TECHNICAL SPECIFICATION

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Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment —

Part 3: Guidelines for achieving agreements on measurement uncertainty statements

Spécification géométrique des produits (GPS) — Vérification par la mesure des pièces et des équipements de mesure —

Partie 3: Lignes directrices pour l'obtention d'accords sur la déclaration des incertitudes de mesure

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years with a view to deciding whether it should be confirmed for a further three years, revised to become an International Standard, or withdrawn. In the case of a confirmed ISO/PAS or ISO/TS, it is reviewed again after six years at which time it has to be either transposed into an International Standard or withdrawn.

Attention is drawn to the possibility that some of the elements of this part of ISO/TS 14253 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 14253-3 was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

ISO 14253 consists of the following parts, under the general title *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment*:

— *Part 1: Decision rules for proving conformance or non-conformance with specifications*

— *Part 2: Guide to the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

— *Part 3: Guidelines for achieving agreements on measurement uncertainty statements*

Annex A of this part of ISO 14253 is for information only.

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Introduction

This part of ISO 14253 is a geometrical product specification (GPS) Technical Specification and is to be regarded as a global GPS Technical Specification (see ISO/TR 14638). It influences links 4, 5 and 6 of all chains of standards in the general GPS matrix.

For more detailed information of the relation of this Technical Specification to other standards and the GPS matrix model, see annex A.

ISO 14253-1 provides decision rules for proving conformance or non-conformance with specifications of workpieces and measuring equipment when taking into account the uncertainty of measurement. ISO/TS 14253-2 provides instructions for preparing uncertainty budgets for determining measurement uncertainty as defined in the *Guide to the Expression of Uncertainty in Measurement* (*GUM*). However, the possibility still exists that disagreement between customer and supplier can occur on the estimated measurement uncertainty.

It is becoming increasingly common for suppliers to have in place a quality system providing satisfactory assurance to the customer that the latter is receiving a product which conforms to specifications. This avoids the need for costly duplicate inspections.

For this reason, the most common case of disagreement over a measurement uncertainty statement or an uncertainty budget involves the customer questioning the supplier's uncertainty budget. The customer also may question the measured value of a characteristic of a workpiece or of measuring equipment, thus indirectly questioning the total uncertainty budget (see ISO 14253-1).

In a rarer case of disagreement, the supplier may question the customer's uncertainty budget when the customer rejects a workpiece or measuring equipment (see 6.2 of ISO 14253-1:1998).

In addition to those mentioned, there are other cases of disagreement, as well as other motivations that may lead to discussion of stated uncertainties.

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Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment —

Part 3: Guidelines for achieving agreements on measurement uncertainty statements

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1 Scope

This part of ISO 14253 provides guidelines and defines procedures for assisting the customer and supplier to reach amicable agreements on disputed measurement uncertainty statements regulated in accordance with ISO 14253-1, and so avoid costly and time-consuming disputes.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 14253. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 14253 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 14253-1:1998, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformance or non-conformance with specification*

ISO/TS 14253-2:1999, *Geometrical Product Specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 2: Guide to the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

ISO 14978:—[1)], *Geometrical Product Specifications (GPS) — General concepts and requirements for GPS measuring equipment*

ISO/TS 17450-1:—[1)], *Geometrical Product Specifications (GPS) — General concepts — Part 1: Model for geometric specification and verification*

ISO/TS 17450-2:—[1)], *Geometrical Product Specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators and uncertainties*

Guide to the Expression of Uncertainty in Measurement (GUM). BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 1st edition, 1993, corrected and reprinted in 1995

International Vocabulary of Basic and General Terms in Metrology (VIM). BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 2nd edition, 1993

1) To be published.

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3 Terms and definitions

For the purposes of this part of ISO 14253, the terms and definitions given in ISO 14253-1, ISO/TS 14253-2, ISO 14978, ISO/TS 17450-1, ISO/TS 17450-2, VIM and GUM, and the following apply.

3.1
operator
ordered set of operations

3.2
specification operator
ordered set of specification operations

NOTE 1 The specification operator is the result of the full interpretation of the combination of the GPS specification or specifications indicated in the technical product documentation in accordance with ISO GPS standards.

