American Gear Manufacturers Association

Technical Resources

ANSI/AGMA ISO 1328-1-B14
Identical to ISO 1328-1:2013

American National Standard

Cylindrical Gears - ISO System of Flank Tolerance Classification - Part 1: Definitions and Allowable Values of Deviations Relevant to Flanks of Gear Teeth

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Approved September 30, 2014

ABSTRACT

This standard provides tolerances for the tooth flanks of unassembled spur and helical gears. Tolerance classes are numbered from 1 to 11. Applicable definitions are provided. The purpose is to provide a common basis for specifying tolerances, which may simplify the procurement of unassembled gears. It is not a design manual for determining the specific tolerance levels for a given application.

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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 ISO 1328-1-B14, *Cylindrical Gears - ISO System of Flank Tolerance Classification - Part 1: Definitions and Allowable Values of Deviations Relevant to Flanks of Gear Teeth.*]

The *Gear Classification Manual*, originally published as AGMA 390.01 in 1961 and revised as AGMA 390.02 in September 1964, provided tolerances for gear tooth flanks. AGMA 390.03, published in 1973, was a major revision that consolidated the information in AGMA 390.02 with several other 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.*

Data was added for gear rack and fine-pitch worms and worm gears. The former separate sections of AGMA 390.02 for coarse-pitch and fine-pitch spur, helical and herringbone gearing were blended to offer a single, compatible classification system. The tolerance identifier “Q” was added to indicate that the tolerances in 390.03 apply. If Q was not used as a prefix in the quality number, tolerances in AGMA 390.01 and 390.02 applied.

ANSI/AGMA 2000-A88, *Gear Classification and Inspection Handbook - Tolerances and Measuring Methods for Unassembled Spur and Helical Gears*, was an update of those sections from AGMA 390.03 for parallel axis gears only. Additionally, the formulas stated the tolerances in both U.S. standard and 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 an American National Standard Institute (ANSI) standard on March 31, 1988.

ANSI/AGMA ISO 1328-1 was developed by ISO Technical Committee 60 as an International Standard with ANSI/AGMA participation. It was first published in February 1995, was adopted without changes by the AGMA membership in June 1999, and was approved as an American National Standard in November 1999. While the subjects covered in this standard were similar to those in ANSI/AGMA 2000-A88, there were significant differences. They included:

- Accuracy grade numbering system was reversed, such that the smallest number represented the smallest tolerance;
- Relative magnitudes of elemental tolerances for a single grade are in a different proportion;
- The “profile evaluation range” and “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”, “design helix”, “slope deviation” and “form deviation” are defined.
- Tolerances are established by geometric mean values of relevant ranges of parameters in tables, not by formulas;

Therefore, the users of ANSI/AGMA ISO 1328-1 were cautioned to be careful when comparing tolerance values formerly specified using ANSI/AGMA 2000-A88.

ANSI/AGMA 2015-1-A01 later replaced ANSI/AGMA 2000-A88 and ANSI/AGMA ISO 1328-1. It combined the grading system of ISO 1328-1with the methods of ANSI/AGMA 2000-A88, and added concepts of accuracy grade grouping for minimum measurement requirements, filtering, data density, and roughness limits to form deviations. Tolerance formulas were based on the actual gear geometry rather than on geometric mean values.

ISO 1328-1:2013 was prepared by Technical Committee ISO/TC 60, Gears. This second edition cancels and replaces the first edition (ISO 1328-1:1995). While the basis of this edition was AGMA 2015-1 A01, the new revision includes significant technical changes. In particular, the following should be noted:

- The scope of applicability has been expanded;
- Revisions have been made to the formulae which define the flank tolerances;
- Annexes have been added to describe additional methods for analysis of modified profiles and helices;
- The evaluation of runout, previously handled in ISO 1328-2, has been brought back into this part of ISO 1328.

AGMA Gear Accuracy Committee approved adoption of the new ISO 1328-1:2013 in November 2013. AGMA membership approved the adoption in August 2014. It was approved as an American National Standard on September 30, 2014.

Suggestions for improvement of this standard will be welcome. They may be submitted to tech@agma.org.

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American National Standard -

Cylindrical Gears - ISO System of Flank Tolerance Classification - Part 1: Definitions and Allowable Values of Deviations Relevant to Flanks of Gear Teeth

IMPORTANT: It is strongly recommended that any user of this part of ISO 1328 be very familiar with the methods and procedures outlined in ISO/TR 10064-1. Use of techniques other than those of ISO/TR 10064-1 combined with the limits described in this part of ISO 1328 might not be suitable.

CAUTION: The use of the flank tolerance classes for the determination of gear performance requires extensive experience with specific applications. Users of this part of ISO 1328 are cautioned against the direct application of tolerance values for unassembled (loose) gears to a projected performance of an assembly using these gears.

1 Scope

This part of ISO 1328 establishes a tolerance classification system relevant to manufacturing and conformity assessment of tooth flanks of individual cylindrical involute gears. It specifies definitions for gear flank tolerance terms, the structure of the flank tolerance class system, and allowable values.

This part of ISO 1328 provides the gear manufacturer and the gear buyer with a mutually advantageous reference for uniform tolerances. Eleven flank tolerance classes are defined, numbered 1 to 11, in order of increasing tolerance. Formulae for tolerances are provided in 5.3. These tolerances are applicable to the following ranges:

$5 \leq z \leq 1\,000$

$5 \text{ mm} \leq d \leq 15\,000 \text{ mm}$

$0.5 \text{ mm} \leq m_n \leq 70 \text{ mm}$

$4 \text{ mm} \leq b \leq 1\,200 \text{ mm}$

$\beta \leq 45°$

where

d is the reference diameter;

m_n is the normal module;

b is the facewidth (axial);

z is the number of teeth;

β is the helix angle.

See Clause 4 for required and optional measuring methods.

Gear design is beyond the scope of this part of ISO 1328.

Surface texture is not considered in this part of ISO 1328. For additional information on surface texture, see ISO/TR 10064-4.

