American
Gear Manufacturers
Association

Technical
Division

ANSI/AGMA 9005-F16
(Revision of ANSI/AGMA 9005-E02)

American National Standard

Industrial Gear Lubrication

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[Revision of ANSI/AGMA 9005-E02]

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Approved March 23, 2016

ABSTRACT

This standard provides lubrication guidelines for enclosed and open gearing installed in general industrial power transmission applications. It is not intended to supplant specific instructions from the gear manufacturer.

Published by

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

Printed in the United States of America

ISBN: 978-1-55589-052-0

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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 9005-F16, *Industrial Gear Lubrication*.]

AGMA formed the Lubrication Committee in 1938 to study gear lubrication problems. This committee drafted tentative standard 250.01, *Lubrication of Enclosed and Open Gearing*, which was accepted in 1943 and adopted as a full standard in 1946. Lubrication Standard 250.01 was revised to include only industrial enclosed gearing and was accepted by the membership in 1955 as AGMA 250.02. AGMA 250.03, which was published in 1972, superseded AGMA 250.02 as well as AGMA 250.02A, *Typical Manufacturer's Oils Meeting AGMA Standard 250.02*, May, 1956, and AGMA 252.02, *Mild Extreme Pressure Lubricants*, May 1959. The list of Typical Manufacturer's Oils was eliminated due to difficulties in keeping such a list up to date. AGMA 250.03 contained instead, a list of detailed specifications that had to be met before an oil could be recommended for use in AGMA rated gear drives. It then became the responsibility of the oil supplier to certify a particular product as meeting AGMA specifications. AGMA 250.04, published in 1981, eliminated lead naphthenate as an EP additive and adjusted the AGMA lubricant numbering system to be coincident with the viscosity ranges established by the American Society for Testing Materials (ASTM D 2422), the British Standards Institute (B.S. 4231), and the International Standards Organization (ISO 3448).

The elimination of open gearing, where the bearings are lubricated separately, from AGMA 250.02 created the need for a new standard to cover this area of lubrication. AGMA Standard AGMA 251.01, *Lubrication of Industrial Open Gearing*, was approved in April 1963. This standard was revised in September, 1974. AGMA 251.02 extended coverage to bevel gears. Other changes included the addition of AGMA Lubricant Numbers based on the ASTM viscosity system and complete specifications for R & O gear oils and EP gear lubricants, and the addition of an appendix on test procedures and limits.

AGMA Standard 9005-D94 again combined enclosed and open gearing, superseding AGMA 250.04 and AGMA 251.02. In addition, it was updated to reflect market changes in availability of heavy bodied open gear lubricants. It was also expanded to provide coverage of modern technology in the area of synthetic oils. Synthetic oils were recognized as a separate class of lubricants with their own specification requirements. Specifications of EP oils were upgraded to reflect advances in technology. EP oils were no longer recommended for wormgear service. Pitch line velocity replaced center distance as the parameter for lubricant selection in other than double enveloping wormgear applications. Annex B provided a copy of Table 3 from AGMA 250.04 for information only.

References to Saybolt viscosity (SSU) were eliminated in favor of kinematic viscosity (mm^2/s, commonly referred to as cSt). This was consistent with practices of the American Society for Testing Materials, the Society of Tribologists and Lubrication Engineers, the British Standards Institution, and industry in general. Annex A provided information on the theory of elastohydrodynamic lubrication.

ANSI/AGMA 9005-E02 attempted to offer the end user and equipment builder more definitive guidelines for selecting lubricants based on current theory and practice in the industry, and attempted to align with current ISO standards. The document was focused on providing the correct viscosity and performance level for the application by providing the user a series of informative tables to match their equipment type, operation, and needs to define an appropriate finished lubricant. The first draft of ANSI/AGMA 9005-E02 was made in May 1999. It was approved by the AGMA membership on March 13, 2003. It was approved as an American National Standard on December 31, 2002.

ANSI/AGMA 9005-F16 incorporates updated lubricant performance characteristic test methods and criteria.

Historically, antiscuff lubricants have been called extreme pressure or EP. Extreme pressure is a generic term that is not an accurate description of a lubricant type. Users of this standard are encouraged to transition their terminology away from EP and toward antiscuff or AS.

The FE 8 roller bearing test has been added to the antiscuff table.

A new section has been added describing lubricant enhanced performance characteristics to aid the user in selecting a lubricant with enhanced characteristics.

The previous edition of this standard moved the focus toward lubricant performance characteristics. This edition continues this trend with the lubrication application information present in previous editions being transitioned to AGMA application standards. Those standards are best suited to address the specific lubrication needs for each application. This change will take a full revision cycle of all the applicable AGMA application standards to be fully implemented. Therefore, some application information has been retained but is expected to diminish or be eliminated in future editions of this standard.

The end user is encouraged to work with their equipment builder and lubricant supplier to achieve the most reliable system for their needs.

The first draft of ANSI/AGMA 9005-F16 was created in May 2012. It was approved by the membership on February 2016 and as an American National Standard on March 23, 2016.

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

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American National Standard–

Industrial Gear Lubrication

1 Scope

This standard provides lubricant classifications, guidelines for minimum performance characteristics, and generalized application and servicing guidelines for both open and enclosed metallic gearing that has been designed and rated in accordance with applicable AGMA Standards. The applicable gear types include spur, helical including double helical and herringbone, worm, non-offset bevel, and face gears.

This standard does not address grease lubricated enclosed gearboxes or aerospace applications. The special regulatory requirements associated with food or drug handling applications are not addressed in this standard, however, the minimum performance characteristics apply. This standard is not intended to replace any existing application standards such as aerospace, automotive, marine, industrial enclosed drives, high speed applications, mill, kiln, or wind turbines. See applicable AGMA application standards for lubrication specific guidelines.

NOTE: This standard is not intended to supplant any specific recommendations of gear manufacturers.

2 Normative references

The following documents contain provisions, which through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions listed were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to apply the most recent editions of the standards indicated below:

ASTM D2596-15, *Standard Test Method for Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)*

ASTM D2711-11, *Standard Test Method for Demulsibility Characteristics of Lubricating Oils*

ASTM D2893-04(2014)e1, *Standard Test Method for Oxidation Characteristics of Extreme-Pressure Lubrication Oils*

ASTM D2983-15, *Standard Test Method for Low-Temperature Viscosity of Lubricants Measured by Brookfield Viscometer*

ASTM D5950-14, *Standard Test Method for Pour Point of Petroleum Products (Automatic Tilt Method)*

DIN 51819-3:2016-02, *Testing of lubricants – Mechanical-dynamic testing in the roller bearing test apparatus FE8 – Part 3: Test method for lubricating oils, axial cylindrical roller bearing*

ISO 2160:1998 (ASTM D130-12), *Petroleum products – Corrosiveness to copper – Copper strip test*

ISO 2592:2000 (ASTM D92-12b), *Determination of flash and fire points – Cleveland open cup method*

ISO 2909:2002 (ASTM D2270-10e1), *Petroleum products – Calculation of viscosity index from kinematic viscosity*

ISO 3016:1994 (ASTM D97-16), *Petroleum products – Determination of pour point*

ISO 3104:1994 (ASTM D445-15a), *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 3448:1992 (ASTM D2422-97(2013)), *Industrial liquid lubricants – ISO viscosity classification*

ISO 4263-4:2006 (ASTM D943-04a(2010)e1), *Petroleum and related products – Determination of the ageing behaviour of inhibited oils and fluids – TOST test – Part 4: Procedure for industrial gear oils*

