ANSI/AGMA 1012-G05
[Revision of
ANSI/AGMA 1012–F90]

AMERICAN NATIONAL STANDARD

Gear Nomenclature, Definition of Terms with Symbols

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American National Standard

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Approved September 29, 2005

ABSTRACT

This standard lists terms and their definitions with symbols for gear nomenclature.

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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 1012-G05, *Gear Nomenclature, Definitions of Terms with Symbols*.]

In 1926 the AGMA adopted a recommended practice for gearing nomenclature, terms and definitions. It included some symbols and abbreviations.

A complete revision of terms and definitions by the AGMA Nomenclature Committee was issued as AGMA 112.02 in October, 1948. This later became AGMA 112.03, and American Standard B6.10-1954, with ASME as a co-sponsor.

A separate project dealing with *Letter Symbols for Gear Engineering* appeared in 1943 as AGMA 111.01, later becoming AGMA 111.03 and American Standard B6.5-1954.

Abbreviations for Gearing was another separate project released as AGMA 116.01 in 1955. Most of these abbreviations were already listed in American Standard Z32.13-1950 *Abbreviations for Use on Drawings*, and it was, therefore, unnecessary to process gearing abbreviations as a separate American Standard. The number of abbreviations used in gearing has intentionally been kept very small to permit memorizing without the need to refer to the standard.

AGMA Standard 112.04, *Gear Nomenclature (Geometry) Terms, Definitions, Symbols and Abbreviations*, was a complete revision and integration of the three standards previously mentioned. Because of the widespread acceptance of the previous standards, changes were kept to a minimum. The standard in this form was approved by the AGMA Membership on April 25, 1965.

AGMA 112.05 included several revisions to keep it abreast of the then current gearing techniques. It was approved by Standards Committee B6, Gears, the Co-Secretariats and the American National Standards Institute on February 3, 1976 and designated ANSI B6.14-1976.

ANSI/AGMA 1012-F90 was a revision of 112.05. This revision incorporated the terms from AGMA Standard 116.01 (Oct., 1972), *Glossary of Terms Used in Gearing*, and terms from ANSI/AGMA 2000-A88, *Gear Classification and Inspection Handbook, Tolerances and Measuring Methods for Unassembled Spur and Helical Gears (Including Metric Equivalents)*. In addition, terms which started to be commonly used in gear load rating were introduced in the annex.

ANSI/AGMA 1012-G05 is a revision that updates the style of presentation, reordered the sequence of some terms, added definitions for right and left flank, and modified annexes B and C.

The first draft of ANSI/AGMA 1012-G05 was made in June 2002. It was approved by the AGMA membership in July, 2005. It was approved as an American National Standard on September 29, 2005.

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.

PERSONNEL of the AGMA Nomenclature Committee

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American National Standard -

Gear Nomenclature, Definitions of Terms with Symbols

1 Scope

This standard establishes the definitions of terms, symbols and abbreviations which may be used to communicate the technology and specifications of external and internal gear teeth. It provides definitive meanings by the use of words and illustrations, for commonly used gearing terms.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of the standard. At the time of publication, the editions were valid. All publications are subject to revision, and the users of this standard are encouraged to investigate the possibility of applying the most recent editions of the publications listed.

ISO 701:1998, *International gear notation - Symbols for geometrical data.*

3 Terms and symbols

3.1 Terms

The terminology used in this standard is intended for use in all AGMA documents and is summarized in the index.

Many terms are listed in the index more than once by restating alphabetically with rearranged key words, to aid user look-up of related terms.

3.2 Symbols

The purpose of standard symbols for gear engineering is to establish a uniform practice in mathematical notation for equations and formulas dealing with toothed gearing. Such equations and corresponding calculations may be used in connection with design, application, manufacture, inspection, new methods, and new problems.

NOTE: The symbols and definitions used in this standard may differ from other AGMA standards. The user should not assume that familiar symbols can be used without a careful study of these definitions.

SI (metric) units of measure, where applicable, are shown in the text. Where equations require a different format or constant for use with SI units, the primary equation has an (M) appended and the secondary expression is shown after the first, indented.

Example:

$$d = z\,m \qquad \text{(2M)}$$

$$D = \frac{N}{P_{\mathrm{d}}} \qquad \text{(2)}$$

Symbols must be distinguished from abbreviations which are shortened forms of words often used on drawings and in tables, but not suitable for mathematical work (see annex A). For example, the symbol for circular pitch is p, whereas the abbreviation is CP.

