

AMERICAN GEAR MANUFACTURERS ASSOCIATION

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*Metallurgical Specifications for Steel  
Gearing*

AGMA 923-B05



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**AGMA INFORMATION SHEET**

(This Information Sheet is NOT an AGMA Standard)

American Gear ***Metallurgical Specifications for Steel Gearing***  
Manufacturers AGMA 923-B05

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Approved May 3, 2005

## **ABSTRACT**

This document identifies metallurgical quality characteristics which are important to the performance of steel gearing. The AGMA gear rating standards identify performance levels of gearing by heat treatment method and grade number. For each heat treatment method and AGMA grade number, acceptance criteria are given for various metallurgical characteristics identified in this document.

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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 Information Sheet 923-B05, *Metallurgical Specifications for Steel Gearing*.]

In November, 1984, an ad hoc Metallurgy and Gear Rating Committee met to define the factors required to qualify the various metallurgical quality grades that were to be introduced into the gear rating standard that eventually became ANSI/AGMA 2001-B88, *Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth*.

In May, 1988, ANSI/AGMA 6033-A88, *Standard for Marine Propulsion Gear Units - Part 1, Materials*, was published using a short list of metallurgical factors in table form.

In September, 1988, ANSI/AGMA 2001-B88 was published using metallurgical factors in table form.

Starting in July, 1992, AGMA representatives participated in writing ISO 6336-5, *Calculation of Load Capacity of Spur and Helical Gears - Part 5: Strength and Quality of Materials*, which was a modification of the tables in ANSI/AGMA and DIN Standards.

In February, 1993, AGMA 6002-B93, *Design Guide for Vehicle Spur and Helical Gears*, was published using a modified version of the tables used in ANSI/AGMA 2001-B88.

In September, 1993, the AGMA Metallurgy and Materials Committee accepted the task of consolidating the various tables to avoid redundancies and conflicting requirements, and started work on AGMA 923-A00, *Metallurgical Specifications for Steel Gearing*.

In January, 1995, a revised ANSI/AGMA 2001-C95 was published using a version of the ANSI/AGMA 2001-B88 tables as revised by the AGMA Helical Gear Rating Committee.

In November, 1997, a revised ANSI/AGMA 2003-B97, *Rating the Pitting Resistance and Bending Strength of Generated Straight Bevel, Zerol Bevel and Spiral Bevel Gear Teeth*, was published using a version of the ANSI/AGMA 2001-B88 tables as revised by the AGMA Bevel Gearing Committee.

The committee reviewed all metallurgical tables of the gear rating standards ANSI/AGMA 2001-B88, ANSI/AGMA 2003-A86, and ISO 6336-5:1996 and their proposed revisions to develop consolidated tables describing the metallurgical characteristics associated with each specific type of heat treatment and metallurgical quality grade. Effort was made to reference ISO specifications where possible. The consolidated tables were submitted to the gear rating committees for their agreement and are published here for reference by other standards.

AGMA's goal is to develop a consistent metallurgical specification which reflects the quality requirements for steel gearing. AGMA 923-A00 was such a document, and was intended to be consistent with the applicable portions of ISO 6336-5:1996, to the extent possible while the two standards were in parallel development. The AGMA Technical Division Executive Committee approved the publication of AGMA 923-A00 in August, 2000.

This edition of the information sheet, AGMA 923-B05, incorporates changes to item 8, microstructure, of table 1, Metallurgical characteristics for through hardened gearing. The balance of the document remains unchanged. The AGMA Technical Division Executive Committee approved the publication of AGMA 923-B05 in May, 2005.

Suggestions for improvement of this information sheet 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 Gear Manufacturers Association -

# Metallurgical Specifications for Steel Gearing

## 1 Scope

This information sheet recommends steel material and metallurgical quality characteristics for use in conjunction with AGMA gear rating standards. This information sheet identifies specifications and requirements for various metallurgical quality grades for through hardened, carburized and hardened, induction and flame hardened, and nitrided gearing. Characteristics covered include raw material, heat treatment and post heat treat processing, and their associated inspections. Topics related to gear design and rating, such as case depth, stress numbers, and quality control sampling plans are not included in this document.

## 2 Normative references

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

AGMA 904-C96, *Metric Usage*

ANSI/AGMA 1010-E95, *Appearance of Gear Teeth - Terminology of Wear and Failure*

ANSI/AGMA 1012-F90, *Gear Nomenclature, Definitions of Terms with Symbols*

ANSI/AGMA 2001-C95, *Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth*

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

ANSI/AGMA 2004-B89, *Gear Materials and Heat Treatment Manual*

ANSI/AGMA 2007-B92, *Surface Temper Etch Inspection After Grinding*

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

ANSI/AGMA 6032-A94, *Standard for Marine Gear Units: Rating*

ASTM A29-99, *Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for*

ASTM A148-93b(1998), *Specification for Steel Castings, High Strength, for Structural Purposes*

ASTM A255-99, *Test Method for Determining Hardenability of Steel*

ASTM A275-98, *Test Method for Magnetic Particle Examination of Steel Forgings*

ASTM A290-95(1999), *Specification for Carbon and Alloy Steel Forgings for Rings for Reduction Gears*

ASTM A291-95(1999), *Specification for Steel Forgings, Carbon and Alloy, for Pinions, Gears and Shafts for Reduction Gears*

ASTM A304-96, *Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements*

ASTM A322-91(1996), *Specification for Steel Bars, Alloy, Standard Grades*

ASTM A370-97a, *Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A388-95, *Practice for Ultrasonic Examination of Heavy Steel Forgings*

ASTM A519-96, *Specification for Seamless Carbon and Alloy Steel Mechanical Tubing*

ASTM A534-94, *Specification for Carburizing Steels for Anti-Friction Bearings*

ASTM A609-91(1997), *Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof*