



American
Gear Manufacturers
Association

Technical Resources

Revision of ANSI/AGMA 6034-A87
Reaffirmed September 2005

American National Standard

Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors

ANSI/AGMA 6034-B92

Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors AGMA 6034-B92 (Revision of 6034-A87)

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 Standards 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 quoted or extracted in their entirety. Credit lines should read: Extracted from AGMA 6034-B92, *Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors* with the permission of the publisher, the American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, Virginia 22314].

Approved February 7, 1992

Reaffirmed March 1999

American National Standards Institute, Inc.

ABSTRACT

This standard gives a method for rating and design of specific enclosed cylindrical wormgear reducers and gearmotors at speeds not greater than 3600 rpm or mesh sliding velocities not more than 6000 ft/min (30 m/s). It contains power, torque and efficiency equations with guidance on component design, thermal capacity, service factor selection, lubrication, and self-locking features of wormgears. Annexes are supplied on service factors and user recommendations.

Copyright © 1992 by American Gear Manufacturers Association

Published by

**American Gear Manufacturers Association
1500 King Street, Suite 201, Alexandria, Virginia 22314**

ISBN: 1-55589-576-X

Contents

	Page
Foreword	v
1 Scope	
1.1 Applicability	1
1.2 Exceptions	1
1.3 System considerations	1
1.4 References	1
2 Symbols and terminology	1
3 Rating	
3.1 Rating for standard materials and construction	2
3.2 Discussion of wear rating formula	3
3.3 Power formula	3
3.4 Empirical factors	5
3.5 Torque at wormgear	5
3.6 Efficiency	5
3.7 Life	5
3.8 Special construction	5
4 Component design	
4.1 Loading	14
4.2 Housing design	14
4.3 Bearings, bolting, keys, and shafting	14
4.4 Special seals and breathers	14
5 Thermal rating	
5.1 Sump temperature	15
5.2 Auxiliary cooling	15
5.3 Thermal rating determination	15
5.4 Special considerations	15
6 Reducer rating	
6.1 No-load losses	15
6.2 Multiple reductions	15
6.3 Spur, helical, and spiral bevel gearing	16
6.4 Momentary overloads	16
7 Selection and service factors	
7.1 Equivalent input power	16
7.2 Service factors	16
7.3 Operating conditions	16
8 Lubrication	
8.1 Lubrication recommendations	17
8.2 Synthetic gear lubricants	17
8.3 Mild extreme pressure lubricants	19
8.4 High speed operation	19
8.5 Temperature limitations	19

Contents (cont)

	Page
8.6 Oil levels	19
8.7 Lubrication maintenance	19
8.8 Lubricants for the food and drug industry	20
9 Self-locking	
9.1 Self-locking static condition	20
9.2 Lead angle	20
9.3 Static friction angle	20
9.4 Testing	20
Tables	
1 Symbols used in equations	2
2 Ratio correction factors, C_m	6
3 Velocity factors, C_v	7
4 Metric velocity factors, C_v	10
5 Coefficient of friction, μ	11
6 Coefficient of friction, μ (metric)	13
7 Overhung load factors	14
8 AGMA lubricant number recommendations for enclosed cylindrical wormgear drives	18
Figures	
1 Materials factor, C_s , for center distances > 3.0 in (76 mm)	4
2 Maximum materials factor, C_s , for center distances < 3.0 in (76 mm)	4
Annexes	
A Service factor information	21
B User recommendations	31
C Formulas for rating factors	33

FOREWORD

[The foreword, footnotes, and annexes, are provided for informational purposes only and should not be construed as a part of American Gear Manufacturers Association 6034-B92, *Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors*.]

The purpose of this document is to provide rating and general design specifications for enclosed speed reducers incorporating cylindrical wormgearing in single or multiple reductions. It covers types of speed reducer designs most commonly made by a number of manufacturers.

The formulas presented in this standard contain terms whose individual values can vary significantly depending on application, system effects, accuracy, and manufacturing method. Proper evaluation of these terms is essential for realistic rating. The knowledge and judgment required to properly evaluate the various rating factors come primarily from years of accumulated experience in designing, testing, manufacturing, and operating similar gear units. The detailed treatment of the general rating formulas for specific product applications is best accomplished by those experienced in the field.

AGMA 6034-A87 was a revision of AGMA 440.04 - 1971, and in addition contained information for cylindrical wormgear hollow output shaft speed reducers and for cylindrical wormgear gearmotors previously contained in AGMA 442.01 - 1965 and 461.01 - 1966. These two standards have been withdrawn.

