based on the concept of an unperturbed atomic transition frequency, which is a true value. The uncertainty analysis of primary frequency standards is principally concerned with possible deviations of the realization from the true value, i.e. with accuracy in the sense as defined in VIM3. In the proposed VIM4 the true value becomes a subcategory of the wider class of reference values and its importance for the definition of accuracy is diminished. In the interest of maintaining a steady, concerted and consistent use of vocabulary in the metrological community, the definition of accuracy from VIM3 should be maintained.	Keep VIM 3 definition	Not accepted. Reference value is used for providing self-consistency of the CD VIM4 namely consistency of the entries ‘measurement accuracy’ and ‘measurement error’. Some rewording of Note 1 is provided for clarification.
0161	3.15	2nd line	ed	As in VIM3, add another expression after "measurement	If the reason for the omission is to include the	Not accepted. Explanation is given in

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ISO 320	3.16			accuracy".3.15 → accuracy of measurementIn "VIM4_CD_Significant_changes" document (N2866), "accuracy of measurement" is written, but it is omitted in the text. What is the reason for this?As in VIM3, add another expression after "measurement trueness".3.16 → trueness of measurementIn "VIM4_CD_Significant_changes" document (N2866), "trueness of measurement" is written, but it is omitted in the text. What is the reason for this?	phrase "systematic error of measurement, random error of measurement" only when there is a specific word in front of "measurement" (e.g. 3.19 systematic measurement error, 3.21 random measurement error), isn't it necessary to delete the phrase "error of measurement" in "3.18 measurement error"?	"significant changes" Annex to the Vocabulary.
0162 **ISO 336** **0164** **VNIIM**	3.16	definition	ge	'Measurement trueness', as well as 'measurement precision', depends on specified condition of measurement, and it should be mentioned in definition. Another point is that in the proposed definition 'measurement trueness' relates to a number of replicate measurements. In this respect the VIM3 definition is preferable.	Closeness of agreement between the average of sufficient number of measured values obtained by replicate measurements under specified conditions and a reference value.	Partially accepted. 'Specified conditions' are included in the definition. Clarification about a number of repeated measurements is given in Note 3.
0163 **IUPAC**	3.16	definition	te	Definition substantially incorrect on two points. i) The concept of trueness refers to the true value; ii) it refers to the expectation of test results. As written, the 'closeness' is known immediately to within measurement uncertainty on taking an average. This change would (as with 'accuracy' above) be is a fundamental departure from existing usage as a theoretical ideal and will conflict irrevocably with other standards in use.	Adopt either the ISO 3534 definition or the (equivalent) VIM 2008 definition	Not accepted. Definition of a 'measurement trueness' is consistent with definition of 'measurement accuracy'. In CD VIM4 accuracy and trueness are considered as qualitative and quantitative concepts. This approach provides consistency in defining 'accuracy ' and 'error'. Detailed explanation of this modification is given in Significant changes" Annex to the Vocabulary.
0165 **ISO 337** **0166** **EC-111**	3.16	Note 4	ed	It is inadequate to use the term "better trueness". Trueness, either expressed as bias (difference to a reference value) or as recovery (ratio to a reference value), is significant or not. Terms associated with trueness should be "significant" or "negligible". Do not use smaller and larger associated with trueness/bias. Another term that might be considered is "adequate".	Note 4: A measurement is said to have a negligible bias when it has a negligible systematic error. In this case, this method has an adequate trueness, which is not related to random error. Inversely, a measurement having a significant bias its trueness is not adequate (needs improvement/correction).	Partially accepted. Note 4 is removed. Some clarification about the relation between trueness, systematic error and bias is given in Note1, which was reworded.
0167 **BelGIM**	3.16	Note 1	ge	Trueness should not be considered to be a quantity that can be evaluated. Previous editions of VIM (VIM2 and VIM3) always considered trueness to be a qualitative concept. Some specific quantitative measures may be used to express trueness numerically: laboratory bias, bias of the measurement method and laboratory component of bias.	The note might read as follows: "The trueness of measurements is a qualitative characteristic. Some specific quantitative measures may be used to express trueness numerically: laboratory bias, bias of the measurement method and laboratory component of bias."	Partially accepted. Note 1 is reworded. Some clarification about the relation between trueness, systematic error and bias is given.

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0168 BelGIM	3.16	Note 2	ge	Quantitative measures of trueness cannot be evaluated for a single measured value or a set of measured values (case from item 3), because of the absence of a reference value for this case.	Item 3 should be deleted.	Not accepted. Item 3 doesn't relate to evaluation of the trueness.
0170 EC-112	3.16	Note 3	te	"In practice, the number of averaged measured values must be large enough […]."This statement can be a knife that cuts at both sides.A trueness assessment based on only a small number of averaged measured values may result in a large uncertainty for measurement precision, thus making it difficult to detect potentially significant differences and investigate accuracy. On the other hand, a too large number of averaged measured values may result in an unrealistically small uncertainty for precision (in case the uncertainty is estimated as the standard error), thus increasing the likelihood of detecting significant differences (biases) between the average of the measured values and reference value.	Please avoid the use of relative adjectives (i.e., large) as these can be subject to numerous contextual interpretations.	Partially accepted. Note 3 is reworded to clarify what is meant by "the number of averaged measured values must be large enough".
0171 IUPAC	3.16	Note 4	ed	"while trueness is not related to random error" does not follow from the rest of the sentence and looks like part of a different note which has been part lost.	Delete "while trueness is not related to random error"	Accepted. Note 4 is deleted and Note 1 is reworded in order to clarify the relation between trueness, systematic error and bias.
0172 IUPAC	3.16	Notes 1-3	te	These notes follow from an incorrectly altered definition and are not valid with respect to the correct definition	Revert to previous edition Notes.	Not accepted. Definition of 'measurement trueness' is consistent with the definition of 'measurement accuracy'. In CD VIM4 accuracy and trueness are considered as qualitative and quantitative concepts. This approach provides consistency in the definitions of 'accuracy 'and 'error'.
0173 ISO 339	3.16	term	te	"trueness" is defined elsewhere as agreement between two true values (true value of measurand and expectation of observations)	Adopt the ISO 3534 definition	Not accepted. Expectation of observations is misleading. Proposed definition of 'measurement trueness' is consistent with the definition of 'measurement accuracy'. In CD VIM4 accuracy and trueness are considered as qualitative and quantitative concepts. This approach provides consistency in the definitions of 'accuracy 'and 'error'. At the same time the proposed definition in CD VIM4 is an extension of the VIM3 definition.

