
**Guideline Calibration of Measuring
DKD-R 6-2 Devices for Vacuum
Part 1 Fundamentals**

Published by the Accreditation Body of the Deutscher Kalibrierdienst (DKD) at the Physikalisch-Technische Bundesanstalt in co-operation with its Technical Committee "Pressure and Vacuum".

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Calibrations carried out by DKD laboratories ensure that the user may rely on measurement results. They increase the customers' confidence and competitiveness on the national and international markets and serve as a metrological basis for the inspection of measuring and test equipment within the framework of quality assurance measures.

Calibrations offered by the DKD cover electrical measurands, length, angles and other geometrical quantities, roughness, coordinate and form measuring techniques, time and frequency, force, torque, acceleration, pressure, flowrate, temperature, humidity, medical measurands, acoustic measurands, optical measurands, ionizing radiation and other measurands.

Publications: see Internet

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Foreword

DKD Guidelines are application documents for the general criteria and procedures which are laid down in DIN EN ISO/IEC 17025 and DKD publications. The DKD Guidelines describe technical and organizational processes serving the calibration laboratories as a model for laying down internal procedures and regulations. DKD Guidelines can become an integral part of quality manuals of calibration laboratories. The application of the Guidelines supports equal treatment of the devices to be calibrated at the different calibration laboratories and improves the continuity and verifiability of the work of the calibration laboratories.

The DKD Guidelines will not impede the further development of calibration procedures and sequences. Deviations from guidelines and new methods are permitted in agreement with the Accreditation Body if they are justified by technical aspects.

The present Guideline was prepared by the Technical Committee "Pressure and Vacuum" in co-operation with the PTB and adopted by the Advisory Board of the DKD. With its publication it is binding for all DKD calibration laboratories unless separate procedural instructions approved by the Accreditation Body are available.

This document is a translation of the German Guideline R 6-2. In case of any disputes the respective German version is binding.

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1 Purpose of the Guideline

In the Deutscher Kalibrierdienst (DKD), laboratories are accredited for the calibration of pressure measuring devices according to DIN ISO 17025. In the quality manual to be submitted, details of the kind of traceability of the measuring equipment to national standards, the calibration methods and the measurement uncertainty budget must be stated.

This Guideline specifies the minimum requirements to be placed on the calibration of the measuring devices. It does not replace the necessary working instructions for DKD calibrations. The individual parts of this Guideline contain details of the calibration of different kinds of vacuum gauges.

2 Scope of application

This Guideline is applicable to the calibration of reference standards, working standards and measuring devices for vacuum.

3 Terms, definitions

In the individual parts of this Guideline the relevant metrological characteristics and terms will be explained only if such explanations are not given in the standards applicable or the International Vocabulary of Basic and General Terms in Metrology. References to the relevant normative documents are to be taken from the part of this Guideline relating to the measuring device in question. Unless expressly stated otherwise, the pressures stated are absolute pressures.

4 Structure of the calibration guideline

This Guideline is subdivided as follows:

- Part 1 Fundamentals
- Part 2 Measurement uncertainties
- Part 3 Diaphragm gauge
- Part 4 Ionization gauge
- Part 5 Pirani gauge

Parts 3, 4 and 5 of this Guideline are structured as follows:

- 1 Scope of application
- 2 Pressure range
- 3 Standards and measuring facilities
- 4 Calibration item
- 5 Calibratability
- 6 Adjustment of calibration item
- 7 Ambient conditions
- 8 Calibration method
- 9 Performance of calibration
- 10 Evaluation, calibration result
- Annex A
- Annex B

5 Technical requirements generally valid

5.1 Metrological traceability

Within a quality system the metrological traceability of the quality-relevant measuring (testing) devices to the SI units is to be properly ensured and demonstrated. The traceability chain thus formed must be complete up to and including the measuring devices used in production. This means that it is presupposed that the calibration facilities referred to in sections 3 of the individual parts of this Guideline (standards / standard measuring devices) have been traced back to national standards (see also DKD-4 and DIN ISO 10012-1).

5.2 Ambient conditions

The temperature requirements to be complied with for the devices used and the ambient conditions are defined in the individual parts of this Guideline in accordance with the different procedures.

Temperature variations and gradients influencing the calibration result are to be allowed for in the uncertainty budget.

5.3 Calibratability

On the basis of the general condition of the measuring device it must first be decided whether the device can be calibrated. For this decision function-specific and metrological criteria are taken into account.

5.4 Calibration methods, scope of calibration

The calibration methods are described in sections 8 of the individual parts of this Guideline. Where appropriate, an accreditation can also relate to modified or basically different methods provided they meet the metrological requirements. The determination of the characteristics is based on the scopes of calibration fixed in the respective part of the Guideline. In dependence on the intended use of the calibration item (application, tolerances, measurement uncertainty, etc.), different scopes can be stated. It is basically possible to calibrate measuring devices only in parts of the range of measurement or only in selected ranges. In the partial calibration the minimum scope specified in the Guideline must in any case be complied with.

5.5 Measurement uncertainty

The uncertainty components with computation examples for the different vacuum gauges are described in sections 10 of the individual parts of the Guideline.

The measurement uncertainty is stated in accordance with DKD-3 (German translation of EA-4/02).

5.6 Documentation

The calibration results are documented in accordance with Guideline DKD-5.

6 Standards cited and other documents

DIN EN ISO/IEC 17025	General criteria for the operation of testing laboratories
DIN EN ISO 9000	Standards for quality management and for quality assurance/ presentation of quality management
DIN ISO 10 012-1	Requirements for quality assurance for measuring devices; certifi- cation system for measuring devices
DKD-3	Expression of the measurement uncertainty in calibrations
DKD-4	Traceability of measuring and testing devices to national standards
DKD-5	Instructions for issuing a DKD Calibration Certificate
DKD-R 6-1	Calibration of pressure gauges
ISO/IEC Guide 25	General requirements for the competence of calibration and testing laboratories
VIM	International Vocabulary of Basic and General Terms in Metrology
GUM	Guide to the Expression of Uncertainty in measurement
DIN 1319-1	Fundamentals of metrology. Basic terms
DIN 1319-3	Fundamentals of metrology. Evaluation of measurements of an individual measurand; measurement uncertainty
DIN 1319-4	Fundamentals of metrology. Evaluation of measurements; meas- urement uncertainty
DIN 28400 parts 1 and 3	Vacuum technique
DIN 28418 parts 1, 2 and 3	Standard methods for the calibration of vacuum gauges
ISO/CD 3567	Vacuum gauges – calibration by direct comparison with a refer- ence gauge