AGMA 6034-A87 power rating formulas were unchanged from those provided in the now withdrawn AGMA 440.04 - 1971.

Service factors which appeared in AGMA 440.04 and 461.01 were revised and placed in the annex rather than the body of AGMA 6034-A87. These factors for modification of basic power ratings have been determined through experience, and are intended as a guide. Suggested service factors for various applications were shown in Appendix A of AGMA 6034-A87 as an additional aid.

A draft of AGMA 6034-A87 was made in October 1982, and that version was approved by the AGMA membership in October 1987. In March 1988 it was approved as an American National Standard.

AGMA 6034-B92 is a revision of AGMA 6034-A87 which updates lubricant recommendations, removes bronze specifications by referring to AGMA 2004-B89, *Gear Materials and Heat Treatment Manual*, and includes other minor editorial changes.

AGMA 6034-B92 was approved as a revision by the AGMA membership in October, 1991.

Suggestions for the improvement of this standard will be welcome. They should be sent to the American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, Virginia 22314.

PERSONNEL of the AGMA Cylindrical Wormgearing Committee

Chairman: Richard J. Will IMO Industries, Inc.

ACTIVE MEMBERS

Robert E. Bergmann ASME-GRI
Joseph R. DeMarais Bison Gear
Werner H. Heller Peerless-Winsmith
George M. Sawchak PT Components
H. Oscar Schlenker Hub City
James Simonelli Cleveland Gear
John W. Tellman Dodge-Reeves
Elias Tzioumis Emerson Electric

ASSOCIATE MEMBERS

Ralph G. Allenby Hamilton Gear & Machine
Jakob Cadisch Reishauer
Arthur S. Cohen Engranes y Maquinaria
J. T. Cook Regal-Beloit
George Day Emerson Power Transmission
R. J. Ericson Otis Elevator
John Forberg Regal-Beloit
A. C. Hayes United Brass Manufacturing
Georges Henriot Institut de L'Engrenage
William A. Johnson Cone Drive - Textron
B. Mackulin Euclid Universal
Joseph R. Mihelick Dodge-Reliance
Allyn E. Phillips Dodge-Reliance
John T. Rawlinson Renold
Paul N. Salvucci IMO Industries, Inc.
Leonard J. Smith Invincible Gear
Robert E. Smith R. E. Smith & Co.
Robert Stephens Regal-Beloit
D. A. Sylvester Foote-Jones
Frank Uherek Foote-Jones
Dennis VonEschen Hub City
George I. Wyss Reishauer

American National Standard – Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors

1 Scope

1.1 Applicability

This standard applies to the rating and design of enclosed cylindrical wormgear speed reducers and gearmotors having either solid or hollow output shafts and single or multiple reductions, including other types of gearing used in conjunction with cylindrical wormgearing. The rating and design considerations contained in this standard are valid for rotational speeds not greater than 3600 rpm and sliding velocities at the mesh of not more than 6000 ft/min (30 m/s).

The knowledge and judgment required to evaluate the various rating factors come from years of accumulated experience in designing, manufacturing, and operating gear units. Empirical factors given in this standard are suited to the particular use shown. This standard is intended for use by the experienced gear designer, capable of selecting reasonable values for the factors. It is not intended for use by the “engineering public at large.”

No limitation is placed on the method of producing the worms and gears, but the tooth form of the gear must be conjugate to the thread form of the worm. See AGMA 341.02, *Design of General Industrial Coarse-Pitch Cylindrical Worm Gearing*.

1.2 Exceptions

This standard does not apply to cylindrical wormgear reducers which are designed or used as speed increasers.

This standard covers only the pitting resistance and wear rating of wormgearing, and does not cover any strength rating method.

1.3 System considerations

This standard does not attempt to address complete drive systems, torsional vibration, critical speeds, or other types of vibrations which may affect operation of enclosed cylindrical worm gear reducers.

1.4 References

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

AGMA 250.04 – 1981, *Specification – Lubrication of Industrial Enclosed Gear Drives*

AGMA 341.02 – 1970, *Design of General Industrial Coarse-Pitch Cylindrical Worm Gearing*

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

ANSI/AGMA 6001-C88, *Design and Selection of Components for Enclosed Gear Drives*

ANSI/AGMA 6010-E88, *Standard for Spur, Helical, Herringbone and Bevel Enclosed Drives*

2 Symbols and terminology

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

ANSI Y10.3 – 1968, *Letter Symbols for Quantities Used in Mechanics of Solids*

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

AGMA 904-B89, *Metric Usage*

NOTE – The symbols and terminology used in this standard may differ from other AGMA Standards. The user should not assume that familiar symbols can be used without careful study of table 1.