

AGMA ISO 10064-2
(ISO/TR 10064-2:1996 IDT)

AMERICAN GEAR MANUFACTURERS ASSOCIATION

*Cylindrical Gears - Code of Inspection
Practice - Part 2: Inspection Related to
Radial Composite Deviations, Runout,
Tooth Thickness and Backlash*

AGMA ISO 10064-2



AGMA INFORMATION SHEET

(This Information Sheet is NOT an AGMA Standard)

American
Gear
Manufacturers
Association

Cylindrical Gears - Code of Inspection Practice - Part 2: Inspection Related to Radial Composite Deviations, Runout, Tooth Thickness and Backlash

AGMA ISO 10064-2

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 quoted or extracted. Credit lines should read: Extracted from AGMA ISO 10064-2, *Cylindrical Gears - Code of Inspection Practice - Part 2: Inspection Related to Radial Composite Deviations, Runout, Tooth Thickness and Backlash*, with the permission of the publisher, the American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, Virginia 22314.]

Approved May 20, 1999

ABSTRACT

This information sheet provides a code of practice dealing with inspection relevant to radial composite deviations, runout, tooth thickness and backlash of cylindrical involute gears (measurements referred to double flank contact), and serves as a supplement to ANSI/AGMA ISO 1328-2, *Cylindrical gears - ISO system of accuracy - Part 2: Definitions and allowable values of deviations relevant to composite deviations and runout information*.

Published by

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

Copyright © 1999 by American Gear Manufacturers Association
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior written permission of the publisher.

Printed in the United States of America

ISBN: 1-55589-737-1

Contents

	Page
Foreword	iv
1 Scope	1
2 References	1
3 Symbols, corresponding terms and definitions	1
4 Measurement of radial composite deviations	4
5 Measurement of runout, determining eccentricity	7
6 Measurement of tooth thickness, tooth span and dimension over balls or cylinders	13
7 Gear limits and fits	18
 Bibliography	 25

Annexes

A Backlash and tooth thickness tolerance	21
--	----

Figures

1 Span and tooth thickness allowances	3
2 Tooth thickness, transverse plane	4
3 Relationship between circumferential j_{wt} , normal j_{bn} , and radial j_r backlash ..	5
4 Principle of measuring radial composite deviations	5
5 Radial composite deviation diagram	6
6 Interpretation of radial composite deviation	7
7 Principle of measuring runout	7
8 Anvil size for measuring runout	8
9 Runout from coordinate measuring machine	9
10 Runout diagram of a gear with 16 teeth	10
11 Runout and pitch deviations of an eccentric gear	11
12 Gear with zero runout, but with considerable pitch and cumulative pitch deviations (all space widths are equal)	11
13 Gear with pitch and cumulative pitch deviations and zero runout	12
14 Actual gear with little runout and substantial cumulative pitch deviation	12
15 Runout measurement with a rider when all space widths are equal and pitch deviations are present	13
16 Addendum and chordal tooth thickness	13
17 Chordal tooth thickness measurement by gear tooth caliper	14
18 Span measurement of helical gears	14
19 Limits of span measurement in base tangent plane	14
20 Dimension M_d over (between) balls or cylinders for spur gear teeth	16
21 Ball size	16
22 Radial composite action test measurement of tooth thickness	18
23 Fit of gear teeth	19

Tables

1 Standard pin diameters, in mm	15
---------------------------------------	----

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 ISO 10064-2, *Cylindrical Gears - Code of Inspection Practice - Part 2: Inspection Related to Radial Composite Deviations, Runout, Tooth Thickness and Backlash.*]

This document was developed by ISO Technical Committee 60 as a Technical Report with ANSI/AGMA participation. It was first published on 1996-03-01. In general, the information in this Information Sheet covers similar subjects as covered in ANSI/AGMA 2000-A88, *Gear Classification and Inspection Handbook - Tolerances and Measuring Methods for Unassembled Spur and Helical Gears*, and ANSI/AGMA 2002-B88, *Tooth Thickness Specification and Measurement*, that currently exist.

The user of this Information Sheet is alerted that differences exist between it and ANSI/AGMA 2000-A88 and ANSI/AGMA 2002-B88. Differences include, but are not limited to:

- Measuring methods refer to an accuracy grade numbering system that is reversed, such that the smallest number represents the smallest tolerance;
- Terminology used for tooth thickness, backlash, limits and fits are different;
- Recommendations for master gear engagement with the product gear are different;
- Runout measurements from CMM measurements are included.

Therefore, the user of AGMA ISO 10064-2 must be very careful when comparing measurement methods formerly specified using ANSI/AGMA 2000-A88 and ANSI/AGMA 2002-B88.

This version was approved by the Inspection Handbook Committee on April 16, 1999. It was approved by the Technical Division Executive Committee as an AGMA Information Sheet on May 20, 1999.

Suggestions for improvement of this Information Sheet 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 Inspection and Handbook Committee

Chairman Classification Section: E. Lawson M&M Precision Systems Corporation

Chairman Measuring Methods Section: R.E. Smith R. E. Smith & Company, Inc.