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0174 **IUPAC**	3.16	term	te	“trueness” is defined elsewhere as agreement between true and observed values	If the present definition is retained, delete alternate term ‘trueness’and add a Note“ ‘measurement trueness’ must not be confused with ‘trueness’ because ‘trueness’ relates to exact but unknown true values and ‘measurement trueness’ does not.”	Not accepted. Definition of ‘measurement trueness’ is consistent with the definition of ‘measurement accuracy’. CD VIM4 contains entries related to measurements only. Proposed definition is an extension of VIM3 definition.
0175 **ISO 340**	3.17	2nd line	ed	If you add “xxx of measurement” in 3.15 and 3.16, add another expression after “measurement precision” to keep consistency.→precision of measurement	If the reason for the omission is to include the phrase “systematic error of measurement, random error of measurement” only when there is a specific word in front of “measurement” (e.g., 3.19 systematic measurement error, 3.21 random measurement error), isn’t it necessary to delete the phrase “error of measurement” in “3.18 measurement error”?	Not accepted. See comments to [0161].
0176 **BelGIM**	3.17	Note 1	ge	Similarly to accuracy and trueness, precision should not be considered to be a quantity that can be evaluated. Some specific quantitative measures may be used to express precision numerically under a specified precision condition: standard deviation, variance, coefficient of variance and limit.	The note might read as follows: "The precision of measurements is a qualitative characteristic. Some specific quantitative measures may be used to express precision numerically under a specified precision condition: standard deviation, variance, coefficient of variance, and limit."	Partially accepted. In the VIM4 CD accuracy, trueness and precision are considered as qualitative and quantitative concepts. The VIM4 CD definition repeats the VIM 3 definition. But Note 1 was reworded according to the remark.
0177 **ISO 341** **0179** **VNIIM**	3.17	Note 1	ge	Precision is a qualitative concept but the measures of precision, such as standard deviation, are indeed quantities that can be evaluated.	NOTE 1 should be deleted.	Accepted. Note 1 was combined with Note 3. Rewording of these two notes were provided
0178 **IUPAC**	3.17	Note 1	te	There are no circumstances in which ‘precision’ can correctly be considered a quantity to be estimated. There are only cases where measures of precision are considered to be quantities.	Delete Note 1.	Accepted.
0180 **ISO 342** **0181** **ISO 345** **0183** **VNIIM**	3.17	Note 3	ed	The specific list of possible measures in which precision may be reported is incomplete: it does not include precision limits.	NOTE 3 should be amended accordingly.	Accepted Note 3 was combined with Note 1 . Rewording of these two notes was provided.
0182 **IUPAC**	3.17	Note 3	ed	permission (“may”) in inappropriate context. This is a possibility and other possibilities exist	Change ‘may’ to ‘can’ and ideally, write ’can be reported, for example, …”	Partially accepted. Rewording of the Note is provided.

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0184 **IUPAC**	3.17	Note 5	ed	", while it is not related to systematic error." does not follow from the rest of the sentence.	Delete ", while it is not related to systematic error."	Partially accepted. Note 5 is deleted and Note 1 is reworded accordingly.
0185 **ILAC** **0186** **ISO 343**	3.17	Note 6	ge	The note is suggestive rather than definitive	Propose rewording the note to read: "Note 6: Measurement precision does not define measurement accuracy."	Partially accepted. Note 6 is deleted.
0187 **ISO 344** **0188** **ISO 346** **0190** **VNIIM**	3.17	Note 7	ed	Variability among items in evaluating precision is considered to be negligible, not contributing to a precision estimate according to the statistical model accepted in ISO 5725-1.	Note 7 should be amended to remove the inconsistency	Accepted. Note 7 is reworded and is in Note 4.
0189 **RNMF_FR**	3.17	Note 7	ed	Interested but the sentence is not clear. Can be only for destructive testing, not for measurement ? Idem for 3.22, 3.24	Precision may be evaluated by replicate measurements on similar items / samples	Partially accepted. Note 7 is reworded for clarification and is in Note 4. The more general term 'object' is used instead of 'item', 'sample' and others.
0191 **ISO 349**	3.18	definition	te	Not consistent with established usage. Error refers to difference from a true value; a measured error is an estimate of that.	change "reference value" to "true value"	Not accepted. In the VIM 4 CD 'reference value' is used in the definitions of accuracy and error accordingly. 'Measured error' is a redundant concept because 'bias' is defined as an estimate of 'systematic error' and measures of precision are used for evaluating random errors.
0192 **IUPAC**	3.18	definition	te	Definition inconsistent with established usage. The concept of error refers to deviation from a true value	change "reference value" to "true value" and add note to the effect that in practice [for estimating error] a reference value is substituted for the true value Consider defining 'estimated error' or 'measured error' separately from 'error' if it is considered essential	Not accepted. In the VIM 4 CD 'reference value' is used in the definitions of accuracy and error accordingly. 'Measured error' is a redundant concept because 'bias' is defined as an estimate of 'systematic error' and measures of precision are used for estimating random errors.
0193 **ISO 350** **0195** **EC-113**	3.18	Note 1	te	If a measurement error is the difference between a measured value and a reference value, then a measurement procedure (which is not a value), measurement instrument (which is not a value either)	Correct definition	Not accepted. Note 1 doesn't say that a measurement procedure has an error. It says that error can pertain to a measurement procedure (similar to measurement accuracy, which can pertain

