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Instructions on how to use the DCC schema to create a digital calibration certificate for non-automatic weighing instruments

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Deutscher Kalibrierdienst (DKD) – German Calibration Service

Since its foundation in 1977, the German Calibration Service has brought together calibration laboratories of industrial enterprises, research institutes, technical authorities, inspection and testing institutes. On 3rd May 2011, the German Calibration Service was reestablished as a *technical body* of PTB and accredited laboratories.

This body is known as *Deutscher Kalibrierdienst* (DKD for short) and is under the direction of PTB. The guidelines and guides developed by DKD represent the state of the art in the respective areas of technical expertise and can be used by the *Deutsche Akkreditierungsstelle GmbH* (the German accreditation body – DAkkS) for the accreditation of calibration laboratories.

The accredited calibration laboratories are now accredited and supervised by DAkkS as legal successor to the DKD. They carry out calibrations of measuring instruments and measuring standards for the measurands and measuring ranges defined during accreditation. The calibration certificates issued by these laboratories prove the traceability to national standards as required by the family of standards DIN EN ISO 9000 and DIN EN ISO/IEC 17025.

Contact:

Physikalisch-Technische Bundesanstalt (PTB)
DKD Executive Office
Bundesallee 100 38116 Braunschweig
P.O. Box 33 45 38023 Braunschweig
GERMANY
Telephone: +49 531 592 8021
Internet: www.dkd.eu

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Authors:
Dr. Julian Haller, Sartorius Lab Instruments GmbH & Co. KG, Göttingen, Deutschland
Dr.-Ing. Gisa Foyer, Physikalisch-Technische Bundesanstalt, Braunschweig, Deutschland
Dr. Klaus Fritsch, Mettler-Toledo GmbH, Greifensee, Schweiz
Dr. Siegfried Hackel, Physikalisch-Technische Bundesanstalt, Braunschweig, Deutschland
Martin Häfner, Häfner Gewichte GmbH, Oberrot, Deutschland
Dr. Dorothea Knopf, Physikalisch-Technische Bundesanstalt, Braunschweig, Deutschland
Heiko Lauer, Bizerba SE & Co. KG, Balingen, Deutschland
Christian Müller-Schöll, Mettler-Toledo Int. Inc., Greifensee, Schweiz
Steffen Osang, Minebea Intec Bovenden GmbH & Co. KG, Bovenden, Deutschland
Alexander Scheibner, Physikalisch-Technische Bundesanstalt, Braunschweig, Deutschland
Zoltan Zelenka, BEV Bundesamt für Eich- und Vermessungswesen/PTP Physikalisch-Technischer Prüfdienst, Wien, Österreich

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Foreword

DKD expert reports aim to provide background information and references in connection with other DKD documents as, for example, the DKD guidelines. In some cases, they may even go far beyond these documents. They do not replace the original DKD documents but do provide a lot of supplementary information worth knowing. The expert reports do not necessarily reflect the views of the DKD's Management Board or Technical Committees in all details.

DKD expert reports are intended to present significant aspects from the field of calibration. Through publication by the DKD they are made available to the large community of calibration laboratories, both nationally and internationally.

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0 Editorial Note

Chapters 1 and 2 of this expert report were taken from an equivalent expert report concerning DCCs for weights and mass [1] and were only adapted to NAWIs, where applicable. These two chapters concern rather general topics about DCCs and it is to be expected that their content will be published in another overarching expert report [2] in the future. When this overarching expert report is available, the content of these two chapters will be significantly reduced accordingly in upcoming revisions of this report and this editorial note will be omitted.

1 Background

Advancing digitalisation does also affect the field of calibration. In view of this development and responding to the needs of industry, the digital calibration certificate (DCC) has been developed [3, 4]. The DCC is an XSD file (XML Schema Definition) that serves as a kind of template for digital calibration certificates for all measurands in XML format (Extensible Markup Language). Its implementation therefore requires further, subject-related specifications. To examine potential applications for the calibration of non-automatic weighing instruments (abbreviated as NAWIs in the following) and to determine the related specifications, the DKD Technical Committee *Mass and Weighing Instruments* has set up a group of experts who have created the present document.

This document describes the contents of the digital calibration certificate for NAWIs. All considerations made here are intended for calibrations according to EURAMET Calibration Guide No. 18, V4.0 [5] (abbreviated as EURAMET cg-18, V4.0 in the following) – they may however partially be applicable to calibrations according to other procedures as well. The focus here is on the flexible information in the DCC. The mandatory information, such as details of the calibration laboratory, customer or calibration date, is described in [2]. The application of the specifications described here to similar calibration items, such as mass standards or density standards, is possible in many cases without any problems.

The present document refers to version 3.3.0 of the DCC schema [6]. For implementation, it is recommended to refer to the latest version of the schema. This version is completely downward compatible and allows, among other things, improved indication of references.

Given the continuous changes in the field of digital certificates, this report can only reflect the current state of discussions – something to be taken into account in any kind of evaluation or referencing. These changes may refer to changes in the schema file or to higher-level specifications such as coordinated *refType* attributes. The validity of the remaining regulations remains unaffected.

2 DCC - General remarks

The term DCC is used hereinafter to refer to the XSD schema file and its specifications. Detailed examples of the implementation in an XML file can be found in the tables and in the appendix.

2.1 Structure

Generally, the DCC consists of a main element dcc:digitalCalibrationCertificate with five child elements:

- dcc:administrativeData
- dcc:measurementResults
- dcc:comments
- dcc:document
- ds:Signature.

Most elements contain sub-elements in which the actual information (calibration certificate number, customer information, calibration results, ...) is arranged on different levels. This document focuses on the elements dcc:administrativeData and dcc:measurementResults. The remaining elements are explained in the DCCWiki and/or the overarching expert report [2]. A potentially relevant use of the ds:Signature element is the "eAttestation" of the German accreditation body DAkkS [7].

2.2 Attributes

It is also possible to attach so-called attributes to various elements. In the DCC these are *id*, *refType* and *refId*. Links are possible with the help of *id* and *refId* (more on this at https://dccwiki.ptb.de/en/id_refid and/or the overarching expert report [2]). *refType* attributes are used to improve machine comprehensibility and are used in particular for elements that occur more than once. More details on the definition and grouping of *refType* attributes can be found in Chapter 5 and/or the overarching expert report [2].

2.3 Namespaces

The "namespaces" used in XML indicate the affiliation of an element to a schema. Due to the fact that the digital SI (D-SI) has its own schema in the digital calibration certificate, there are the namespaces "dcc" and "si". The labelling is carried out using the namespace and a separating colon (example: dcc:administrativeData and si:real).

2.4 Notation

In the DCC, lower camel case is used for all contents (elements, attributes, and specifications in *refType*). This means that a) words are combined, b) the initial letter is written in lower case and c) new word beginnings within the composition are written in upper case. Examples of this are dcc:coreData, dcc:respAuthority and dcc:nominalValue.

2.5 Multi-language support

Depending on the element type in the DCC, it is possible to specify several languages. Many values are expressed as numbers, dates, or the like. In these cases, multi-language support is not possible. For the elements dcc:name, dcc:description and dcc:text, however, more than one language can be used continuously (multi-language support). The language is specified in sub-elements by the corresponding country abbreviation: <dcc:content **lang="en"**>Conventional

weight</dcc:content> for an English language variant. Information on the languages used can be found in the element dcc:coreData in the sub-elements dcc:usedLangCodeISO639_1 and dcc:mandatoryLangCodeISO639_1.

2.6 Basic rules in the DCC

2.6.1 The plural in element descriptions

Within the DCC, we often find a combination of the plural form in the parent element and the singular form in the child element.

Example: dcc:measurementResults → dcc:measurementResult

In all cases, it is possible to create a list of child elements here, with the parent element serving as a kind of collective folder. In some cases, it is also possible to globally define a name, a description and other information for a list at parent element level.

2.6.2 Local before global

A lot of information, such as measurement methods or general comments, can be stored at various points in the DCC. Hence, the following statement applies: Local information takes precedence over global information. In the absence of local information, the global information passes on to the next level (below).

Example: If a general reference to accreditation is made in the DCC, then it is to be assumed that the accreditation applies to all the information listed. Individual results outside the scope of accreditation should then be explicitly marked. Alternatively, information on accreditation can also be given exclusively for each individual result.

2.7 D-SI indications in the DCC

The digital SI (D-SI) is described in a separate XML schema; elements are therefore marked with the prefix "si". It concentrates on the indication of numerical values including their uncertainty. For more information on this schema, see [8] and [9].

The D-SI does also contain various sub-elements. For calibration certificates of NAWIs, however, only the si:real element and the si:realListXMLList element are used.

The subelements of the si:real element that are used in DCCs for NAWIs are listed in the following table. There are further subelements possible for the si:real element (namely si:quantityType, si:significantDigit, si:expandedUnc (deprecated), si:coverageInterval (deprecated)) that are not used for NAWIs.

Element	Mandatory (M) or Optional (O)	Explanation	Content type	Sample value
si:label	Optional	Designation	String	reference value
si:value	Mandatory	Numerical value	Double	1.00000009
si:unit	Mandatory	Unit to numerical value	String according to chapter 3 in [8]	\kilogram
si:dateTime	Optional	Time stamp	date and time with difference to UTC in ISO 8601 [10] format	2025-01-06T02:42:14.5+01:00

Table 1: Subelements of si:real that are used for DCCs of NAWIs

Furthermore, where appropriate, the measurement uncertainty should be reported within an element si:measurementUncertaintyUnivariate that comprises the optional selectable subelements si:standardMU (if a standard uncertainty shall be reported, not recommended here), si:coverageIntervalMU (if a coverage interval shall be reported, not recommended here) or si:expandedMU (if an expanded uncertainty shall be reported). Only the latter one is recommended here, which comprises the following subelements:

Element	Mandatory (M) or Optional (O)	Explanation	Content type	Sample value
si:valueExpandedMU	Mandatory	Value of the measurement uncertainty (in the same unit as the associated value)	Double	0.00000032
si:coverageFactor	Mandatory	Coverage factor	Double	2
si:coverageProbability	Mandatory	Coverage probability	Double	0.95
si:distribution	Optional	Uncertainty distribution	String	normal

Table 2: Subelements of si:expandedMU which is recommended to be used for DCCs of NAWIs

For clarity, the complete si:real element is given here as it would look like for the example entries of the above table:

```
<si:real>
  <si:label>reference value</si:label>
  <si:value>1.00000009</si:value>
  <si:unit>\kilogram</si:unit>
  <si:dateTime>2025-01-06T02:42:14.5+01:00</si:dateTime>
  <si:measurementUncertaintyUnivariate>
    <si:expandedMU>
      <si:valueExpandedMU>0.00000032</si:valueExpandedMU >
      <si:coverageFactor>2</si:coverageFactor>
      <si:coverageProbability>0.95</si:coverageProbability>
      <si:distribution>normal</si:distribution>
    </si:expandedMU>
  </si:measurementUncertaintyUnivariate>
</si:real>
```

Additionally, the element si:realListXMLList is used for DCCs of NAWIs that is basically the same as the si:real element, but just allows in all subelements for several entries that are separated by a blank space. A respective si:realListXMLList element would look as follows:

```
<si:realXMLList>
  <si:labelXMLList>reference values</si:labelXMLList>
  <si:valueXMLList>1.01 2.02 5.05</si:valueXMLList>
  <si:unitXMLList>\kilogram</si:unitXMLList>
  <si:dateTimeXMLList>2025-01-06T02:42:14.5+01:00 2025-01-06T02:43:14.5+01:00 2025-01-
06T02:44:14.5+01:00</si:dateTimeXMLList>
  <si:measurementUncertaintyUnivariateXMLList>
    <si:expandedMUXMLList>
      <si:valueExpandedMUXMLList>0.10 0.20 0.50</si:valueExpandedMUXMLList>
      <si:coverageFactorXMLList>2.1 2.2 2.5</si:coverageFactorXMLList>
      <si:coverageProbabilityXMLList>0.95</si:coverageProbabilityXMLList>
      <si:distributionXMLList>normal</si:distributionXMLList>
    </si:expandedMUXMLList>
  </si:measurementUncertaintyUnivariateXMLList>
</si:realXMLList>
```

Note: When all entries of such an "XMLList" element would be the same, it is sufficient to denote the entry only once, i.e. <si:coverageFactorXMLList>2 2 2 </si:coverageFactorXMLList> is the same as <si:coverageFactorXMLList>2</si:coverageFactorXMLList>

3 Using the DCC elements for calibrations of NAWIs

3.1 Administrative part (dcc:administrativeData and child elements)

The dcc:administrativeData element comprises 8 child elements:

- dcc:calibrationLaboratory
- dcc:coreData
- dcc:customer
- dcc:dccSoftware
- dcc:items
- dcc:refTypeDefinitions
- dcc:respPersons
- dcc:statements

For most of them (namely dcc:calibrationLaboratory, dcc:coreData, dcc:customer, dcc:dccSoftware and dcc:respPersons), no considerations specific for the calibration of NAWIs are necessary so that general rules and considerations apply instead. Only for the remaining 3 child elements, specific rules are stipulated here:

3.1.1 Identification of the calibration object (dcc:items)

The DCC schema since version 3.3.0 allows a recursive structure for the dcc:items element as follows:

dcc:items (n=1) → dcc:item (n=1…∞) → dcc:subitems (n=0…∞) → dcc:item (n=1…∞) → ...

For NAWIs, the following considerations apply:

- it should be possible to identify the instrument as a whole
- it may be also necessary to identify several parts (e.g. platform and indicator) being parts (i.e. subelements) of the complete instrument
- it should be possible to identify ranges/intervals
- strictly speaking, the metrological characteristics (Max_i, d_i, Min_i) might belong (i.e. be defined by) either to the complete instrument or to one of the components (platform, indicator,…), but for calibrations it is not relevant to identify which part defines the characteristics and to make it easier to find the characteristics it should be avoided that they are identified at different levels for different instruments.

Therefore, the following strategy to use the above recursive structure is recommended here:

- Usually results for only one NAWI are reported in one DCC, but it should nevertheless be possible to report results for several NAWIs in one DCC – therefore, it is recommended to consider each instrument to be calibrated as one dcc:item in dcc:items
- Any information (see list of possible subelements below) concerning the complete instrument can be documented within the subelements of this dcc:item element.
- Each range/interval of the instrument should be identified as one dcc:item in the dcc:subitems element.
- Parts of modular devices that shall each be identified, e.g. platforms, weighing cells, indicators should also be identified as one dcc:item in the same dcc:subitems element.

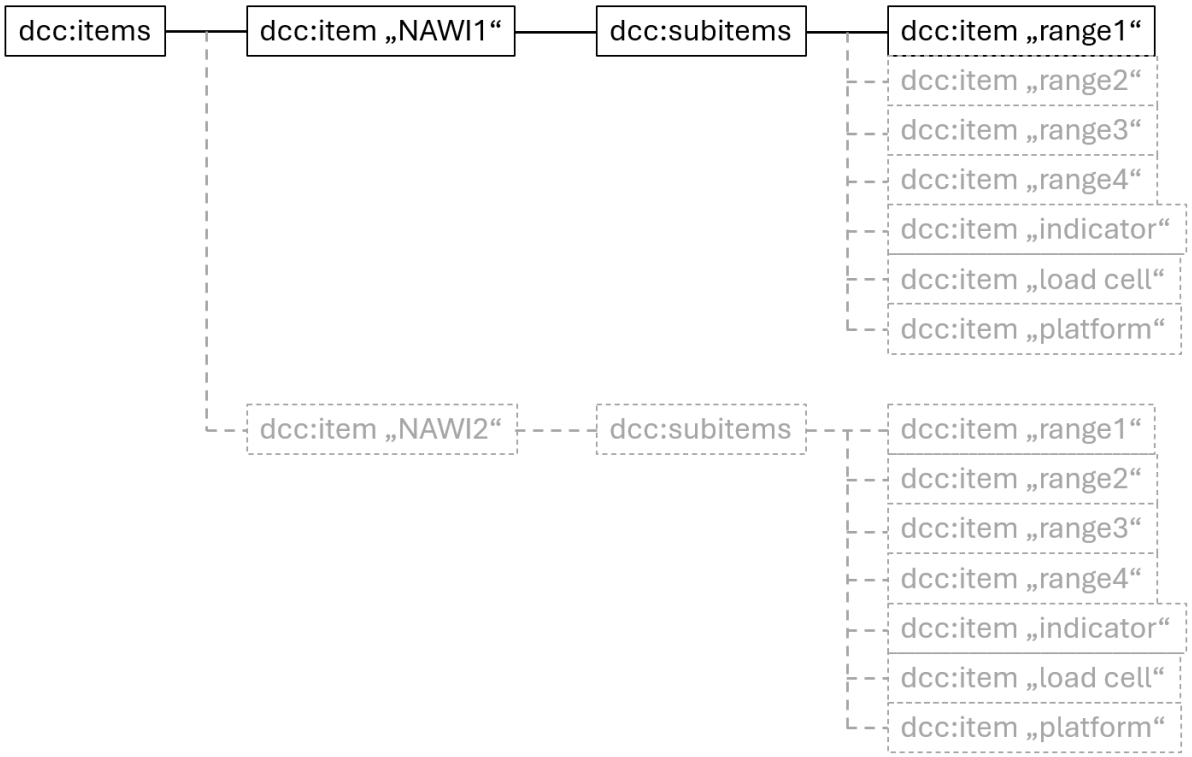

Figure 2: Schematic structure how to identify instruments as well as ranges/intervals and parts of modular devices. Elements in black should always be present, elements in grey only if applicable.

Both dcc:items and dcc:item comprise several mandatory (M) or optional (O) further subelements:

- dcc:description (O)
- dcc:equipmentClass (O)
- dcc:identifications (M in dcc:item, O in dcc:items)
- dcc:installedSoftwares (O, only in dcc:item)
- dcc:itemQuantities (O, only in dcc:item)
- dcc:manufacturer (O)
- dcc:model (O, only in dcc:item)
- dcc:name (M in dcc:item, O in dcc:items)
- dcc:owner (O)
- dcc:subItems (O, only in dcc:item)

For most of them (namely dcc:name, dcc:description, dcc:installedSoftwares, dcc:model, dcc:manufacturer and dcc:owner), no considerations specific for the calibration of NAWIs are necessary so that general rules and considerations apply instead. From the remaining 4 child elements, dcc:identifications, dcc:itemQuantities and dcc:subItems should be used as demonstrated in subchapter 3.1.1.2.

Note: As dcc:identifications is a mandatory element in dcc:item, each dcc:item needs at least one kind of identification (i.e. at least one dcc:identification element). While there should be respective information (e.g. serial number and/or measuring equipment number) available for the device itself as well as for possible modules (indicator, platform, load cell), the ranges as items usually don't have such a dedicated identification information. Therefore, it is suggested to add a dcc:identification element as follows for each dcc:item element denoting a (partial) range with dcc:value denoting the number of the range:

```
<dcc:item refType="NAWI_range1">
  <dcc:identifications>
    <dcc:identification>
      <dcc:issuer>manufacturer</dcc:issuer>
      <dcc:value>1</dcc:value>
      <dcc:name>
        <dcc:content lang="en">Weighing range</dcc:content>
      /<dcc:name>
    </dcc:identification>
  </dcc:identifications>
</dcc:item>
```

3.1.1.1 Identification of the instrument category (dcc:equipmentClass)

For the remaining subelement of dcc:items and dcc:item, namely dcc:equipmentClass, the following applies: This element is designed to reference entries in existing databases, standards or lists by featuring child elements dcc:reference (to name a respective database, standard or list), dcc:classID (to name the respective entry therein) and dcc:link (to provide a link to the entry itself or the reference, when existing).
For NAWIs to the authors knowledge, there exists no particular standard or database that would list categories of NAWIs in a sufficiently structured way. Therefore, it is recommended to reference this document with the following dcc:classID values:

- NAWI-SR: single range instrument, having one scale interval d and one maximum capacity Max
- NAWI-MR: multiple range instrument with $i = 2 \ldots n$ ranges, each extending from 0 to Max_i with a respective scale interval d_i
- NAWI-MI: multi-interval instrument with $i = 2 \ldots n$ partial ranges, each one extending from Max_{i-1} (or 0 in case of $i = 2$) to Max_i with a respective scale interval d_i

A respective entry for a single range instrument should thus be

```
<dcc:equipmentClass>
  <dcc:reference>DKD-E 7-3 Instructions on how to use the DCC schema to create a digital calibration certificate for non-automatic weighing instruments</dcc:reference>
  <dcc:classID>NAWI-SR</dcc:classID>
  <dcc:link>https://doi.org/10.7795/550.20250325</dcc:link>
</dcc:equipmentClass>
```

and for a multiple range instrument

```
<dcc:equipmentClass>
  <dcc:reference>DKD-E 7-3 Instructions on how to use the DCC schema to create a digital calibration certificate for non-automatic weighing instruments</dcc:reference>
  <dcc:classID>NAWI-MR</dcc:classID>
  <dcc:link>https://doi.org/10.7795/550.20250325</dcc:link>
</dcc:equipmentClass>
```

3.1.1.2 Identification of the nominal metrological characteristics (dcc:subitems)

As mentioned above, it is recommended to use one dcc:subitems\dcc:item element for each range/interval of an instrument. The nominal metrological characteristics should be identified in at least one dcc:itemQuantity element with a refType math_maximum for the maximum capacity and one dcc:itemQuantity element with a refType NAWI_resolutionOfDisplayingDevice for the actual scale interval *d*. Additionally, it is common and helpful to identify the minimum of each range - if this is done, it should be done in a dcc:itemQuantity element with a refType math_minimum.

Note: The minimum marked with the refType math_minimum is not to be understood as a minimum weight, but the smallest indication value for the corresponding range – this is 0 for SR and MR instruments and the first range of MI instruments. Only in the case of a possible second, third or fourth range, the maximum of the next lowest range should be denoted here.

A respective example is schematically given below.

Example: Identification of a modular instrument (consisting of a platform and an indicator that are to be identified) and its ranges/intervals

```
<dcc:items>
  <dcc:item>
    <dcc:name>
      <dcc:content lang="en">Modular non-automatic weighing instrument</dcc:content>
    </dcc:name>
    <dcc:identifications>
    <!--Identifications (e.g. model name, serial number,...) of the complete instrument -->
    </dcc:identifications>
    <dcc:subitems>
      <dcc:item refType="NAWI_range1">
       <dcc:itemQuantities>
         <dcc:itemQuantity refType="NAWI_resolutionOfDisplayingDevice basic_nominalValue">
           <!-- Actual scale interval in D-SI -->
         </dcc:itemQuantity>
         <dcc:itemQuantity refType="math_maximum basic_nominalValue">
           <!-- Maximum capacity in D-SI -->
         </dcc:itemQuantity>
         <dcc:itemQuantity refType="math_minimum basic_nominalValue">
           <!-- Minimum in D-SI -->
         </dcc:itemQuantity>
       </dcc:itemQuantities>
      </dcc:item>
      <dcc:item refType="NAWI_range2">
        <!-- Item quantities as above, if the instrument has a 2nd range/interval -->
      </dcc:item>
      <dcc:item refType="NAWI_range3">
        <!-- Item quantities as above, if the instrument has a 3rd range/interval -->
      </dcc:item>
      <dcc:item refType="NAWI_range4">
        <!-- Item quantities as above, if the instrument has a 4th range/interval -->
      </dcc:item>
      <dcc:item>
       <dcc:name>
        <dcc:content lang="en">Weighing platform</dcc:content>
       </dcc:name>
       <dcc:identifications>
        <dcc:identification>
          <!--Identifications (e.g. model name, serial number,...) of the platform -->
```

```
        </dcc:identification>
       </dcc:identifications>
      </dcc:item>
      <dcc:item>
       <dcc:name>
        <dcc:content lang="en">Indicator</dcc:content>
       </dcc:name>
       <dcc:identifications>
        <dcc:identification>
         <!--Identifications (e.g. model name, serial number,...) of the indicator -->
        </dcc:identification>
       </dcc:identifications>
      </dcc:item>
    </dcc:subitems>
  </dcc:item>
</dcc:items>
```

3.1.2 Location for refType definitions (dcc:refTypeDefinitions)

Valid refTypes are stored with respective definitions and scope notes in a dedicated TemaTres database. Besides the location for the generally applicable refTypes from the namespace basic_, and the the location for the generally applicable refTypes for mathematical terms and operators math_, also a link to the refTypes that are specific for NAWIs (namespace NAWI_) should be given as shown below. All currently existing refTypes from the NAWI_ namespace are listed in chapter 5.

```
<dcc:refTypeDefinitions>
  <dcc:refTypeDefinition>
    <dcc:name>
      <dcc:content lang="de">Allgemeine Begriffe</dcc:content>
      <dcc:content lang="en">general terms</dcc:content>
    </dcc:name>
    <dcc:namespace>basic</dcc:namespace>
    <dcc:link>https://digilab.ptb.de/dkd/refType/vocab/index.php?tema=2&/basic</dcc:link>
  </dcc:refTypeDefinition>
  <dcc:refTypeDefinition>
    <dcc:name>
      <dcc:content lang="de">Mathematische Begriffe und Operatoren</dcc:content>
      <dcc:content lang="en">Mathematical terms and operators</dcc:content>
    </dcc:name>
    <dcc:namespace>math</dcc:namespace>
    <dcc:link>https://digilab.ptb.de/dkd/refType/vocab/index.php?tema=292&/math</dcc:link>
  </dcc:refTypeDefinition>
  <dcc:refTypeDefinition>
    <dcc:name>
      <dcc:content lang="de">Waagenspezifische refTypes</dcc:content>
      <dcc:content lang="en">refTypes specific for weighing instruments</dcc:content>
    </dcc:name>
    <dcc:namespace>NAWI</dcc:namespace>
    <dcc:link>https://digilab.ptb.de/dkd/refType/vocab/index.php?tema=278&/nawi</dcc:link>
  </dcc:refTypeDefinition>
</dcc:refTypeDefinitions>
```

3.1.3 Statements (dcc:statements)

Most of the harmonized uses of the dcc:statement element are not considered to be specific for NAWIs and will thus be explained in a cross-sectional expert report yet to be published [2]. However, the following use concerns a use case that is quite common for the calibration of NAWIs and is thus listed here explicitly as well:

3.1.3.1 Specification of calibrated range(s)

It is both quite common that only a limited range of a single-range instrument is calibrated or only particular (partial) ranges of multiple range or multi-interval instruments are calibrated. In this case, the calibrated range(s) should explicitly be documented as required in section 8.2 of EURAMET cg-18, V4.0 and explained and demonstrated in section 4.3 of this document.

3.2 Measurement results and measurement conditions (dcc:measurementResults and child elements)

The dcc:measurementResults element comprises the following 5 optional elements:

- dcc:influenceConditions
- dcc:measurementMetaData
- dcc:measuringEquipments
- dcc:usedMethods
- dcc:usedSoftware

as well as any number (but at least 1) of dcc:measurementResult elements that each again comprises the above 5 optional elements as well as one further optional element dcc:description and two mandatory elements:

- dcc:name
- dcc:results

Note: For reasons of data economy, all "meta information" (i.e. dcc:influenceConditions, dcc:measurementMetaData, dcc:measuringEquipments, dcc:usedMethods, dcc:usedSoftware) should be placed on the level where it applies to all underlying results, and at the highest level possible. For example, if a particular influence condition applies to all results, it should be denoted below dcc:measurementResults, while if it applies to results in one dcc:measurementResult element only, it should be denoted there.

