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Country Code[1]	Clause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Convener's responses
0001 ISO 535	6		te	The definition in 6.13 examining system is inadequate. G. Iverson, R. Luce 1998, The representational measurement approach to psychophysical and judgmental problems, in Measurement, Judgment, and Decision Making, (Academic Press, Cambridge)	Rewrite definitions respecting current scientific state-of-the-art. To best describe ordinal and nominal properties and how these are perceived, the concept of "classification" system is introduced [Pendrill 2014a] as an "extension" of the classical measurement system shown in Figure E.3 of JCGM GUM-6:2020. A classification system consists of a measurement system but with the important addition of a classification process [section 2.4.3, Pendrill 2019]:"(e) decision-making: algorithm producing an output on a categorical scale: the result of a decision, such as the binary, dichotomous response to e.g. the question "is the temperature Tm below or above tolerance TSL?": (2.6)or a polytomous response distributed over a number of categories. Typically, decisions can be of two kinds, as in psychophysics [Iverson and Luce 1998]:identification: T_SLin (2.6) is a specification limit for the quality characteristic of the entity being assessed for conformitychoice: T_SL=T_m' in (2.6) where T_m'is a second (e.g. prior) measurement result"Such "classification systems" are characterised by so-called "performance" metrics which differ principally from tradition measurement systems metrics – such as bias – by referring, instead to measurement system 'accuracy', to [section 2.4.4, Pendrill 2019]:… "Accuracy (decision-making) = response categorisation – input (true) categorisation (2.8)where P_successis a metric of measurement system performance in terms of the probability of making the 'correct' decision."	Disagree regarding 6.13 examining system. What in fact the comment proposes is to add another definition, about the entire system including the examining system – as defined here – the object under examination, the environment, etc. Introduction of definitions of 'measurerment system' and 'examination system' in VIM might introduce confusion. Further consideration of this will be left to the VIM5.
0002 ISO 537	6		te	It is not clear why different concepts for nominal properties are required. If the definition of quantity is corrected, there will be no need for a definition of nominal property or examination. Nominal quantities will fall within the concept of measurement	Correct the definition of quantity as follows:1.1 quantity property whose instances can be compared by ratio or by order or by equivalence. Remove Chapter 6.	Disagree. The concept 'nominal quantity' contradicts a century-long tradition, and however is unjustified, given that it assumes that "quantity" has the same meaning as "property". The JCGM has mandated that the VIM4 contains significantly more entries pertaining to nominal properties.
0003 ISO 051	6	6+Introduction	ge/te	The treatment of ordinal and nominal properties in this draft VIM4 does not seem to take account of much	Give examples of current scientific communities of stakeholders interested in ordinal properties.There are many examples concerning ordinal and nominal	We thank for this comment, but the VIM aims at providing a basic terminology, not the

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				current research in progress. The statement (in the Introduction) that: "a scientific community of stakeholders interested in ordinal properties was not found" seems to confirm this.L R Pendrill 2014a, "Man as a Measurement Instrument". NCSLI Measure, 9(4), 24-35. https://doi.org/10.1080/19315775.2014.11721702A J Stenner, W P Fisher Jr., M H Stone, and D S Burdick, 2013, "Causal Rasch models". Frontiers in Psychology: Quantitative Psychology and Measurement, 4(536), 1-14L R Pendrill, A Espinoza, J Wadman, F Nilsask, J Wretborn, U Ekelund, and U Pahlm 2021, "Reducing search times and entropy in hospital emergency departments with real-time location systems", IISE Transactions on Healthcare Systems Engineering, https://doi.org/10.1080/24725579.2021.1881660E Bashkansky and S Dror 2015, "Matrix Approach to Analysis of Human Errors and their Prevention by Quality Engineering and Managerial Tools", Quality and Reliability Engineering International, 32, 535–45, https://doi.org/10.1002/qre.1770L R Pendrill 2014b, "Using measurement uncertainty in decision-making & conformity assessment", Metrologia 51 S206, doi:10.1088/0026-1394/51/4/S206J Melin, S J Cano and L R Pendrill 2021, The Role of Entropy in Construct Specification Equations (CSE) to Improve the Validity of Memory Tests, Entropy 23(2):212, https://doi.org/10.3390/e23020212	properties perceived by human beings – and not technical measuring instruments – are responding [Pendrill 2014a]. For instance, since the 1960s there have been extensive psychometric studies – in fields such as education and health [Stenner et al. 2013] – as well as the broad field of psychophysics, of concerning for instance in understanding sensory studies and consumer behaviour. Other examples concerning ordinal and nominal properties – such as quoted below – do not necessarily involve individual human beings but can still be described in terms of an instrument (agent) which responds in some way to the perceived phenomena. The ability of staff of a hospital Emergency Department to perform the task of finding essential equipment [Pendrill et al. 2021]The ability of an organisation to perform preventative or mitigating (security or quality assurance) actions [Bashkansky and Dror 2015]The ability of an indenter to make an indentation in a block of a certain hardness in materials testing The ability of a decision-maker to perform the task of correctly assessing conformity of a product or process to specification where the task difficulty is determined by measurement quality (uncertainty) [Pendrill 2014b]The ability of a patient to perform the task of recalling a sequence of words [as studied in the EMPIR NeuroMET2 project, Melin et al. 2021]	presentation of advanced topics like the mentioned papers do. Further consideration of this will be left to the VIM5.
0004 ISO 536	6	all	ge	The concept of qualitative measurement for nominal properties within the chemical and biological analytical community is well established and understood. The introduction of the terms examination/examinand is not necessary and likely to cause confusion. Nominal property values for the identity of substances or species require quantitative measurement which is interpreted for qualitative analysis.	We propose that the terms measurement and measurand apply equally to qualitative and quantitative measurement.	Whether the scope of measurement encompasses also nominal properties or not is a strategic question. The decision to treat nominal properties in a separate chapter in VIM4 has been made in conjunction with JCGM.
0005 ISO 538	6	all	ge	Nominal properties are not related to the quantity concept which is the basis for the definition of measurements, and examinations are carefully	Consider deletion of a whole chapter on nominal properties.The integration of the specific terms of the VIN of IFCC-IUPAC into the VIM is not recommended	Whether the scope of measurement encompasses also nominal properties or not is a strategic question. The decision to treat nominal properties in a separate chapter in