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				cannot have a measurement error.See 2.12 Note 1a		to a measurement procedure). More detailed clarification is given in Note 1 to the entry 3.15.
0194 IUPAC	3.18	Note 1	te	note untrue and inconsistent with definition. Error is defined (even here) a single value. It can not be thought of as applying to a procedure or to an instrument. Nor can it easily apply to a set of values unless the set only contains one member.	Delete note 1	Not accepted. In the VIM4 CD 'accuracy' and 'error' are related concepts ' and they can pertain to measurement procedure, measuring instrument or measured values. More detailed clarification is given in Note 1 to the entry 3.15.
0196 IUPAC	3.18	Note 2	te	The note confuses the issues much more than it helps understanding. The definition clearly describes an observable quantity with a value and an uncertainty; there is no need to talk about measurement standards with negligible uncertainty. As noted above, a reference value can never be a true value (unless by definition) because to be a reference value it must be known.	Delete note 2	Partially accepted. Note 2 is reworded for clarification.
0197 ISO 351 0198 VNIIM	3.18	Note 3	te	Traditionally, when considering measurement error, random error components are mentioned first rather than systematic error components.	Note 3 should be amended accordingly	Not accepted. In the VIM4 CD the following order is maintained: accuracy > trueness> precision.
0199 ISO 348 0200 ISO 352 0201 VNIIM	3.18	Note 4	ed	Only systematic measurement error may be considered known (although with some uncertainty).	The word systematic is to be added: "A known systematic error should be reported…"	Partially accepted. Note 4 is deleted and corresponding clarification is given in Note 2 which was reworded.
0202 ISO 353 0203 EC-114	3.18	Note 4	te	According to the note, a measurement result should for example be given as:15 g/kg with an error of 2 g/kg and the expanded measurement uncertainty is 1 g/kgIt is very unlikely that anybody understands this.	Correct definition	Partially accepted. Note 4 is deleted and corresponding clarification is given in Note 2 which was reworded.
0204 IUPAC	3.18	term	te	"error" is defined elsewhere as a difference between true and observed values	Delete alternate term 'error'and add a Note" 'measurement error' must not be used for 'error' (or vice versa) because 'error' relates to a true value and 'measurement error' does not."	Not accepted. In the VIM4 CD 'accuracy' and 'error' are defined using 'reference value' to provide self-consistency of the document.
0205	3.18 3.25	2nd line	ed	If you do not add phrases in 3.15, 3.16, and 3.17, remove "error of measurement" for consistency.Or,If	3.18 →error of measurement	Not accepted. See response to comments in [0161].

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ISO 347	3.27			you add phrases in 3.15, 3.16, 3.17, add the below expressions after “measurement repeatability”.3.25 → repeatability of measurement3.27 → reproducibility of measurement		
0206 **ISO 354** **0207** **MB IMEKO-115**	3.19		te	Text:systematic measurement errorsystematic error of measurementsystematic errorcomponent of measurement error that in replicate measurements remains constant or varies in a predictable manner	See the Reference in comment ISO 008Reference: F. Pavese: “On the classification in random and systematic effects”, AMCTM XI, 2018, in A.B. Forbes, N.F. Zhang, A.G. Chunovkina, S. Eichstädt, F. Pavese, (Eds.): "Advanced Mathematical and Computational Tools in Metrology and Testing XI”, vol.11, Series on Advances in Mathematics for Applied Sciences vol 89, World Scientific, Singapore, October 2018, pp. 58–69	There is no concrete suggestion for improvement.
0208 **ISO 355** **0209** **EC-116**	3.19	definition	te	What is the difference between systematic measurement error and measurement bias?	Delete one of the two definitions.	Not accepted. In the VIM4 CD a measurement bias is defined as an estimate of a systematic error that implies providing associated uncertainty.
0210 **IUPAC**	3.19	Note 1	te	a true value cannot be a reference value because it cannot be used.	Delete ‘true value , or a’	Not accepted. In the VIM4 CD as well as in the VIM3 ‘reference value’ includes ‘true value’.
0211 **IUPAC**	3.19	Note 1	te	A reference value often has a non-negligible measurement uncertainty and this note appears to prevent use of such standards	delete “of negligible measurement uncertainty,”	Accepted.
0212 **ISO 356** **0213** **EC-117**	3.19	Note 2	te	The given statement is not clear on whether a “known” systematic error automatically suggests that also the uncertainty associated to the applied correction (factor) is known. The latter is a critical, and obvious, requirement for any correction of systematic error made.	A proposal for revision of Note 2 may be: “Systematic error, and its causes, can be known or unknown. A correction can be applied to compensate for a known systematic error, provided the uncertainty of the correction is known or negligible.”	Partially accepted. See revised Note 2.
0214 **IUPAC**	3.19	Note 3	te	In defining systematic error as part of an observable difference the definition rules out Note 3 because the random error can not be known. Note 3 would only be true in a theoretical framework to which the definition can not apply.	Delete note 3	Accepted.
0215 **ISO 357** **0219** **ILAC**	3.19 and 3.20		te	The definition of “bias” does not appear to align properly with the earlier definition of “systematic error”. Also, this is not aligned with the common understanding of the term “bias” nor its common application in the world of chemistry measurements.	Propose redefining “bias” to be synonymous to “measurement error” or “deviation from the Reference Value”.	Not accepted. In the VIM4 CD a measurement bias is defined as an estimate of a systematic error. Note 1 is reworded for clarification.

