American
Gear Manufacturers
Association

ANSI/AGMA 6006-B20
(Revision of ANSI/AGMA/AWEA 6006-A03)

American National Standard

Standard for Design and Specifications of Gearboxes for Wind Turbines

ANSI/AGMA 6006-B20

American National Standard

Standard for Design and Specifications of Gearboxes for Wind Turbines
ANSI/AGMA 6006-B20
[Revision of ANSI/AGMA/AWEA 6006-A03]

Approval of an American National Standard requires verification by American National Standard Institute (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 b6336e addressed to the American Gear Manufacturers Association (AGMA).

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 6006-B20, *Standard for Design and Specifications of Gearboxes for Wind Turbines,* published by the American Gear Manufacturers Association, 1001 N. Fairfax Street, Suite 500, Alexandria, Virginia 22314, http://www.agma.org.]

Approved February 11, 2020

ABSTRACT

This standard is intended to apply to wind turbine gearboxes. It provides information for specifying, selecting, designing, manufacturing, testing, procuring, operating and maintaining reliable speed increasing gearboxes for wind turbine generator system service.

Annex information is supplied on wind turbine architecture, wind turbine load description, quality assurance, operation and maintenance, minimum purchaser gearbox manufacturer ordering data, lubrication selection and monitoring, determination of an application factor from a load spectrum using the equivalent torque, and bearing stress calculations.

Published by

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

Printed in the United States of America

ISBN: 978-1-64353-073-4

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 6006-B20, *Standard for Design and Specification of Gearboxes for Wind Turbines*.]

The operation and loading of a wind turbine speed increasing gearbox is unlike most other gear applications. The intent of this standard is to describe the differences. Much of the information is based on field experience. This standard is a tool whereby wind turbine and gearbox manufacturers can communicate and understand each other's needs in developing a gearbox specification for wind turbine applications. The annexes present informative discussion of various issues specific to wind turbine applications and gear design.

A combined committee of AWEA and AGMA members representing wind turbine manufacturers, operators, researchers, consultants, and gear, bearing and lubricant manufacturers were responsible for the drafting and development of this standard.

The committee first met in 1993 to develop AGMA/AWEA 921-A97, *Recommended Practices for Design and Specification of Gearboxes for Wind Turbine Generator Systems*. The AGMA Information Sheet was approved by the AGMA/AWEA Wind Turbine Gear Committee on October 25, 1996 and by the AGMA Technical Division Executive Committee on October 28, 1996. This standard supersedes AGMA/AWEA 921-A97.

The first draft of ANSI/AGMA/AWEA 6006-A03 was made in March 2000. It was approved by the AGMA membership in October 2003. It was approved as an American National Standard on January 9, 2004.

In 2005, ANSI/AGMA/AWEA 6006-A03 was adopted internationally as International Standards Organization (ISO) 81400-4, *Wind Turbines – Part 4: Design and Specification of Gearboxes*.

The International Electrotechnical Commission (IEC) published IEC 61400-4 in 2012, updating the initial work established in ANSI/AGMA/AWEA 6006-A03.

ANSI/AGMA 6006-B20 is a revision of ANSI/AGMA/AWEA 6006-A03. This edition continues the development from the previous standards to provide concise requirements for gearbox design and specifications as well as introducing a reliability calculation method.

The first draft of ANSI/AGMA 6006-B20 was created in July 2016. It was approved by the AGMA membership in August 2, 2019. It was approved as an American National Standard on February 11, 2020.

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

PERSONNEL of the AGMA Wind Turbine Committee

Chairman: Brent Reardon ..... Siemens
Vice Chairman: Doug Guthrie ..... Vestas Wind Systems A/S

ACTIVE MEMBERS

M. Blumenfeld ..... ExxonMobil Research and Engineering
K. Buzdygon ..... ExxonMobil Research and Engineering
A. Cardis ..... Cardis Consulting, LLC
R. Errichello ..... Geartech
C. Halse ..... Romax Technology Limited
J. Haspert ..... Castrol USA
J. Keller ..... National Renewable Energy Lab
J. Leather ..... Castrol USA
D. Lucas ..... Timken Company
M. Michaud ..... REM Surface Engineering
A. Milburn ..... Milburn Engineering, Inc.
R. O'Connor ..... EDF Renewables, Inc.
K. Taliaferro ..... GE
F. Uherek ..... Rexnord
W. Weber ..... Flender

American National Standard –

Standard for Design and Specifications of Gearboxes for Wind Turbines

1 Scope

This standard is applicable to enclosed speed increasing gearboxes for horizontal axis wind turbine drivetrains with a power rating in excess of 500 kW. This applies to wind turbines installed both onshore and offshore. This standard applies to modular and integrated designs.

The standard provides guidance on the application of the wind turbine loads in relationship to the design of gears and gearbox elements. A standardized method for calculating gearbox reliability is included which allows for an objective comparison of different gearbox designs. Furthermore, this method provides a means to evaluate designs based upon gearbox lifetime economics.

The gearing elements referenced include spur, helical or double helical and their combinations in parallel and epicyclic arrangements in the main power path.

The standard applies to designs using rolling element bearings. Plain bearings are permissible, although their use and rating is not covered.

Guidance is included on the specification of shafts, shaft interfaces and fits, bearings and gear housing structure.

Lubrication of the gearbox is covered along with prototype and production testing.

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 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 documents indicated below.

ANSI/AGMA ISO 6336-6-A08, *Calculation of Load Capacity of Spur and Helical Gears – Part 6: Calculation of Service Life Under Variable Load*

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

AMS 2301, *Steel Cleanliness, Aircraft Quality Magnetic Particle Inspection Procedure*

ANSI/AGMA ISO 1328-1, *Cylindrical Gears – ISO System of Accuracy – Part 1: Definitions and Allowable Values of Deviations Relevant to Corresponding Flanks of Gear Teeth*

ANSI/AGMA 6001, *Design and Selection of Components for Enclosed Gear Drives*

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

ASTM-A388-16, *Standard Practice for Ultrasonic Examination of Steel Forgings*

ASTM-E127, *Standard Practice for Fabrication and Control of Flat Bottomed Hole Ultrasonic Standard Reference Blocks*

ASTM-A485, *Standard Specification for High Hardenability Antifriction Bearing Steel*

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

DIN 471, *Retaining Rings for Shafts – Normal Type and Heavy Type*

ANSI/AGMA 6123-, *Design Manual for Enclosed Epicyclic Gear Drives- Chair to approve*

