

Calibration Guidelines, Expert Reports, Technical Reports

Thermometry

Reference	Title	Title (original)	Available in
DKD-R 5-1	Calibration of Resistance Thermometers https://doi.org/10.7795/550.20231207	Kalibrierung von Widerstandsthermometern https://doi.org/10.7795/550.20231130	de, en, es, ru
DKD-R 5-3	Calibration of thermocouples	Kalibrierung von Thermoelementen https://doi.org/10.7795/550.20180828AD	de
DKD-R 5-4	Calibration of temperature block calibrators	Kalibrierung von Temperatur-Blockkalibratoren https://doi.org/10.7795/550.20180828AE	de, es
DKD-R 5-5	Calibration of temperature-indicating devices and simulators by electrical simulation and measurement	Kalibrierung von Temperaturanzeegeräten und -simulatoren durch elektrische Simulation und Messung https://doi.org/10.7795/550.20180828AF	de
DKD-R 5-6	Determination of thermometer characteristics https://doi.org/10.7795/550.20180828AGEN	Bestimmung von Thermometerkennlinien https://doi.org/10.7795/550.20200610	de, en
DKD-R 5-7	Calibration of climatic chambers https://doi.org/10.7795/550.20250403	Kalibrierung von Klimaschränken http://doi.org/10.7795/550.20180828AH	de, en
DKD-R 5-8	Calibration of hygrometers for the direct measurement of relative humidity https://doi.org/10.7795/550.20190214EN	Kalibrierung von Hygrometern zur direkten Erfassung der relativen Feuchte https://doi.org/10.7795/550.20190214	de, en, es
DKD-E 5-1	Additions to guidelines DKD-R 5-1:2018, DKD-R 5-3:2018 and DKD-R-5-4:2018, General recommendations on comparisons https://doi.org/10.7795/550.20220610	Ergänzungen zu den Richtlinien DKD-R 5-1:2018, DKD-R 5-3:2018 und DKD-R 5-4:2018, Allgemeine Empfehlungen und Empfehlungen zu Vergleichen https://doi.org/10.7795/550.20220502	de, en
DKD-E 5-2	Calibration of dew point hygrometers with gas temperature measurement for relative humidity https://doi.org/10.7795/550.20250318	Kalibrierung von Taupunktspiegel-Hygrometern mit Gastemperaturmessung auf relative Feuchte https://doi.org/10.7795/550.20250123	de, en

Calibration Guidelines:

DKD calibration guidelines (DKD-R) are application documents that meet the requirements of DIN EN ISO/IEC 17025. The guidelines contain a description of technical, process-related and organizational procedures used by accredited calibration laboratories as a model for defining internal processes and regulations. DKD guidelines may become an essential component of the quality management manuals of calibration laboratories. The implementation of the guidelines promotes equal treatment of the equipment to be calibrated in the various calibration laboratories and improves the continuity and verifiability of the work of the calibration laboratories. In addition, the implementation of the guidelines allows the state of the art in the respective field to be incorporated into laboratory practice.

Expert Reports:

DKD expert reports (DKD-E) 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.

Download of DKD documents: <https://www.ptb.de/cms/nc/en/metrological-services/dkd/publications.html>

Last update: JAN 2026

Annex – Abstracts

DKD-R 5-1	<p>Calibration of Resistance Thermometers</p> <p>This guideline was prepared to fulfil the need for a guide in the form of a general document dealing with the calibration of resistance thermometers. It applies above all to platinum resistance thermometers complying with the requirements of the standard DIN EN 60751 and covering the temperature range from -200 °C to 850 °C.</p> <p>It is also valid for all categories of resistance thermometers among which the following are of particular importance:</p> <ul style="list-style-type: none"> • resistance thermometers from spectrally pure platinum meeting the requirements of the ITS-90 (temperature range -259 °C to 962 °C) • nickel resistance thermometers • copper resistance thermometers • semiconductor resistance thermometers (thermistors, NTCs, PTCs) <p>Furthermore, the guideline is applicable to:</p> <ul style="list-style-type: none"> • direct-indicating electrical thermometers with resistance sensor • resistance thermometers with measuring transducer, the output signal of the latter being either analogue or digital standardized signals • data loggers with an electrical resistance thermometer as sensor.
DKD-R 5-3	<p>Calibration of thermocouples</p> <p>This guideline describes the calibration of thermocouples. It applies primarily to standardised thermocouples in accordance with the reference tables for emf and temperature given in DIN EN 60584-1: 19962, covering a temperature range between -200 °C and +1600 °C, with the calibrations being carried out with reference to the 1990 International Temperature Scale (ITS-90). Although the majority of the aspects covered by this guideline may also be applicable to other "non-standard" thermocouples, there might be other important considerations outside the scope of these guidelines that need to be considered.</p>
DKD-R 5-4	<p>Calibration of temperature block calibrators</p> <p>This guideline applies to dry-block temperature calibrators. It should be mentioned that in the relevant documents (data sheets, instructions, etc.) or on the websites of the various companies or of some institutes, other terms are also used to refer to this type of instrument (e.g., dry block furnace, dry block temperature calibrator, dry block temperature calibrator, dry well temperature calibrator, dry furnace calibrator, dry block temperature calibrator, thermostatic furnace for temperature calibration, etc.).</p> <p>In this type of instrument, an adjustable temperature is generated inside a solid block for the purpose of calibrating thermometers in its bore holes. A dry block type temperature calibrator consists at least of a solid block, a block temperature control device, and a thermometer for determining the block temperature with its respective indicator. The above components form a compact unit (i.e., they are integrated into one single instrument) - if this is not the case, it must be possible to clearly allocate them to each other. The guideline is valid for a temperature range of -80 °C to +1300 °C; however, the temperature ranges specified by the manufacturer must not be exceeded.</p>

