

AMERICAN GEAR MANUFACTURERS ASSOCIATION

*Code of Inspection Practice - Part 5:
Recommendations Relative to Evaluation
of Gear Measuring Instruments*

AGMA ISO 10064-5-A06



AGMA INFORMATION SHEET

(This Information Sheet is NOT an AGMA Standard)

American
Gear
Manufacturers
Association

Code of Inspection Practice - Part 5: Recommendations Relative to Evaluation of Gear Measuring Instruments

AGMA ISO 10064-5-A06

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ABSTRACT

This information sheet provides methods and examples to support the implementation of ANSI/AGMA ISO 18653-A06. It proposes evaluation and calibration procedures for involute, helix, runout, and tooth thickness measurement processes. Methods are given for the evaluation of condition and alignment of instrument elements such as centers, guideways, probe systems, etc. Guidance is given on the application of measurement processes to the inspection of product gears, including fitness for use and the recommended limits for U_{95} uncertainty based upon the accuracy tolerances of product gears to be inspected.

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Contents

Foreword	iv
1 Scope	1
2 Normative references	1
3 Definitions of terms	2
4 Instrument environment	2
5 Measurement system condition	4
6 Artifacts	16
7 Uncertainty estimation guidelines	24
8 Measurement procedures	27
9 Comparator measurement uncertainty estimation examples	29
10 Statistical process control	32
11 Instrument fitness for use	35
12 Measurement process (instrument) correlation	38

Bibliography	62
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Annexes

A Effect of temperature on gears and artifacts	40
B Modified involute, helix, pitch artifact testing	43
C Non-involute pin, ball, or plane (flank) artifact interpretation	49

Tables

1 Recommended guidelines for deviations when checking instrument alignment	5
2 Probe system guidelines	13
3 Gear measurement process uncertainty guidelines	37

Figures

1 Alignment error of the spindle axis and the between-centers axis	5
2 Center runout test	6
3 Tailstock alignment measurement method (vertical axis instruments only) ..	7
4 Tailstock center alignment fixture for horizontal or vertical work spindles	7
5 Z-axis to "between centers" axis alignment verification –axial plane parallel to the measuring (base tangent) plane	8
6 Z-axis to "between centers" axis alignment verification – perpendicular to measuring plane	8
7 Position of the base tangent slide during the deflection tests (+ maximum length of roll for the verified measuring volume)	9
8 CMM volumetric tests	10
9 Ball plate tests	11
10 Rotary table tests	11
11 Gaging system gain	13
12 LVDT system linearity	14
13 Linearity with step gauge	14
14 Gaging system lost motion	14

15	Types of filtering	15
16	Proportions for involute master	17
17	Proposed design for helix artifact	18
18	Proposed design for pitch, cumulative pitch and runout artifact	19
19	Plane artifact (flank artifact)	21
20	Pin artifact	21
21	Measurement of pin artifact	21
22	Ball (sphere) artifact	22
23	Constructing the X and MR chart	34
24	A graphical representation of the GPS method	35
25	Example of the GPS approach to determining fitness for purpose	36
26	Uncertainty contributors in measurement	37

Foreword

[The foreword, footnotes and annexes, if any, in this document are provided for informational purposes only and are not to be construed as a part of AGMA ISO 10064-5-A06, *Code of Inspection Practice – Part 5: Recommendations Relative to Evaluation of Gear Measuring Instruments*.]

In 1988, The American Gear Manufacturers Association recognized the need for establishment of standards for the calibration of gear measuring instruments. The AGMA Calibration Committee was formed between April 1989 and their first meeting in February 1990. Between 1995 and 1999, this committee, as members of the Committee on Gear Metrology (COGM), was instrumental in the establishment of the Oak Ridge Gear Metrology Laboratory for the purpose of calibrating gear artifacts traceable to the National Institute for Standards and Technology.

The AGMA Calibration Committee, between 1990 and 1998, developed and published three national standards on calibration of gear measuring instruments: ANSI/AGMA 2110-A94, *Measuring Instrument Calibration – Part I, Involute Measurement*, ANSI/AGMA 2113-A97, *Measuring Instrument Calibration, Gear Tooth Alignment Measurement*, and ANSI/AGMA 2114-A98, *Measuring Instrument Calibration, Gear Pitch and Runout Measurements*.

These standards covered elemental measurements specified in the accuracy requirements of ANSI/AGMA 2015-1-A01, *Accuracy Classification System – Tangential Measurements for Cylindrical Gears*.

In 1999, the content of these standards was combined and submitted to ISO as a proposed work item. As a result, ISO TC60/WG2 used this as the basis for development of ISO 18653:2003, *Gears – Evaluation of instruments for the measurement of gears*, and ISO/TR 10064-5:2005, *Code of inspection practice – Part 5: Recommendations relative to evaluation of gear measuring instruments*.

During the ISO development period the Calibration Committee decided that supplemental information, on measurement system conditions for calibration, accuracy requirements and uncertainty determination, was desirable to have in an AGMA Information Sheet. This resulted in the publication of AGMA 931-A02, *Calibration of Gear Measuring Instruments and Their Application to the Inspection of Product Gears*, in 2002.

The ISO documents expanded the AGMA work and included material on the determination of uncertainty of measurement and the introduction of spherical calibration artifacts. The natural evolution, therefore, was the adoption of the two comprehensive ISO documents as national documents in place of the four AGMA documents.

AGMA ISO 10064-5-A06 replaces AGMA 931-A02, also the instrument set-up and measurement recommendations contained within ANSI/AGMA 2010-A94, ANSI/AGMA 2110-A94, ANSI/AGMA 2113-A97, and ANSI/AGMA 2114-A98. The requirements for instrument calibration can be found in ANSI/AGMA ISO 18653-A06.

This information sheet is an identical adoption of ISO/TR 10064-5:2005.

The first draft of AGMA ISO 10064-5-A06 was made in October 2005. It was approved by the AGMA membership in July 2006.

Suggestions for improvement of this standard will be welcome. They should be sent to the American Gear Manufacturers Association, 500 Montgomery Street, Suite 350, Alexandria, Virginia 22314.

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American National Standard – Code of Inspection Practice – Part 5: Recommendations Relative to Evaluation of Gear Measuring Instruments

1 Scope

This information sheet provides additional information and examples to support the implementation of ANSI/AGMA ISO18653. It provides evaluation and calibration procedures for involute, helix, pitch, runout, and tooth thickness measurement processes.

Methods are provided for evaluation of the condition and alignment of instrument elements such as centers, guide ways, probe systems, etc. Recommendations are included for establishment of a proper environment and for statistical data evaluation procedures.

It also covers the application of gear artifacts to the estimation of U_{95} measurement process uncertainty. Guidance on the application of measurement processes to the inspection of product gears is provided, including fitness for use and the recommended limits for U_{95} uncertainty based upon the accuracy tolerances of product gears to be inspected.

Many of its recommendations may also be applicable to the measurement of worms, worm wheels, bevel gears and gear cutting tools.

2 References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ANSI/AGMA ISO 18653-A06, *Gears – Evaluation of instruments for the measurement of gears*

ISO 1122-1:1998, *Glossary of gears – Geometrical definitions*

ISO1328-1:1995, *Cylindrical gears – ISO system of accuracy – Part 1: Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth*

ISO1328-2:1997, *Cylindrical gears – ISO system of accuracy – Part 2: Definitions and allowable values of deviations relevant to radial composite deviation and runout information*

ISO/TR 10064-1:1995, *Code of inspection practice – Part 1: Inspection of corresponding flanks of gear teeth;*

ISO/TR 10064-2:1996, *Code of inspection practice – Part 2: Inspection related to radial composite deviations, runout, tooth thickness and backlash*

ISO/TR 10064-3:1996, *Code of inspection practice – Part 2: Recommendations relative to gear blanks, shaft center distance and parallelism of axes*

ISO 10360-1:2000, *Geometrical Product Specifications (GPS) – Acceptance and reverification tests for coordinate measuring machines (CMM) – Part 1: Vocabulary*

ISO 14253-1:1998, *Geometrical Product Specifications (GPS) – Inspection by measurement of workpieces and measuring equipment – Part 1: Decision rules for proving conformance or non-conformance with specifications*

ISO/TS 14253-2:1999, *Geometrical product specifications (GPS) – Inspection by measurement of workpieces and measuring equipment – Part 2 Guide to the estimation of uncertainty in GPS measurement, in calibration of measuring equipment and in product verification*

Guide to the expression of uncertainty in measurement (GUM), BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML 1st edition 1993, corrected and reprinted in 1995