The flexibility of the DCC schema allows to document several types of measurement results (e.g. several calibrations under different conditions, but also individual measurements (like a repeatability or an eccentricity measurement) of a complete calibration) in different ways and on different hierarchy levels of the schema. Taking into account the suggested respective considerations on semantic network, structural conventions, identification conventions and application conventions [11], the following general principles for the reporting of measurement results are recommended here:

- Calibrations under different conditions (e.g. so-called "as found/as left" calibrations) should each be reported in dedicated dcc:measurementResult elements (see section 4.1 for details)
- Calibrations of different (partial) ranges should each be reported in dedicated dcc:measurementResult elements (see section 4.3 for details)
- Measurement results of the individual measurements that are typically conducted for the calibration of NAWIs according to EURAMET cg-18, V4.0 (namely repeatability, eccentricity, error of indication and optionally auxiliary measurements) should each be reported in dedicated dcc:result elements (see section 3.2.7 for details)

Taking these general structural conventions into account, the following specific rules are stipulated here for the above-listed child elements:

3.2.1 Description and identification of particular measurementResult blocks (dcc:description, dcc:name and child elements)

In principle, the general rules and conventions for the elements dcc:name and dcc:description apply – however, with the above structural considerations they should be explicitly used here to explain the content of the respective dcc:measurementResult block for human readers. See below for a respective example:

```
<dcc:measurementResults>
    <dcc:measurementResult refId="range1">
      <dcc:name>
        <dcc:content lang="de">Kalibrierung des ersten Bereichs, vor Justierung</dcc:content>
        <dcc:content lang="en">Calibration of the first range, before adjustment</dcc:content>
      </dcc:name>
      <!—Several mandatory elements omitted here for clarity-->
    </dcc:measurementResult>
    <dcc:measurementResult refId="range2">
      <dcc:name>
        <dcc:content lang="de">Kalibrierung des zweiten Bereichs, vor Justierung</dcc:content>
        <dcc:content lang="en">Calibration of the second range, before adjustment</dcc:content>
      </dcc:name>
      <!—Several mandatory elements omitted here for clarity-->
    </dcc:measurementResult>
    <dcc:measurementResult refId="range1">
      <dcc:name>
        <dcc:content lang="de">Kalibrierung des ersten Bereichs, nach Justierung</dcc:content>
        <dcc:content lang="en">Calibration of the first range, after adjustment</dcc:content>
      </dcc:name>
      <!—Several mandatory elements omitted here for clarity-->
    </dcc:measurementResult>
    <dcc:measurementResult refId="range2">
      <dcc:name>
        <dcc:content lang="de">Kalibrierung des zweiten Bereichs, nach Justierung</dcc:content>
        <dcc:content lang="en">Calibration of the second range, after adjustment</dcc:content>
      </dcc:name>
      <!—Several mandatory elements omitted here for clarity-->
    </dcc:measurementResult>
  </dcc:measurementResults>
```

3.2.2 Influence Conditions for particular measurementResult blocks (dcc:influenceConditions and child elements)

The dcc:influenceConditions element comprises any number of dcc:influenceCondition elements that comprises 5 child elements:

- dcc:certificate
- dcc:data
- dcc:description
- dcc:name
- dcc:status

Generally, the use of this element is considered self-explanatory and it is the decision of the individual laboratory to decide, which influence conditions are considered to have an influence on the measurement results so that they have to be reported according to section 7.8.4.1 b) of

ISO/IEC 17025:2017 and section 8.2 of EURAMET cg-18, V4.0. These influence conditions should be documented in dedicated dcc:influenceCondition elements with respective refTypes from the basic_ namespace like basic_temperature or basic_humidityRelative.

One particular common use of a dcc:influenceCondition element for NAWIs however is the documentation of the adjustment status and/or the repair status as explained in section 4.2.

3.2.3 Metadata for particular measurementResult blocks (dcc:measurementMetaData and child elements)

There is currently no use of the dcc:measurementMetaData element considered to be specific or common for NAWIs. If used however, possible conventions and rules from the cross-sectional expert report [2] apply.

3.2.4 Software used for particular measurementResult blocks (dcc:usedSoftware and child elements)

If separate dedicated software(s) have been used for acquisition of raw values and/or calculation of measurement results and uncertainties, they can be documented here as dcc:usedSoftware.

Note: In the dcc:administrativeData section, another element dcc:dccSoftware is possible for reporting the software used for creation of the DCC. If one software is used for all steps of the DCC creation (acquisition of raw values, calculation of measurement results and uncertainties, creation of the DCC), it is recommended to denote it in both locations, i.e. under dcc:dccSoftware in dcc:administrativeData as well as under dcc:usedSoftware in dcc:measurementResults.

3.2.5 Measuring equipment used for particular measurementResult blocks (dcc:measuringEquipments and child elements)

There is currently no use of the dcc:measuringEquipments element considered to be specific or common for NAWIs. If used however, possible conventions and rules from the cross-sectional expert report apply.

3.2.6 Methods used for particular measurementResult blocks (dcc:usedMethods and child elements)

It is recommended to explicitly mention EURAMET cg-18, V4.0 (11/2015) as the calibration method (refType basic_calibrationMethod) as well as the method for determining the measurement uncertainty of the calibration results (refType basic_methodMeasurementUncertainty) as shown below. Further procedures that additionally apply like region-specific documents (e.g. the “GUM” [12] and/or EA-4/02 M:2022 [13]) or laboratory-specific documents may be referred to as well with the respective refType, if applicable.

```
<dcc:usedMethods>
  <dcc:usedMethod refType="basic_methodMeasurementUncertainty">
    <dcc:name>
      <dcc:content lang="en">Expanded uncertainty</dcc:content>
    </dcc:name>
    <dcc:description>
```

```
      <dcc:content lang="en">
      <!-- Human readable text about the method to determine measurement uncertainties -->
      </dcc:content>
    </dcc:description>
    <dcc:reference>EURAMET Calibration Guide No. 18, V4.0: Guidelines on the Calibration of Non-Automatic Weighing Instruments<
/dcc:reference>
  </dcc:usedMethod>
  <dcc:usedMethod refType="basic_calibrationMethod">
    <dcc:name>
      <dcc:content lang="en">The following calibration procedure was used:</dcc:content>
    </dcc:name>
    <dcc:reference>EURAMET Calibration Guide No. 18, V4.0: Guidelines on the Calibration of Non-Automatic Weighing Instruments<
/dcc:reference>
  </dcc:usedMethod>
</dcc:usedMethods>
```

3.2.7 Measurement results (dcc:results and child elements)

The dcc:results element can have any number of dcc:result elements as child elements.

With the structural considerations made in the beginning of section 3.2 in mind, it is recommended to use dedicated dcc:result elements for each of the individual measurements mentioned in Chapter 5 of of EURAMET cg-18, V4.0, namely repeatability, eccentricity, error of indication and optionally auxiliary measurements. In each of the dcc:result elements, only general the possible child elements dcc:name and dcc:description

3.2.7.1 Results of the repeatability measurement

The dcc:result element bearing the results of the repeatability measurement should be identified with a dedicated refType NAWI_repeatabilityMeasurement

For the child elements dcc:name (mandatory) and dcc:description (optional), general conventions apply. For the mandatory child element dcc:data, the following is recommended:

The child elements dcc:text, dcc:formula, dcc:byteData and dcc:xml can be used as desired by the individual laboratory – general conventions and rules apply however.

It is quite common with NAWIs to perform one repeatability measurement, but EURAMET cg-18, V4.0 explicitly allows in section 5.1 that "*The test may be performed at more than one test point*" – therefore, it is recommended to generally use one dcc:list element per repeatability measurement for reporting the results (instead of the other remaining option to use dcc:quantity elements directly on this level).

Within the dcc:list element, most child elements (namely dcc:name, dcc:description, dcc:dateTime, dcc:dateTimeXMLList, dcc:usedMethods, dcc:usedSoftware, dcc:measuringEquipment, dcc:influenceConditions and dcc:measurementMetaData) are optional and can be used as desired by the individual laboratory. From the remaining possible child elements dcc:quantity and dcc:list, it is recommended to use dcc:quantity elements for reporting the several quantities that are usually reported for the repeatability measurement. Those are the nominal value of the used weight, the measured values (i.e. the single indications of the repetitions) as well as the standard deviation as a commonly reported result and they shall be identified with refTypes basic_nominalValue, basic_measuredValue and math_standardDeviationSample, respectively. While the nominal value and the standard deviation can be reported in an si:real element, the measured values should be reported in an si:realListXMLList element. An example is given below.

```
<dcc:result refType="NAWI_repeatabilityMeasurement">
  <dcc:name>
    <dcc:content lang="en">Repeatability</dcc:content>
  </dcc:name>
  <dcc:data>
    <dcc:list>
      <dcc:name>
        <dcc:content lang="en">Repeatability Measurement at 1 g</dcc:content>
      </dcc:name>
      <dcc:quantity refType="basic_nominalValue">
        <si:real>
          <si:value>0.001</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:quantity>
      <dcc:quantity refType="basic_measuredValue">
        <si:realListXMLList>
          <si:valueXMLList>0.00100005 0.00100003 0.00100005 0.00100003 0.00100005
          </si:valueXMLList>
          <si:unitXMLList>\kilogram</si:unitXMLList>
        </si:realListXMLList>
      </dcc:quantity>
      <dcc:quantity refType="math_standardDeviationSample">
        <dcc:description>
          <dcc:content lang="en">Standard deviation of the repeatability measurement
          </dcc:content>
        </dcc:description>
        <si:real>
          <si:value>0.000000011</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:quantity>
    </dcc:list>
    <dcc:list>
      <dcc:name>
        <dcc:content lang="en">Repeatability Measurement at 100 g</dcc:content>
      </dcc:name>
      <dcc:quantity refType="basic_nominalValue">
        <si:real>
          <si:value>0.100</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:quantity>
      <dcc:quantity refType="basic_measuredValue">
        <si:realListXMLList>
          <si:valueXMLList>0.10000005 0.10000003 0.10000005 0.10000003 0.10000005
          </si:valueXMLList>
          <si:unitXMLList>\kilogram</si:unitXMLList>
        </si:realListXMLList>
      </dcc:quantity>
      <dcc:quantity refType="math_standardDeviationSample">
        <dcc:description>
          <dcc:content lang="en">Standard deviation of the repeatability measurement
          </dcc:content>
        </dcc:description>
        <si:real>
          <si:value>0.000000011</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:quantity>
    </dcc:list>
  </dcc:data>
</dcc:result>
```

3.2.7.2 Results of the eccentricity measurement

The dcc:result element bearing the results of the eccentricity measurement should be identified with a dedicated refType NAWI_eccentricityMeasurement

For the child elements dcc:name (mandatory) and dcc:description (optional), general conventions apply. For the mandatory child element dcc:data, the following is recommended:

The child elements dcc:text, dcc:formula, dcc:byteData and dcc:xml can be used as desired by the individual laboratory – general conventions and rules apply however.

Contrary to the repeatability measurement(s), usually only one eccentricity measurement is performed with NAWIs – nevertheless for symmetry reasons and to have the opportunity to report several eccentricity measurements (e.g. with different loads), it is recommended here again to use an intermediate dcc:list element. Therein the quantities that are usually reported for eccentricity measurements, namely the nominal value of the used weight, the measured values (i.e. the single indications at the different positions) as well as the deviations from the centric loading indication and/or their maximum as a commonly reported result should be reported in dedicated dcc:quantity elements each with respective refTypes. Again, the nominal value and the measured values should be reported in a dcc:quantity element with refType basic_nominalValue and an si:real element therein and in another dcc:quantity element with refType basic_measuredValue with an si:realListXMLList element therein, respectively.

The indication at the center position should be reported in a dcc:quantity element with refType basic_referenceValue and an si:real element therein.

For the deviations from the centric loading indication, it is possible to report the single values as a dcc:quantity element with refType basic_measurementError with an si:realListXMLList element therein and/or the maximum deviation as another dcc:quantity element with refTypes basic_measurementError and math_maximum with an si:real element therein.

Concerning the identification of the different positions during the eccentricity measurement, it should be noted that there is currently no completely machine-readable/-interpretable way to identify them. It is instead suggested here to assign a position numbering with si:labelXMLList elements and to explain the position numbering in a (human-readable) way in a dedicated dcc:text element. An example is given below.

```
<dcc:result refType="NAWI_eccentricityMeasurement">
  <dcc:name>
    <dcc:content lang="en">Eccentricity</dcc:content>
  </dcc:name>
  <dcc:data>
    <dcc:text>
      <dcc:content lang="en">Position1: Front left</dcc:content>
      <dcc:content lang="en">Position2: Back left</dcc:content>
      <dcc:content lang="en">Position3: Back right</dcc:content>
      <dcc:content lang="en">Position4: Front right</dcc:content>
    </dcc:text>
    <dcc:list>
      <dcc:name>
        <dcc:content lang="en">Eccentricity measurement at 100 g</dcc:content>
      </dcc:name>
      <dcc:quantity refType="basic_nominalValue">
```

```
        <si:real>
          <si:value>0.100</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:quantity>
      <dcc:quantity refType="basic_referenceValue">
        <dcc:name>
          <dcc:content lang="en">Reference value</dcc:content>
        </dcc:name>
        <dcc:description>
          <dcc:content lang="en">Indication at center position</dcc:content>
        </dcc:description>
        <si:real>
          <si:value>0.10000004</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:quantity>
      <dcc:quantity refType="basic_measuredValue">
        <si:realListXMLList>
          <si:labelXMLList>Position1 Position2 Position3 Position4</si:labelXMLList>
          <si:valueXMLList>0.10000005 0.10000003 0.10000005 0.10000003
          </si:valueXMLList>
          <si:unitXMLList>\kilogram</si:unitXMLList>
        </si:realListXMLList>
      </dcc:quantity>
      <dcc:quantity refType="basic_measurementError">
        <dcc:description>
          <dcc:content lang="en">Deviation from centric loading indication</dcc:content>
        </dcc:description>
        <si:realListXMLList>
          <si:labelXMLList>Position1 Position2 Position3 Position4</si:labelXMLList>
          <si:valueXMLList>0.10000001 -0.00000001 0.00000001 -0.00000001
          </si:valueXMLList>
          <si:unitXMLList>\kilogram</si:unitXMLList>
        </si:realListXMLList>
      </dcc:quantity>
      <dcc:quantity refType="basic_measurementError math_maximum">
        <dcc:description>
          <dcc:content lang="en">Maximum deviation from centric loading indication
          </dcc:content>
        </dcc:description>
        <si:real>
          <si:value>0.00000001</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:quantity>
    </dcc:list>
  </dcc:data>
</dcc:result>
```

Note: EURAMET cg-18, V4.0 in section 5.3 allows different methods for the eccentricity measurement (with/without taring the load at centric position, with/without recording the zero indications, with/without returning to the centric position). The above described approach is generally suitable for all of them, although the example is for a method without taring the load at centric position, without recording the zero indications and without returning to the centric position. Examples for other methods will be given in future revisions of this report.

3.2.7.3 Results of the error of indication measurement

The dcc:result element bearing the results of the error of indication measurement (and thus the formal calibration result) should be identified with a dedicated refType NAWI_errorOfIndicationMeasurement

For the child elements dcc:name (mandatory) and dcc:description (optional), general conventions apply. For the mandatory child element dcc:data, the following is recommended:

The child elements dcc:text, dcc:formula, dcc:byteData and dcc:xml can be used as desired by the individual laboratory – general conventions and rules apply however.