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0008 **PTB**				distinguished from measurements. Given the definition of metrology in 2.2, examination of nominal properties does not directly belong to metrology. Therefore, a whole new chapter about nominal properties does currently not seem to be justified.In any case this chapters needs intensive discussions with involvement of CCQM and other CCs.		VIM4 has been made in conjunction with JCGM.
0006 **ISO 539**	6	all	ge	including essential terms for qualitative assessment is useful but this goes too far by inventing terms and definitions with no consensus and no apparent use in practice	Reduce this section existing terms which are in regular use in metrology or that a metrologist may reasonably encounter in closely allied fields Also, where possible, use definitions from existing international standards	See detailed responses below to comments proposing to remove specific entries.
0007 **IUPAC**	6	all	ge	While the idea of including essential terms for qualitative assessment is laudable, this section goes far beyond the inclusion of necessary terms, by inventing terms and definitions for which there seems to be no broad consensus and no current use	Restrict section 6 to existing terms which are in regular use in metrology or that a metrologist may reasonably encounter in closely allied fields These are nominal scale, nominal property, examination, examinand, and possibly attribute agreement analysis Where possible, adopt definitions from existing international standards and (in a foreword to this section) refer to sectoral guidance for other definitions	See detailed responses below to comments proposing to remove specific entries. Regarding specific statistical procedures, such as attribute agreement analysis, we find it beyond the scoop for VIM
0009 **ISO 540**	6.1		ed	An additional new line below the table is missing	Insert some space below the table.	Thanks. Noted
0010 **ISO 541** **0013** **MB IMEKO-176**	6.1		te	nominal property <general>general nominal property nominal property in the general sense kind of nominal property property whose instances can be compared only by equivalence NOTE 1 Nominal properties can be general nominal properties or individual nominal properties	a) Instances are those of a "quantity. Do not use the same term for "properties" ": of a property can be called "attributes". b) Non-quantitative scales only, but the "Ordinal" are objective, the "Nominal" are subjective. Therefore the "instance" has a different definition in the two cases. Use "attribute". c) The term "equivalence" is not defined. A better wording would be if one simply writes that a nominal property is a property that cannot be placed in a quantitative or ordinal ordering. However, a formulation close to the one put forward would be to	a) Disagree in principle, because the concept 'instance' is generic, and not specifically related to quantities. However, the definition is rephrased to omit the term "instance" in line with the corresponding rephrasing of 1.1 quantity. b) Disagree. The fact that a property is nominal has nothing to do with its being subjective. c) Disagree. A good definition is not phrased in negative terms. We assume that what equivalence relations (i.e., relations that are

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					say as follows: A nominal property is a property that can only be compared by means of an equivalence relation with a Note saying: Equivalence relations are relations such as similarity and congruence, which from a logical point of view has the features of being reflexive, asymmetric, and transitive. d) The term "property" is used only with the attribute "nominal", except for "of measuring devices" in (4.) and in 5.13. e) Can a property only be an 'attribute' of a "quantity" or of a "material, as in VIM4 draft?	reflexive, symmetric, and transitive) are generally known. d) Disagree. The term "property" appears, e.g., in the definition of 'quantity', thus making it clear that quantities are specific properties, like nominal properties are, according to this definition. e) The question is not clear? A quantity is a property of an object. No specific proposal provided.
0011 ISO 542 0014 EC-177	6.1		ge	See the comment to entry 1.1	Keep the VIM3 definition	Disagree. In line with corresponding changes för 1.1 quantity, "kind of nominal property" is deleted as allowed term for a nominal property. The new concept "nominal properties of the same kind" has been introduced.
0012 ISO 543	6.1		te	nominal property is described as property whose instances can be compared only by equivalence. I do not agree with this comment. For example, in my field of RM production of pure substance organic calibration standards this is not correct, many analytes are identified by interpreting spectroscopic data using first principles and, in some instances, by comparison to a similar analyte (e.g. regioisomers, stereoisomers).	Property whose instances can be compared only by equivalence to a reference	Disagree. What the comment proposes ("compared only by equivalence to a reference") is just a specific case of what the definition says.
0015 ISO 544	6.1	definition	te	In "property whose instances can be compared only by equivalence", is "only by equivalence" meaning "both by equivalence and un-equivalence" or, else should property "equivalence" may have values, "TRUE" and "FALSE"?	Please clarify the meaning of "equivalence".	A Note added that clarify the meaning.
0016 ISO 545	6.1	definition	te	In "whose instance", use of "instance" is unfamiliar.	Change "instance" to "value", which is easier.	Disagree in principle. However, the definition is rephrased to omit the term "instance", in line with the rephrasing of 1.1 quantity.
0017 CMI	6.1	definition	te	In this definition the term „compared" appears to be a bit misleading as there is no "ordered scale" here. Would not be „classified" better ?	„classified"	Disagree. There can be comparisons, of individual properties of the same kind, which are purely nominal (e.g., the blood types of two individuals can be compared, and assessed to be the same or not).
0018 ISO 546	6.1	Note 1	ed	An additional new line below the table is missing	Insert some space below the table.	Thanks. Noted