NOTE 2 A specification operator can be incomplete, in which case it could introduce specification uncertainty.

NOTE 3 A specification operator is intended to define, for example, a specific possible "diameter" in a cylinder (e.g. two-point diameter, minimum circumscribed circle diameter, maximum inscribed circle diameter, Least Squares circle diameter), and not the generic concept "diameter".

NOTE 4 The difference between the specification operator and the functional operator causes correlation uncertainty.

3.3
verification operator
ordered set of verification operations

NOTE 1 The verification operator is the metrological emulation of a specification operator. The verification operator is the basis for the measurement procedure.

NOTE 2 A verification operator might not be a perfect simulation of the given specification operator. In that case, the differences between the specification operator and the verification operator will result in uncertainty contributors, which are part of the measurement uncertainty.

3.4
actual specification operator
specification operator derived from the actual specification given in the actual technical product documentation

NOTE 1 The standard or standards according to which the actual specification operator is to be interpreted are identified explicitly or implicitly.

NOTE 2 An actual specification operator can be a complete specification operator or an incomplete specification operator.

NOTE 3 An actual specification operator can be either a special specification operator or a default specification operator.

3.5
actual verification operator
ordered set of actual verification operations

NOTE The actual verification operator can be chosen so that it is different from the required perfect verification operator. The divergence between the perfect verification operator and the chosen actual verification operator is the measurement uncertainty (sum of the method uncertainty and implementation uncertainty).

3.6
perfect verification operator
verification operator based on a full set of perfect verification operations performed in the prescribed order

NOTE 1 The only measurement uncertainty contributions from a perfect verification operator are from metrological characteristic deviations in the implementation of the operator.

NOTE 2 The purpose of calibration is generally to evaluate the magnitude of these measurement uncertainty contributors, originating from the measuring equipment.

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3.7
specification uncertainty
uncertainty inherent in an actual specification operator when applied to a real workpiece/feature

NOTE 1 Specification uncertainty is of the same nature as measurement uncertainty and can — if relevant — be part of an uncertainty budget.

NOTE 2 The specification uncertainty quantifies the ambiguity in the specification operator.

NOTE 3 For the purposes of this part of ISO 14253, specification uncertainty is considered part of the compliance uncertainty.

NOTE 4 Specification uncertainty is a property related to the actual specification operator.

NOTE 5 The magnitude of the specification uncertainty is also dependent on the expected or actual variation of the geometrical characteristics (deviations of form and angularity) of workpieces.

3.8
simplified verification operator
verification operator including one or more simplified verification operations or deviations from the prescribed order of operations, or both

NOTE 1 The simplified verification operations, deviation in the order of operations, or both, cause measurement uncertainty contributions in addition to those measurement uncertainty contributions from the metrological characteristic deviations in the implementation of the operator.

NOTE 2 The magnitude of these uncertainty contributions is also dependent on the geometrical characteristics (deviations of form and angularity) of the actual workpiece.

3.9
measuring task
quantification of a measurand according to its definition

[ISO/TS 14253-2:1999, definition 3.3]

3.10
basic measurement task
measurement task(s) which, alone or together with others of its kind, forms the basis for the evaluation of more complicated characteristics of a workpiece or measuring equipment

[ISO/TS 14253-2:1999, definition 3.4]

3.11
overall measurement task
complicated measuring task, evaluated on the basis of several, possibly different, basic measurements

[ISO/TS 14253-2:1999, definition 3.5]

3.12
measurement
set of operations having the object of determining a value of a quantity

[VIM:1993, definition 2.1]

NOTE For the purposes of this Technical Specification, the term “measuring process” is used as a synonym for measurement.

3.13
basic measuring process
basic measurement
measuring process which, alone or together with others of its kind, forms the basis of the evaluation/measurement of more complex GPS characteristics

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3.14
overall measuring process
overall measurement
complex measuring process consisting of several, possibly different, basic measuring processes

3.15
task-related calibration
calibration of only the metrological characteristics which influence the measurement uncertainty for the intended use

NOTE 1 A task-related calibration will normally include only the calibration of those metrological characteristics having a major influence on the measurement uncertainty for the intended use.