For the error of indication, usually the nominal values and the conventional mass values of the test loads, the measured values (i.e. the single indications at the different loads) and the measurement errors at the different test points are reported. This should be done in dedicated dcc:quantity elements with refTypes basic_nominalValue, basic_referenceValue, basic_measuredValue and basic_measurementError, respectively. As the error of indication is determined at several test points, all values should be reported in si:realListXMLList elements. An example is given below:

```
<dcc:result refType="NAWI_errorOfIndicationMeasurement">
  <dcc:name>
    <dcc:content lang="en">Error of indication</dcc:content>
  </dcc:name>
  <dcc:data>
    <dcc:quantity refType="basic_nominalValue">
      <dcc:description>
        <dcc:content lang="en">Testload (nominal value)</dcc:content>
      </dcc:description>
      <si:realListXMLList>
        <si:valueXMLList>0.000 0.050 0.100 0.150 0.220</si:valueXMLList>
        <si:unitXMLList>\kilogram</si:unitXMLList>
      </si:realListXMLList>
    </dcc:quantity>
    <dcc:quantity refType="basic_referenceValue">
      <dcc:description>
        <dcc:content lang="en">Testload (conventional mass value)</dcc:content>
      </dcc:description>
      <si:realListXMLList>
        <si:valueXMLList>0.00000000 0.05000006 0.10000004 0.15000010 0.22000005
        </si:valueXMLList>
        <si:unitXMLList>\kilogram</si:unitXMLList>
      </si:realListXMLList>
    </dcc:quantity>
    <dcc:quantity refType="basic_measuredValue">
      <dcc:description>
        <dcc:content lang="en">Indication</dcc:content>
      </dcc:description>
      <si:realListXMLList>
        <si:valueXMLList>0.00000000 0.05000005 0.10000005 0.15000008 0.22000007
        </si:valueXMLList>
        <si:unitXMLList>\kilogram</si:unitXMLList>
      </si:realListXMLList>
    </dcc:quantity>
    <dcc:quantity refType="basic_measurementError">
      <dcc:description>
        <dcc:content lang="en">Error</dcc:content>
      </dcc:description>
      <si:realListXMLList>
```

```
        <si:valueXMLList>0.00000000 -0.00000001 0.00000001 -0.00000002 0.00000002
        </si:valueXMLList>
        <si:unitXMLList>\kilogram</si:unitXMLList>
        <si:measurementUncertaintyUnivariateXMLList>
          <si:expandedMUXMLList>
            <si:valueExpandedMUXMLList>0.000000033 0.000000073 0.00000012 0.00000019 0.00000027
            </si:valueExpandedMUXMLList>
            <si:coverageFactorXMLList>2.87 2.01 2.00 2.00 2.00
            </si:coverageFactorXMLList>
            <si:coverageProbabilityXMLList>0.95</si:coverageProbabilityXMLList>
            <si:distributionXMLList>normal</si:distributionXMLList>
          </si:expandedMUXMLList>
        </si:measurementUncertaintyUnivariateXMLList>
      </si:realListXMLList>
    </dcc:quantity>
  <dcc:data>
</dcc:result>
```

Note: EURAMET cg-18, V4.0 in section 5.2 allows different methods for the error of indication measurement (increasing and/or decreasing load steps, with/without unloading between the single load steps). The above described approach is generally suitable for all of them, although the example is for a method with only increasing load steps. Examples for other methods will be given in future revisions of this report.

3.2.7.4 Results of the auxiliary measurements

If a laboratory wants to report results of such auxiliary measurements as mentioned in section 5.4 of EURAMET cg-18, V4.0, this should be done in a dcc:result element identified with a dedicated refType NAWI_auxiliaryMeasurement.

Future revisions of this report might contain examples of respective use cases.

4 Application rules for NAWIs in DCCs

4.1 Good practice for reporting results of several calibrations (e.g. as found/as left)

For NAWIs, it is quite common to perform an initial calibration before any intervention like external adjustment or repair (so-called “as found” calibration) and a second/final calibration after the intervention (so-called “as left” calibration). In this case, it is further common for NAWIs to perform complete calibrations (i.e. usually, the initial calibration is not a somewhat reduced calibration, but has the same extent as the final calibration).

Therefore, it is recommended to list each calibration as a separate dcc:measurementResult element. This also applies to additional calibrations that are applied (e.g. additional calibration of a reduced range, with a tare vessel or under different environmental condition). In all cases, a differentiation between the calibrations should be possible via the (human readable) dcc:description element as well as via differences in the dcc:influenceConditions. Below, some examples are given.

Example 1: Calibrations before and after adjustment and repair

```
<dcc:measurementResults>
  <dcc:measurementResult refType=”NAWI_initialMeasurement”>
    <dcc:name>
      <dcc:content lang="en">Measurement results before repair and adjustment</dcc:content>
    </dcc:name>
    <dcc:influenceConditions>
      <dcc:influenceCondition refType="basic_repair">
        <dcc:status>beforeRepair</dcc:status>
      </dcc:influenceCondition>
      <dcc:influenceCondition refType="basic_adjustment">
        <dcc:status>beforeAdjustment</dcc:status>
      </dcc:influenceCondition>
    </dcc:influenceConditions>
  <!--Further elements omitted for clarity-->
  </dcc:measurementResult>
  <dcc:measurementResult refType=”NAWI_finalMeasurement”>
    <dcc:name>
      <dcc:content lang="en">Measurement results after repair and adjustment</dcc:content>
    </dcc:name>
    <dcc:influenceConditions>
      <dcc:influenceCondition refType="basic_repair">
        <dcc:status>afterRepair</dcc:status>
      </dcc:influenceCondition>
      <dcc:influenceCondition refType="basic_adjustment">
        <dcc:status>afterAdjustment</dcc:status>
      </dcc:influenceCondition>
    </dcc:influenceConditions>
  <!--Further elements omitted for clarity-->
  </dcc:measurementResult>
</dcc:measurementResults>
```

Example 2: Calibrations with an air exhaust switched on and off

```
<dcc:measurementResults>
  <dcc:measurementResult>
    <dcc:name>
      <dcc:content lang="en">Measurement results, air exhaust switched on</dcc:content>
    </dcc:name>
    <dcc:influenceConditions>
```

```
      <dcc:influenceCondition>
        <dcc:name>
          <dcc:content lang="en">Air exhaust switched on</dcc:content>
        </dcc:name>
      </dcc:influenceCondition>
    </dcc:influenceConditions>
  <!--Further elements omitted for clarity-->
  </dcc:measurementResult>
  <dcc:measurementResult>
    <dcc:name>
      <dcc:content lang="en">Measurement results, air exhaust switched off</dcc:content>
    </dcc:name>
    <dcc:influenceConditions>
      <dcc:influenceCondition>
        <dcc:name>
          <dcc:content lang="en">Air exhaust switched off</dcc:content>
        </dcc:name>
      </dcc:influenceCondition>
    </dcc:influenceConditions>
  <!--Further elements omitted for clarity-->
  </dcc:measurementResult>
</dcc:measurementResults>
```

4.2 Denoting repair and adjustment status in DCCs for NAWIs

It is recommended, if not required, to document the repair status and the adjustment status as well as the used adjustment weight in a DCC. This should be done in dedicated dcc:influenceCondition elements with respective refTypes:

4.2.1 Repair status:

4.2.1.1 No repair

If the device has not been repaired in the course of the calibration, no respective DCC element is necessary.

4.2.1.2 Calibration after repair

If the device has been repaired and a calibration has been performed afterwards, this should be documented as follows:

```
<dcc:influenceCondition refType="basic_repair">
  <dcc:description>
  <!--Any human readable description of the repair intervention can be documented here-->
  </dcc:description>
  <dcc:status>afterRepair</dcc:status>
</dcc:influenceCondition>
```

4.2.1.3 Calibration before and after repair

If the device has been calibrated before the repair, the results have to be documented in a separate dcc:measurementResult element with a respective dcc:influenceCondition element as follows:

```
<dcc:influenceCondition refType="basic_repair">
  <dcc:status>beforeRepair</dcc:status>
</dcc:influenceCondition>
```

4.2.2 Adjustment status:

4.2.2.1 No adjustment

If the device has not been adjusted in the course of the calibration, no respective DCC element is necessary.

4.2.2.2 Calibration after adjustment with an internal weight

If the device has been adjusted with an internal weight and a calibration has been performed afterwards, this should be documented as follows:

```
<dcc:influenceCondition refType="basic_adjustment">
  <dcc:description>
  <!--Any human readable description of the adjustment can be documented here-->
  </dcc:description>
  <dcc:status>afterAdjustment</dcc:status>
  <dcc:data>
    <dcc:quantity refType="basic_nominalValue">
      <si:real>
        <si:value>0.100</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
      <dcc:measuringEquipments>
        <dcc:measuringEquipment>
          <dcc:equipmentClass>
            <dcc:reference>EURAMET Calibration Guide No. 18 Version 4.0 (11/2015)</dcc:reference>
            <dcc:classID>internalWeight</dcc:classID>
          </dcc:equipmentClass>
        </dcc:measuringEquipment>
      </dcc:measuringEquipments>
    </dcc:quantity>
  </dcc:data>
</dcc:influenceCondition>
```

Note: Usually, the nominal value of the internal adjustment weight is not known to calibration laboratories. Since however a dcc:quantity element is needed to report the dcc:classID “internalWeight” in a sub-element dcc:measuringEquipment, it is appropriate to denote <si:value>NaN</si:value> for the nominal value, when unknown.

4.2.2.3 Calibration after adjustment with an external weight

If the device has been adjusted with an external weight and a calibration has been performed afterwards, this should be documented as follows:

```
<dcc:influenceCondition refType="basic_adjustment">
  <dcc:description>
  <!--Any human readable description of the adjustment can be documented here-->
  </dcc:description>
  <dcc:status>afterAdjustment</dcc:status>
  <dcc:data>
    <dcc:quantity refType="basic_nominalValue">
      <si:real>
        <si:value>0.100</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
```

```
      <dcc:measuringEquipments>
        <dcc:measuringEquipment>
          <dcc:equipmentClass>
            <dcc:reference>EURAMET Calibration Guide No. 18 Version 4.0 (11/2015)</dcc:reference>
            <dcc:classID>externalWeight</dcc:classID>
          </dcc:equipmentClass>
          <dcc:equipmentClass>
            <dcc:reference>OIML R111-1:2004</dcc:reference>
            <dcc:classID>E2</dcc:classID>
          </dcc:equipmentClass>
        </dcc:measuringEquipment>
      </dcc:measuringEquipments>
    </dcc:quantity>
  </dcc:data>
</dcc:influenceCondition>
```

Note: Any further information about the external adjustment weight (marking, conventional mass value, calibration certificate, description,…) can be documented via respective child elements of the dcc:measuringEquipment element.

4.2.2.4 Calibration before any adjustment

If the device has been calibrated before the adjustment, the results have to be documented in a separate dcc:measurementResult element with a respective dcc:influenceCondition element as follows:

```
<dcc:influenceCondition refType="basic_adjustment">
  <dcc:status>beforeAdjustment</dcc:status>
</dcc:influenceCondition>
```

4.3 Instruments with several (partial) measuring ranges

For instruments with several (partial) measuring ranges, the following recommendations should be considered:

1. (Partial) ranges should each be specified as a dcc:item element in dcc:subitems
2. The parameters of each nominal (partial) range of an instrument should be identified as dcc:itemQuantity elements.
3. The parameters of the different calibrated (partial) ranges should be defined in respective dcc:statement elements with refType basic_validityRange.
4. For each calibrated (partial) range of an instrument, there should be at least one dedicated dcc:measurementResult element (more than one in case of measurements before and after significant interventions).
5. The dcc:item elements defining the respective (partial) ranges should be identified via a respective refType NAWI_range1, NAWI_range2,….. and the respective dcc:statement and dcc:measurementResult elements should be linked to the dcc:item elements via id/refId combinations.

Below, an example for an instrument with two ranges is given - irrelevant elements are omitted for clarity:

```
<dcc:administrativeData>
  <dcc:items>
    <dcc:item>
```

```
    <dcc:subitems>
      <dcc:item id="range1" refType="NAWI_range1">
        <dcc:itemQuantities>
          <dcc:itemQuantity refType="math_minimum">
            <!-- Content omitted for clarity-->
          </dcc:itemQuantity>
          <dcc:itemQuantity refType="math_maximum">
            <!-- Content omitted for clarity-->
          </dcc:itemQuantity>
          <dcc:itemQuantity refType="NAWI_resolutionOfDisplayingDevice">
            <!-- Content omitted for clarity-->
          </dcc:itemQuantity>
          <dcc:itemQuantity refType="NAWI_verificationScaleInterval">
            <!-- Content omitted for clarity-->
          </dcc:itemQuantity>
        </dcc:itemQuantities>
      </dcc:item>
      <dcc:item id="range2" refType="NAWI_range2">
        <dcc:itemQuantities>
          <dcc:itemQuantity refType="math_minimum">
            <!-- Content omitted for clarity-->
          </dcc:itemQuantity>
          <dcc:itemQuantity refType="math_maximum">
            <!-- Content omitted for clarity-->
          </dcc:itemQuantity>
          <dcc:itemQuantity refType="NAWI_resolutionOfDisplayingDevice">
            <!-- Content omitted for clarity-->
          </dcc:itemQuantity>
          <dcc:itemQuantity refType="NAWI_verificationScaleInterval">
            <!-- Content omitted for clarity-->
          </dcc:itemQuantity>
        </dcc:itemQuantities>
      </dcc:item>
    </dcc:subitems>
  </dcc:item>
</dcc:items>
<dcc:statements>
  <dcc:statement refId="range1" refType="basic_validityRange">
    <dcc:declaration>
      <dcc:content lang="en">Specification of the weighing range that has been calibrated (Range 1):</dcc:content>
    </dcc:declaration>
    <dcc:data>
    <dcc:quantity refType="math_minimum">
      <!-- Content omitted for clarity-->
    </dcc:quantity>
    <dcc:quantity refType="math_maximum">
      <!-- Content omitted for clarity-->
    </dcc:quantity>
    <dcc:quantity refType="NAWI_resolutionOfDisplayingDevice">
      <!-- Content omitted for clarity-->
    </dcc:quantity>
    </dcc:data>
  </dcc:statement>
  <dcc:statement refId="range2" refType="basic_validityRange">
    <dcc:declaration>
      <dcc:content lang="en">Specification of the weighing range that has been calibrated (Range 2)</dcc:content>
    </dcc:declaration>
    <dcc:data>
      <dcc:quantity refType="math_minimum">
        <!-- Content omitted for clarity-->
      </dcc:quantity>
      <dcc:quantity refType="math_maximum">
        <!-- Content omitted for clarity-->
```

```
        </dcc:quantity>
        <dcc:quantity refType="NAWI_resolutionOfDisplayingDevice">
          <!-- Content omitted for clarity-->
        </dcc:quantity>
      </dcc:data>
    </dcc:statement>
  </dcc:statements>
<!-- Other elements of dcc:administrativeData omitted for clarity-->
</dcc:administrativeData>
<dcc:measurementResults>
  <dcc:measurementResult refId="range1">
    <dcc:name>
      <dcc:content lang="en">Measurement results, range 1</dcc:content>
    </dcc:name>
    <!--Content omitted for clarity-->
  </dcc:measurementResult>
  <dcc:measurementResult refId="range2">
    <dcc:name>
     <dcc:content lang="en">Measurement results, range 2</dcc:content>
    </dcc:name>
    <!--Content omitted for clarity-->
  </dcc:measurementResult>
</dcc:measurementResults>
```

4.3.1 Specification of the nominal metrological data of the range(s) of the instrument:

- Preferred solution is to specify the (nominal) metrological data of the instrument in one dcc:itemQuantity element per characteristic (i.e. one for each of Max1, d1, Min1, Max2, d2,…..).
- Identification of these elements should be done with dedicated refTypes math_minimum, math_maximum, NAWI_resolutionOfDisplayingDevice, NAWI_verificationScaleInterval.
- Within these elements, the subelements dcc:name and/or dcc:description can be used for human readable identification (e.g. “Maximum of range 1”).