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0216 **National Institute of Standards (NIS), Egypt**	3.19 systematic measurement error	Note 3	ge	The word “minus” in “Systematic error usually equals measurement error minus random error.” Causes confusion to reader, because minus refers to a known deductible value, which is not the case of random error.	“Systematic error usually equals measurement error without considering random error.”	Accepted. Note 3 is deleted.
0217 **ISO 358**	3.20		te	Text:measurement biasbiasestimate of a systematic error	See the Reference in comment ISO 008:Reference: F. Pavese: “On the classification in random and systematic effects”, AMCTM XI, 2018, in A.B. Forbes, N.F. Zhang, A.G. Chunovkina, S. Eichstädt, F. Pavese, (Eds.): "Advanced Mathematical and Computational Tools in Metrology and Testing XI”, vol.11, Series on Advances in Mathematics for Applied Sciences vol 89, World Scientific, Singapore, October 2018, pp. 58–69	There is no concrete suggestion for improvement.
0218 **MB IMEKO-118**	3.20		te	Text: measurement bias bias estimate of a systematic error	See the Reference here at the end.	There is no concrete suggestion for improvement.
0220 **BelGIM**	3.20	definition	ge	A definition or some explanation of the term "estimate" would be desirable there. Should the term "estimate" be the same as defined in ISO 3534-1:2006 (1.31), or should it be interpreted in some other way?	The definition should be extended by note in accordance with this comment.	Partially accepted. In the current document as well as in the VIM3 ‘bias’ is understood as an estimate of a systematic measurement error. This understanding differs from the statistical meaning of a bias. The corresponding Note is clarified.
0221 **IUPAC**	3.20	definition	te	definition inconsistent with 3.18 and 3.19 and with current usage. measurement error is a single difference; systematic error is accordingly a component of a single value. Bias is not an estimate of measurement error; it is an actual difference between expectation (average of a large number of measurements) and a true value.	Adopt ISO 3534 concept of bias (difference between expectation [average of large number…] and true value)and add notes to the effect that 1 bias is usually estimated by comparison of a mean of a finite number of observations and a reference value.2 when there is a risk of confusion between a measured or estimated bias and the true value for bias, the qualitfications ‘measured bias’ or ‘estimated bias’ and ‘true bias’ can be used for clarity.Consider also adding measured biasdifference between a reference value and the average of a number of observations	Not accepted. In the current document as well as in the VIM3 ‘bias’ is understood as an estimate of a systematic measurement error. This understanding differs from the meaning of a bias in math statistics. The corresponding Note is clarified. See also Note 1 to 3.15 for clarification.
0222 **IUPAC**	3.20	Note 1	te	This note is nonsense in the context of the definition; the definition already says the concept is an estimate. And other definitions make it impossible to understand how the systematic measurement error (as defined here) can ever be known.	Redefine in terms of the ISO 3534 concept and then amend Note 1	Partially accepted. Rewording of Note 1 is provided.

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0223 IUPAC	3.20	Note 1	te	True values cannot be reference values because they are unknown (see 1.24)	Delete “is not known (i.e., where the reference value is a true value) and therefore it”	Partially accepted. Note 1 is reworded.
0224 RNMF_FR	3.20	Note 1	te	NOTE 1 This definition applies to measurements where the systematic error is not known (i.e., where the reference value is a true value) and therefore it needs to be estimated. In these cases, the estimated value should be accompanied with an uncertainty.Difficult to understand the usefulness to write « in this cases », even if we used a reference value different than a true value, the uncertainty should be given ?	To remove “in these cases”	Accepted. Note 1 is reworded.
0225 ISO 359 0226 EC-119	3.20	Note 2	te	A correction, either to a measured value or incorporated in a measurement model, should only be made if the systematic error is “known”, i.e., this is that both the origin and behaviour of the systematic error is understood.	Please consider the following extension:“Sometimes measurement bias is incorporated in a measurement model as a correction for a known systematic error.”	Accepted.
0227 IUPAC	3.20	term	te	‘bias’ is defined differently (fundamentally so) elsewhere, in terms of true value and expectation.	Delete alternative term ‘bias’and add a Note“ ‘measurement bias’ must not be used for ‘bias’ (or vice versa) because ‘bias’ relates to a true value and expectation and ‘measurement bias’ does not.”	Partially accepted. Note 1 is reworded to clarify differences in using ‘bias’ in metrology and math statistics.
0228 ISO 360 0231 EC-120	3.21	Note 1	te	Random variability reduces (or precision increases) with the number of replicates. This variability, indeed, can become negligible when it is estimated as standard error. This approach is, however, not very practical. Therefore, a more cost-efficient and realistic strategy is to determine the minimum number of replicates that yield a “constant” random variability.	Please revise Note 1 as follows:“[…] In practice, the number of averaged values must be large enough to make random variability constant.”	Not accepted. The proposed formulation is ambiguous. Random variability of what is meant? Variability of average cannot be a constant because it depends on a number of replicates.
0229 ISO 361	3.21	Note 1	te	Regarding the reference value of random error of NOTE 1 of term 3.21, the concept has the following questions:	It is recommended to delete NOTE 1 and do not use the concept of random error reference value. The averaging method in NOTE 1 may be appropriately added to the note in term 3.19 or 3.20, if necessary.	Accepted.
0230 IUPAC	3.21	Note 1	te	It is not useful to consider a ‘reference value’ for a random error as random error can never be estimated separately	Delete Note 1	Accepted.
0232 IUPAC	3.21	term	te	‘random error’ is defined in terms of true value elsewhere	delete alternative term ‘random error’and add a Note“ ‘random measurement error’ must not be confused with ‘random error’ (or vice versa) because ‘random error’ relates to a true value and ‘random	Not accepted. Random error’ doesn’t refer to true value or conventional value directly. It’s important only that replicate measurement are obtained under specified

