

JJF

**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Calibration specification for gear measuring centers
(English Translation)**

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Table of Contents

Introduction...	5
1 Scope...	6
2 Normative references...	6
3 Overview...	6
4 Measurement characteristics...	8
4.1 Oblique circular runout of the tip of the main rotary axis...	8
4.2 Coaxiality of the upper tip axis and the main rotary axis...	8

1 Scope

This specification is applicable to the calibration of gear measurement centers that measure gears with a modulus of not less than 0.3 mm and grade 3 and below.

2 Normative references

This specification makes reference to the following documents.

JJF 1059.1 Evaluation and expression of uncertainty in measurement

JJF 1064-2010 Calibration specification for coordinate measuring machine

JJF 1331-2011 Calibration specification for inductive micrometers

ISO 1328-1:2013 Cylindrical gears - ISO system of flank tolerance classification - Part 1. Definitions and allowable values of deviations relevant to flanks of gear teeth

ISO 1328-2:1997 Cylindrical gears - ISO system of accuracy - Part 2.

Definitions and allowable values of deviations relevant to radial composites deviations and runout information

ISO/TR 10064.5:2005 Cylindrical gears - Code of inspection practice - Part

5. Recommendations relative to evaluation of gear measuring instruments

For dated references, only the dated version applies to this specification; for undated references, the latest edition (including all amendments) applies to this specification.

3 Overview

The gear measurement center is an instrument that uses cylindrical or polar coordinate measurement methods and makes measurement in accordance with the electronic

development method. It generally includes three linear coordinate axis X, Y, Z and one rotary coordinate axis C. The working principle is as shown in Figure 1. It consists of mechanical main body, control system, probe unit and computer software. It can measure multiple parameters of gears with one loading. In addition, it can be used for the measurement of workpieces

4.3 Parallelism between the lines from the movement of the

axial guide to the two tips

4.10 Indication error of total accumulative deviation

measurement of pitch

4.12 Indication error of gear radial runout measurement

Note: The indication error of the probe and the indication error of the coordinate axis positioning are supplementary measurements for the large-scale gear measurement center. See Appendix A for details.

Appendix A

Additional measurement of the gear measurement center

When the size of the physical gear standard tool cannot reach 50% of the measurement range of the gear measurement center, it is recommended to increase the measurement of the probe indication error of the instrument and the indication error of the coordinate position.

A.1 Indication error of probe

A.1.1 The probe equipped for the gear measuring center are mostly three-dimensional digital type. For the calibration of the indication error of this type of probe, it may refer to the requirements of clause 7.1 of JJF 1064-2010. The probes shall be distributed as evenly as possible along the standard ball (at least half of the ball is measured), to obtain 25 measurement points, through determining the spherical distance from the 25 measurement points to the center of the least squares fit, EVALUATE the three-dimensional probing error of the probe, which shall not exceed the maximum allowable error provided by the supplier.

A.1.2 If the gear measuring center is equipped with an inductive probe, the calibration of the indication error of this type can refer to the requirements of clause 7.2.6 of JJF 1331-2011. During calibration, USE the measuring block of the smallest size in not less than 3 equivalent measuring block group to align the zero position, USE the measuring block of other sizes to measure the indication error along positive direction; then USE the measuring block of maximum size to align the zero position, USE the measuring block of other sizes to measure the indication error along negative direction, the indication error of

each calibration point is obtained by the formula (A.1).

Where.

r_i - The indication value read by the probe, μm ;

L_i - The actual size of the measuring block used for the calibration point, mm;

L_0 - The actual size of the measuring block aligned to zero, mm.

In the measuring range, the maximum allowable error of the probe is calculated in accordance with formula (A.2).

Where.

s_i - The nominal value of the calibration point, μm ;

I - The range of the calibration point gear, μm .

A.2 Measurement of the indication error of the coordinate position

A.2.1 Within the measurement range allowed by the gear measuring center,

USE the measuring block group of 5 different sizes (or step gauges), MAKE one round-trip calibration for the measuring block group of 5 sizes (of step gauges) at the 3 positions in X, Y, Z and 3 diagonal positions. MEASURE one point at each working end surface of each measuring block, the size measurement value is the distance between the two points along the length direction of the measuring block. CALCULATE the difference between each measurement value and the reference values of the measuring block group (or step gauges), to obtain the indication error E for each dimension measurement.

For the gear measurement center with position compensation function, the position error is compensated and then judged. The indication error shall not exceed the maximum allowable error provided by the manufacturer.

A.2.2 For the gear measurement center using the laser interferometer to

measure the error compensation, the laser interferometer shall be placed as close as possible to the coordinate axis to be measured during calibration. The mirror is firmly mounted near the probe and moved to the limit position of the range along the axis. ADJUST the optical path to meet the measurement requirements, SET the appropriate measurement interval in accordance with the movement range of the coordinate axis, MAKE one round-trip measurement in the range of the entire coordinate axis. The difference between the raster count I' of the instrument and the laser measurement data I is the position error of the axis. For the gear measurement center with position compensation function, the position error is compensated and then judged, the indication error shall not exceed the maximum allowable error provided by the manufacturer.

A.3 Angle positioning error of the main rotatory axis

INSTALL the standard gear between the two peaks of the gear measurement center or the center of the rotary table, SET the measurement starting position on the gear, so that the starting position of the rotary table and the standard gear are sequentially shifted by 45° , each time from the starting position,

MEASURE the pitch accumulative total deviation F_p of the standard gear, to obtain the F_{pi} ($i = 1, 2, \dots, 8$) from 8 positions measured totally, then the angle positioning error of the main rotatory axis is approximated by the formula (A.3).

Pitch circle

Appendix D

Calibration certificate content and inside page format

D.1 The calibration certificate includes at least the following information.

- a) Title. "Calibration certificate";
- b) The name and address of the laboratory;
- c) The location where the calibration is performed (if different from the laboratory address);
- d) The uniqueness identification of the certificate (such as the number), the identification of each page and the total number of pages;
- e) The name and address of the customer;
- f) Description and clear identification of the calibrated object;
- g) The date of calibration, if it is related to the validity and application of the calibration result, the date of receipt of the calibrated object;
- h) If it is relevant to the validity of the calibration result, the sampling procedure of the calibrated sample shall be explained;
- i) The identification of the technical specification on which the calibration is based, including the name and code;
- j) The traceability and validity description of the measurement standards used in this calibration;
- k) The description of the calibration environment;
- l) The description of the calibration results and measurement uncertainty;
- m) The description of the deviation from the calibration specification;
- n) The signature, title or equivalent identification of the certificate or calibration report issuer;