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0019 IUPAC	6.1	Note 1, table	ed	'sequence variation' may be one technically valid term for the property but it can also mean the general phenomenon of variation between sequences. "variant	Consider "nucleic acid sequence" with instance "nucleic acid sequence of a particular gene in a given person"	Disagree. The term is meant to designate the deviations from a specified part of a reference sequence of the same kind, and should be understood when instantiated for a given gene in a given person.
0020 IUPAC	6.1	Note 2	te	"Individual nominal properties that are instances of the same general nominal property are comparable" does not make any sense; it is values that can be compared, not properties	Delete the sentence 'Individual nominal properties that are instances of the same general nominal property are comparable, and are said to be "nominal properties of the same kind". '	Disagree. Instances of general properties are not necessarily values (e.g., the blood types of two individuals in principle could be compared even without knowing the corresponding values in the ABO System). Compare responses 0016 and 0023.
0021 NPL, UK	6.1	Note 2	ed	There is a missing 'a'.	The text should read '...for example a sodium ion...'	Thanks. Note has been reworded and renumbered.
0022 ISO 547	6.1	Note 3	ed	In "greater or lesser", greater and lesser are not noun.	"being greater or lesser".	Thanks. Accepted.
0023 IUPAC	6.1	Note 3	ed	properties (length, mass) cannot be compared in terms of relative magnitude	Amend note 3 to "NOTE 3 Nominal properties are distinguished from quantities, which are properties whose values can be compared in terms of greater or lesser." Alternatively, delete the Note	Disagree. Quantities, as well as their values, can be compared in terms of being greater or lesser.
0024 ISO 548	6.1	Note 5	te	Can "address" be nominal property? While longitude and latitude are quantity.	Take the example, if appropriate.	We disagree that "address" can be seen as a nominal property.
0025 IUPAC	6.1	Note 5	te	The note is nonsense. Colour is a perceived sensation with a label; it is not a quantity and the same colour can arise from different mixtures of light of different wavelengths. It is the wavelength that can be compared by magnitude, not the colour. Further, no comprehensive colour space gives an unambiguous total ordering for colours and even the white light spectrum is perceptually circular – violet is perceptually 'between' red and blue.	Delete note 5	Accepted.
0026 IEC-DE 35	6.1	Table	ed, ge	An additional newline below the table is missed (see above)	Insert some space below the table.	Thanks
0027 ISO 549	6.1	term	te	"Kind of nominal property" (proposed in this VIM4 draft as a synonym for "nominal property") contains the same confusion of concepts and their relations which has been proposed to be introduced in clause 1.1. The English word "Kind" has several different meanings,	Introduce a separate definition of "Kind of nominal property". Note that nominal properties are not quantities since they cannot be judged to be commensurable (i.e. measurable or comparable to a common standard, as specified in SE5).	Disagree. Kind of nominal property, as an admitted term for nominal property in a general sense, has been deleted. A new concept "Nominal properties of the same kind" has been introduced.

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				ranging from "all kinds of things" to the specific classification (as introduced by Newton in his latin: *ejusdem generis*). As described in comment SE6, the latter interpretation is essential as a basis for several key concepts.		
0028 **ISO 551**	6.2	definition	ed	In the example, the word "instance" needs to be used in plural because they are related to properties.	Write "instances" instead.	The entry 6.2 'individual nominal property' is deleted in parallel with the deletion of 1.2 individual quantity
0029 **IEC-DE 36**	6.2	Example	ed	The word "instance" needs to be used in plural because they are related to properties.	Write "instances" instead.	The entry 6.2 'individual nominal property' deleted in parallel with the deletion of 1.2 individual quantity
0030 **ISO 550** **0031** **KR-OIML**	6.2	definition	ed	"instance of a nominal general property" should be changed to "instance of a general nominal property"	Nominal property is divided into general nominal property and individual nominal property.	The comment is correct. However, the entry is deleted (see above)
0032 **ISO 552**	6.3		te	There is no "reference set of nominal properties" but a "reference set of a nominal property". Its elements should not be nominal properties (cf. the conflict in def. 6.4). Possibly, it is a set of identifiers of objects.	Define the "reference set of a nominal property" instead of "reference set of a nominal properties."	Disagree. The concept 'set of X' assumes that X is plural (in this case, "nominal properties", implicitly in the sense of "individual nominal properties"). The entry has been modified to "reference nominal property".
0033 **ISO 553** **0034** **MB IMEKO-178**	6.3		te	'reference set of nominal properties' nominal scale set of individual nominal properties of the same kind, accepted by agreement, where each nominal property is associated with an element of a set of identifiers	Why "reference"? Being of the same kind is not a reason to become a "reference". So why of the same kind? Why using nominal "set" instead of "nominal scale", formed by the set (here correct) of "identifiers" or indexes? Put instead as in the term "nominal scale" (about using "scale" see the general recommendations).	Partially accepted. The entry has been modified to "reference nominal property" and "nominal scale" has been defined as a new concept.
0035 **ISO 554**	6.3	definition	te	The definition does not make sense well.	Please add an example.	Accepted. The entry has been modified. An example has been added.
0036 **IEC-DE 37**	6.3	definition	te	There is no "reference set of nominal properties" but a "reference set of a nominal property"! Its elements should not be nominal properties (cf. the conflict in def. 6.4). Possibly its a set of identifiers of objects.	Define the "reference set of a nominal property" instead of "reference set of a nominal properties."	See 0032.
0037 **ISO 555**	6.3	definition	te	The definition differs significantly, and unnecessarily, from existing standard usage. The ISO 3534 definition is in terms of unordered categories.	adopt the ISO 3534 definition of 'nominal scale'	Disagree. The entry has been modified for other reasons and "nominal scale" has been introduced as a separate entry.

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						Please check the related explanation in the "Significant changes" Annex at the end of the VIM4 2CD (and consider that ISO 3534 is a standard about statistics, not metrology).
0038 IUPAC	6.3	definition	te	The definition assumes a scale is a set of properties. It is not clear that this is so; if it were, surely the scale for biological species would include actual instances of each species. But this is not the case; the "scale" for biological species consists of the list of conceptual instances, descriptors or identifiers for instances, not of the instances themselves. Indeed, the ISO 3534 definition says the scale consists of unordered categories, and (elsewhere) categories are considered not instances but concepts. This is probably true of most nominal scales.	adopt the ISO 3534 definition of 'nominal scale' without change.	See 0037.
0039 IUPAC	6.3	definition	te	definition almost unreadable and also inconsistent with standard definitions elsewhere	adopt the ISO 3534 definition of 'nominal scale' without change.	See 0037.
0040 IUPAC	6.3	Examples	ed	There are no examples, leaving the definition unsupported	consider adding examples of easily recognisable nominal scales. Some scales are given under 6.4; others might include the base quantities of the SI the chemical elements the set of all countries the set {n-pentane, 2-methylbutane, 2,2-dimethylpropane} forms a finite nominal scale for the classification of saturated acyclic pentanes the set of all biological species the set of 32 crystallographic point groups the set of regular convex 3-dimensional polyhedra** though note that this also supports several ordering relations NB: all of these can be considered nominal scales; none is explicitly a 'reference set'	Accepted. The entry has been modified. An example has been added.
0041 ISO 556	6.3	term	te	There is no "reference set of nominal properties" but a "reference set of a nominal property". Its elements should not be nominal properties (cf. the conflict in def. 6.4). Possibly, it is a set of identifiers of objects.	Define the "reference set of a nominal property" instead of "reference set of a nominal properties."	See 0032.

