

AMERICAN NATIONAL STANDARD

***Gear Materials, Heat Treatment and
Processing Manual***

ANSI/AGMA 2004-C08



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Gear Materials, Heat Treatment and Processing Manual ANSI/AGMA 2004-C08

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ABSTRACT

This standard provides information pertaining to ferrous and nonferrous materials used in gearing. Factors in material selection, including material forms, properties, and associated processing and heat treatments are discussed. Manufacturing procedures to prepare materials for machining and final heat treatment are included. Heat treating procedures used for gearing are covered in detail, including process descriptions, product specifications, process controls, and characteristics of heat treated gearing. Post-heat treatment processes to meet gearing requirements are discussed. Product inspection methods and documentation are covered. Term definitions, test methods, distortion and residual stress, sources for additional information, and a bibliography are included.

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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 AGMA Standard 2004-C08, *Gear Materials, Heat Treatment and Processing Manual*.]

ANSI/AGMA 2004-C08 provides a broad range of information on gear materials, gear heat treatment, and associated processing. This information is intended to assist the designer, the process and manufacturing engineer, and the heat treater to effectively produce the gearing required for the application. Data contained herein represents a consensus from metallurgical representatives of member companies of AGMA.

The goal of ANSI/AGMA 2004-C08 is to present information in a sequence that can be used to make the necessary technical decisions when producing gearing. ANSI/AGMA 2004-C08 includes updated and extensively revised information from ANSI/AGMA 2004-B89 along with additional information needed to achieve this goal.

ANSI/AGMA 2004-B89 superseded AGMA 240.01, *Gear Materials Manual*, October 1972, because of a Metallurgy and Materials Committee decision to revise the document format. On January 23, 1989, ANSI/AGMA 2004-B89 was approved as an American National Standard.

This standard has been updated to reflect current technology in the area of steel making and heat treatment, and edited to include cross references to relevant AGMA standards and information sheets.

The first draft of AGMA 2004-C08 was completed in May 2001. It was approved by the AGMA membership in October, 2007. It was approved as an American National Standard on January 8, 2008.

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.

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American National Standard – Gear Materials, Heat Treatment and Processing Manual

1 Scope

This manual was developed to provide basic information and recommend sources of additional information pertaining to metallic gear materials, their treatments, and other considerations related to the manufacture and use of gearing.

The gearing application conditions, including allowable stresses, environment, component geometry, and component weight limitations, must be understood to select the proper gear material.

Metallurgical aspects of gearing as related to rating (allowable contact stress number and allowable bending stress number) are not included, but are covered in AGMA rating standards.

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 apply the most recent editions of the publications listed.

AGMA 920-A01, *Materials for Plastic Gears*

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

AGMA 930-A05, *Calculated Bending Load Capacity of Powder Metallurgy (PM) External Spur Gears*

ANSI/AGMA 2003-B97, *Rating the Pitting Resistance and Bending Strength of Generated Straight Bevel, Zerol Bevel, and Spiral Bevel Gear Teeth*

ANSI/AGMA 2007-C00, *Surface Temper Etch Inspection After Grinding* (Same as ISO 14104)

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

ANSI/AGMA 6002-B93, *Design Guide for Vehicle Spur and Helical Gears*

ANSI/AGMA 6005-B89, *Power Rating for Helical and Herringbone Gearing for Rolling Mill Service*

ANSI/AGMA 6008-A98, *Specifications for Powder Metallurgy Gears*

ANSI/AGMA 6011-I03, *Specification for High Speed Helical Gear Units*

ANSI/AGMA 6114-A06, *Gear Power Rating for Cylindrical Shell and Trunnion Supported Equipment* (Metric Edition)

ANSI/AGMA 6123-B06, *Design Manual for Enclosed Epicyclic Gear Drives*

ANSI/AGMA 6133-B98, *Materials for Marine Propulsion Gearing*

ANSI/AGMA 6135-A02, *Design, Rating and Application of Industrial Globoidal Wormgearing* (Metric Edition)

ASTM A47/A47M-99, *Specification for Ferritic Malleable Iron Castings*

ASTM A48/A48M-03, *Specification for Gray Iron Castings*

ASTM A220/A220M-99, *Specification for Pearlitic Malleable Iron*

ASTM A255-07, *Test Methods for Determining Hardenability of Steel*

ASTM A534-04, *Specification for Carburizing Steels for Anti-Friction Bearings*

ASTM A536-84, *Specification for Ductile Iron Castings*

ASTM A897/A897M-06, *Specification for Austempered Ductile Iron Castings*

ASTM E45-05, *Test Methods for Determining the Inclusion Content of Steel*

ISO 642:1999, *Steel - Hardenability test by end quenching (Jominy test)*