DKD-R 5-5	<p>Calibration of temperature-indicating devices and simulators by electrical simulation and measurement</p> <p>This guideline applies to the calibration of temperature indicating devices and temperature simulators by electrical simulation and measurement, namely for temperature indicators and temperature simulators intended for use with resistance thermometers or standardised thermocouples as well as simulators which reproduce the electrical output quantities of resistance thermometers or standardised thermocouples. Indicating devices and simulators for thermocouples may be designed with or without reference (cold) junction compensation. Under normal operating conditions, temperature indicators are used together with a temperature sensor to measure temperature. Calibration by electrical simulation, as described in this document, only confirms the accuracy of the temperature indicator itself. It does not take into account the metrological performance of the temperature sensors subsequently used together with the indicator.</p>
DKD-R 5-6	<p>Determination of thermometer characteristics</p> <p>This guideline defines generally valid procedures for the approximation of the characteristic curves of industrially used thermometers in order to create a uniform and industry-wide basis for the surveillance of test equipment. Likewise, the user of this guideline shall be given instructions regarding the handling of approximation equations as well as the performance of the actual approximation.</p> <p>Basically, this guideline is valid for all thermometers. However, it is especially tailored to the requirements of platinum resistance thermometers (especially Pt-100), thermocouples and thermistors. As these instruments have very different measurement uncertainties, depending on the type of sensor and temperature range, the guideline has been designed for different requirements related to the measurement uncertainty.</p> <p>This guideline is not intended to develop or prescribe newer or better approximation methods or characteristic curve types than those currently in use. It rather seeks to recommend the optimum type(s) of characteristic for certain boundary conditions – such as temperature range and required measurement uncertainty – which are state of the art today. These recommendations are compatible with existing software and measuring instruments and can be easily entered or integrated.</p>
DKD-R 5-7	<p>Calibration of climatic chambers</p> <p>This guideline lays down the minimum requirements for the calibration procedure and the determination of the measurement uncertainty in the calibration of climatic chambers. It is applicable to the calibration of climatic chambers for gas temperature and relative gas humidity or only for gas temperature. In the context of this guideline, gas humidity is understood to mean gaseous material systems consisting exclusively of the components water and carrier gas. The scope of the guideline covers the carrier gases air and nitrogen. For other carrier gases proof of validation is required.</p> <p>This guideline also applies to the calibration of individual measuring locations in climatic chambers; in this case, the calibration is not valid for the entire climatic chamber.</p>
DKD-R 5-8	<p>Calibration of hygrometers for the direct measurement of relative humidity</p> <p>This guideline defines minimum requirements for the reference standard, calibration equipment, calibration procedure and the estimation of the measurement uncertainty in the calibration of hygrometers. It applies to calibration devices with direct measurement of relative humidity by means of resistive, capacitive, resistive-electrolytic as well as mechanical sensor elements. In this guideline, the term gas humidity refers to gaseous substance systems consisting of the components water and carrier gas. The guideline applies to the carrier gases air and nitrogen. For other carrier gases, the application of the guideline still is to be assessed.</p> <p>If the calibration of the gas temperature is required in addition to the humidity calibration, the guidelines DKD-R 5-1 or DKD-R 5-3 apply to the temperature calibrations. The selection of the guideline depends on the sensor element.</p>

<p>DKD-E 5-1</p>	<p>Additions to guidelines DKD-R 5-1:2018, DKD-R 5-3:2018 and DKD-R-5-4:2018, General recommendations on comparisons</p> <p>This expert report provides guidance to calibration laboratories on various topics in the field of thermodynamic measurands. Although these topics have already been discussed within DKD's Technical Committee Temperature and Humidity as well as in the DKD Guidelines, binding regulations have not yet been established. Hence, this report aims to ensure adaptation to the international state of the art as well as a consistent approach to strengthen the competence of the accredited calibration laboratories. The following chapters provide supplementary information and recommendations regarding the calibration of resistance thermometers according to DKD-R 5-1, the calibration of thermocouples according to DKD-R 5-3 as well as the recalibration intervals of reference standards and the axial temperature distribution in block calibrators (DKD-R 5-4). Another essential point is the subject of comparison measurements. The report offers recommendation concerning the documentation of proficiency testing / comparison measurements presenting a result indicator by which the significance of comparison measurements can be uniformly assessed.</p>
<p>DKD-E 5-2</p>	<p>Calibration of dew point hygrometers with gas temperature measurement for relative humidity</p> <p>The aim of this expert report outlines the technical conditions for the calibration of dew point hygrometers with connected temperature sensors with regard to the measurand relative humidity and thus to create a uniform approach among calibration laboratories, technical assessors and users. All symbols and formula symbols are used in analogy to the definition in DKD-R 5-8:2019. The report addresses specifically accredited calibration laboratories or calibration laboratories in the process of accreditation.</p>