American Gear Manufacturers Association

ANSI/AGMA 6102-D20
(Metric edition of ANSI/AGMA 6002-D20)

American National Standard

Design Guide for Vehicle Spur and Helical Gears (Metric Edition)

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[Metric Edition of ANSI/AGMA 6002-D20]

[Tables or other self-supporting sections may be referenced. Citations should read: See ANSI/AGMA 6102-D20, *Design Guide for Vehicle Spur and Helical Gears (Metric Edition),* published by the American Gear Manufacturers Association, 1001 N. Fairfax Street, Suite 500, Alexandria, Virginia 22314, http://www.agma.org.]

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ABSTRACT

This standard provides information on the design of spur and helical vehicle power transmission gears. Included are considerations for design, material and heat treatment, lubrication, determination of load capacity, mounting features, and typical design problems.

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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 6102-D20, *Design Guide for Vehicle Spur and Helical Gears (Metric Edition)*.]

The decision to produce a vehicle gearing design guide was made by the Vehicle Gearing Committee on May 4, 1971. The first draft of AGMA 170.01 was dated May 1972. AGMA 170.01 was approved by the AGMA membership in February 1976.

The Vehicle Gearing Committee was reactivated in October 1987 to develop an updated vehicle gearing design guide. ANSI/AGMA 6002-B93 updates, expands, and replaces AGMA 170.01

ANSI/AGMA 6002-B93 was published in 1993.

ANSI/AGMA 6102-C15 updates, expands, and replaces ANSI/AGMA 6002-B93. The standard has been completely rewritten with updated material throughout. A sample of the changes to the standard include:

– Metric conversion of ANSI/AGMA 6002-C15;
– New sections on macro gear tolerances and high contact ratio gears;
– A new chapter on surface finish;
– An expansion of lubrication considerations from one section to an entire chapter;
– A complete rewrite of the load capacity section so that the material is more in line with the ANSI/AGMA 2101-D04;
– Four new annexes were created that include: a design example; vehicle gearing equations; a discussion of splines; and an annex on lubrication considerations for planetary carriers.

ANSI/AGMA 6102-D20 has the following updates:

– Nomenclature for gear tooth failure modes has been made consistent with ANSI/AGMA 1010-F14.
– Nomenclature and symbols for gear geometry made consistent with ANSI/AGMA 1012-G05.

The first draft of ANSI/AGMA 6102-D20 was made in December 2017. It was approved by the AGMA membership in September 2019. It was approved as an American National Standard on February 06, 2020.

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

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American National Standard –

Design Guide for Vehicle Spur and Helical Gears (Metric Edition)

1 Scope

This standard provides information on the design of spur and helical vehicle power transmission gears. Included are considerations for design, material and heat treatment, lubrication, determination of load capacity, mounting features, and typical design problems.

In determining load capacity, the knowledge and judgment required to evaluate the various rating factors come from years of accumulated experience in designing, manufacturing, and operating gear units. This standard is intended for use by the experienced gear designer, capable of selecting reasonable values for the rating factors. It is not intended for use by the engineering public at large.

Vehicle gearing is defined as: "Steel drive line components of self-propelled, wheeled or non-wheeled vehicles; for transportation, recreational or industrial use. Propulsion of these vehicles should be a primary function of its power source, and its mobility not confined to the constraints of a closely defined area."

2 Normative references

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

AGMA 901-A92, *A Rational Procedure for the Preliminary Design of Minimum Volume Gears*

AGMA 923-B05, *Metallurgical Specifications for Steel Gearing*

AGMA 925-A03, *Effect of Lubrication on Gear Surface Distress*

AGMA 938-A05, *Shot Peening of Gears*

ANSI/AGMA 1010-F14, *Appearance of Gear Teeth – Terminology of Wear and Failure*

ANSI/AGMA 1012-G05, *Gear Nomenclature, Definitions of Terms with Symbols*

ANSI/AGMA 2015-2-B15, *Gear Tooth Flank Tolerance Classification System - Definitions and Allowable Values of Double Flank Radial Composite Deviations*

ANSI/AGMA 2101-D04, *Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth (Metric Edition)*

ANSI/AGMA 9005-F16, *Industrial Gear Lubrication*

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*

ASTM A534-09, *Standard Specification for Carburizing Steels for Anti-Friction Bearings*

ASTM A866-09, *Standard Specification for Medium Carbon Anti-Friction Bearing Steel*

3 Definitions and symbols

3.1 Definitions

The terms used, wherever applicable, conform to the following standards:

ANSI/AGMA 1012, *Gear Nomenclature, Definitions of Terms with Symbols*

ANSI/AGMA 2101, *Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth (Metric Edition)*

3.2 Symbols

The symbols used in this document are shown in Table 1.

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.

Table 1 – Symbols and terms

Symbols	Terms	Units	Where first used
b	Net engaged face width between two mating gears	mm	4.3.5
b_{k}	Edge break (round)	mm	Figure 5
$b_{\mathrm{k\,max}}$	Edge break (round), maximum	mm	Eq 10
$b_{\mathrm{k\,min}}$	Edge break (round), minimum	mm	Eq 9
C_{dc}	Macropitting derating factor	- -	8.2.2
C_{dt}	Bending derating factor	- -	8.1.3
C_{G}	Gear ratio factor	- -	Eq 16
d	Reference diameter	mm	Eq 7
d_{a}	Tip diameter (external major and internal minor diameters)	mm	4.4
$d_{\mathrm{a\,max}}$	Tip diameter, maximum	mm	Figure 3
$d_{\mathrm{a\,min}}$	Tip diameter, minimum	mm	Figure 3
d_{aTOL}	Tip diameter total tolerance	mm	Eq 7
d_{f}	Root diameter	mm	4.4
$d_{\mathrm{f\,max}}$	Root diameter, maximum	mm	Figure 3
$d_{\mathrm{f\,min}}$	Root diameter, minimum	mm	Figure 3
d_{fTOL}	Root diameter tolerance	mm	Figure 3
d_{w1}	Pitch diameter of pinion	mm	Eq 16
F_{t}	Transmitted tangential load	N	Table 2
g_{α}	Length of path of contact	mm	Eq 11
h	Tooth whole depth	mm	Figure 2
h_{aP0}	Addendum of the tool standard basic rack tooth profile	mm	Eq 5
h_{aP1}	Addendum coefficient of the pinion	- -	Figure 2
h_{aP2}	Addendum coefficient of the gear	- -	Figure 2
h_{c}	Total case depth	mm	Figure 18
$h_{\mathrm{c\,min}}$	Minimum total case depth for external nitrided gear teeth	mm	Eq 16
h_{FaP0}	Straight part of tip flank of tool – generating profile	mm	Eq 4
h_{P}	Tooth whole depth factor	- -	Figure 1
K_{B}	Rim thickness factor	- -	4.6
K_{H}	Load distribution factor	- -	Eq 19