American Gear Manufacturers Association

ANSI/AGMA 6002-C15
(Revision of ANSI/AGMA 6002-B93)

American National Standard

Design Guide for Vehicle Spur and Helical Gears

ANSI/AGMA 6002-C15

American National Standard

Design Guide for Vehicle Spur and Helical Gears

ANSI/AGMA 6002-C15

[Revision of ANSI/AGMA 6002-B93]

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing or using products, processes or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretation of this standard should be addressed to the American Gear Manufacturers Association.

CAUTION NOTICE: AGMA technical publications are subject to constant improvement, revision or withdrawal as dictated by experience. Any person who refers to any AGMA Technical Publication should be sure that the publication is the latest available from the Association on the subject matter.

[Tables or other self-supporting sections may be referenced. Citations should read: See ANSI/AGMA 6002-C15, *Design Guide for Vehicle Spur and Helical Gears,* published by the American Gear Manufacturers Association, 1001 N. Fairfax Street, Suite 500, Alexandria, Virginia 22314, http://www.agma.org.]

Approved July 6, 2015

ABSTRACT

This standard provides the engineer, who is familiar with gear designing, a guide to sound design approaches for vehicle gear applications.

Through this standard, the engineer is guided to selecting design considerations paramount to the parallel axis gear sets required in vehicle drive lines. These include tooth and blank proportions, metallurgy, lubrication, profile and lead modification requirements, and gear tooth tolerances. Properties of the commonly used steels and processes for their heat treatment are outlined, as well as details for calculating design limits for bending and contact stresses.

Published by

American Gear Manufacturers Association
1001 N. Fairfax Street, Suite 500, Alexandria, Virginia 22314

Printed in the United States of America

ISBN: 978-1- 55589-001-8

Contents

Annexes

Tables

Figures

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 6002-C15, *Design Guide for Vehicle Spur and Helical Gears*.]

This standard was created to serve as a guide to provide sound approaches for designing gears used in vehicle drive lines. This standard is intended for use by design engineers capable of selecting reasonable values for rating factors, material grades, heat treatment, and gear manufacturing capabilities. It updates, expands, and replaces ANSI/AGMA 6002-B93, *Design Guide for Vehicle Spur and Helical Gears*. The committee intends to continue updating this standard to incorporate the latest data and technologies as they are developed.

This guide establishes a gear set design by following a sequential approach using: design considerations; lubrication and cooling; surface treatments; material and heat treatment; load capacity determination; and variable duty cycle loading.

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 and 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 was published in 1993.

Over the last 21, years the committee has worked on refining ANSI/AGMA 6002-B93. The standard has been completely rewritten with updated material throughout. A sample of the changes to the standard include:

- 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 2001-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.

For full effectiveness, this guide should be used in conjunction with other applicable AGMA Standards.

The first draft of ANSI/AGMA 6002-C15 was made in April 2012. It was approved by the AGMA membership in March 2015. It was approved as an American National Standard on July 6, 2015.

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

PERSONNEL of the AGMA Vehicle Gearing Committee

Chairman: Rick L. Platt ..... Allison Transmission, Inc.
Vice Chairman: Richard W. Miller ..... Fairfield Manufacturing Co., Inc.

ACTIVE MEMBERS

G. Blake..... Rolls-Royce Corp.
D. Breuer ..... Metal Improvement Company
D. Brownlie ..... United Gear & Assembly, Inc.
M.R. Chaplin ..... Consultant
J. Chen ..... GM Gear Center (Retired)
C.E. Dieterle ..... C-Dot Engineering
J. Dougherty ..... Fairfield Manufacturing Co., Inc.
M. Frechette ..... REM Surface Engineering
B. Laviolette ..... Metal Improvement Company
J.E. Masseth ..... Meritor, Inc.
T. McGinty ..... McGinty Gear (Retired)
I. Napau ..... GM Powertrain Global Headquarters
M. Pierz ..... Delta Gear
B. Sheen..... Eaton Corporation - Vehicle Group
L.L. Witte ..... Allison Transmission, Inc. (Retired)
H. Xu ..... GM Powertrain Global Headquarters
D. Zini ..... GM Powertrain

American National Standard –

Design Guide for Vehicle Spur and Helical Gears

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

AGMA 912-A04, *Mechanisms of Gear Tooth Failures*

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

ANSI/AGMA 2001-D04, *Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical 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*

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*

3 Definitions and symbols

3.1 Definitions

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

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

ANSI/AGMA 2001-D04, *Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth*