ACTIVE MEMBERS

W.A. Bradley Consultant
D.R. Choiniere . . Profile Engineering, Inc.
J. Clatworthy Gear Metrology, Inc.
B.L. Cox Lockheed Martin Energy Sys.
T.C. Glasener . . . Xtek, Incorporated
G.G. Grana The Gleason Works
D. Heinrich Xtek, Incorporated

B. Hofrichter Arrow Gear Company
I. Laskin Consultant
S. Lindley The Falk Corporation
D.A. McCarroll . . ZF Industries
D.R. McVittie Gear Engineers, Inc.
L.J. Smith Invincible Gear Company

ASSOCIATE MEMBERS

M. Antosiewicz . . The Falk Corporation
M.J. Barron Oliver Gear, Inc.
R.E. Brown Caterpillar, Inc.
M.K. Considine . . Considine Associates
R. Considine Considine Associates
J.S. Cowan Eaton Corporation
M.E. Cowan M&M Precision Systems Corp.
B. Cowley Mahr Corporation
C. Dick The Horsburgh & Scott Co.
H.D. Dodd Caterpillar, Inc.
R. Green Eaton Corporation
D. Gregory Gear Products, Inc.
B. Gudates Fairfield Manufacturing Co., Inc.
J.S. Hamilton . . . Regal-Beloit Corporation
H. Harary NIST
G. Henriot Consultant
J. Horwell Brown & Sharpe Mfg. Corp.
S. Johnson The Gear Works - Seattle, Inc.
T. Klemm Liebherr Gear Technology Co.
D.E. Kosal National Broach & Machine Co.
J. Koshiol Columbia Gear Corp.
W.E. Lake Focus Tech. - Gear Mfg & Met.
A.J. Lemanski . . . Penn State University

G.A. Luetkemeier Rockwell Automation/Dodge
J. Marfice Caterpillar, Inc.
D. Matzo Northwest Gears, Inc.
M. May The Gleason Works
P.A. McNamara . . Caterpillar, Inc.
W.J. Michaels . . . Sundstrand Corporation
M. Milam Amarillo Gear Company
T. Miller The Cincinnati Gear Co.
M. Nanlawala . . . IIT Research Institute
M. Octrue CETIM
T. Okamoto Nippon Gear Company, Ltd.
J.A. Pennell Univ. of Newcastle-Upon-Tyne
K.R. Price Eastman Kodak Company
R.S. Ramberg . . . The Gear Works - Seattle, Inc.
V.Z. Rychlinski . . Brad Foote Gear Works, Inc.
D.H. Senkfor Precision Gear Company
S. Shariff PMI Food Equipment Group
E.L. Storm Consultant
T. Waldie Philadelphia Gear Corporation
R.F. Wasilewski . Arrow Gear Company
F.M. Young Forest City Gear Company
P. Zwart Caterpillar, Inc.

(This page is intentionally left blank.)

American Gear Manufacturers Association - Cylindrical Gears - Code of Inspection Practice - Part 2: Inspection Related to Radial Composite Deviations, Runout, Tooth Thickness and Backlash

1 Scope

This part of the ISO Technical Report constitutes a code of practice dealing with inspection relevant to radial composite deviations, runout, tooth thickness and backlash of cylindrical involute gears; i.e., with measurements referred to double flank contact.

In providing advice on gear checking methods and the analysis of measurement results, it supplements the standard ANSI/AGMA ISO 1328-2. Most of the terms used are defined in ANSI/AGMA ISO 1328-2.

Annex A provides a method to select gear tooth thickness tolerances and minimum backlash of a gear mesh. Suggested values for minimum backlash are included.

2 References

The following standards contain provisions which, through reference in this text, constitute provisions of AGMA ISO 10064-2. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on AGMA ISO 10064-2 are encouraged to investigate the possibility of applying the most recent

editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 53:1974, *Cylindrical gears for general and heavy engineering - Basic rack.*

ISO 54:1977, *Cylindrical gears for general engineering and heavy engineering - Modules and diametral pitches.*

AGMA 915-3-A99, *Inspection practices - Gear blanks, shaft center distance and parallelism.*

ANSI/AGMA ISO 1328-1:1995, *Cylindrical gears - ISO system of accuracy - Part 1: Definitions and allowable values of deviations relevant to corresponding flanks of gear teeth.*

ANSI/AGMA ISO 1328-2:1997, *Cylindrical gears - ISO system of accuracy - Part 2: Definitions and allowable values of deviations relevant to radial composite deviations and runout information.*

ISO/TR 10064-1:1992, *Cylindrical gears - Code of inspection practice - Part 1: Inspection of corresponding flanks of gear teeth.*

3 Symbols, corresponding terms and definitions

3.1 Lower case symbols

Symbol	Definition	Units
a	center distance	mm
b	facewidth	mm
d	reference diameter	mm
d_b	base diameter	mm
d_a	tip diameter	mm
f_e	eccentricity	mm
f_i''	tooth-to-tooth radial composite deviation	μm
h_a	addendum	mm
h_c	reference chordal height	mm
m_n	normal module	-
s_n	normal tooth thickness	mm
s_{nc}	normal chordal tooth thickness	mm
x	profile shift coefficient	-
z	number of teeth	-