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0042 **IUPAC**	6.3	term	te	'reference set of nominal properties' as defined here is neither in current use nor equivalent to the well-established usage of the term 'nominal scale'	delete the term 'reference set of nominal properties' and define 'nominal scale' using the ISO 3534 definition.	See 0037.
0043 **IUPAC**	6.3	term	te	'reference set of nominal properties' implies that the set is used for reference, but the definition implies that the defining characteristic is that of an agreed standard set. Agreement or adoption is a characteristic of a standard (norm) rather than a reference	If there is a documented need for the idea of a standard nominal scale (and we are not aware of any) define the separate term "standard nominal scale" as "nominal scale accepted or adopted for the purpose of harmonisation"	Partially accepted. A new entry for "nominal scale" has been created.
0044 **ISO 557**	6.4		te	The definition looks awkward. It means that the value of a property is a property and hence the value of a property is a property of a property of a ...	It may be better to write "element of the reference set of the"	Disagree. Please check the related explanation in the "Significant changes" Annex at the end of the VIM4 2CD.
0045 **ISO 558**	6.4		te	In the example, it looks like, while a sphere is hollow (the boundary of a ball), the other "shapes (prism, pyramid) are solid.	If appropriate replace "sphere" by "ball" or use two-dimensional objects like "disc", "triangle", ...	Disagree. However, "sphere" is replaced by "cube".
0046 **ISO 559** **0048** **MB IMEKO-179**	6.4		te	Text: value of a nominal property value <nominal property> individual nominal property identified in a reference set of nominal properties	In VIM4 draft "value" is used only here for indicating an individual "nominal property" in a "set" (6.3)—NOT a "reference set". In addition, it should be an 'attribute' of the property. The term "value" is associated only to "quantity", not to "property". On a scale, each nominal property is an "element" of the nominal scale: why the need to call it "value"?	Disagree. Please see the related explanation in the "Significant changes" Annex at the end of the VIM4 2CD.
0047 **ISO 560**	6.4		te	It is very unlikely that "sphere", "Pollachius virens" etc. are regarded as "values" by more than a negligible fraction of people.	A better term than "value" should be found for these qualities.	See 0046.
0049 **EC-180**	6.4		te	It is very unlikely that "sphere", "Pollachius virens" etc. are regarded as "values" by more than a negligible fraction of people.	A better term than "value" should be found for these qualities.	See 0046.
0050 **IEC-DE 38** **0051** **ISO 561**	6.4	definition	te	The definition looks awkward. It means that the value of a property is a property and hence the value of a property is a property of a property of a ...	It may be better to write "element of the reference set of the".	See 0046
0052 **IUPAC**	6.4	definition	te	values are not properties; values in a nominal scale are categories	change to "category from a nominal scale" [see ISO 3534 definition of 'nominal scale']	See 0046.
0053 **IUPAC**	6.4	definition	te	why does the value have to be in a reference set?	omit requirement for a reference set	Disagree. There needs to be a set of at least two individual nominal properties in order for a general nominal property to be meaningful.

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						Please see the related explanation in the "Significant changes" Annex at the end of the VIM4 2CD.
0054 IEC-DE 39	6.4	Example	te	It looks to me that while a sphere is hollow (the boundary of a ball) the other "shapes (prism, pyramid) are solid.	If appropriate replace "sphere" by "ball" or use two-dimensional objects like "disc", "triangle", ...	See 0045.
0055 ISO 562	6.4	Example 1	te	In the example, it looks like, while a sphere is hollow (the boundary of a ball), the other "shapes (prism, pyramid) are solid.	If appropriate replace "sphere" by "ball" or use two-dimensional objects like "disc", "triangle", ...	See 0045.
0056 NPL, UK	6.4	Note 1	te	This note is unclear. 'Sphere' is clearly a geometrical entity, but surely is also a term at the same time, insomuch as the term 'sphere' needs definition as a geometrical entity in order to distinguish it from 'prism' (for instance).	Alter the note to make clear that the values in the set have a meaning with respect to the nominal properties they are describing and are not simply an arbitrary set of terms representing properties, e.g. X = {banana, 15, @, ♫, β, 桌子}.	Partially accepted. The Note 1 has been clarified (and "sphere" has been replaced with "cube").
0057 IUPAC	6.4	Note 4	te	This definition is fundamentally different from that used in the cited Vocabulary (Nordin et al) and it is highly misleading to cite the previous source without making that clear.	Delete note 4 or add "but the definition is not consistent with the definition given in that source"	Accepted. Note 4 has been deleted.
0058 ILAC 0059 ISO 563 0060 ISO 564	6.5		ge	The choice of the word 'examination' for defining the process to obtain values for nominal properties is disputable. 'Examination' is already a keyword in the definition of inspection and, essentially, a word used in medical laboratories (ISO 15189) for activities that could be/include measurements and the examinations addressed in the VIM. This has the potential to confuse users and other interested parties. By other side, nominal properties are not exclusive of the clinical sector. Thus, we should not be limited to that sector jargon.	To debate in WG2 a better term. We considered a couple of alternatives, but none was fully convincing.	This is not a technical comment, but a strategic one, about the term to designate the attribution of values to nominal properties. WG2 was not able to identify a commonly accepted term.
0061 ISO 565	6.5	definition	te	In "experimentally obtaining", examination is not necessarily achieved by using experiment. Just using visual recognition can achieve it.	Please delete the phrase or add corresponding wording to the example of recognition.	Agree in principle. However, for consistency with 'measurement', "experimentally" will be maintained.
0062 ISO 566	6.5	Note 3	te	"testing" or "qualitative testing" should be among the common term, while "measurement" is not.	Please add either of them.	Partially accepted. "Qualitative analysis" has been added as admitted term for examination. "Testing" and "qualitative testing" have been added to the list of other terms in Note 5.
0063	6.5	Note 5	te	since the proposed VIM term 'value of a nominal property' differs fundamentally from the corresponding	Delete note 5 or add "Because of the change in the term 'value' (6.4) to denote a property, this definition	Disagree. The note, now Note 7, has been modified.