AGMA is changing to use symbols consistent with symbols used by ISO. In the definition titles, where the old AGMA symbol is still commonly used but differs from the ISO symbol, both symbols are listed with the ISO symbol at the end of the line. Annex C contains an alphabetical list of the old symbols with the new symbols also listed.

3.2.1 Subscripts

A subscript following the general symbol may be used to indicate a value applying to a particular gear or tool, or a value taken at a particular position or in a particular direction. For convenience and brevity, it is desirable to use a general symbol without a subscript when only one value of a given kind is involved. Thus, in a spur gear or a straight-tooth bevel gear, there is occasion to consider only one cross section of the teeth, namely, the transverse

section, and it is convenient and natural to refer, for instance, simply to the circular pitch, p, and the pressure angle, ϕ. In the case of gears with oblique teeth, on the other hand, it is usually necessary to be specific and to refer to the transverse pitch, p_t, and the transverse pressure angle, ϕ_t, in order not to leave any doubt as to whether values are being given for the transverse plane or normal plane.

3.2.2 Typography

In accordance with the usual practice in published text, symbols, whether upper or lower case, should be printed in serif italic font. This is done to avoid confusion in reading the symbols and to make a distinction between upper and lower case. An exception is Greek capital letters and all subscripts, which are always vertical sans serif font.

Numbers appearing as coefficients, subscripts, superscripts, or exponents should be printed in vertical Arabic numerals. Abbreviations should always be printed vertical and are not recommended for use in formulas. Trigonometric functions should be printed in lower case vertical type. Standard mathematical notation should be followed.

4 Geometric definitions

There is an old Chinese proverb that states: *The beginning of wisdom is to call things by their right names.* Unfortunately, gearing terms and meanings vary in different offices, shops, textbooks, and among gear authorities.

To obtain related continuity, the terms have been grouped in what may be called a textbook arrangement in preference to alphabetical order. Many of the definitions have been written in a way that makes them depend on one another, as a logical series. This arrangement leads to a more comprehensive understanding of the concepts and geometrical relations.

4.1 General designations

4.1.1 Gears

Gears are machine elements that transmit motion by means of successively engaging teeth, see figure 1.

4.1.2 Gear (wheel)

A gear (wheel) is a machine part with gear teeth. Of two gears that run together, the one with the larger number of teeth is called the gear, see figure 1. (Wheel per ISO 1122-1:1998).

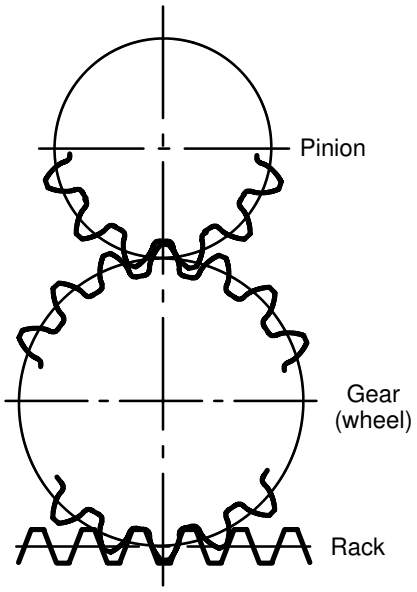

Figure 1 - Gears

4.1.3 Pinion

A pinion is a machine part with gear teeth. Of two gears that run together, the one with the smaller number of teeth is called the pinion, see figure 1.

4.1.4 Worm

A worm is a gear with one or more teeth in the form of screw threads, see figures 2 and 9.

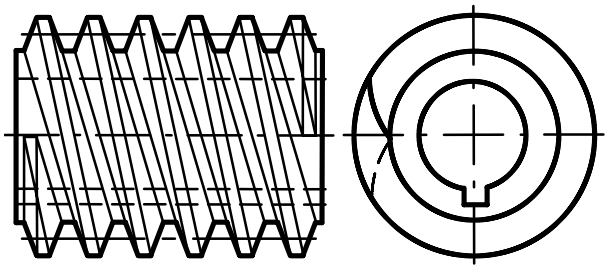

Figure 2 - Worm

4.1.5 Rack

A rack is a gear with teeth spaced along a straight line, and suitable for straight line motion. It can be regarded as part of a gear of infinitely large diameter, see figure 1.