NOTE 2 Task related-calibrations can be performed using other, more economical procedures than those employed in global calibration; a task-related calibration can be designed to deliver information (values and conditions) optimized for use in the specific uncertainty budget.

NOTE 3 This definition of task-related calibration has been formulated differently from the definition of the same term given in ISO 12179, intentionally and without changing the meaning. The difference reflects a development in the GPS field.

[ISO 14978:—, definition 3.11]

4 Reaching an agreement on a stated expanded uncertainty

4.1 Early agreement on the stated measurement uncertainty

In a case where either the customer's or supplier's measurement uncertainty statement is in question, an uncertainty budget supporting and documenting the measurement uncertainty statement may be necessary. It is the responsibility of the party preparing the uncertainty budget to justify the individual components and the resulting estimated expanded uncertainty of the uncertainty budget.

In an ideal situation, customer and supplier will address the issue of measurement uncertainty at the same time as they address the product specifications of the workpiece, at the pre-contract stage. Agreement on the magnitude of the measurement uncertainty or uncertainties and the rules for its application at this early stage of the business relationship will avoid later disputes over acceptance or rejection of product and the consequent need to apply the default rules given in ISO 14253-1.

NOTE In most cases, there are several GPS characteristics specified for a workpiece and for each of these characteristics a measuring task with corresponding measurement uncertainty statement is required.

Two different persons can produce two different uncertainty statements due to differing knowledge, experience and assumptions. Resolving these differences at the pre-contract stage is likely to be less contentious and less costly than waiting until an argument develops over the acceptance or rejection of the product during the manufacture and delivery stage.

4.2 Possibilities for solving disagreements over a stated measurement uncertainty

The most basic way of reaching an agreement is to agree to choose one or the other of the two statements of measurement uncertainty from either party to the agreement. If this type of settlement is not appropriate, another solution is to use the more refined procedure given in clause 5, or to use a third party consultation, review or both these.

Clause 6 of ISO 14253-1:1998 gives specific rules on dealing with uncertainty of measurement when proving conformance or non-conformance with a specification:

— supplier proving conformance with specifications (6.2 of ISO 14253-1:1998);

— customer proving non-conformance with specifications (6.3 of ISO 14253-1:1998).

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The magnitude of the measurement uncertainty is of importance, because it decreases (supplier proving conformance) and increases (customer proving non-conformance) the specification.

According to ISO 14253-1, the measurement uncertainty is stated by the party providing the proof of conformance or non-conformance with a specification, i.e. the party making the measurements. In the following clauses of this part of ISO 14253, the party stating the measurement uncertainty is designated “party 1”. The other of the two parties is designated “party 2”. “Party 2” is the party likely to question or disagree with the stated measurement uncertainty.

NOTE When the supplier is proving conformance with specification, the supplier is “party 1” and it is the customer, “party 2”, who provides the specification. When the customer is proving non-conformance, the customer is “party 1” and is also considered to have provided the specification, hence it is the supplier who is “party 2”.

A number of scenarios can be demonstrated for cases where a stated measurement uncertainty from “party 1” may be questioned by “party 2”. Figure 1 illustrates the most common scenarios, as follows.

a) A measurement uncertainty is stated by “party 1” (**box a**).

b) “Party 2” has two options (**box b**).

   1) If “party 2” agrees to the measurement uncertainty statement (**box b — “Yes”**), both parties have come to the same conclusion. The issue is resolved (**box z**).

      NOTE A measurement uncertainty statement can be a simple claimed value without any documentation or an uncertainty budget with a resulting expanded uncertainty according to ISO/TS 14253-2.

   2) If “party 2” disagrees with the measurement uncertainty statement (**box b — “No”**), this part of ISO 14253 applies.

c) The two parties may use a third party to resolve their disagreement.

   1) If yes (**box c — “Yes”**), the third party will evaluate the uncertainty budget (**box v**). The issue is resolved (**box z**).