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IUPAC				term in the cited source, the proposed definition is fundamentally inconsistent with the original source and not just 'adapted'	is not consistent with the definition given in Nordin et al	
0064 ISO 567	6.5	term	te	The proposed use of the word "Examination" in this VIM4 draft is not recommended. "Classification" (rather than "Examination" which has so far been proposed in the draft VIM4) is preferred as the designation of data on ordinal and nominal scales, for the following reasons: The English word "examination"– to quote a common dictionary – is either: 'a detailed inspection or study, or a formal test of a person's knowledge or proficiency in a subject or skill'. But data on ordinal and nominal scales do not have to be obtained by detailed observations or formal tests. Examinations are classifications but not all classifications are examinations. In a typical medical examination (Dybkaer 2009), a clinician makes a judgment about a patient's state of health. "Examination" used in the sense common in medical care can be considered a synonym for "inspection" as defined for example in ISO/IEC 17000:2004 §4.3, as including a determination of conformity (of the entity being inspected) with specified requirements. René Dybkaer 2009, "An Ontology on Property for Physical, Chemical, and Biological Systems", ISBN 978-87-990010-1-9, http://ontology.iupac.orgISO/IEC 17000:2004 Conformity assessment — Vocabulary and general principles The VIM on the other hand has explicitly excluded conformity assessment from its scope. Therefore "examination" is not an appropriate term for qualitative analyses – whereas "classification" (which has a long history for instance in taxonomy) is. According to the Encyclopaedia Britannica: "Classification, in biology, the establishment of a hierarchical system of categories on the basis of presumed natural relationships among organisms. The science of biological classification is commonly called taxonomy (q.v.)."	Replace the term "examination" and related terms (such as Examinand etc) by the term "Classification" (and related terms, such as "classificand" etc) as conventionally used in established disciplines such as taxonomy.	Disagree. "Examination" is kept as preferred term, but "qualitative analysis" has been added, together with "classification", as admitted terms.
0065	6.5	term	te	The full defined term relates to nominal properties only, but the established 15189 usage – the only sector in	All definitions from 6.6 to 6.17 should include "nominal examination" (or "nominal examinand")	Not accepted. See 0058.

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Country Code[1]	Clause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Convener's responses
IUPAC				which the term 'examination' is current and therefore the sector most affected by its introduction in the VIM - suggests considerable caution in use of the abbreviated term in all later definitions	and not just "examination" in the primary defined term, with the (present) shorter form as permitted alternative, so that there is no conflict with existing standardized usage. Similarly, the qualification 'nominal' should be included in all definitions where 'examinand' or 'examination' occur, to avoid incorrect application to measurements in the context of 15189	Note 4, now 6, has been clarified.
0066 IUPAC 0067 IUPAC	6.6	all	te	this is simply an adaptation of 'principle' from 'measurement principle' and there seems no good reason to have a separate term for this	Add "principle" as an alternate term on "measurement principle", add a Note to 'measurement principle' to say that the term 'examination principle' can be used for examinations, and add a note to "examination" to say that "The terms 'principle', 'method' and 'procedure' may be used in conjunction with 'examination' to denote, respectively, the general principle, sequence of operations, and detailed steps of an examination"	Not agreed. As measurement is not used to designate the attribution of values to nominal properties the proposed change is not possible.
0068 IUPAC	6.7	all	te	this is simply an adaptation of 'method from 'measurement principle' and there seems no good reason to have a separate term for this	Add "principle" as an alternate term on "measurement principle", add a Note to 'measurement principle' to say that the term 'examination principle' can be used for examinations, and add a note to "examination" to say that "The terms 'principle', 'method' and 'procedure' may be used in conjunction with 'examination' to denote, respectively, the general principle, sequence of operations, and detailed steps of an examination"	See 0066-67. As measurement is not used to designate the attribution of values to nominal properties the proposed change is not possible.
0069 IUPAC	6.8	all	te	this is simply an adaptation of 'procedure' from 'measurement procedure' and there seems no good reason to have a separate term for this	Add "principle" as an alternate term on "measurement principle", add a Note to 'measurement principle' to say that the term 'examination principle' can be used for examinations, and add a note to "examination" to say that "The terms 'principle', 'method' and 'procedure' may be used in conjunction with 'examination' to denote, respectively, the general principle, sequence of operations, and detailed steps of an examination"	See 0066-67. As measurement is not used to designate the attribution of values to nominal properties the proposed change is not possible.
0070 ISO 568	6.8	Note 2	ed	The spaces between the numbers of the notes and the texts associated with are inconsistent.	Unify the spaces to a constant size throughout the whole document.	Noted
0071 IEC-DE 40	6.8	Notes	ed	The spaces between the numbers of the notes and the texts associated with are terribly variating!	Unify the spaces to a constant size throughout the whole document.	Noted

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0072 **IEC-DE 41** **0073** **ISO 569**	6.9	definition	te	Why isn't it stated in the definition that the nominal property is an individual nominal property? Why must it stated in Note 1???	Write "individual nominal property" in the definition and discard note 1 but without the examples.	Disagree. For the sake of simplicity of the definition the distinction of 'individual' is put in a Note.
0074 **IUPAC**	6.9	Note 2	ed	The note confuses in much the same way as note 5 of 2.3; in normal usage, the 'property being examined' is always the examinand; if it is not, a mistake has been made. We also find it hard to identify a condition in which a nominal property itself would be altered by the conditions of a properly designed and executed test, unless the test was intended to convert (say) from one chemical species to another in order to provide a detectable response – but that would just mean that an alternative examinand – intentionally sought and therefore an examinand in its own right - is used as an indicator for another. This is somewhat analogous to the way a voltmeter might be used to measure pH – the meter measures volts but it is still pH that is being measured by the system. This is not something that requires a warning. We are accordingly unable to see the relevance of this note for nominal properties, or to suggest an improvement.	Delete note 2	Disagree. The property being examined, or the property interacting with the examining (measuring), system is not always the intended examinand.
0075 **IUPAC**	6.9	Note 2, Example	te	In the example, 'deviating' implies a mistake. In addition, if the test applied did not respond to the acid form, the test conditions would be arranged to guarantee the salt form and vice versa.	delete the example	Partially accepted. Note 2 modified for clarity. The term "deviation" replaced with "difference" in the EXAMPLE
0076 **IUPAC** **0079** **IUPAC**	6.10	Note 3	te	since the proposed VIM term 'value of a nominal property' differs from the corresponding term in the cited source, the proposed definition now refers to a set of properties and is not consistent with the original source	Correct 6.4 to as proposed in comments to 6.4 or add, at the end of note 3 "Because of the change in the term 'value' (6.4) to denote a property, this definition is not consistent with the definition given in Nordin et al	Disagree. The wording of the definition for "examination result" is consistent between the VIN and VIM4 1CD, taking the difference in wording of 'value' into account.
0077 **ISO 570**	6.10 and 6.11	definition	te	Per definition 6.10, the examination result is a set of values and per definition 6.11 a (single) examined value is representing a examination result which means, a set of values. This is inconsistent.	Needs to be thoroughly evaluated and discussed.	Disagree. An element of a set can be taken to represent the set (as it is basically the definition of 'statistic'). This is analogous to the relation between measured value and measurement result, where a single measured value represents an entire set that is a measurement result.
0078	6.10, def 6.11	definition	te	Per definition 6.10 is the examination result a set of values and per definition 6.11 a (single) examined value	I have no solution. Fichez-moi la paix!	See 0077.