4.1.6 Basic rack

For every pair of conjugate involute profiles, there is a basic rack (see 4.7.1). This basic rack is the profile of the conjugate gear of infinite pitch radius, see figure 3.

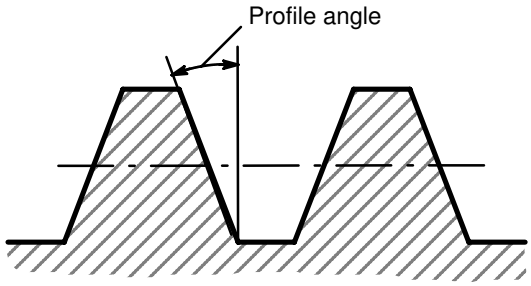

Figure 3 – Basic rack in normal plane

4.1.7 Generating rack

A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear shaper cutter.

4.1.8 Number of teeth or threads, N, z

Number of teeth or threads is the number of teeth contained in the whole circumference of the pitch circle.

4.1.9 Gear ratio, m_G, u

Gear ratio is the ratio of the larger to the smaller number of teeth in a pair of gears.

$$u = \frac{z_2}{z_1} \qquad (1M)$$

$$m_G = \frac{N_G}{N_P} \qquad (1)$$

4.2 Kinds of gears

4.2.1 External gear

An external gear is one with the teeth formed on the outer surface of a cylinder or cone, see figure 4.

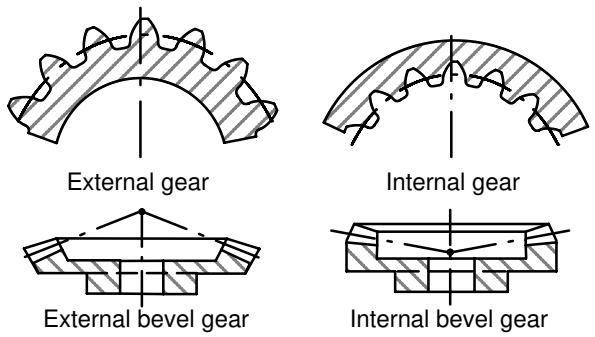

Figure 4 – External and internal gears

4.2.2 Internal gear

An internal gear is one with the teeth formed on the inner surface of a cylinder or cone. For bevel gears, an internal gear is one with the pitch angle exceeding 90°, see figure 4.

An internal gear can be meshed only with an external pinion.

4.2.3 Parallel axis gears

Gears which operate on parallel axes. External helical gears on parallel axes have helices of opposite hands, see figure 5. If one of the members is an internal gear, the helices are of the same hand.

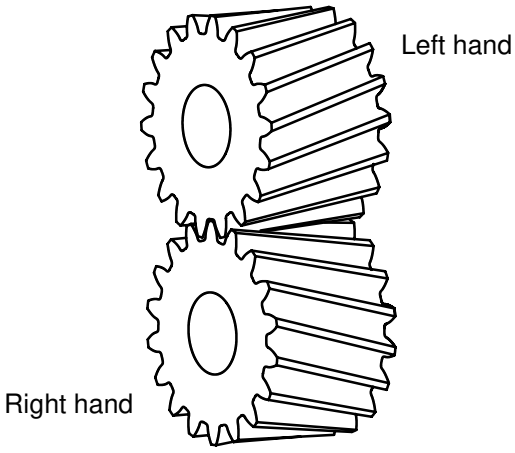

Figure 5 – Parallel helical gears

4.2.3.1 Spur gear

A spur gear has a cylindrical pitch surface and teeth that are parallel to the axis, see figure 6.

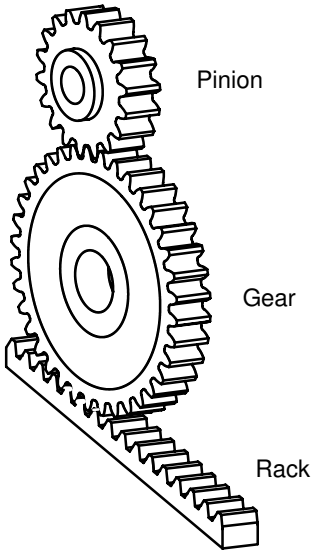

Figure 6 – Spur gears