   2) If no (**box c — “No”**), the two parties continue with the procedure (**box d**).

d) “Party 1” may or may not have generated an uncertainty budget according to ISO/TS 14253-2 (**box d**).

   1) If an uncertainty budget does not exist (**box d — “No”**), there are two options.

      i) The two parties agree, by decision, and without further documentation, on a “new” measurement uncertainty statement (**box e — “Yes”**). In this case “party 1” shall change the uncertainty statement according to the agreement (**box f**), and the issue is resolved (**box z**).

      ii) “Party 2” requires an uncertainty budget from “party 1” (**box e — “No”**). “Party 1” then has two options.

         I) Use a third party (**box g — “Yes”**). The third party shall evaluate the uncertainty budget (**box v**). The issue is resolved (**box z**).

         II) Do not use third party (**box g — “No”**). “Party 1” shall generate an uncertainty budget (**box h**) according to the guidelines given in ISO/TS 14253-2 **(box j**). When the uncertainty budget is prepared, the procedure recommences from the starting point (**box a**).

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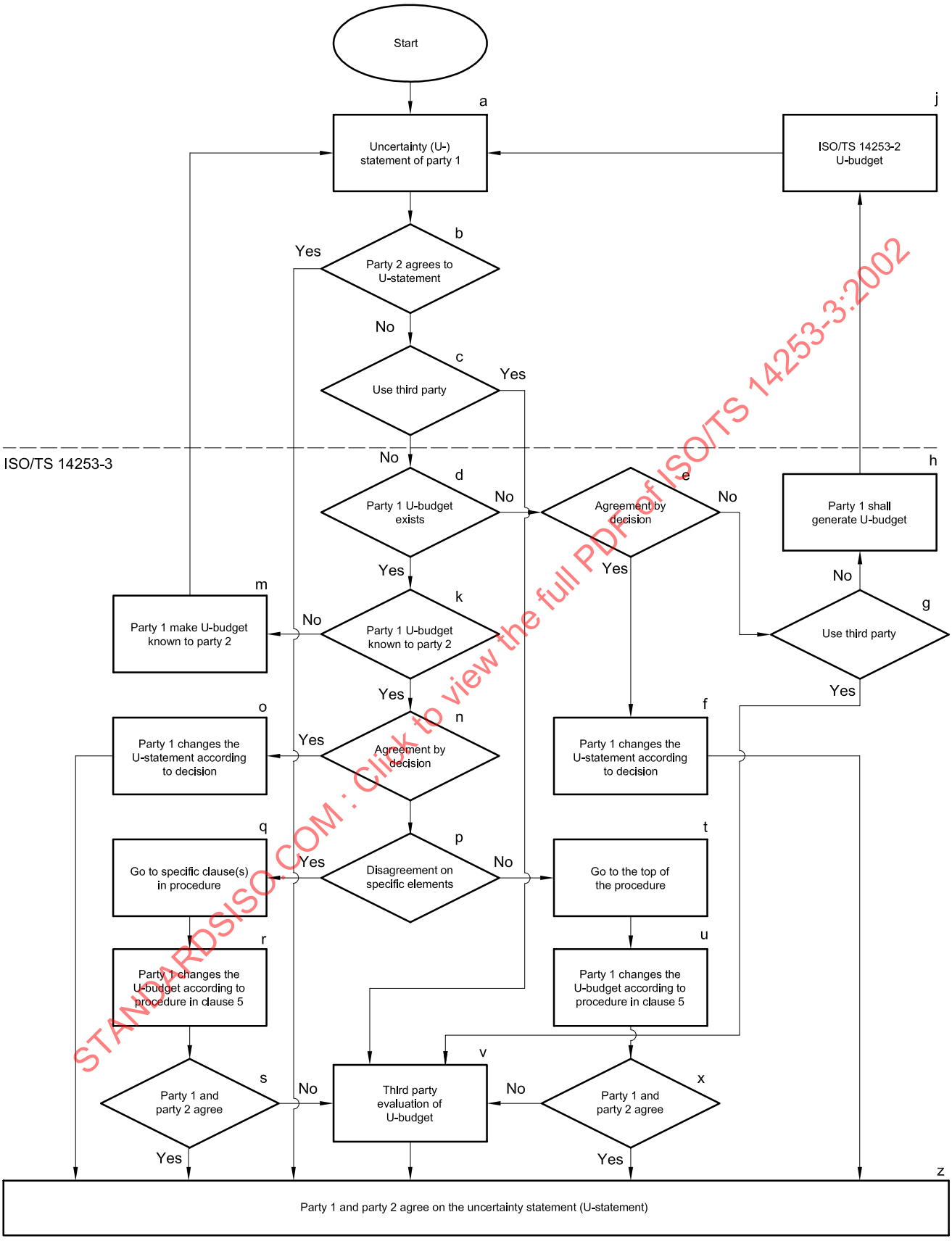

