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American
Gear Manufacturers
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Technical Resources

Replaces ANSI/AGMA 2000–A88
Reaffirmed January 2008

**American National Standard**

# Accuracy Classification System – Tangential Measurements for Cylindrical Gears

ANSI/AGMA 2015-1-A01

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American National Standard

***Accuracy Classification System - Tangential Measurements for Cylindrical Gears***

ANSI/AGMA 2015–1–A01

[Revision of ANSI/AGMA 2000–A88]

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Approved August 1, 2002

## ABSTRACT

This standard, for spur and helical gearing, correlates gear accuracy grades with gear tooth tolerances. It provides information on minimum requirements for accuracy groups as well as gear measuring practices. Annex material provides guidance on filtering and information on comparison of gear inspection methods.

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## Contents

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# 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 ANSI/AGMA Standard 2015–1–A01, *Accuracy Classification System – Tangential Measurements for Cylindrical Gears*.]

This standard provides tolerances for different gear accuracy grades from A2 to A11 for unassembled spur and helical gears. Applicable definitions are provided.

The purpose is to provide a common basis for specifying accuracy, and for the procurement of unassembled gears. It is not a design manual for determining the specific quality levels for a given application.

AGMA 390.03 of 1973 was a consolidation of several AGMA publications, including:

AGMA 235.02 (Feb. 1966), *Information Sheet for Master Gears*

AGMA 239.01 (Oct. 1965), *Measuring Methods and Practices Manual for Control of Spur, Helical and Herringbone Gears*

AGMA 239.01A (Sept. 1966), *Measuring Methods and Practices Manual for Control of Bevel and Hypoid Gears,* and parts of

AGMA 236.05 (ASA B6.11, June 1956), *Inspection of Fine–Pitch Gears*

AGMA 390.02 (Sept. 1964), *Gear Classification Manual* originally published as AGMA 390.01 (1961)

Data was added for Gear Rack and Fine–Pitch Worms and Wormgears. The former AGMA 390.02 for Coarse–Pitch and Fine–Pitch Spur, Helical and Herringbone Gearing was enhanced to offer a single, compatible classification system. The tolerance identifier “Q” was added to indicate that the tolerances in 390.03 apply. If Q is not used as a prefix in the quality number, tolerances in AGMA 390.01 and 390.02 applied.

ANSI/AGMA 2000–A88 was an update of those sections from AGMA 390.03 for parallel axis gears only. Additionally, the formulas stated the tolerances in metric terms. The content was revised, but basic tolerance levels were unchanged from AGMA 390.03. The other material in AGMA 390.03 on Bevels and Worms was replaced by ANSI/AGMA 2009–A99 and ANSI/AGMA 2011–A98, respectively. ANSI/AGMA 2000 was approved by AGMA membership in January 1988, and as a American National Standard Institute (ANSI) standard on March 31, 1988.

The user of this American National Standard is alerted that differences exist between it and ANSI/AGMA 2000–A88. Differences include, but are not limited to:

- Accuracy grade numbering system is reversed, such that the smallest number represents the smallest tolerance;
- Relative magnitudes of elemental tolerances for a single grade are in a different proportion;
- The “helix evaluation range”, where the tolerances are applied, are defined for less flank area than in ANSI/AGMA 2000–A88;
- The “K Chart” is not used for the permissible tolerance values;
- Runout is not included as one of the elements with a tolerance;
- Concepts of “mean measurement trace”, “design profile”, “slope deviation” and “form deviation” are added, similar to ISO 1328–1.

Therefore, the user of ANSI/AGMA 2015–1–A01 must be very careful when comparing tolerance values formerly specified using ANSI/AGMA 2000–A88.

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ANSI/AGMA 2015–1–A01 is a replacement for ANSI/AGMA 2000–A88 and ANSI/AGMA ISO 1328–1. It is a complete revision, including accuracy grades, in order to be more compatible with ISO. It combines the grading system of ISO 1328–1 with the methods of ANSI/AGMA 2000–A88, and adds concepts of accuracy grade grouping for minimum measurement requirements, filtering, data density, and roughness limits to form deviations.

This revision was started by the AGMA Inspection and Handbook Committee in 1997. It was approved by the AGMA membership in June, 2001. It was approved as an American National Standard on August 1, 2002.

Suggestions for improvement of this standard will be welcome. They should be sent to the American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, Virginia 22314.

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American National Standard –

# Accuracy Classification System – Tangential Measurements for Cylindrical Gears

## 1 Scope

This part of ANSI/AGMA 2015 establishes an accuracy grade system relevant to tangential measurements on flanks of individual cylindrical involute gears.

It specifies definitions for gear tooth accuracy terms, the structure of the gear accuracy grade system, and allowable values.

It is strongly recommended that any user of this part of ANSI/AGMA 2015 be very familiar with the methods and procedures outlined in AGMA 915-1-A02. Use of techniques other than those of AGMA 915-1-A02 combined with the limits described in this part of ANSI/AGMA 2015 may not be suitable.

This standard provides the gear manufacturer and the gear buyer with a mutually advantageous reference for uniform tolerances. Ten accuracy grades are defined in this standard, numbered A2 through A11, in order of decreasing precision.

### 1.1 Equations for tolerances

Equations for tolerances and their ranges of validity are provided in 7.2 for the defined accuracy of gearing. In general, these tolerances cover the following ranges:

$5 \leq z \leq 1000$ or $10\,000/m_n$ whichever is less

5 mm $\leq D \leq$ 10 000 mm

$0.5 \leq m_n \leq 50$

4 mm $\leq b \leq$ 1000 mm

$\beta \leq 45°$

where

$D$ is pitch diameter;

$m_n$ is normal module;

$b$ is facewidth (axial);

$z$ is number of teeth;

$\beta$ is helix angle.

See clause 4 for required and optional measuring methods.

### 1.2 Exceptions

This standard does not apply to enclosed gear unit assemblies, including speed reducers or increasers, gear motors, shaft mounted reducers, high speed units, or other enclosed gear units which are manufactured for a given power, speed, ratio or application.

Gear design is beyond the scope of this standard. The use of the accuracy grades for the determination of gear performance requires extensive experience with specific applications. Therefore, the users of this standard are cautioned against the direct application of tolerance values to a projected performance of unassembled (loose) gears when they are assembled. Refer to the latest AGMA Publications Index for applicable standards.

**NOTE:** Tolerance values for gears outside the limits stated in this standard should be established by determining the specific application requirements. This may require setting a tolerance smaller than calculated by the formulas in this standard.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

AGMA 915-1-A02, *Inspection Practices – Part 1: Cylindrical Gears – Tangential Measurements*

AGMA 915-3-A99, *Inspection Practices – Gear Blanks, Shaft Center Distance and Parallelism*