Example for an instrument with two ranges:

```
<dcc:subitems>
  <dcc:item refType="NAWI_range1">
    <dcc:itemQuantities>
      <dcc:itemQuantity refType="math_minimum">
        <dcc:name>
          <dcc:content lang="en">Minimum of Range 1</dcc:content>
        </dcc:name>
        <si:real>
          <si:value>0</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:itemQuantity>
      <dcc:itemQuantity refType="math_maximum">
        <dcc:name>
          <dcc:content lang="en">Maximum of Range 1</dcc:content>
        </dcc:name>
        <si:real>
          <si:value>0.12</si:value>
          <si:unit>\kilogram</si:unit>
        </si:real>
      </dcc:itemQuantity>
      <dcc:itemQuantity refType="NAWI_resolutionOfDisplayingDevice">
        <dcc:name>
          <dcc:content lang="en">Resolution/actual scale interval of Range 1</dcc:content>
```

```
      </dcc:name>
      <si:real>
        <si:value>0.00000001</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:itemQuantity>
    <dcc:itemQuantity refType="NAWI_verificationScaleInterval">
      <dcc:name>
        <dcc:content lang="en">Verification scale interval of Range 1</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.000001</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:itemQuantity>
  </dcc:itemQuantities>
 </dcc:item>
 <dcc:item refType="NAWI_range2">
  <dcc:itemQuantities>
    <dcc:itemQuantity refType="math_minimum">
      <dcc:name>
        <dcc:content lang="en">Minimum of Range 2</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:itemQuantity>
    <dcc:itemQuantity refType="math_maximum">
      <dcc:name>
        <dcc:content lang="en">Maximum of Range 2</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.22</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:itemQuantity>
    <dcc:itemQuantity refType="NAWI_resolutionOfDisplayingDevice">
      <dcc:name>
        <dcc:content lang="en">Resolution/actual scale interval of Range 2</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.0000001</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:itemQuantity>
    <dcc:itemQuantity refType="NAWI_verificationScaleInterval">
      <dcc:name>
        <dcc:content lang="en">Verification scale interval of Range 2</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.000001</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:itemQuantity>
  </dcc:itemQuantities>
 </dcc:item>
</dcc:subitems>
```

Note: It is intentionally recommended here to use refTypes range1, range2, … for ranges of multiple range devices as well as for partial ranges of multi-interval devices to keep the number of refTypes smaller. Distinguishing between ranges of multiple range instruments

and partial ranges of multi-interval instruments can be done by writing “Partial range 1” etc in the name elements, by the Min values of higher ranges (Min2=Max1 for MI balances) and by the dcc:equipmentClass element as described in 3.1.1.1.

4.3.2 *Specification of the calibrated range(s) of the instrument:*

- Preferred solution is to specify the calibrated ranges of the instrument in one dcc:statement element per calibrated (partial) range.
- Identification of these dcc:statement elements should be done with the dedicated basic_ refType basic_validityRange and the above-mentioned linking via id/refId to dcc:item elements with NAWI_ refTypes NAWI_range1, NAWI_range2,…..
- Within these elements, the subelements dcc:name and/or dcc:description can be used for human readable identification (e.g. “*Range 1*”) and a dcc:data element can be used to have dcc:quantity elements for the relevant metrological data (Max and Min).

Example for the above instrument with two ranges, when the second range is calibrated only from 50 g to 150 g (just to have a difference to the nominal range2 values):

```
<dcc:statement refId="range1" refType="basic_validityRange">
  <dcc:declaration>
    <dcc:content lang="en">Specification of the weighing range that has been calibrated (Range 1):</dcc:content>
  </dcc:declaration>
  <dcc:data>
    <dcc:quantity refType="math_minimum">
      <dcc:name>
        <dcc:content lang="en">Lower limit of the calibrated weighing range (Range 1)</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:quantity>
    <dcc:quantity refType="math_maximum">
      <dcc:name>
        <dcc:content lang="en">Upper limit of the calibrated weighing range (Range 1)</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.12</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:quantity>
    <dcc:quantity refType="NAWI_resolutionOfDisplayingDevice">
      <dcc:name>
        <dcc:content lang="en">Actual scale interval of Range 1</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.0000001</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:quantity>
  </dcc:data>
</dcc:statement>
<dcc:statement refId="range2" refType="basic_validityRange">
  <dcc:declaration>
    <dcc:content lang="en">Specification of the weighing range that has been calibrated (Range 2):</dcc:content>
  </dcc:declaration>
  <dcc:data>
    <dcc:quantity refType="math_minimum">
```

```
      <dcc:name>
        <dcc:content lang="en">Lower limit of the calibrated weighing range (Range 2)</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.05</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:quantity>
    <dcc:quantity refType="math_maximum">
      <dcc:name>
        <dcc:content lang="en">Upper limit of the calibrated weighing range (Range 2)</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.15</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:quantity>
    <dcc:quantity refType="NAWI_resolutionOfDisplayingDevice">
      <dcc:name>
        <dcc:content lang="en">Actual scale interval of Range 2</dcc:content>
      </dcc:name>
      <si:real>
        <si:value>0.000001</si:value>
        <si:unit>\kilogram</si:unit>
      </si:real>
    </dcc:quantity>
  </dcc:data>
</dcc:statement>
```

5 List of refType identifiers for calibrations of NAWIs

5.1 Scope

This document gives a list of refType-identifiers based on the concept of the DCC (Digital Calibration Certificate) described under "wording" (DCCWiki). The list also gives definitions for identifiers that are already accepted as "basic" or "math" but focuses on the special terms needed for calibration certificate of NAWIs. These carry the prefix "NAWI_". The list is ordered alphabetically. The order has no implication on the importance or frequency of use of the term. All uses are recommendations.

All valid refType identifiers (both basic_ and subject-specific) are also listed in a publicly accessible TemaTres database for better referencing and dynamic expansion. Readers are advised to refer to the entries in this database as the most up-to-date list of all refType identifiers is available there.

5.2 Introduction

The list contains refType identifiers in the following form of description:

refType identifier (title of the chapter)

definition of the identifier

PREFIX:	either basic_ or math_ or NAWI_
SOURCE:	source of the definition of the identifier
NOTE:	note for a better understanding of the identifier; reference to external definitions; reference to another source for explanation of use
EXAMPLE:	specific example for the use of the refType identifier.
ELEMENT:	dcc element at which the identifier is supposed to be used

Note: The definition of further basic_ and math_ refTypes is currently in progress. Some of the ones listed here are therefore marked with the prefix math_ (proposed) or basic_ (proposed) and may change before they are finally published. Readers should therefore always use the TemaTres database mentioned above as the most up-to-date source.

5.3 Alphabetical list of identifiers

5.3.1 adjustment

Definition note - Deutsch: Justierstatus eines Kalibriergegenstands

Definition note - English: Adjustment status of a calibration object

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_	basic_
Quelle:	Bibliographic note	Für die Erklärung von "Justierung": Deutsch-Englische Fassung des ISO/IEC-Leitfaden 99:2007 (3. Auflage) 3.11	For "adjustment" see: ICGM 200:2012 (VIM), 3.11
HINWEIS:	Scope note	In einem Element mit diesem refType muss das Element dcc:status genutzt werden.	In an element with this refType, the element dcc:status must be used.
ELEMENT:	Related Term	dcc:influenceCondition	dcc:influenceCondition
BEISPIEL:	Example note	<dcc:influenceCondition refType="basic_adjustment"> <dcc:name> <dcc:content lang="en">Adjustment status of the calibration object</dcc:content> </dcc:name> <dcc:status>afterAdjustment</dcc:status> </dcc:influenceCondition>	

5.3.2 auxiliaryMeasurement

Definition note - Deutsch: Zusätzliche Messung gemäß Kapitel 5.4 der EURAMET cg-18

Definition note - English: Auxiliary measurement according to chapter 5.4 of EURAMET cg-18

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
Quelle:	Bibliographic note	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015) 5.4	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015) 5.4
HINWEIS 1:	Scope note (1)	Dieser refType kann genutzt werden um dcc:result Elemente zu kennzeichnen, in denen zusätzliche Messungen gemäß Kapitel 5.4 der EURAMET cg-18 aufgeführt werden.	This refType can be used to identify dcc:result elements in which additional measurements according to chapter 5.4 of EURAMET cg-18 are reported.
HINWEIS 2:	Scope note (2)	Für mehr Informationen zur Verwendung siehe Abschnitt 3.2.7.4 in DKD-E 7-3	For more information on use see section 3.2.7.4 in DKD-E 7-3
ELEMENT:	Related Term	dcc:result	dcc:result
BEISPIEL:	Example note	<dcc:result refType="NAWI_auxiliaryMeasurement"> <dcc:name> <dcc:content lang="en">Auxiliary measurement</dcc:content> </dcc:name> <dcc:data> <!--Content omitted for clarity--> </dcc:data> </dcc:result>	

5.3.3 calibratedInterval

Definition note - Deutsch: Statement über den kalibrierten Bereich

Definition note - English: Statement about the calibrated range

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_	basic_
HINWEIS 1:	Scope note (1)	Was in Abhängigkeit von den gewählten Prüfpunkten als kalibrierter Bereich betrachtet werden kann, ergibt sich ggf. aus der entsprechenden Kalibrierrichtlinie.	What can be considered as calibrated interval depending on the selected test points may be determined in the corresponding calibration guidelines.
HINWEIS 2:	Scope note (2)	Die Angabe dient bei kontinuierlich anzeigenden Instrumenten, die punktweise kalibriert werden, dem Nutzer gegebenenfalls als Hinweis, dass der kalibrierte Bereich nicht mit dem nominellen Anzeigebereich des Kalibriergegenstandes und/oder oder dem Intervall zwischen kleinstem und größtem Kalibrierpunkt übereinstimmt.	In the case of continuously displaying instruments that are calibrated point-by-point, the indication may serve as an indication to the user that the calibrated range does not correspond to the nominal indication interval of the calibration object and/or not to the range between lowest and highest calibration point.
HINWEIS 3:	Scope note (3)	Wenn der kalibrierte Bereich in Absprache mit dem Auftraggeber festgelegt wurde kann dies in diesem dcc:statement-Element festgehalten werden.	If the calibrated range was determined in agreement with the customer, this can be documented in this dcc:statement element.
ELEMENT:	Related Term	dcc:statement	dcc:statement
BEISPIEL:	Example note	<dcc:statement refType="basic_calibratedInterval"> <dcc:declaration> <dcc:content lang="en">It has been agreed with the customer that only the following indication interval(s) of the instrument shall be calibrated:</dcc:content> </dcc:declaration> <dcc:data> <!-- Specification of the calibrated interval --> </dcc:data> </dcc:statement>	

5.3.4 calibrationMethod

Definition note - Deutsch: Verweis auf die Beschreibung der verwendeten Kalibriermethode.

Definition note - English: Link to the description of the calibration method used.

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_	basic_
HINWEIS:	Scope note	Der Verweis auf die Beschreibung der Kalibriermethode (Norm, Richtlinie, Arbeitsanweisung o.ä.) sollte in dcc:norm oder dcc:reference dieser dcc:usedMethod enthalten sein (siehe Beispiel).	The reference to the description of the calibration method (standard, guideline, work instruction, etc.) should be contained in dcc:norm and/ or dcc:reference of this dcc:usedMethod (see example).
ELEMENT:	Related Term	dcc:usedMethod	dcc:usedMethod
BEISPIEL:	Example note	<dcc:usedMethod refType="basic_calibrationMethod"> <dcc:name> <dcc:content lang="en">Calibration procedure</dcc:content> <dcc:content lang="en">Kalibrierverfahren</dcc:content> </dcc:name> <dcc:description> <dcc:content lang="en">According to DKD-R 5-1: 2023-11, the object was calibrated comparing the indicated values of the calibration object and the values from the reference thermometer.</dcc:content>	

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
		<dcc:content lang="en">Die Kalibrierung erfolgte gemäß DKD-R 5-1: 2023-11 im Vergleichsverfahren</dcc:content> </dcc:description> <dcc:norm>DKD-R 5-1:2023-11</dcc:norm> <dcc:link>https://doi.org/10.7795/550.20231207</dcc:link> </dcc:usedMethod>	

5.3.5 eccentricityMeasurement

Definition note - Deutsch: Messung bei außermittiger Belastung

Definition note - English: Measurement at eccentric loading

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
Quelle:	Bibliographic note	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015) 5.3	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015) 5.3
HINWEIS:	Scope note	Für mehr Informationen zur Verwendung siehe Abschnitt 3.2.7.2 in DKD-E 7-3	For more information on use see section 3.2.7.2 in DKD-E 7-3
ELEMENT:	Related Term	dcc:result	dcc:result
BEISPIEL:	Example note	<dcc:result refType="NAWI_eccentricityMeasurement"> <dcc:name> <dcc:content lang="en">Eccentricity measurement</dcc:content> </dcc:name> <dcc:data> <!--Content omitted for clarity--> </dcc:data> </dcc:result>	

5.3.6 errorOfIndicationMeasurement

Definition note - Deutsch: Messung der Abweichung der Anzeige

Definition note - English: Measurement of the error of indication

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
Quelle:	Bibliographic note	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015) 5.2	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015) 5.2
HINWEIS:	Scope note	Für mehr Informationen zur Verwendung siehe Abschnitt 3.2.7.3 in DKD-E 7-3	For more information on use see section 3.2.7.3 in DKD-E 7-3
ELEMENT:	Related Term	dcc:result	dcc:result
BEISPIEL:	Example note	<dcc:result refType="NAWI_errorOfIndicationMeasurement"> <dcc:name> <dcc:content lang="en">Error of indication measurement</dcc:content> </dcc:name> <dcc:data> <!--Content omitted for clarity--> </dcc:data> </dcc:result>	