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Figure 1 — How to agree on a uncertainty statement

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2) If the uncertainty budget exists (**box d — "Yes"**), proceed to the next option.

e) The uncertainty budget prepared by "party 1" may or may not be known to "party 2" at this moment (**box k**).

1) If the uncertainty budget exists, but only the measurement uncertainty has been reported to "party 2" (**box k — "No"**), "party 1" shall make the uncertainty budget and the inherent documentation known to "party 2" (**box m**). The procedure then recommences from the starting point (**box a**).

2) If the uncertainty budget is known to "party 2" the following situations arise (**box k — "Yes")**.

f) The two parties either will or will not come to an immediate agreement based on the presented uncertainty budget and without making further detailed investigations (**box n**).

1) The two parties can, by decision, and without further documentation, agree on the stated or a "new" measurement uncertainty statement (**box n — "Yes"**). In the case of a "new" uncertainty statement, "party 1" shall change the uncertainty budget and the uncertainty statement according to the agreement (**box o**), thus resolving the issue (**box z**).

2) If the two parties cannot agree immediately on the presented uncertainty budget (**box n — "No"**), the approach will depend on the level of the uncertainty budget at which they disagree.

g) Disagreement on the presented uncertainty budget, measurement uncertainty or both could be limited to specific components in the uncertainty budget, or it could be a general disagreement (**box p**).

1) If the disagreement concerns only specific and identifiable components of the uncertainty budget and its preconditions, it is possible (**box q**) to re-evaluate, and work directly on, the elements in the procedure described in clause 5. "Party 1" shall modify the uncertainty budget or preconditions or both, as well as the resulting uncertainty statement (**box r**), according to common agreement.

i) The result may not be acceptable to one of the parties (**box s — "No"**). The possibility of an amicable solution remains, by means of third party evaluation (**box v**), and the issue is resolved (**box z**).

ii) If the result of the modification in the uncertainty budget is acceptable to both parties (**box s — "Yes"**), the issue is resolved (**box z**).

2) If the disagreement on the uncertainty budget and its preconditions are of a general character, the solution is to proceed to the starting point of the procedure given in clause 5 (**box t**). "Party 1" shall modify the uncertainty budget or preconditions or both, as well as the resulting uncertainty statement (**box u**).

i) The result may not be acceptable to one of the parties (**box x — "No"**). Use third party evaluation of the uncertainty budget (**box v**). The issue is resolved (**box z**).

ii) If the result of the modification in the uncertainty budget is acceptable to both parties (**box x — "Yes"**), the issue is resolved (**box z**).

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5 Sequential procedure for evaluating and reaching agreement on an uncertainty statement

5.1 General

The basis and documentation of an uncertainty statement is the uncertainty budget together with its defined preconditions (see 9.2 in ISO/TS 14253-2:1999). The basis for an agreement on an uncertainty statement is the agreement on the uncertainty budget together with the preconditions of that budget.

In simple cases, and if experience exists, the uncertainty statement may be accepted and agreed to by both parties without the documentation of a specific uncertainty budget.

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To reach common agreement on the uncertainty statement in more complex cases, the sequence of activities/stages (see Figure 2, 1 to 11) in an uncertainty budgeting process (given in 5.2 to 5.12) shall be executed in the mentioned order. Agreement shall be reached clause by clause in order to establish, from the outset, the argumentation and proof for the uncertainty as the agreed prerequisites.

