

Use for Industry

The large gear standard is suited for the quantification and validation of gear measurements within National Metrology Institutes, calibration laboratories as well as industry. Representing three different involute gearings it allows a comprehensive evaluation of the measurement process. The product-like design of the standard is particularly advantageous for industrial use. It facilitates high-precision measurements on gear measuring instruments as well as coordinate measuring machines with or without the use of a rotary table. With its compact shape, transport hooks and isostatic three-point bearing easy transportability and handling are ensured. The massive construction minimizes elastic deformations. Thermal loading, as prevailing in close-to-production environments, will be effectively subdued by the gold coating.



Measurement of the standard on a CMM

The large gear standard will be used for national and international intercomparisons. Additionally, with PTB's large gear standard the prerequisite for accreditations in the field of large gears via the DAkkS (Deutsche Akkreditierungsstelle / German accreditation institute) has been provided.

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Large Gear Standard for Industry



PTB

Large Gears in Industry



Fields of application of large gears, e. g. wind power facilities, mineral oil conveyance, ship driving mechanisms

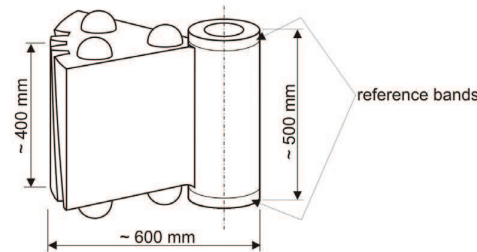
Large gears have become an indispensable part of modern engineering. Growing branches of industry – such as, for example, wind power facilities, shipbuilding and mineral oil conveying plants – are based on the use of large gears. Gear efficiency, noise emission and service life depend decisively on the quality of the gears used.

For example, up to accuracy class 3, tolerances below $10\ \mu\text{m}$ are required for a 1 m gear. This is why quality assurance has become particularly important in this field. Suitable standards, which allow the traceability of these measurements to be ensured and, thus, the quality of the measurement to be assessed by means of a task-specific measurement uncertainty have not been available so far.

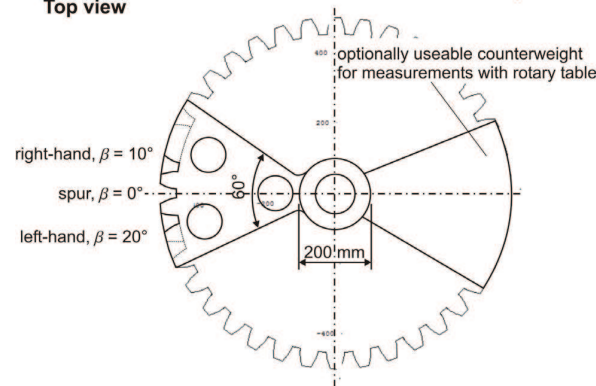
The Large Gear Standard

The large gear standard which has been developed at PTB¹ is a segment of a complete gear. This special design allows the standard to realize a large gear of 1 m in diameter which can at the same time just be calibrated on the established measuring devices at PTB. The standard can be used for both profile measurements and helix measurements. Different helix angles and hands of helices allow the standard to be universally used.

3D view



Top view



Drafts of PTB's large gear standard

Parameter	Description
Gear type	external
Number of teeth z	38
Normal module m_n	25 mm
Pressure angle a_n	20°
Face width b	400 mm
Helix angle β / hand	0° / spur 10° / right 20° / left
Outside diameter d_a	1000 mm
Root diameter d_f	905 mm
Material / coefficient of thermal expansion	steel / $11.5\ \mu\text{m}/\text{K}/\text{m}$
Weight (incl. counterweight)	450 kg (700 kg)
Reference bands form deviation	200 mm $1\ \mu\text{m}$

Gear data and parameter

For measurements with rotary tables, the removable counterweight allows a uniform weight distribution.

The measurement of large components is decisively influenced by the thermal ambient conditions and the workpiece temperature. For the reduction of this uncertainty contribution, it is indispensable to know the exact workpiece temperature during a measurement. To decrease the influence of the thermal radiation on the standard and to allow – if and when required – a thermographic determination of the workpiece temperature over the whole area, the standard was coated with gold. The functional areas were spared.

¹The respective activities were performed within the scope of the European Metrology Research Programme