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# Traceable Calibration of Master Gears at PTB

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## TECHNICAL PAPER

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[The statements and opinions contained herein are those of the author and should not be construed as an official action or opinion of the American Gear Manufacturers Association.]

## Abstract

The PTB (Physikalisch-Technische Bundesanstalt) is able to measure (calibrate) master gears for industry traceable to national gear standards and in compliance with the International System of Units (SI).

For this purpose primary gear standards and standard measuring devices for the reference values  $F_\alpha$ ,  $F_\beta$ ,  $F_\rho$  (total profile deviation, total helix deviation, total cumulative pitch deviation) being available.

To calibrate the master gears of industry, PTB mostly uses coordinate measuring machines (CMMs) which are traceable by instrument-specific calibration methods. In addition, with the aid of the PTB's primary standards, a task specific uncertainty of measurement is determined for all gearing calibrations carried out for industry, which is taken into account as correction value when the transfer measurement uncertainty is stated.

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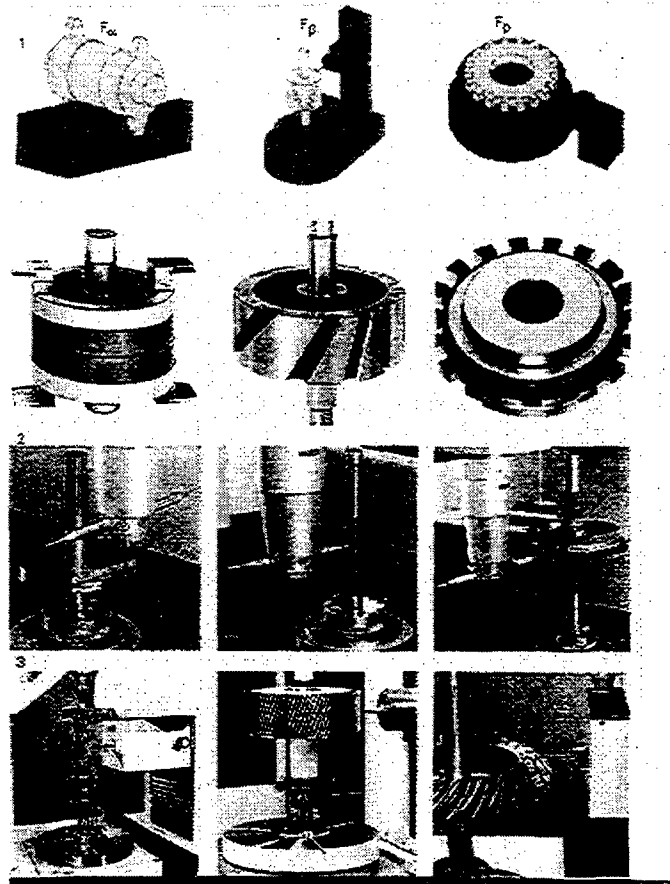
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## 1 Introduction

The Physikalisch-Technische Bundesanstalt (PTB) is Germany's national metrology institute whose main task consists in ensuring, the realization and dissemination of the SI base units on a high technical level. Furthermore, when required, the physical quantities derived from the seven SI base units, such as the geometrical measurands derived from the base unit of metre - diameter, straightness, roundness, involute, pitch -, are also realized at the PTB through measurement standards or standard devices. The PTB standard devices mainly serve to calibrate the reference standards of the customers, thus proving traceability to national standards. This is in part made within the scope of an accreditation within the Deutscher Kalibrierdienst (DKD = German Calibration Service) in accordance with EN 45000 and ISO/IEC Guide 25.

For about 25 years, the PTB has also created national measurement standards for gear quantities for cylindrical gears and set up the relevant traceability chains. Thus the requirements according to ISO 9000 and following can be met, i.e. the link-up of simple measuring means to national measurement standards is possible via a traceability chain in accordance with the International System of Units (SI). In this contribution, the three highest steps of the traceability chains for  $F_a$ ,  $F_b$  and  $F_p$  (Fig. 1) will be described in more detail. The description of the

Figure 1: Calibration chain for  $F_a$ ,  $F_b$ ,  $F_p$