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					measurement error' does not."	conditions.
0233 **National Institute of Standards (NIS), Egypt**	3.21	Note 1	ge	Adding the phrase "an infinite number of" to the sentence "A reference value for a random error is the average that would ensue from replicate measurements of the same measurand." to be clearer.	"A reference value for a random error is the average that would ensue from an infinite number of replicate measurements of the same measurand."	Partially accepted. Note 1 is deleted according to remarks 0229,0230.
0234 **National Institute of Standards (NIS), Egypt**	3.21	Note 3	ge	The word "minus" in "Random error usually equals measurement error minus systematic error." Causes confusion to reader, because minus refers to a known deductible value, which is not the case of random error.	"Random error usually equals measurement error without considering systematic error."	Partially accepted. Note 3 is deleted.
0235 **ISO 362** **0238** **ISO 365**	3.22		te	repeatability condition of measurement Why do you mention the number in replication for repeatability and not for intermediate measurement precision or reproducibility?	For consistency purpose in 3.22, 3.24 and 3.26, please use the same wording and choose between "replicate" and "two or more" in all definitions	Accepted.
0236 **ISO 363** **0245** **ILAC**	3.22		ge	Replace the word 'Fixed' by 'Stable'To bring in more clarity.The word 'fixed' is not understandable and is rigid.	condition of measurement that is fixed stable while performing two or more measurements over a short period of time	Partially accepted. Rewording of the definition is provided.
0237 **ISO 364** **0239** **EC-121**	3.22	definition	te	This definition is phrased much less clearly than the definition of the term in ISO 5725.	Take over the definition from ISO 5725	Partially accepted. Rewording of the definition is provided, which is in agreement with the ISO 5725 definition.
0240 **ISO 366** **0241** **EC-122**	3.22	Note 1	te	It should be clear to the reader that the given list of repeatability conditions is not necessarily exhaustive.	Please revise as follows: "A set of repeatability conditions typically includes, but not necessarily limited to, measurement procedure, measuring system, measuring system operator, operating conditions, and measurement location.	Partially accepted, text has been revised.
0242 **IUPAC**	3.22	Note 2	te	Note inaccurate; the (nglish) term "intra-serial precision condition of measurement" has apparently only ever been used in the VIM. (Google only returns instances of the VIM definition's notes) There are also several other far more common names; within-run or within-batch	Delete Note 2	Accepted.

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				precision probably being the most common. It is not useful to give one almost unused phrase without mentioning the more common terms. Since an exhaustive list is unrealistic we suggest removing the note.		
0243 **ISO 367** **0244** **VNIIM**	3.22	Note 4	ed	Variability among objects (or items) in evaluating repeatability is considered to be negligible, not contributing to a repeatability estimate.	Note 4 should be amended to remove the inconsistency or deleted in view of Note 7 in 3.17	Accepted . Rewording is provided in new Note 3.
0246 **IUPAC**	3.22	term and definition	te	Standards referring to repeatability conditions do not require a definition for 'repeatability condition of measurement';	Delete 3.22 as unnecessary. Adopt the ISO 3534 definition of 'repeatability conditions [note the plural]	Partially accepted. New definition is in agreement with ISO 3534 but adapted for metrology.
0247 **ISO 368**	3.23		te	repeatability condition of measurementThe definition explains how to obtain repeatability but does not explain what it intrinsically represents (and so what it can be used for).We propose to add the following note:	Please add:NOTE Measurement repeatability represents the minimum measurement precision of a defined measurement process.	Not accepted. Measurement precision is defined above. It's not correct to speak about 'minimum precision', because 'minimum' can be related to a quantitative concept only.
0248 **ISO 369** **0250** **EC-123**	3.23	definition	te	This definition is phrased much less clearly than the definition of the term in ISO 5725.	Take over the definition from ISO 5725	Partially accepted The only difference is that ISO 5725 talks about 'precision' /'repeatability' and in the VIM 'measurement precision'/'measurement repeatability' are considered.
0249 **IUPAC**	3.23	definition	ed	After defining 'repeatability conditions' (see comment on 3.22', 'a set of' is unnecessary	delete 'a set of' after defining 'repeatability conditions	Accepted.
0251 **ISO 370** **0252** **EC-124**	3.24	Note 1	te	It should be clear to the reader that the given list of changes is not necessarily exhaustive.	Please revise as follows :"The changes mentioned in the definition may include, but not necessarily limited to, new calibrations, calibrators, operators, and measuring systems"	Accepted.
0253 **ISO 373** **0254** **ILAC**	3.24		te	The difference, based on the proposed definitions in 3.24 and 3.26 between "Intermediate precision condition of measurement" and "reproducibility condition of measurement" is unclear and ambiguous. Based on the current definitions, the former is nothing other than a case of the latter. Why then is it then specially defined. They appear to one and the same thing.	Propose removing 3.24	Not accepted . The important difference between 'intermediate precision condition of measurement ' and 'reproducibility condition of measurement' is 'laboratory/location'. Rewording of the definitions are provided.