5.3.7 finalMeasurement

Definition note - Deutsch: letzte Messung in einer Reihe aus 1...*n* Messungen

Definition note - English: last measurement in a series of 1...*n* measurements

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
HINWEIS:	Scope note	Der refType sollte an die letzte Messung angebracht werden. Wenn nur eine Messung durchgeführt wurde, sollte er ebenfalls (zusammen mit dem refType NAWI_initialMeasurement) angebracht werden.	The refType should be added to the last measurement. If only one measurement has been performed, it should also be added (together with the refType NAWI_initialMeasurement)
HINWEIS 2:	Scope note (2)	Für die letzte Messung wird oftmals der Begriff "as left" benutzt.	The term "as left" is often used for the last measurement.
HINWEIS 3:	Scope note (3)	Für mehr Informationen zur Verwendung siehe Abschnitt 4.1 in DKD-E 7-3	For more information on use see section 4.1 in DKD-E 7-3
ELEMENT:	Related Term	dcc:measurementResult	dcc:measurementResult
BEISPIEL:	Example note	Example 1: Only one measurement has been performed <dcc:measurementResult refType="NAWI_initialMeasurement NAWI_finalMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> Example 2: Two measurements have been performed (e.g. one before adjustment and one afterwards) <dcc:measurementResults> <dcc:measurementResult refType="NAWI_initialMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> <dcc:measurementResult refType="NAWI_finalMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> </dcc:measurementResults> Example 3: Three measurements have been performed (e.g. one without any intervention, one with internal adjustment and one with external adjustment) <dcc:measurementResults> <dcc:measurementResult refType="NAWI_initialMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> <dcc:measurementResult> <!-- other elements omitted --> </dcc:measurementResult> <dcc:measurementResult refType="NAWI_finalMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> </dcc:measurementResults>	

5.3.8 initialMeasurement

Definition note - Deutsch: erste Messung in einer Reihe aus 1...*n* Messungen

Definition note - English: first measurement in a series of 1...*n* measurements

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung Englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
HINWEIS 1:	Scope note (1)	Der refType sollte an die erste Messung angebracht werden. Wenn nur eine Messung durchgeführt wurde, sollte er ebenfalls (zusammen mit dem refType NAWI_finalMeasurement) angebracht werden.	The refType should be added to the first measurement. If only one measurement has been performed, it should also be added (together with the refType NAWI_finalMeasurement).
HINWEIS 2:	Scope note (2)	Für die erste Messung wird oftmals der Begriff "as found" benutzt. Dieser Begriff wird hier bewusst nicht benutzt, da er suggeriert, dass keinerlei Intervention am Kalibrierobjekt vorgenommen wurde ("wie vorgefunden"). Mit diesem refType soll allerdings die erste Messung identifiziert werden, unabhängig davon, ob vorher eine Intervention stattgefunden hat.	The term "as found" is often used for the first measurement. This term is deliberately not used here, as it suggests that no intervention was made on the calibration object before. This refType however is intended to identify the first measurement, regardless of whether an intervention has taken place before.
HINWEIS 3:	Scope note (3)	Für mehr Informationen zur Verwendung siehe Abschnitt 4.1 in DKD-E 7-3	For more information on use see section 4.1 in DKD-E 7-3
ELEMENT:	Related Term	dcc:measurementResult	dcc:measurementResult
BEISPIEL:	Example note	Example 1: Only one measurement has been performed <dcc:measurementResult refType="NAWI_initialMeasurement NAWI_finalMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> Example 2: Two measurements have been performed (e.g. one before adjustment and one afterwards) <dcc:measurementResults> <dcc:measurementResult refType="NAWI_initialMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> <dcc:measurementResult refType="NAWI_finalMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> </dcc:measurementResults> Example 3: Three measurements have been performed (e.g. one without any intervention, one with internal adjustment and one with external adjustment) <dcc:measurementResults> <dcc:measurementResult refType="NAWI_initialMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> <dcc:measurementResult> <!-- other elements omitted --> </dcc:measurementResult> <dcc:measurementResult refType="NAWI_finalMeasurement"> <!-- other elements omitted --> </dcc:measurementResult> </dcc:measurementResults>	

5.3.9 maximum

Definition note - Deutsch: Größter Wert aus einer endlichen Anzahl von Werten

Definition note - English: Biggest value out of a finite number of values

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	math_	math_
HINWEIS 1:	Scope note (1)	Über eine Verknüpfung per id/refId kann identifiziert werden, aus welchen Werten das Maximum bestimmt wurde.	A link via id/refId can be used to identify the values used to determine the maximum.
QUELLE:	Bibliographic note	ISO 80000-2:2019, 2-10.22	ISO 80000-2:2019, 2-10.22
ELEMENT:	Related Term	dcc:quantity, dcc:itemQuantity, dcc:usedMethodQuantity, dcc:measuringEquipmentQuantity	dcc:quantity, dcc:itemQuantity, dcc:usedMethodQuantity, dcc:measuringEquipmentQuantity
BEISPIEL:	Example note	<dcc:data> <dcc:list> <dcc:quantity id="single values"> <si:realXMLList> <si:valueXMLList>0.5 0.6 0.7 0.8 0.9 1.0 </si:valueXMLList> <si:unitXMLList>\kilogram </si:unitXMLList> </si:realXMLList> </dcc:quantity> <dcc:quantity refType="math_minimum" refId="single values"> <si:real> <si:value>0.5</si:value> <si:unit>\kilogram </si:unit> </si:real> </dcc:quantity> <dcc:quantity refType="math_maximum" refId="single values"> <si:real> <si:value>1.0</si:value> <si:unit>\kilogram </si:unit> </si:real> </dcc:quantity> </dcc:list> </dcc:data>	

5.3.10 measuredValue

Definition note - Deutsch: Größenwert, der ein Messergebnis repräsentiert.

Definition note - English: Quantity value representing a measurement result

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_	basic_
QUELLE:	Bibliographic note	Deutsch-Englische Fassung des ISO/IEC-Leitfaden 99:2007 (3. Auflage) 2.10 “Messwert”.	ICGM 200:2012 (VIM) 2.10
ELEMENT:	Related Term	dcc:quantity	dcc:quantity
BEISPIEL:	Example note	<dcc:result> <dcc:name> <dcc:content lang="en">Measuring result</dcc:content> </dcc:name> <dcc:data> <dcc:quantity refType="basic_measuredValue"> <dcc:name> <dcc:content lang="en">mass</dcc:content> </dcc:name> <si:real> <si:value>0.999997191</si:value>	

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
		<si:unit>\kilogram</si:unit> <si:dateTime>2018-02-26T12:18:38</si:dateTime> <si:measurementUncertaintyUnivariate> <si:expandedMU> <si:valueExpandedMU>0.00000053</si:valueExpandedMU> <si:coverageFactor>2</si:coverageFactor> <si:coverageProbability>0.95</si:coverageProbability> </si:expandedMU> </si:measurementUncertaintyUnivariate> </si:real> </dcc:quantity> </dcc:data> </dcc:result>	

5.3.11 measurementError

Definition note - Deutsch: Messwert minus einem Referenzwert.

Definition note - English: measured value minus a reference value

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_	basic_
HINWEIS 1:	Scope note (1)	Kann in jeder dcc:result angegeben werden.	Can be reported in any dcc:result element
QUELLE:	Bibliographic note	Deutsch-Englische Fassung des ISO/IEC-Leitfaden 99:2007 (3. Auflage) 2.16 “Messabweichung”.	JCGM 200:2012 (VIM), 2.16
ELEMENT:	Related Term	dcc:quantity	dcc:quantity
BEISPIEL:	Example note	<dcc:result> <dcc:name> <dcc:content lang="de">Konventioneller Wägewert</dcc:content> <dcc:content lang="en">Conventional mass</dcc:content> </dcc:name> <dcc:data> <dcc:quantity refType="basic_measurementError"> <si:real> <si:value>0.0000002</si:value> <si:unit>\kilogram</si:unit> <si:dateTime>2021-06-01T12:01:02</si:dateTime> <si:measurementUncertaintyUnivariate> <si:expandedMU> <si:valueExpandedMU>0.00000053</si:valueExpandedMU> <si:coverageFactor>2</si:coverageFactor> <si:coverageProbability>0.95</si:coverageProbability> </si:expandedMU> </si:measurementUncertaintyUnivariate> </si:real> </dcc:quantity> </dcc:data> </dcc:result>	

5.3.12 methodMeasurementUncertainty

Definition note - Deutsch: Beschreibung der Methode zur Bestimmung der Messunsicherheitsangaben im Dokument.

Definition note - English: description of method to determine the measurement uncertainties stated in the document

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_	basic_
HINWEIS 1:	Scope note (1)	Referenzen zu Leitfäden wie EA-4/02 M:2022 sollten verwendet werden.	References on guiding documents such as EA-4/02 M:2022 should be used.
ELEMENT:	Related Term	dcc:usedMethod	dcc:usedMethod
BEISPIEL:	Example note	<dcc:usedMethod refType="basic_methodMeasurementUncertainty"> <dcc:name> <dcc:content lang="de">Messunsicherheit</dcc:content> <dcc:content lang="en">Measurement uncertainty</dcc:content> </dcc:name> <dcc:description> <dcc:content lang="de"> Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standar dmessunsicherheit durch Multiplikation mit dem Erweiterungsfaktor *k* ergibt. Sie wurde gemäß EA -4/02 M:2013 ermittelt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von 95 % im zu geordneten Werteintervall.</dcc:content> <dcc:content lang="en"> The reported expanded uncertainty is stated as the standard uncertainty multiplied by a coverage factor k. The coverage factor *k*=2 for a normal distribution corresponds to a coverage probability of approx. 95 %.</dcc:content> </dcc:description> <dcc:norm>EA-4/02 M:2022</dcc:norm> </dcc:usedMethod>	

5.3.13 minimum

Definition note - Deutsch: Kleinster Wert aus einer endlichen Anzahl von Werten

Definition note - English: Smallest value out of a finite number of values

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	math_	math_
HINWEIS 1:	Scope note (1)	Über eine Verknüpfung per id/refId kann identifiziert werden, aus welchen Werten das Minimum bestimmt wurde.	A link via id/refId can be used to identify the values used to determine the minimum.
QUELLE:	Bibliographic note	ISO 80000-2:2019, 2-10.21	ISO 80000-2:2019, 2-10.21
ELEMENT:	Related Term	dcc:quantity, dcc:itemQuantity, dcc:usedMethodQuantity, dcc:measuringEquipmentQuantity	dcc:quantity, dcc:itemQuantity, dcc:usedMethodQuantity, dcc:measuringEquipmentQuantity
BEISPIEL:	Example note	<dcc:data> <dcc:list> <dcc:quantity id="single values"> <si:realXMLList> <si:valueXMLList>0.5 0.6 0.7 0.8 0.9 1.0 </si:valueXMLList> <si:unitXMLList>\kilogram </si:unitXMLList> </si:realXMLList> </dcc:quantity> <dcc:quantity refType="math_minimum" refId="single values"> <si:real> <si:value>0.5</si:value> <si:unit>\kilogram </si:unit>	

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
		</si:real> </dcc:quantity> <dcc:quantity refType="math_maximum" refId="single values"> <si:real> <si:value>1.0</si:value> <si:unit>\kilogram </si:unit> </si:real> </dcc:quantity> </dcc:list> </dcc:data>	

5.3.14 nominalValue

Definition note - Deutsch: Gerundeter angenäherter Wert einer charakteristischen Größe eines Messgeräts oder Messsystems, der auf dessen sachgemäßen Gebrauch hinweist.

Definition note - English: rounded or approximate value of a characterizing quantity of a measuring instrument or measuring system that provides guidance for its appropriate use

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_	basic_
HINWEIS 1:	Scope note (1)	Nominalwert kann ein Mittel zur Identifikation als auch ein Teil des Ergebnisses sein.	Nominal value can be a means of identification as well as a part of the result.
QUELLE:	Bibliographic note	Deutsch-Englische Fassung des ISO/IEC-Leitfaden 99:2007 (3. Auflage) 4.6 “Nennwert”	JCGM 200:2012 (VIM) 4.6
ELEMENT:	Related Term	dcc:quantity, dcc:itemQuantity, dcc:measuringEquipmentQuantity	dcc:quantity, dcc:itemQuantity, dcc:measuringEquipmentQuantity
BEISPIEL:	Example note	<dcc:result refType="mass_conventionalMass"> <dcc:name> <dcc:content lang="de">Konventioneller Wägewert</dcc:content> <dcc:content lang="en">Conventional mass</dcc:content> </dcc:name> <dcc:data> <dcc:quantity refType="basic_nominalValue"> <dcc:name> <dcc:content lang="de">Nennwert</dcc:content> <dcc:content lang="en">Nominal value</dcc:content> </dcc:name> <si:real> <si:value>2</si:value> <si:unit>\kilogram</si:unit> </si:real> </dcc:quantity> <dcc:quantity refType="basic_measuredValue"> <si:real> <si:value>2.00000020</si:value> <si:unit>\kilogram</si:unit> <si:dateTime>2021-06-01T12:01:02</si:dateTime> <si:measurementUncertaintyUnivariate> <si:expandedMU> <si:valueExpandedMU>0.00000053</si:valueExpandedMU> <si:coverageFactor>2</si:coverageFactor> <si:coverageProbability>0.95</si:coverageProbability> </si:expandedMU> </si:measurementUncertaintyUnivariate> </si:real> </dcc:quantity> <dcc:quantity refType="basic_measurementError"> <si:real> <si:value>0.0000002</si:value> <si:unit>\kilogram</si:unit>	

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
		<si:dateTime>2021-06-01T12:01:02</si:dateTime> <si:measurementUncertaintyUnivariate> <si:expandedMU> <si:valueExpandedMU>0.00000053</si:valueExpandedMU> <si:coverageFactor>2</si:coverageFactor> <si:coverageProbability>0.95</si:coverageProbability> </si:expandedMU> </si:measurementUncertaintyUnivariate> </si:real> </dcc:quantity> </dcc:data> </dcc:result>	

5.3.15 range1

Definition note - Deutsch: Erster (Teil-)Wägebereich bei Mehrbereichs- oder Mehrteilungswaagen; Wägebereich bei Einbereichswaagen

Definition note - English: First (partial) weighing range for multiple range balances or multi-interval balances; weighing range for single range balances

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
HINWEIS 1:	Scope note (1)	“Range” ist hier explizit sowohl für Wägebereiche bei Mehrbereichswaagen als auch für Teilwägebereiche bei Mehrteilungswaagen zu verstehen.	“range” is explicitly to be understood here for weighing ranges in case of multiple range balances was well as for partial weighing ranges in case of multi-interval balances
HINWEIS 2:	Scope note (2)	Die in der Definition verwendeten Begriffe “Mehrbereichswaage” und “Mehrteilungswaage” sind in OIML R76-1:2006, T3.2.6 bzw. T.3.2.7 definiert. Hier sei dabei explizit darauf hingewiesen, dass der dort verwendete Begriff “scale interval” im Zusammenhang mit Kalibrierungen als “Teilungswert d” zu verstehen ist.	The terms “multiple range balance” and “multi-interval balance” used in the definition are defined in OIML R76-1:2006, T3.2.6 and T.3.2.7 respectively. It should be explicitly pointed out that the term “scale interval” used there is to be understood in connection with calibrations as “actual scale interval *d*”.
HINWEIS 3:	Scope note (3)	Für mehr Informationen zur Verwendung siehe Abschnitt 4.3 in DKD-E 7-3	For more information on use see section 4.3 in DKD-E 7-3
QUELLE:	Bibliographic note	OIML R76-1:2006, T.3.1.4	OIML R76-1:2006, T.3.1.4
ELEMENT:	Related Term	dcc:item	dcc:item
BEISPIEL:	Example note	<dcc:items> <dcc:item> <dcc:subitems> <dcc:item refType="NAWI_range1"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> <dcc:item refType="NAWI_range2"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item>	