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Country Code[1]	Clause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Convener's responses
IEC-DE 42				is representing a examination result which means, a set of values. Crazy!		
0080 ISO 571	6.12		te	A "reference value of a nominal property" is not yet defined.	Needs to be discussed.	Agree. An entry has been added for 'reference value of a nominal property'.
0081 ISO 572	6.12	definition	te	In "a reference value", meaning of "reference" does not make sense. It would be rather an intended value.	Please change.	See 0080.
0082 IEC-DE 43	6.12	definition	te	A "reference value of a nominal property" is not yet defined!		See 0080
0083 ISO 573	6.12	definition	ge	'Reference value of a nominal property' is not defined in the Draft of VIM4. Moreover, in our opinion, in this context the term 'examined value' should be used.	probability that an examined value is the same as a value of an examinand or probability that an examined value is the same as the value of a nominal property to be examined	See 0080
0084 ISO 574	6.12	definition	te	A "reference value of a nominal property" is not yet defined.	Needs to be discussed.	See 0080
0085 IUPAC 0086 IUPAC	6.12	definition	te	An examined value for a test item is only the same as a reference value by chance unless it is a reference value for the item under test; most test items do not have reference values. The definition is accordingly not usable.	Either adopt the exact term, definition and notes used by Nordin et al or delete all of 6.12	Disagree. Without a reference value, the accuracy cannot be determined. "examination accuracy" has been added as an admitted term.
0087 VNIIM	6.12	definition	ge	'Reference value of a nominal property' is not defined in the Draft of VIM4. Moreover, in our opinion, in this context the term 'examined value' should be used.	probability that an examined value is the same as a value of a examinand or probability that an examined value is the same as the value of a nominal property to be examined	See 0080.
0088 ISO 575 0086 IUPAC	6.12	Example 1	te	Error rates between 0.01 and 0.15 %, i.e., several orders of magnitude higher are quoted in Scientific Reports volume 10, Article number: 5750 (2020)	Check the error rate for DNA sequencing.	The comment seems to refer to an earlier VIM4 draft, and not the distributed VIM 1CD.
0090 ISO 576	6.12	Example 2	te	If, in EXAMPLE 2, the reliability is 1/5 =0.2, the examination is not verifying "equivalence" but" un-equivalence" or "difference".	Please change.	Partially accepted. EXAMPLE 2 has been rephrased for clarity.
0091 IUPAC	6.12	Note 1	te	Given the error in use of 'reliability' the Note does not apply	Delete all of Note 1	Not accepted. Comment not understood.

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.0092 **IUPAC**	6.12	Note 1, Example 2	te	calculating a probability from five observations is seriously inadequate; the confidence interval for the probability in this case is between about 0.4 and 0.96	Delete the example	Not accepted. EXAMPLE 2 has been rephrased for clarity. The number of replicates is few, but is given to illustrate the principles
0093 **ISO 577**	6.12	term	te	"uncertainty" for nominal properties is not sufficiently well established or harmonised to include a term in this vocabulary. Further. 'reliability' is not the same thing as probability of correctness.	Delete 6.12 and its notes	Agree about the first part of the comment, and in fact this entry does not deal with uncertainty. Disagree about the second part. While the concept of uncertainty, as it applies to nominal properties, is not yet sufficiently well established to include a term and well-defined concept in this vocabulary, a concept related to the quality of examinations and their results is required here, and both 'reliability' (i.e., "the quality of being able to be trusted") and 'confidence' (i.e., "the feeling that you can trust, believe in and be sure about...") fit well.
0094 **IUPAC**	6.12	term	te	The concept of uncertainty as it applies to nominal properties not sufficiently well established to include a term in this vocabulary	Delete 6.12 and its notes Consider including a comment in the foreword to say that the concept of uncertainty as it applies to nominal properties is not yet sufficiently well established to include a term and well-defined concept in this vocabulary.	See 0093
0095 **IUPAC**	6.12	term and definition	te	The definition does not describe reliability, and reliability and confidence are different things	Either adopt the exact term, definition and notes used by Nordin et al or delete all of 6.12	See 0093
0096 **ISO 578**	6.12, 6.16	definitions		The text as it stands, contains a number of serious misconceptions about metrological traceability and measurement uncertainty when assuring the quality of classification of ordinal and nominal properties. E Bashkansky, T Gadrich and I Kuselman 2012 Interlaboratory comparison of test results of an ordinal or nominal binary property: analysis of variation Accred. Qual. Assur. 17 239–43T Akkerhuis, J de Mast and T Erdmann 2017, "The statistical evaluation of binary test without gold standard: Robustness of latent variable approaches", Measurement 95, 473 – 9, doi: 10.1016/j.measurement.2016.10.043G. Nordin, R. Dybkaer, U. Forsum, X. Fuentes-Arderiu, F. Pontet, 2018, Vocabulary on nominal property, examination, and related concepts for clinical laboratory sciences	Rewrite definitions respecting current scientific state-of-the-art. As explained in section 2.4.4 of Pendrill [2019]:"For a simple binary decision (eq. 2.6), a correct decision is described as assigning the response to the category at the output of the measurement system corresponding to the 'correct' category of the measurement entity at the input to the measurement system. Analogous to the usual measurement error (eq. 2.7), the closer the categorisation, the greater the 'accuracy', measured in terms of (eq. 2.8).Bashkansky et al. [2012] describe an 'accurate' system as one in which the off-diagonal elements (α and β, the risks of type-1, respectively, type-2 decision errors) of the (binary) confusion matrix are minimised (where Psuccess =1 – α or 1 – β). Akkerhuis et al. [2017] take a similar approach, where measurement error is expressed as	The comment concerns ordinal quantities and binary nominal properties, which is a special case of nominal properties. We are not sure we understand what is suggested by the reviewer, but think it is out of scope for VIM4 chapter 6 on nominal properties. Maybe for VIM5?