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0255 **ISO 371** **0257** **EC-125**	3.24	definition	te	This definition is phrased much less clearly than the definition of the term in ISO 5725.	Take over the definition from ISO 5725	Partially accepted. Rewording is provided and the current definition is in agreement with the ISO 5725 definition.
0256 **ISO 372**	3.24	definition	te	intermediate precision condition of measurementWhy “over an extended period of time” in the definition?In industry, statistical analyses are realized to identify the impact of specific condition. Typically, the impact of the change of operator on a process measurement: we ask to a defined number of operators to realise measurement in repeatability condition. However, this study is not done “over an extended period of time” but NOTE 1 seems to class it as intermediate precision condition of measurement.The notion of time is not present in the definition for Reproducibility so why do you include it here?Put the notion of time in a note as proposed:	Modify as follows:condition of measurement, out of a set of conditions that includes the same measurement procedure, same location, and replicate measurements on the same or similar objects over an extended period of time, but may include other conditions involving changes NOTE 4 An extended period of time long enough to allow for conditions involving changes to actually occur can be a condition of changing.	Partially accepted. Rewording of the definition is provided.
0258 **IUPAC**	3.24	Note 1	ed	permission (‘may’) in inappropriate context and applied to overly restrictive list	change to ‘can’ and/or insert ‘, for example,’ after ‘include’	Partially accepted. Rewording of the Note is provided.
0259 **IUPAC**	3.24	Note 2	te	Note inconsistent with definition. The term is defined as applying to a single condition; no other conditions need to be specified in defining a single condition. This note only applies to the plural term ‘intermediate precisions conditions’	Delete the note.	Accepted. The main term is changed so this note can be kept. .
0260 **IUPAC**	3.24	Note 3	te	Note inaccurate; the (nglish) term “inter-serial precision condition of measurement” has apparently only ever been used in the VIM. There are also several other far more common names; between—run or within-laboratory precision probably being the most common.	Delete Note 2 or amend to[Standard] uses the term “inter-serial precision condition of measurement” to refer to an intermediate precision condition	Accepted, Note 3 has been deleted..
0261 **IUPAC**	3.24	Note 4	ed	Poor construction: conditions always ‘occur’. It is the occurrence of changes that must be allowed for	Amend to read“NOTE 4 The extended period of time mentioned in the definition is intended to be long enough to allow for changes in the specified conditions.”	Accepted.
0262 **ISO 374** **0266**	3.24	Note 5	ed	The same as above Variability among objects (or items) in evaluating repeatability is considered to be negligible, not contributing to a repeatability estimate.	The same as above NOTE 5 should be amended to remove the inconsistency or deleted in view of NOTE 7 in 3.17	Accepted.

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VNIIM 0264 ISO 376						
0263 ISO 375 0265 EC-126	3.24	Note 4	te	While it may be covered indirectly by the term “variability”, one may want to emphasise that the objects must be sufficiently stable during the extended period of time.	Please consider revision as follows:“Intermediate precision may be evaluated by replicate measurements on similar objects, provided variability among the objects is accounted for, or is negligible, and that the objects are sufficiently stable during the extended period of time.”	Not accepted. Proposed rewording is misleading. In the definition ‘same or similar objects’ and extended period of time are mentioned. Note 4 says that relating variability is negligible.
0267 IUPAC	3.24	term and definition	te	Standards referring to intermediate conditions do not require a definition for ‘intermediate precision condition of measurement’.	Delete 3.24 as unnecessary. Adopt the ISO 3534 definition of ‘intermediate precision conditions [note the plural]	Partially accepted. The ISO 3534 definition is adapted for metrology.
0268 IUPAC	3.25	definition	ed	After defining ‘intermediate conditions’(see comment on 3.24’, ‘a set of’ is unnecessary	delete ‘a set of’ after defining ‘intermediate precision conditions	Accepted.
0269 ISO 377 0271 IUPAC	3.26	definition	te	the definition conflicts with ISO 3534 and ISO 5725, which are referred to in the Notes	Adopt the ISO 3534 definition of ‘reproducibility conditions’ [note the plural] and delete Note 2	Partially accepted. Rewording of the definition is provided. The concept has broader meaning comparing with ISO 5725. Explanation is given by a new EXAMPLE and in Note 2.
0270 ISO 378 0272 EC-127	3.26	definition	te	This definition is phrased much less clearly than the definition of the term in ISO 5725.	Take over the definition from ISO 5725	Partially accepted. Rewording of the definition is provided.
0273 IUPAC	3.26	Note 1	te	Note inconsistent with definition. The term is defined as applying to a single condition; no other conditions need to be specified in defining a single condition. This note only applies to the plural term ‘reproducibility precisions conditions’	Delete the note.	Accepted. Rewording of the definition and the Notes are provided.
0274 RNMF_FR	3.26	Note 2	te	« NOTE 2 In some cases the different measuring systems mentioned in the definition may use different measurement procedures ».Warning : In Standard ISO 5725, the definition of reproducibility involved the same method/procedure.	To be specified“ that this definition differs that of the 5725 reproducibility definition”	Partially accepted. Explanation of the difference is given by a new EXAMPLE and in Note 2 .
0275 IUPAC	3.26	term and definition	te	Standards referring to reproducibility conditions do not require a definition for ‘reproducibility precision condition of measurement’.	Delete 3.26 as unnecessary. Adopt the ISO 3534 definition of ‘reproducibility conditions’ [note the plural]	Partially accepted. The ISO 3534 definition is adapted.

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0276 **ISO 379**	3.27		te	measurement reproducibilityIn some standards (ISO 21748, ISO 5725-3), the reproducibility can be used as estimator of uncertainty. This information seems interesting enough to be signalled.	Please add: NOTE 2 In some conditions, the standard deviation of reproducibility can be an estimation of standard uncertainty of a measurement process.	Not accepted. Evaluation of measurement uncertainty is beyond the scope of the document.
0277 **ISO 380** **0279** **EC-128**	3.27	definition	te	This definition is phrased much less clearly than the definition of the term in ISO 5725.	Take over the definition from ISO 5725	Partially accepted. Rewording of the definition is provided. The concept has broader meaning comparing with ISO 5725. Explanation is given by a new EXAMPLE and in Note 2.
0278 **IUPAC**	3.27 (3.25)	definition	ed	After defining 'reproducibility conditions'(see comment on 3.22', 'a set of' is unnecessary	delete 'a set of' after defining 'reproducibility conditions'	Accepted This doesn't apply here, but rather to 3.25.
0280 **ISO 381**	3.28		ed	The new section 3.28 refers to the old section 4.26 (instead of 2.26).Reference to VIM3: 2.26 is wrong.	Change reference to: VIM3: 4.26	Accepted.
0281 **ISO 382**	3.28		ge	NOTE 2 may raise questions such as what tolerance is. Thus, a definition of tolerance should be introduced, e.g. one in JCGM 106:2012.	Adding two terms to define: tolerance limit specified upper or lower bound of permissible values of a property olerance difference between upper and lower tolerance limits	Not accepted. Definition of 'tolerance' is beyond the scope of the document because it doesn't apply directly to measurements, but rather to manufacturing specification.
0282 **IUPAC**	3.28	definition	te	Unnecessarily verbose – consider the effect of substitution Note also that 'extreme' can also mean 'smallest'.	amend to "largest measurement error permitted by regulation or specifications"and add a note to the effect that '"maximum permissible measurement error" is usually specified with respect to a known reference value and for a given measurement, measuring instrument, or measuring system'	Not accepted. "Extreme" means the upper limit or the lower limit, because an error can be also negative It's clear from the context and 'extreme' is used in all previous editions of the VIM.
0283 **ISO 384**	3.28	Example	te	There are multiple types of Limits of Error which are not formally defined in any globally accepted documentation. Propose the addition of the six types of Limits of Error as examples which will serve to harmonize these terms.	Example 1: Bilateral-Symmetrical - A two-sided Limit of Error allowing fixed, equal values of extreme measurement error with respect to a known reference value e.g., 1 mA +/- 0.1 mA Example 2: Bilateral-Asymmetrical - A two-sided Limit of Error allowing fixed, but unequal values of extreme measurement error with respect to a known reference value e.g., 1 mA + 0.1 mA / - 0.05 mA Example 3: Unilateral-Positive - A one-sided Limit of Error allowing for a fixed, extreme measurement error in the positive direction with respect to a known reference value, with no allowance in the negative direction with respect to the known reference value e.g., 38.608 mm + 0.025 mm / - 0.000 mm Example 4: Unilateral-Negative - A one-sided Limit of Error	Not accepted. These detailed examples are not in keeping with other entries in the document.

