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Policy

Decision rules describe how measurement uncertainty is accounted for when a statement of conformity is made alongside a reported result. Shirley Technologies Limited will, when required, apply the below decision rule as standard unless the client requests an alternative.

Scope

This procedure describes the requirements for decision rules and Shirley Technologies Limited approach to these requirements.

Definitions

Measurement Uncertainty – Is a parameter, associated with the result of a measurement (e.g. a calibration or test) that defines the range of the values that could reasonably be attributed to the measured quantity.

Decision Rule – a rule that describes how measurement uncertainty is accounted for when stating conformity with a specified requirement.

Statement of Conformity - evaluation of a reported value against a documented specification, for example Pass/Fail.

Rounding – making a number simpler but keeping its value close to what it was, the result is less accurate but easier to use.

Measurement Uncertainty and Decision Risk

The purpose of a measurement is to provide information about a quantity of interest. However, no measurement is exact. When a quantity is measured, the outcome is dependent on the measuring system, the procedure for measurement, the skill of the operator, the environment in which the measurement is made and other effects. Even if the quantity were measured several times, in the same way, under the same circumstances, a different value would in general be obtained each time, assuming the resolution of the measurement system was sufficient to distinguish between the values.
The measurement uncertainty is an expression of the statistical dispersion of these measured values.

When performing a measurement, and making a statement of conformity of that measurement in relation to a given specification, there are two possible outcomes;

a. A correct decision is made regarding conformance to the specification.
b. An incorrect decision is made regarding conformance to the specification.

The risk of an incorrect decision being made is directly proportional to the uncertainty associated with the measurement.

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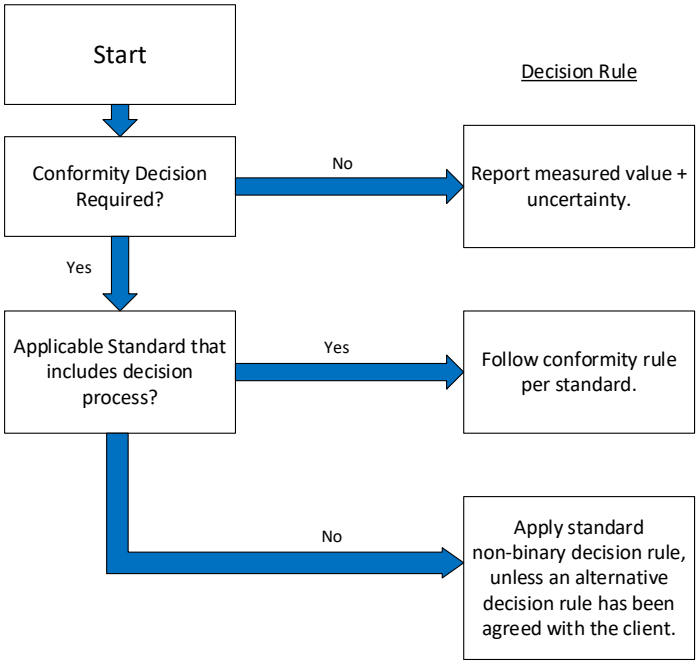
Decision Rules

The decision rule defines how measurement uncertainty is accounted for when stating conformity of a measurement with a specified requirement.
Decision rules are only required when a statement of conformity is to be reported along with a measured value.
If the decision rule is inherent in the requested specification or standard, the specification or standard describes how to account for measurement uncertainty, this must be followed.
Therefore, we are only required to determine a decision rule for reports which include a statement of conformity to a specification or standard which does not define how to account for measurement uncertainty.