If any major modification is made at any stage in the sequence, it is essential that the modification be sequentially applied right through to the final statement of U, in order to see the effect on the function of the product and its impact on any possible agreement.

Details of the uncertainty estimation and its necessary budgeting referred to in the following subclauses are given in ISO/TS 14253-2. References to the relevant clauses in ISO/TS 14253-2 are given as follows.

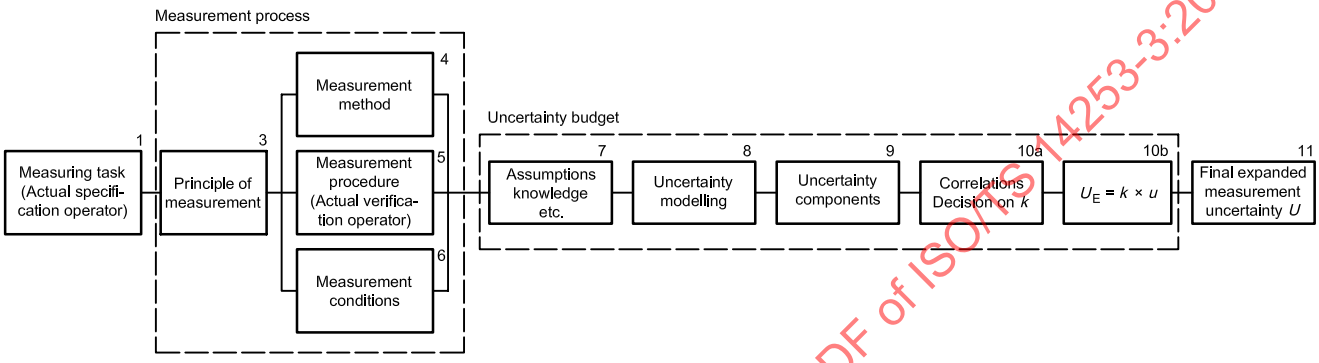

Figure 2 — Stages from measuring task (actual specification operator) to stated uncertainty

5.2 Agreement on measuring task — Measurand (specification operator)

One of the prerequisites of an uncertainty budget is the specification operator. Without definition and agreement on the actual specification operator, discussion or evaluation of the uncertainty budget and statement of uncertainty is meaningless (see **box 1** in Figure 2). The necessary elements that the two parties shall agree upon at this stage are the following:

— the definition or definitions of the actual specification operator, based on the specification given in the product documentation;

— the overall measuring task or tasks and, if necessary, the basic measuring task or tasks allowed by the actual specification operator definition;

— the ISO GPS standards defining the drawing indication (actual specification operator) and the resulting chain or chains of standards (see ISO/TR 14638) and their content;

— possible imperfections in the measurement object (workpiece or measuring equipment) that might influence the specification uncertainty and measurement uncertainty.

The findings about the actual specification operator shall be documented to form the basis of the subsequent stages in the sequence of an agreed measurement uncertainty evaluation (see Figure 2).

5.3 Agreement on acceptability of actual verification operator
(9.2 and 9.3 of ISO/TS 14253-2:1999)

A second prerequisite for an uncertainty budget is the choice of the actual verification operator in accordance with the actual specification operator. Without definition and agreement on the verification operator, discussion or evaluation of the uncertainty budget and statement of uncertainty is meaningless (see **boxes 3 to 6** in Figure 2). Based on the agreed specification operator, agreement shall be reached on the detailed definition of the verification operator.

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The necessary elements that the two parties shall agree upon at this stage are the

— overall and basic measuring processes to be performed (see **boxes 3 to 6** in Figure 2, and 9.2 and 9.3 of ISO/TS 14253-2:1999),

— measurement principle (see **box 3** in Figure 2, and 9.2 and 9.3 of ISO/TS 14253-2:1999),

— measurement method (see **box 4** in Figure 2, and 9.2 and 9.3 of ISO/TS 14253-2:1999),

— measurement procedure, including the choice of measuring equipment (see **box 5** in Figure 2, and 9.2 and 9.3 of ISO/TS 14253-2:1999),

— necessary details in the documented instruction/procedure,

— partition, extraction, filtration, association, collection, construction and evaluation (see clause 8, and Annex C, of ISO/TS 17450-1:—),

— the identification of a piece measuring equipment (or measuring equipment group), and

— measuring conditions, documented (see **box 6** in Figure 2).