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					allowing for a fixed, extreme measurement error in the negative direction with respect to a known reference value, with no allowance in the positive direction with respect to the known reference value e.g., 6.35 mm + 0.000 mm / - 0.254 mm Example 5: Infinite-Positive - A one-sided Limit of Error allowing for infinite extreme measurement error in the positive direction above a specified value with respect to a known reference value, with no allowance below the specified value in the negative direction e.g., Bandwidth >=-3dB from the reference value Example 6: Infinite-Negative - A one-sided Limit of Error allowing for infinite extreme measurement error in the negative direction below a specified value with respect to a known reference value, with no allowance above the specified value in the positive direction e.g., Temperature <=+150 °C NOTE: The TUR for Infinite tolerance types results in ∞:1 because the numerator is ∞, rendering it meaningless.	
0284 ILAC 0285 ISO 383	3.28	Note 2	te	The note dictates that “tolerance” should not be used as a synonym for “MPE but does not give a reason why. This is problematic since it is contradictory to the very common use and understanding of the term “tolerance” in the measurement and testing industry.	Propose that the note be expanded to provide an explanation motivating the reason and also that “Tolerance” be defined as a separate entity in the VIM in its metrological context.	Not accepted. Tolerance is a different concept not necessarily related to measurement error. Note only says that it should not be used for referring to MPE.
0286 IUPAC	3.28	Note 2	te	‘tolerance’ is undefined here and could (and often does) indicate a maximum permissible error in a specification.	Either delete the note or explain (in the note) why the term can not be used	Partially accepted, further explanation is provided..
0287 ISO 385 0288 VNIIM	3.28	Reference line	te	Should be: VIM3: 4.26 (not 2.26)	Correct	Accepted.
0289 ISO 386 0290 PTB 0291 PTB-OIML	3.28	definition	ed	The new section 3.28 refers to the old section 4.26 (instead of 2.26).Reference to VIM3: 2.26 is wrong.	Change reference to: VIM3: 4.26	Accepted.

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0292 **PTB-OIML**	3.28	definition	ed	Reference to VIM3: 2.26 is wrong.		Accepted.
0293 **INRIM**	3.28	definition	te	MPEs are widely used for rating measurement instruments and system. The indications of measurement instruments or systems are subject to a number of influences. To capture this, MPEs may be not single values rather functions of the admitted operating conditions (e.g. temperature, vibrations, magnitude of the measurand).See also comment to 4.20 & 4.22.	“extreme measurement error, with respect to a known reference value, permitted by specifications or regulations for a given measurement, measuring instrument, or measuring system working at the rated operating conditions”NOTE 3 An MPE may be expressed as a single value, or a set of values or a function, to cover different operating conditions within the rated operating conditions.	Accepted.
0321 **ISO 397** **0322** **EC-132**	3.28	definition	te	Measurement errors also depend on the applied operating conditions of measuring instruments.	Please consider revision as follows: “Extreme measurement error, with respect to a known reference value, permitted by specifications or regulations for a given measuring instrument, or measuring system, and under a rated operating condition. ”The term “rated operating condition”, which is defined in entry 4.20, should be highlighted.	Accepted.
0294 **ISO 388** **0295** **ILAC**	3.29		te	Does this definition then mean that all calibration certificates report the “datum measurement error” and not the “measurement error”? Also, per definition, since all measurements can only be performed at a a specific nominal measurement value, all measurement errors must therefore be “datum measurement errors. This is very confusing.	Propose the removal of 3.29	Partially accepted. Entry 3.29 is kept and 3.30 is introduced as a Note to 3.29. Comment is correct. In calibration comparison of indications obtained by measurement standard with indications obtained by calibrating measuring instrument is realised at specified values. But the results of comparisons are extended over the interval. Sometimes it requires additional consideration. Finally, measurement error is defined over specified interval.
0296 **ISO 387** **0297** **EC-129**	3.29	term	te	This term is not needed. It just blows up the document without contributing anything to a clearer understanding of the subject.	Delete the definition to make the document more usable.	Not accepted. The entry is kept for historical reasons. Entries 3.29 and 3.30 have been combined, however, adding 3.30 as a Note to 3.29.
0298 **ILAC**	3.30		te	This is an obvious combination of a primitive and the term “error”.	Delete 3.30	Partially accepted. Entries 3.29 and 3.30 have been combined, however, adding 3.30 as a Note to 3.29.
0299 **ISO 389**	3.30		te	The comments for 3.29 above (comment ISO 388) apply equally to 3.30	Propose the removal of 3.30	Partially accepted. Entries 3.29 and 3.30 have been combined, however, adding 3.30 as a Note to 3.29.
0300	3.30	term	te	This term is not needed. It just blows up the document	Delete the definition to make the document more	Partially accepted. Entries 3.29 and 3.30