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				(IFCC-IUPAC Recommendations 2017). Pure Appl. Chem. 90(5), 913–35 https://doi.org/10.1515/pac-2011-0613	a misclassification, statistically evaluated in terms of the misclassification probabilities, α and β (or their complements sensitivity and specificity) for binary tests ranging broadly from visual quality inspections of industrially manufactured parts to diagnostic and screening tests in medicine. In the example 1 of VIN §3.9 Examination uncertainty given by Nordin et al. [2018]: "The reference nominal property value is 'B'. The nominal property value set … of all possible nominal property values is {A, B}. For one of 10 examinations … the examined value differs from 'B'. The examination uncertainty is therefore 0.1 (10 %)". Again, misclassification probabilities, α and β, are considered as accuracy measures. But performance metrics such as , α or β often belong to the 'counted fraction' kind of data and in general are of ordinal, rather than fully quantitative nature, not directly amenable to regular statistics [section 3.5.1]. There is also the same task of separating the instrument factor from the sought-after object factor even in qualitative, categorical responses of the measurement systems. In section 2.4.5 of Pendrill [2019]: "The Rasch measurement model, mentioned in section 1.2.1 and eq. (1.1), can be applied in the first approximation to transform the ordinal, 'counted fraction' data, onto the more quantitative scale for θ and δ." Construct specification equations can provide references for metrological traceability based on ordinal and nominal properties, as described in Melin et al. 2021].	
0097 IUPAC	6.13	definition	ed	definition unnecessarily verbose	replace with "set of one or more devices and other components used for examination of a nominal property"	Accepted, according to the corresponding modification of the definition of 'measuring system' (4.2).
0098 IEC-IT NC05 0099 ISO 579	6.13	Note 2	te	We deem that not only "a human eye" may be an essential element of an examining system.	Modify note as follows: NOTE 2 A human eye may be an essential element of an examining system. Human senses are essential elements in taste analysis.	See comment to 0100
0100 IUPAC	6.13	Note 2	ed	Note 2 is (obviously) untenable as written.	replace with "Human observation can form an essential part of an examining system" Consider, also, moving this to 6.7 or 6.8 instead of 6.13	Partially accepted. Note has been modified. We find the Note well placed at 6.13.

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0101 **IUPAC**	6.14	definition	ed	unnecessarily verbose and adding non-essential features	replace with "realization of the definition of a given nominal property, used as a reference"	Disagree. This definition mirrors the one of 'measurement standard' (and for an object to be a measurement / examination, standard, the value of the quantity / nominal property it realizes must be stated, together with an associated uncertainty / reliability).
0102 **IUPAC**	6.14	Example 1	te	The example is not an example of a standard	delete example 1	Accepted. A new example is provided.
0103 **IUPAC**	6.14	Example 2	te	The example is not an example of a standard	delete example 2	Accepted. Example 3 renumbered.
0104 **IUPAC**	6.14	Example 4	te	The example illustrates a description, not a realization of the description	delete example 4	Accepted
0105 **IUPAC**	6.14	Note 1	te	The only unambiguous example of a realization in this list is a reference material. The others are, respectively, a description, an examination procedure (or part of it), or a value in a nominal scale. None fulfil the definition	Replace with "A reference material can be an examination standard"	Partly accepted. The Note modified.
0106 **ISO 580**	6.15	definition	te	"capacity" does not make any sense, but "capability" is much correct.	Please change.	Accepted.
0107 **IEC-IT NC06** **0108** **ISO 581**	6.15	definition	te	Since "persons" are already included in the concept of "examining system" (see clause 6.13. Note 2), we deem that it is appropriate to modify the definition.	Delete specification "to one or more persons or" from the definition. Also consider to modify the definition of "examining system" (clause 6.13) in order to explicitly address this relevant aspect.	Accepted: "to one or more persons" removed. We think Note 2 in 6.13, now 6.12, is adequate.
0109 **IUPAC**	6.15	definition	te	calibration and staff training are separate concepts and in introducing the idea of training here, the clarity of the concept is seriously compromised. Note particularly that all staff training is intended to provide staff with the capacity to undertake examinations, whether or not the staff concerned are part of the system. Further, if personnel do form part of a system, there is no need to refer to them separately.	process that confers to one or more persons or to an examining system the capacity to provide values of a nominal property, and the examination reliability of each value, from specified examinations after having examined one or more examination standards under specified conditions	Not accepted. What is proposed is not consistent with the comment.
0110 **IUPAC**	6.15	Example	te	This is an example of staff training, not of calibration in any useful sense.	delete the example	Partially accepted. The example has been modified.
0111 **ISO582**	6.15	term	te	"examination calibration" is not making sense but "examination training" is much correct. (The definition	Please change.	Disagree.