The findings on the actual verification operator shall be documented, in order to form the basis for the subsequent stages in the sequence of steps for reaching an agreed measurement uncertainty evaluation.

The two parts forming the basis for the uncertainty budget, requirement and measurement, have now been established. The next stages in the sequence enable calculation or estimation of the consequence of the foundation on the uncertainty only.

5.4 **Agreement on assumptions** (box 7 of Figure 2)

It is seldom necessary to document all activities and conditions. A number of assumptions have to be made. Agreement at this stage shall include the following.

— A list of supplementary assumptions. If there is disagreement, a combined list from “party 1” and “party 2” may help towards a resolution.

— Consideration of whether or not the documentation for the assumptions is sufficient.

— Consideration of whether the use of simplified verification operators is acceptable — documentation on the manner in which the difference from the perfect verification operator is solved, either by adjustment or task-related calibration of the simplified verification operator or by both.

5.5 **Agreement on uncertainty modelling** (box 8 of Figure 2)

The choice of the uncertainty model is important, because it must reflect the actual verification operator and the level of information present about the conditions. The agreement shall include

— a choice of black box or transparent box or partially black/transparent box model (see 8.4, 8.5 and 8.6 of ISO/TS 14253-2:1999),

— use of the PUMA-principle of upper bound estimates where doubt exists (see clause 5 of ISO/TS 14253-2:1999),

— a decision on a possible mathematical model (see 9.3.4 of ISO/TS 14253-2:1999),

— a statement of the time period and duration for which the uncertainty statement is valid,

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— a check for possible outliers or the possible risk posed by outliers (see clause 7 of ISO/TS 14253-2:1999), and

— documentation.

5.6 Agreement on list of uncertainty contributors/components (box 9 of Figure 2)

The list of contributors shall, as a minimum, include the dominant uncertainty contributors. If not, the resulting uncertainty will be definitely too small.

As the tools to obtain a full list and a systematic approach, use

— the three elements of Figure 6 of ISO/TS 14253-2:1999: “reference point”, “travel” and “measuring point” (see 9.1 of ISO/TS 14253-2:1999),

— the check lists of clause 7, and Figures 3 and 4, of ISO/TS 14253-2:1999, and

— if relevant, the specification uncertainty contributors as inclusions in the list.

If in disagreement, use or investigate the combined list of the two parties and include from this list the missing contributors of importance (larger ones relative to the already largest contributors).

5.7 Agreement on possible corrections

In cases where corrections are taken into account in the uncertainty budget, the two parties shall agree on the following:

— that the performed corrections be made with correct values according to the present documentation and conditions;

— that the correction procedure used in the uncertainty budget be in accordance with the measurement procedure;

— that the uncertainty of the correction itself (i.e. the remaining uncertainty component) be included in the uncertainty budget.

5.8 Agreement on magnitude of uncertainty contributors (box 9 of Figure 2)

With the total agreed–upon list of uncertainty contributors/contributions, an essential task is to evaluate the magnitude of each of them. Starting the investigation with the dominant (large) contributors, check the effect of each on the resulting expanded uncertainty.

For each uncertainty component (see clause 8 of ISO/TS 14253-2:1999) investigate and agree on the following.

a) The needed/performed corrections or detailed assumptions or both, concerning the individual component.

b) The evaluation method, Type A or Type B (see clause 8 of ISO/TS 14253-2:1999).

c) Documentation and argumentation for the magnitude of the uncertainty component (data validity and data correctness for Type A evaluation; limit value and assumptions about distribution type for Type B evaluation) — see 8.3, and annexes A, B and C, of ISO/TS 14253-2:1999. Special attention shall be given to

   — calibration certificates (traceable calibration values for MPEs) for uncertainty statements,

   — calibration records,

   — calibration intervals,

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