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ISO 390 **0301** **EC-130**				without contributing anything to a clearer understanding of the subject.	usable.	have been combined, however, adding 3.30 as a Note to 3.29. See also reply to [0294], [0295].
0302 **ILAC**	3.31		te	This is an obvious combination of a primitive and the term “measurement uncertainty”.	Delete 3.31	Not accepted. Rewording is provided..
0303 **ISO 392**	3.31		ed	Reference to VIM3: 2.29 is wrong.	Change reference to: VIM3: 4.29	Accepted.
0304 **RNMF_FR**	3.31	definition	te	The term “null measurement uncertainty” could be confusing	To replace “null measurement uncertainty” by “measurement uncertainty at zero “	Partially accepted. Suggested term is added as a synonym.
0305 **ISO 391** **0306** **ISO 393**	3.31	Note 1	ed	The phrase "…an interval where one does not know whether the measurand is too small to be detected…" is confusing and has in fact an opposite meaning.	Rephrase as "…an interval where one does not know whether the measurand is sufficient to be detected…"	Partially accepted. Rewording is provided.
0307 **IUPAC**	3.31	Note 1	ed	a measurement uncertainty does not cover an interval (consider expression as standard uncertainty)	amend to ‘characterizes an interval’ But see also further comment on this point relating to detectability	Partially accepted. Rewording is provided.
0308 **IUPAC**	3.31	Note 1	ed	a measurand is neither small nor large; only its value is	amend to ‘value of the measurand’ But see also further comment on this point relating to detectability	Partially accepted. Rewording is provided.
0309 **IUPAC**	3.31	Note 1	ed	Noise is far from the only contributor to uncertainty at zero	delete ‘or the indication of the measuring instrument is due only to noise’.But see also further comment on this point relating to detectability	Partially accepted. Some rewording is provided.
0310 **IUPAC**	3.31	Note 1	ed	Note inconsistent with definition; by definition, the indication of the instrument must be zero because the indication is the measured value from the instrument	delete ‘or near zero’ and ‘or the indication of the measuring instrument is due only to noise’.But see also further comment on this point relating to detectability	Partially accepted. Some rewording is provided.
0311 **IUPAC**	3.31	Note 1	te	if the measured value is zero it is known that the value of the measurand is too small to be detected.We see no way of correcting this as the idea of detectability differs in important respects from measurement uncertainty. For example, there may be values of the measurand within the null uncertainty interval that would generate a nonzero signal.	Delete the Note	Partially accepted. Rewording is provided.
0312	3.31	Note 1	ed	The phrase “…an interval where one does not know whether the measurand is too small to be detected…” is	Rephrase as “…an interval where one does not know whether the measurand is sufficient to be	Partially accepted. Some rewording is provided.

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VNIIM				confusing and has in fact an opposite meaning.	detected…"	
0313 **ISO 394** **0314** **VNIIM**	3.31	Reference line	te	Should be: VIM3: 4.29 (not 2.29)	Correct	Accepted.
0315 **ISO 395** **0316** **EC-131**	3.31	term	te	This term is not needed. It just blows up the document without contributing anything to a clearer understanding of the subject.	Delete the definition to make the document more usable.	Partially accepted. Rewording is provided.
0317 **IUPAC**	3.31	term and definition	te	Unclear whether this term is used or needed in metrology	delete 3.31	Not accepted. Rewording is provided.
0318 **ISO 396** **0319** **PTB** **0320** **PTB-OIML**	3.31	definition	ed	Reference to VIM3: 2.29 is wrong.	Change reference to: VIM3: 4.29	Accepted.
0323 **ISO 398**	3.xx	New item	te	If the above request for "measurement uncertainty in uncorrected use" is approved, then another term should be added consequently for the case where a correction is applied This new uncertainty (accounting for: (a) the calibration uncertainty and (b) any effects during the usage interval like wear and tear, (c) the use of the instrument like resolution, repeatability etc.) does not have a proper name yet.	We kindly ask WG to discuss if a new term could be introduced:measurement uncertainty in corrected useMeasurement uncertainty resulting from: (a) the calibration uncertainty and (b) effects during the usage interval (c) the use of the instrument.	Not accepted. A new term 'measurement uncertainty in uncorrected use' is redundant . All components of uncertainty indicted in the remark are taken into account at uncertainty evaluation.
0324 **ISO 399**	3.xx	New item	te	A general issue to consider:Both industrial and legal metrology heavily rely on using calibrated instruments without correcting the readings according to the information given in the calibration certificate. Instead, the error of indication is incorporated as a contributor to an enlarged uncertainty that will be applied in use. This new uncertainty (accounting for: (a) the calibration uncertainty and (b) for the uncorrected error as	We kindly ask WG to discuss if a new term could be introduced:measurement uncertainty in uncorrected useMeasurement uncertainty resulting from: (a) the calibration uncertainty and (b) for the uncorrected error and (c) effects during the usage interval (d) the use of the instrument.	Not accepted. A new term 'measurement uncertainty in uncorrected use' is redundant . All components of uncertainty indicted in the remark are taken into account at uncertainty evaluation.

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				mentioned above and (c) any effects during the usage interval like wear and tear, (d) the use of the instrument like resolution, repeatability etc.) does not have a proper name yet.EURAMET CG-18 proposes a term "global uncertainty" which we find meaningless, not clear to understand and therefore do not recommend to use.We therefore suggest a term"measurement uncertainty in uncorrected use" for circumstance detailed above.See also DOI: 10.2478/msr-2019-0026 for a discussion on the technical and scientific circumstances.		

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