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				looks explaining "training" but not "calibration". The concept of examination calibration is completely different from that of measurement and clear explanation statement is necessary in order not to have readers misled.)		Example 1 has been modified and new Example 2 and 3 have been added for clarity.
0112 IUPAC	6.15	term	te	calibration and staff training are generally completely different and separate concepts	delete alternate term 'examination training'	Accepted
0113 ISO 583	6.15	term and definition	te	This concept is not at all like 'calibration' and the term should not be used for this defined concept.	Delete 6.15	Disagree: nevertheless, the definition has been changed, to avoid possible ambiguities.
0114 IUPAC	6.15	term and definition	te	After a careful study of the wording, here, this concept is not sufficiently close to calibration for the term to apply. There is, in addition, no need to have a definition for 'training' as that is well understood	Delete 6.15	Disagree: nevertheless, the definition has been changed, to avoid possible ambiguities.
0115 IUPAC	6.16	Example 1	te	This example looks like a traceability statement but gives no evidence of calibration, a defining characteristic in the definition.	Show how the sequence of comparisons has been calibrated or delete the example	Partially accepted. The example has been modified to stress the need for validation of each step in the chain of traceability.
0116 IUPAC	6.16	Example 2	te	The example is an assertion about traceability but again fails to demonstrate how traceability is achieved	delete the example	Partially accepted. The example has been modified to stress the need for validation of each step in the chain of traceability.
0117 IUPAC	6.16	Note 1	te	The note says that a nominal scale (reference set of nominal properties) could be a reference. That is the same as claiming that the mass scale can be a reference. It cannot; the reference for mass is the kg, not the scale that uses the kg, and traceability is through the values of measurement standards. In the case of nominal values, the reference(s) would need to be one or more realizations (a reference set of _objects_), whereas the scale is simply the collection of categories to be realized.	Delete "One type of reference is an agreed reference set of nominal properties. "Add "One type of reference is an authenticated sample of the material under examination". (or "a certified reference standard")	Partially accepted. The Note has been modified.
0118 IUPAC	6.16	Note 1	te	Generally, traceability 'to a procedure' is a valid way to achieve traceability if and only if the procedure is an agreed reference method and values from the procedure are used to calibrate the method in use. Otherwise, reference to a procedure is generally better thought of as defining an operationally defined measurand and any traceability is through the experimental conditions defining the procedure.	Amend to read "The reference can be a specified examination procedure where the procedure has been established for use in providing reference values, and for which the procedure in use has been calibrated using reference values from the reference procedure."	Partially agreed. The Note has been modified. The concepts of 'reference value of a nominal property' and 'reference examination procedure' have been defined in new entries.

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0119 ISO 584	6.16	term and definition	te	First, 'examination calibration' is insufficiently well defined to refer to here; second, many ("primary"?) examination references arise through establishment of authenticity, which is not well covered by the ideas here	Revise to avoid 'examination calibration' and to respect the validity of establishment of authenticity via provenance. Alternatively, delete 6.16	Partially accepted. Note 1 modified, explaining that one type of reference is an authenticated sample.
0120 IUPAC 0121 IUPAC	6.16	term and definition	te	See comments on calibration. Reliance on an improperly constructed concept of calibration invalidates the definition given in 6.16	delete the term and definition	Not accepted. Note 1 expanded.
0122 IUPAC	6.16	term and definition	te	"reference" unclear. In this document, the only	delete the term and definition	Not accepted. Note 1 expanded.
0123 IUPAC	6.17	Example 1	te	Are biological fluids assessed against a colour system developed for matte paint colours?	Check this. If the RAL system is not actually used for this purpose, remove the reference to the RAL system and include a specific colour system that is.	Agree. The comment is correct. The example modified to cover examination of eye colour with reference to a given classification system.
0124 IUPAC	6.17	Example 2	te	The example is insufficient. It is not enough to claim that the results are given using the same system; it must be shown that they used antibodies that are in turn verified against the same primary references. (Compare measurement: two measurement results given in metres are comparable if and only if they are demonstrably traceable to the same metrological reference, not simply because the values are given in metres).	Replace with an example that clearly shows that the results are traceable to the same realisation of the definitions, not just claiming to be.	Partially agreed. The example has been modified to explain the necessity also for a common nominal scale for examination results to be comparable.
0125 ISO 585	6.17	definition	te	The definition is confusing.	Rewrite definition respecting that nominal properties are not quantities since they cannot be judged to be commensurable (i.e. measurable or comparable to a common standard, as specified in SE-158).	Disagree. The definition does not mention commensurability, and comparability does not need to be quantitative.
0126 PTB-OIML	6	all	ge	Nominal properties are not related to the quantity concept which is the basis for the definition of measurements, and examinations are carefully distinguished from measurements. Given the definition of metrology in 2.2, examination of nominal properties does not directly belong to metrology. Therefore, a whole new chapter about nominal properties does currently not seem to be justified.In any case this chapters needs intensive discussions with involvement of CCQM and other CCs.	Consider deletion of a whole chapter on nominal properties. The integration of the specific terms of the VIN of IFCC-IUPAC into the VIM is not recommended	Disagree. Whether the scope of measurement encompasses also nominal properties or not is a strategic question. The decision to treat nominal properties in a separate chapter in VIM4 has been made in conjunction with JCGM.

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0127 **ILAC**	6, 6.1, 6.5		ge	In chapter 6 of the VIM4 a novel approach on 'the 'examination' of so called 'nominal properties' is described. We see multiple issues arising by this approach. A formal issue is the redefinition of a term like "examination", which is already defined in ISO 15189. This could prevent a harmonized use of the wording. A second general issue originate in the approach on nominal properties and their examination itself. This approach extends the scope of the VIM significantly to areas outside of metrology (see examples in section 6.1). So far the VIM is well established as a reference document in the technical field of metrology but to our knowledge the recognition of this document in other technical fields is minor. We doubt that technical fields outside of metrology would directly adapt the VIM as a reference for their terminology without further measures. From our point of view, prior to the extension of the scope of the VIM, a broad discussion on this topic should be initiated in all concerned technical committees of the JCGM members and partners beyond the present members.We are not convinced that work on nominal properties and examination are sufficiently mature at this stage to enter into the VIM 4.Therefore we strongly believe the introduction of the chapter 6 should be omitted to secure the VIM as a robust and indisputable vocabulary in metrology.	Remove chapter 6 completely from VIM4. Although we are supportive of the idea to cover nominal properties and examination the VIM needs not to contradict definitions that are already well established. Further the areas of metrology addressed by chapter 6 should not be limited to only the medical area as it is obviously written for. There are numerous fields outside medicals that does perform quantitative measurements on nominal properties which we have dealt with for years, like sensorics and functionality testing. Therefore, in the development process of VIM5 create awareness in technical fields outside metrology for these necessary amendments to the VIM e.g. by contacting experts from technical committees of JCGM members (e.g. ISO CASCO).	Disagree. Whether the scope of measurement encompasses also nominal properties or not is a strategic question. The decision to treat nominal properties in a separate chapter in VIM4 has been made in conjunction with JCGM.

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