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
		</dcc:subitems> </dcc:item> </dcc:items>	

5.3.16 range2

Definition note - Deutsch: Zweiter (Teil-)Wägebereich bei Mehrbereichs- oder Mehrteilungswaagen

Definition note - English: Second (partial) weighing range for multiple range balances or multi-interval balances

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
HINWEIS 1:	Scope note (1)	"Range" ist hier explizit sowohl für Wägebereiche bei Mehrbereichswaagen als auch für Teilwägebereiche bei Mehrteilungswaagen zu verstehen.	"range" is explicitly to be understood here for weighing ranges in case of multiple range balances was well as for partial weighing ranges in case of multi-interval balances
HINWEIS 2:	Scope note (2)	Die in der Definition verwendeten Begriffe "Mehrbereichswaage" und "Mehrteilungswaage" sind in OIML R76-1:2006, T3.2.6 bzw. T.3.2.7 definiert. Hier sei dabei explizit darauf hingewiesen, dass der dort verwendete Begriff "scale interval" im Zusammenhang mit Kalibrierungen als "Teilungswert d" zu verstehen ist.	The terms "multiple range balance" and "multi-interval balance" used in the definition are defined in OIML R76-1:2006, T3.2.6 and T.3.2.7 respectively. It should be explicitly pointed out that the term "scale interval" used there is to be understood in connection with calibrations as "actual scale interval *d*".
HINWEIS 3:	Scope note (3)	Für mehr Informationen zur Verwendung siehe Abschnitt 4.3 in DKD-E 7-3	For more information on use see section 4.3 in DKD-E 7-3
QUELLE:	Bibliographic note	OIML R76-1:2006, T.3.1.4	OIML R76-1:2006, T.3.1.4
ELEMENT:	Related Term	dcc:item	dcc:item
BEISPIEL:	Example note	<dcc:items> <dcc:item> <dcc:subitems> <dcc:item refType="NAWI_range1"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> <dcc:item refType="NAWI_range2"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> </dcc:subitems> </dcc:item> </dcc:items>	

5.3.17 range3

Definition note - Deutsch: Dritter (Teil-)Wägebereich bei Mehrbereichs- oder Mehrteilungswaagen

Definition note - English: Third (partial) weighing range for multiple range balances or multi-interval balances

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
HINWEIS 1:	Scope note (1)	"Range" ist hier explizit sowohl für Wägebereiche bei Mehrbereichswaagen als auch für Teilwägebereiche bei Mehrteilungswaagen zu verstehen.	"range" is explicitly to be understood here for weighing ranges in case of multiple range balances was well as for partial weighing ranges in case of multi-interval balances
HINWEIS 2:	Scope note (2)	Die in der Definition verwendeten Begriffe "Mehrbereichswaage" und "Mehrteilungswaage" sind in OIML R76-1:2006, T3.2.6 bzw. T.3.2.7 definiert. Hier sei dabei explizit darauf hingewiesen, dass der dort verwendete Begriff "scale interval" im Zusammenhang mit Kalibrierungen als "Teilungswert d" zu verstehen ist.	The terms "multiple range balance" and "multi-interval balance" used in the definition are defined in OIML R76-1:2006, T3.2.6 and T.3.2.7 respectively. It should be explicitly pointed out that the term "scale interval" used there is to be understood in connection with calibrations as "actual scale interval *d*".
HINWEIS 3:	Scope note (3)	Für mehr Informationen zur Verwendung siehe Abschnitt 4.3 in DKD-E 7-3	For more information on use see section 4.3 in DKD-E 7-3
QUELLE:	Bibliographic note	OIML R76-1:2006, T.3.1.4	OIML R76-1:2006, T.3.1.4
ELEMENT:	Related Term	dcc:item	dcc:item
BEISPIEL:	Example note	<dcc:items> <dcc:item> <dcc:subitems> <dcc:item refType="NAWI_range1"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> <dcc:item refType="NAWI_range2"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> <dcc:item refType="NAWI_range3"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> </dcc:subitems> </dcc:item> </dcc:items>	

5.3.18 range4

Definition note - Deutsch: Vierter (Teil-)Wägebereich bei Mehrbereichs- oder Mehrteilungswaagen

Definition note - English: Fourth (partial) weighing range for multiple range balances or multi-interval balances

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
HINWEIS 1:	Scope note (1)	"Range" ist hier explizit sowohl für Wägebereiche bei Mehrbereichswaagen als auch für Teilwägebereiche bei Mehrteilungswaagen zu verstehen.	"range" is explicitly to be understood here for weighing ranges in case of multiple range balances was well as for partial weighing ranges in case of multi-interval balances
HINWEIS 2:	Scope note (2)	Die in der Definition verwendeten Begriffe "Mehrbereichswaage" und "Mehrteilungswaage" sind in OIML R76-1:2006, T3.2.6 bzw. T.3.2.7 definiert. Hier sei dabei explizit darauf hingewiesen, dass der dort verwendete Begriff "scale interval" im Zusammenhang mit Kalibrierungen als "Teilungswert d" zu verstehen ist.	The terms "multiple range balance" and "multi-interval balance" used in the definition are defined in OIML R76-1:2006, T3.2.6 and T.3.2.7 respectively. It should be explicitly pointed out that the term "scale interval" used there is to be understood in connection with calibrations as "actual scale interval *d*".
HINWEIS 3:	Scope note (3)	Für mehr Informationen zur Verwendung siehe Abschnitt 4.3 in DKD-E 7-3	For more information on use see section 4.3 in DKD-E 7-3
QUELLE:	Bibliographic note	OIML R76-1:2006, T.3.1.4	OIML R76-1:2006, T.3.1.4
ELEMENT:	Related Term	dcc:item	dcc:item
BEISPIEL:	Example note	<dcc:items> <dcc:item> <dcc:subitems> <dcc:item refType="NAWI_range1"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> <dcc:item refType="NAWI_range2"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> <dcc:item refType="NAWI_range3"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> <dcc:item refType="NAWI_range4"> <dcc:itemQuantites> <!-- other elements omitted --> </dcc:itemQuantites> </dcc:item> </dcc:subitems> </dcc:item> </dcc:items>	

5.3.19 referenceValue

Definition note - Deutsch: Wert, der als Grundlage für den Vergleich mit Werten der gleichen Art verwendet wird

Definition note - English: Value used as a basis for comparison with values of the same kind

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_	basic_
Quelle:	Bibliographic note	Deutsch-Englische Fassung des ISO/IEC-Leitfaden 99:2007 (3. Auflage) 5.18	ICGM 200:2012 (VIM), 5.18
HINWEIS 1:	Scope note (1)	Typischerweise wird der "wahre Wert" mit diesem refType gekennzeichnet, aber auch andere Werte, die zum Vergleich herangezogen werden können mit diesem refType gekennzeichnet werden.	Typically, the "true value" is labeled with this refType, but other values that can be used for comparison can also be labeled with this refType.
HINWEIS 2:	Scope note (2)	Wenn auf gleicher Ebene ein dcc:quantity-Element mit dem refType basic_measurementError existiert, dann stellt das dcc:quantity-Element mit dem refType basic_referenceValue den in der Definition basic_measurementError erwähnten Referenzwert dar.	If there is a dcc:quantity element at the same level with the refType basic_measurementError, the element with refType basic_referenceValue represents the reference value mentioned in the definition basic_measurementError.
ELEMENT:	Related Term	dcc:quantity	dcc:quantity
BEISPIEL:	Example note	<dcc:result> <dcc:data> <dcc:quantity refType="basic_measuredValue"> <si:real> <si:value>2.00000050</si:value> <si:unit>\kilogram</si:unit> </si:real> </dcc:quantity> <dcc:quantity refType="basic_referenceValue"> <si:real> <si:value>2.00000020</si:value> <si:unit>\kilogram</si:unit> </si:real> </dcc:quantity> <dcc:quantity refType="basic_measurementError"> <si:real> <si:value>0.0000003</si:value> <si:unit>\kilogram</si:unit> </si:real> </dcc:quantity> </dcc:data> </dcc:result>	

5.3.20 repair

Definition note - Deutsch: Reparaturstatus eines Kalibriergegenstands

Definition note - English: Repair status of a calibration item

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	basic_ (vorgeschlagen)	basic_ (proposed)
Quelle:	Bibliographic note	ISO/IEC 17025:2017 7.8.4.1. d)	ISO/IEC 17025:2017 7.8.4.1. d)

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
HINWEIS 1:	Scope note (1)	Jede einzelne Messung in einer Kette von Interventionen muss in einem dcc:measurementResult mit den entsprechenden Umgebungsbedingungen, Methoden, Messmittel und Ergebnissen angegeben werden. Jede Messung in einer Kette von Interventionen muss ein dcc:influenceCondition Element mit einem dcc:status-Element enthalten. Im Falle eines Austausches oder einer Reparatur muss dcc:status auf beforeRepair oder afterRepair gesetzt werden.	Each individual measurement in a chain of interventions must be specified in a dcc:measurementResult with the corresponding environmental conditions, methods, measuring equipment and results. Each measurement in a chain of interventions must contain a dcc:influenceCondition element with a dcc:status element. In case of replacement or repair, dcc:status must be set to beforeRepair or afterRepair.
HINWEIS 2:	Scope note (2)	Im Falle eines ausgetauschten Kalibriergegenstandes sind beide Gegenstände in dcc:items aufzulisten und die dcc:measurementResult-Elemente referenzieren diese mit refId.	In the case of a replaced calibration item, both items must be listed in dcc:items and the dcc:measurementResult elements reference these with refId.
HINWEIS 3:	Scope note (3)	Sofern das Gerät im Zuge der Kalibrierung nicht repariert wurde, ist kein entsprechendes DCC-Element erforderlich.	If the device has not been repaired in the course of the calibration, no respective DCC element is necessary.
ELEMENT:	Related Term	dcc:influenceCondition	dcc:influenceCondition
BEISPIEL:	Example note	Example note (1): Example of replacing an object from a set of objects/ Beispiel für den Austausch eines Gegenstandes aus einem Satz	

```
<dcc:administrativeData>
 <dcc:items>
  <dcc:item id="item1">
   <dcc:identifications>
    <dcc:identification refType="mass_setPositionNo">
     <dcc:issuer>manufacturer</dcc:issuer>
     <dcc:value>b4</dcc:value>
    </dcc:identification>
   </dcc:identifications>
  </dcc:item>
  <dcc:item id="item2">
   <dcc:manufacturer>
    <dcc:name>
     <dcc:content>Weights Co Ltd.</dcc:content>
    </dcc:name>
   </dcc:manufacturer>
   <dcc:identifications>
    <dcc:identification refType="mass_setPositionNo">
     <dcc:issuer>manufacturer</dcc:issuer>
     <dcc:value>a2</dcc:value>
    </dcc:identification>
   </dcc:identifications>
  </dcc:item>
  <dcc:item id="item3">
   <dcc:manufacturer>
    <dcc:name>
     <dcc:content>Mass Creators GmbH</dcc:content>
    </dcc:name>
   </dcc:manufacturer>
   <dcc:identifications>
    <dcc:identification refType="mass_setPositionNo">
     <dcc:issuer>manufacturer</dcc:issuer>
     <dcc:value>a2</dcc:value>
    </dcc:identification>
   </dcc:identifications>
  </dcc:item>
 </dcc:items>
</dcc:administrativeData>
<dcc:measurementResults>
 <dcc:measurementResult refId="item1">
 </dcc:measurementResult>
 <dcc:measurementResult refId="item2">
```

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch

```
    <dcc:influenceConditions>
     <dcc:influenceCondition refType="basic_repair">
      <dcc:name>
       <dcc:content lang="en">Calibration before weight piece exchange</dcc:content>
       <dcc:content lang="de">Kalibrierung vor Gewichtsstückaustausch</dcc:content>
      </dcc:name>
      <dcc:status>beforeRepair</dcc:status>
     </dcc:influenceCondition>
    </dcc:influenceConditions>
   </dcc:measurementResult>
   <dcc:measurementResult refId="item3">
    <dcc:influenceConditions>
     <dcc:influenceCondition refType="basic_repair">
      <dcc:name>
       <dcc:content lang="en">Calibration after weight piece exchange</dcc:content>
       <dcc:content lang="de">Kalibrierung nach Gewichtsstückaustausch</dcc:content>
      </dcc:name>
      <dcc:status>afterRepair</dcc:status>
     </dcc:influenceCondition>
    </dcc:influenceConditions>
   </dcc:measurementResult>
  </dcc:measurementResults>
```

5.3.21 repeatabilityMeasurement

Definition note - Deutsch: Messung der Wiederholpräzision

Definition note - English: Measurement of the measurement repeatability

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
Quelle:	Bibliographic note	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015) 5.1	EURAMET Calibration Guide No. 18 Version 4.0 (11/2015) 5.1
HINWEIS:	Scope note	Für mehr Informationen zur Verwendung siehe Abschnitt 3.2.7.1 in DKD-E 7-3	For more information on use see section 3.2.7.1 in DKD-E 7-3
ELEMENT:	Related Term	dcc:result	dcc:result
BEISPIEL:	Example note		

```
<dcc:result refType="NAWI_repeatabilityMeasurement">
 <dcc:name>
  <dcc:content lang="en">Repeatability measurement</dcc:content>
 </dcc:name>
 <dcc:data>
  <!--Content omitted for clarity-->
 </dcc:data>
</dcc:result>
```

5.3.22 resolutionOfDisplayingDevice

Definition note - Deutsch: Auflösung eines visuell anzeigenden Messgeräts (Teilungswert *d*)

Definition note - English: smallest difference between displayed indications that can be meaningfully distinguished (Actual Scale Interval *d*)