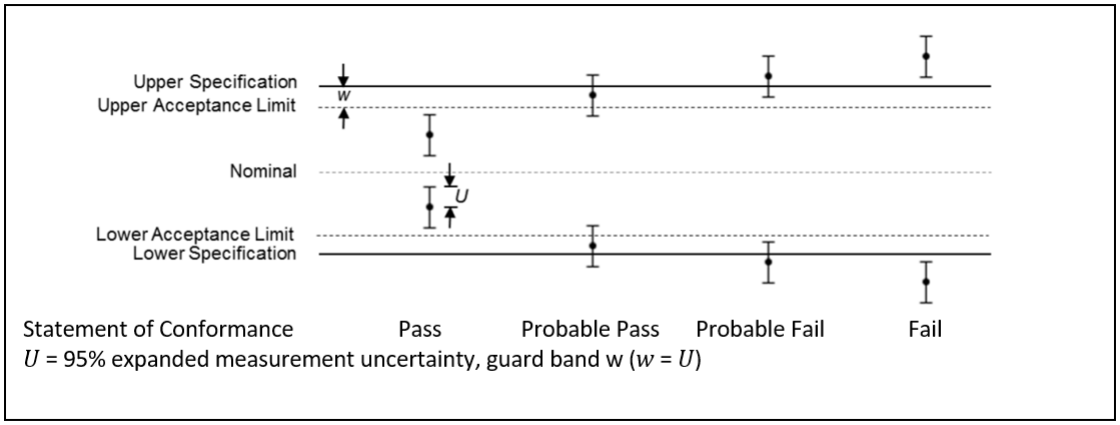
Shirley Technologies Limited Policy for Decision Rules

The Shirley Technologies Limited policy for decision rules is as follows;



If no statement of conformity is requested no decision rule is required, the measured value is reported along with the measurement uncertainty.
If a statement of conformity to a defined specification or standard is requested, and the defined specification or standard describes how to account for measurement uncertainty, then the result is reported in accordance with the requirements of the defined specification or standard.
If a statement of conformity to a defined specification or standard is requested, and the defined specification or standard does not describe how to account for measurement uncertainty, then as standard we will employ the below non-binary decision rule:

The outcome will depend upon where the result lies within the Acceptance or Specification/Tolerance intervals (acceptance limits below shown with a guard band equal in size to the k=2 expanded uncertainty). The below shows 4 instances.



For a statement of conformity to be valid, any test conditions with non-measurable outputs, for example environmental conditions or equipment specifications, must conform to the requirements detailed within the test standard or specification.
Testing will only take place if the test conditions meet the requirements detailed in the test standard (an expanded uncertainty (k=2, approximately 95% confidence level) will be applied when determining these test condition requirements).

All clients requiring a decision rule will be notified of the company policy to use the standard non-binary decision rule, where a client would prefer an alternative decision rule this can be discussed and agreed upon.

Reporting

In reports both the result and expanded UoM are given along with the conformity decision. The below examples are also to be reported as an appendix in the test report:
Examples using specification limit (SL) and acceptance Limit (AL) where the size of the guard band (w) equals the size of the expanded measurement uncertainty (k=2, approximately 95% confidence level). In each case all testing conditions/equipment calibrations also conform to the relevant standard within 95% confidence limits unless stated.

Examples using an upper specification limit (SL) and acceptance Limit (AL)

- Pass - the measured result is below the acceptance limit, $AL = SL - w$.
- Probable Pass - the measured result is inside the guard band and below the specification limit, in the interval $[SL - w, SL]$.
- Probable Fail - the measured result is equal to or above the specification limit but below the specification limit added to the guard band, in the interval $[SL, SL + w]$.
- Fail - the measured result is above the specification limit added to the guard band, $SL + w$.

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Examples using a lower specification limit (SL) and acceptance Limit (AL)

- Pass - the measured result is above the acceptance limit, $AL = SL + w$.
- Probable Pass - the measured result is inside the guard band but above the specification limit, in the interval [$SL + w$, SL].
- Probable Fail - the measured result is equal to or below the specification limit but above the specification limit added to the guard band, in the interval [SL, $SL - w$].
- Fail - the measured result is below the specification limit with the guard band deducted, $SL - w$.

Applying Uncertainty and Rounding

Some test methods or specifications require test results to be rounded prior to any conformity assessment. If the test method or specification describes when and how to apply uncertainty of measurement and rounding of the test result follow the instructions given. If the test method or specification does not clearly describe when and how to apply uncertainty of measurement and rounding of the test result follow this process. This process agrees with clause 6.9 of Edition 4 of M3003 which states "Rounding should always be carried out at the end of the process in order to avoid the effects of cumulative rounding errors"

- Perform the test in accordance with the test method and obtain the raw test result.
- Apply the uncertainty of measurement to the raw test result to give the result range.
- Apply rounding, as described in the test method or specification, to the result range.
- Make conformity assessment based on the rounded result range.