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_

Element	Element in TemaTres	Beschreibung Deutsch	Beschreibung englisch
		(basic_ vorgeschlagen)	(basic_proposed)
Quelle:	Bibliographic note	Deutsch-Englische Fassung des ISO/IEC-Leitfaden 99:2007 (3. Auflage) 4.15	ICGM 200:2012 (VIM) 4.15
HINWEIS 1:	Scope note (1)	Dieser refType kennzeichnet generell eine Auflösung (Teilungswert) *d*_ - ob es sich dabei um einen nominellen Wert oder einen während der Kalibrierung tatsächlich vorliegenden Wert handelt, ergibt sich aus dem Kontext, siehe GoodPractice bzgl. der Kennzeichnung nomineller und tatsächlich kalibrierter Bereiche.	This refType generally denotes a resolution (actual scale interval) *d* - whether this is a nominal value or a value actually present during calibration is determined by the context, see GoodPractice regarding the denoting of nominal and actually calibrated ranges.
HINWEIS 2:	Scope note (2)	Für mehr Informationen zur Verwendung siehe Abschnitt 3.1.1.2 in DKD-E 7-3	For more information on use see section 3.1.1.2 in DKD-E 7-3
ELEMENT:	Related Term	dcc:itemQuantity	dcc:itemQuantity
BEISPIEL:	Example note	<dcc:itemQuantity refType="NAWI_resolutionOfDisplayingDevice"> <dcc:name> <dcc:content lang="en">Resolution/Actual Scale Interval</dcc:content> </dcc:name> <si:real> <si:value>0.00000001</si:value> <si:unit>\kilogram</si:unit> </si:real> </dcc:itemQuantity>	

5.3.23 standardDeviationSample

Definition note - Deutsch: Standardabweichung aus einer Stichprobe von (Mess-)Werten

Definition note - English: standard deviation of a sample of measurement results/values

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	math_ (vorgeschlagen)	math_ (proposed)
HINWEIS 1:	Scope note (1)	Die Standardabweichung ist die positive Quadratwurzel der Varianz.	The standard deviation is the positive square root of the variance.
HINWEIS 2:	Scope note (2)	Für die Standardabweichung einer Stichprobe ist "*n*-1" als Divisor zu benutzen.	For the standard deviation of a sample, the divisor "*n*-1" has to be used.
ELEMENT:	Related Term	dcc:quantity	dcc:quantity
BEISPIEL:	Example note	<dcc:quantity refType="NAWI_standardDeviationSample"> <dcc:description> <dcc:content lang="en">Standard deviation of the repeatability measurement </dcc:content> </dcc:description> <si:real> <si:value>0.000000011</si:value> <si:unit>\kilogram</si:unit> </si:real> </dcc:quantity>	

5.3.24 standardDeviationPopulation

Definition note - Deutsch: Standardabweichung einer Grundgesamtheit von (Mess-)Werten

Definition note - English: standard deviation of a population of measurement results/values

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	math_ (vorgeschlagen)	math_ (proposed)
HINWEIS 1:	Scope note (1)	Die Standardabweichung ist die positive Quadratwurzel der Varianz.	The standard deviation is the positive square root of the variance.
HINWEIS 2:	Scope note (2)	Für die Standardabweichung einer Grundgesamtheit ist "*n*" als Divisor zu benutzen.	For the standard deviation of a population, the divisor "*n*" has to be used.
ELEMENT:	Related Term	dcc:quantity	dcc:quantity
BEISPIEL:	Example note	<dcc:quantity refType="NAWI_standardDeviationPopulation"> <dcc:description> <dcc:content lang="en">Standard deviation of a population of measurement values</dcc:content> </dcc:description> <si:real> <si:value>0.000000011</si:value> <si:unit>\kilogram</si:unit> </si:real> </dcc:quantity>	

5.3.25 verificationScaleInterval

Definition note - Deutsch: Eichwert *e*

Definition note - English: Verification Scale Interval *e*

Element	Element in TemaTres	Beschreibung deutsch	Beschreibung englisch
PRÄFIX:	Broader Term	NAWI_	NAWI_
Quelle:	Bibliographic note	OIML R76-1:2006, T.3.2.3	OIML R76-1:2006, T.3.2.3
HINWEIS:	Scope note	Obwohl der Eichwert üblicherweise für Kalibrierungen irrelevant ist, wird er oftmals auf Kalibrierscheinen zugelassener Waagen mit angegeben.	Although the verification scale interval usually is not relevant for calibrations, it is often documented on calibration certificates of type-approved weighing instruments
HINWEIS 2:	Scope note (2)	Für mehr Informationen zur Verwendung siehe Abschnitt 3.1.1.2 in DKD-E 7-3	For more information on use see section 3.1.1.2 in DKD-E 7-3
ELEMENT:	Related Term	dcc:itemQuantity	dcc:itemQuantity
BEISPIEL:	Example note	<dcc:itemQuantity refType="NAWI_verificationScaleInterval"> <dcc:name> <dcc:content lang="en">Verification Scale Interval</dcc:content> </dcc:name> <si:real> <si:value>0.000001</si:value> <si:unit>\kilogram</si:unit> </si:real> </dcc:itemQuantity>	

6 Guidance on reading information from a DCC for a NAWI

In addition to creating a digital calibration certificate, reading it also presents a challenge. The principles described in this report are intended to enable clear addressing of information. This is illustrated in the following examples. XSLT has been used for all examples; an equivalent procedure is of course also possible in other programming languages. Other solutions with the same result are also possible for all examples.

6.1 Date of calibration

This is a single entry in the format YYYY-MM-DD in the DCC.

Procedure:

1. Go to dcc:endPerformanceDate
2. Output value

XSLT example:

```
<xsl:value-of select="//dcc:endPerformanceDate"/>
```

6.2 Issuing date of the calibration certificate

This is a single entry in the format YYYY-MM-DD in the DCC.

Procedure:

1. Go to dcc:issueDate
2. Output value

XSLT example:

```
<xsl:value-of select="//dcc:issueDate"/>
```

6.3 Standard deviations of all repeatability measurements

The repeatability measurements are stored as dcc:result entries with refType NAWI_repeatabilityMeasurement. Therein, the standard deviations are stored as dcc:quantity entries with refType math_standardDeviationSample. The elements themselves contain sub-elements that must be addressed individually. This is not considered here.

6.3.1 Standard deviations

Procedure:

1. Search (first) dcc:result element with refType=”NAWI_repeatabilityMeasurement”
2. Go to (first) dcc:quantity element with refType=“math_standardDeviationSample”
3. Output value
4. Start again with 2. and search for next dcc:quantity element with refType=”math_standardDeviationSample”
5. Start again with 1. and search for next dcc:result element with refType=”NAWI_repeatabilityMeasurement”

XSLT example:

```
<xsl:for-each select="//dcc:result[@refType='NAWI_repeatabilityMeasurement']">
 <xsl:for-each select="//dcc:quantity[@refType='math_standardDeviationSample']">
  <p>
   <xsl:value-of select="dcc:data/dcc:list/dcc:quantity[@refType='math_standardDeviationSample']"/>
  </p>
 </xsl:for-each>
</xsl:for-each>
```

6.3.2 Standard deviations together with respective nominal test loads

The nominal values of the test loads are stored in dcc:quantity elements with a refType="basic_nominalValue" on the same hierarchy level as the standard deviation.

Procedure:

1. Search (first) dcc:result element with refType="NAWI_repeatabilityMeasurement"
2. Within this dcc:result element, go to (first) element with refType="basic_nominalValue"
3. Output value
4. Go to element with refType="math_standardDeviationSample"
5. Output value
6. Start again with 2. And search for next element with refType="basic_nominalValue"
7. Start again with 1. and search for next dcc:result with refType="NAWI_repeatabilityMeasurement"

XSLT example:

```
<table>
 <tr>
  <th>Nominal Value of the test load</th>
  <th>Standard deviation determined</th>
 </tr>
 <xsl:for-each select="//dcc:result[@refType='NAWI_repeatabilityMeasurement']">
  <xsl:for-each select="*[@refType='basic_nominalValue']">
   <tr>
    <td>
     <xsl:value-of select="dcc:data/dcc:list/dcc:quantity[@refType='basic_nominalValue']"/>
    </td>
    <td>
     <xsl:value-of select="dcc:data/dcc:list/dcc:quantity[@refType='math_standardDeviationSample']"/>
    </td>
   </tr>
  </xsl:for-each>
 </xsl:for-each>
</table>
```

6.4 List of ranges (nominal ranges, calibrated ranges, test loads)

The nominal measurement ranges are stored as dcc:item in the dcc:subItems element of the weight. The validity range is stored in dcc:statement. The error of indication is stored in the associated dcc:measurementResult. The results are available as si:real with several sub-elements that must be addressed individually. This is not considered here.

Procedure:

1. Find first listed range (dcc:subItems/dcc:item with refType=”range…”)
2. Note (down) id of the range
3. Go to elements within range with refType=”math_minimum” and refType=”math_maximum”
4. Output both values
5. Search dcc:statement with the same range-id and refType=”basic_validityRange”
6. Go to elements with refType=”math_minimum” and refType=”math_maximum”
7. Output both values
8. Search dcc:measurementResult with matching refId=id
9. Search dcc:result with refType=”NAWI_errorOfIndicationMeasurement”
10. Go to quantity with refType=”basic_referenceValue”
11. Output value of the corresponding si:realListXMLList

XSLT example:

```
<xsl:for-each select="//dcc:subItems/dcc:item">
  <xsl:variable name="id" select="@id"/>
  <p>
    <xsl:value-of select="@id"/> (<xsl:value-of select="dcc:name"/>)
  </p>
  <table>
    <xsl:if test="contains(@refType,'range')">
      <tr>
        <td>Nominal range (minimum, maximum):</td>
        <td><xsl:value-of select="dcc:itemQuantities/dcc:itemQuantity[@refType='math_minimum']"/></td>
        <td><xsl:value-of select="dcc:itemQuantities/dcc:itemQuantity[@refType='math_maximum']"/></td>
      </tr>
    </xsl:if>
    <xsl:if test="//dcc:statement[(@refId=$id) and (@refType='basic_validityRange')]">
      <tr>
        <td>Calibrated range (minimum, maximum):</td>
        <td><xsl:value-of select="//dcc:statement[(@refId=$id) and
(@refType='basic_validityRange')]/dcc:data/dcc:quantity[@refType='math_minimum']/si:real"/>
        </td>
        <td><xsl:value-of select="//dcc:statement[(@refId=$id) and
(@refType='basic_validityRange')]/dcc:data/dcc:quantity[@refType='math_maximum']/si:real"/>
        </td>
      </tr>
    </xsl:if>
    <xsl:if test="//dcc:measurementResult[@refId=$id]/dcc:results/dcc:result[@refType='NAWI_errorOfIndicationMeasurement']">
      <tr>
        <td>Test loads:</td>
        <td colspan="2"><xsl:value-of
select="//dcc:measurementResult[@refId=$id]/dcc:results/dcc:result[@refType='NAWI_errorOfIndicationMeasurement']/dcc:data
/dcc:list/dcc:quantity[@refType='basic_referenceValue']/si:realListXMLList"/>
        </td>
      </tr>
    </xsl:if>
  </table>
</xsl:for-each>
```

7 Bibliography

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8 Revision history

Revision	Date	Changes
0	03/2025	First version

Appendix A Example of a digital calibration certificate for a single range balance with two measurements (before/after adjustment)

The example matches the example given in Annex H1 of EURAMET cg-18, concerning the instrument and the results (Option 1 for both measurements).

Maximum capacity Max=220 g
Scale interval *d*=0.1 mg

Note: According to the example in H1.2/B, the measurements of repeatability and eccentricity have not been performed after adjustment and are thus not denoted in the second dcc:measurementResult block.

The DCC Examples are attached to this PDF and can usually be accessed via clicking on the paperclip symbol:

Additionally, they can be found via the following links:

Example Appendix A: https://doi.org/10.7795/550.20250326
Example Appendix B: https://doi.org/10.7795/550.20250327
Example Appendix C: https://doi.org/10.7795/550.20250328

Or via the DKD website: https://www.ptb.de/cms/en/metrological-services/dkd/dkd-dcc.html

Appendix B Example of a digital calibration certificate for a multiple range balance

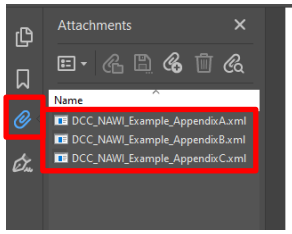
The example comprises a multiple range balance with two ranges:
Max=600 g / 6200 g
d=0.01 g / 0.1 g

The example comprises the following aspects:

- The second range was calibrated only up to 5 kg
- Repeatability was measured at 500 g (range 1)
- Eccentricity was measured at 2 kg (range 2)

The temperature was 21 °C with an expanded uncertainty of 1 °C.

The DCC Examples are attached to this PDF and can usually be accessed via clicking on the paperclip symbol:



DKD
Instructions on how to use the DCC schema to create a digital calibration certificate for non-automatic weighing instruments
https://doi.org/10.7795/550.20250325

Additionally, they can be found via the following links:

Example Appendix A: https://doi.org/10.7795/550.20250326
Example Appendix B: https://doi.org/10.7795/550.20250327
Example Appendix C: https://doi.org/10.7795/550.20250328

Or via the DKD website: https://www.ptb.de/cms/en/metrological-services/dkd/dkd-dcc.html

Appendix C Example of a digital calibration certificate for a multi-interval balance consisting of two identifiable parts (indicator and platform)

The example matches the example of a multi-interval instrument given in Annex H2 of EURAMET cg-18, concerning the instrument and the results (Option 1 for both measurements).

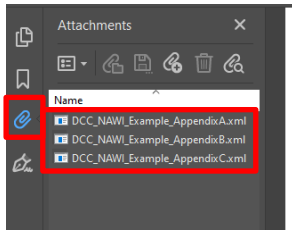
Maximum capacity Max = 12000 g | 30000 g | 60000 g
Scale interval *d* = 2 g | 5 g | 10 g

The example comprises the following aspects:

- Repeatability was measured at 10 kg (partial range 1) and 25 kg (partial range 2)
- Eccentricity was measured at 20 kg (partial range 2)
- A modular instrument consisting of an indicator and a platform was chosen

---

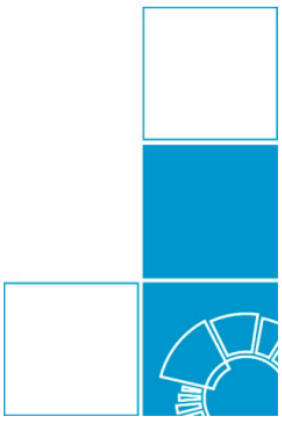
The DCC Examples are attached to this PDF and can usually be accessed via clicking on the paperclip symbol:



Additionally, they can be found via the following links:

Example Appendix A: https://doi.org/10.7795/550.20250326
Example Appendix B: https://doi.org/10.7795/550.20250327
Example Appendix C: https://doi.org/10.7795/550.20250328

Or via the DKD website: https://www.ptb.de/cms/en/metrological-services/dkd/dkd-dcc.html



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38116 Braunschweig

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