

**ANSI/AGMA 2005-D03**

Revision of  
ANSI/AGMA 2005-C96)

**AMERICAN NATIONAL STANDARD**

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***Design Manual for Bevel Gears***

ANSI/AGMA 2005-D03



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**AGMA STANDARD**

# American National Standard

## ***Design Manual for Bevel Gears***

ANSI/AGMA 2005-D03

[Revision of ANSI/AGMA 2005-C96]

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[Tables or other self-supporting sections may be referenced. Citations should read: See ANSI/AGMA 2005-D03, *Design Manual for Bevel Gears*, published by the American Gear Manufacturers Association, 500 Montgomery Street, Suite 350, Alexandria, Virginia 22314, <http://www.agma.org>.]

Approved September 30, 2003

### **ABSTRACT**

This manual provides the standards for the design of straight bevel, zero bevel, spiral bevel and hypoid gears, along with information on the fabrication, inspection and mounting of these gears. Topics include preliminary design parameters, blank design including standard taper, uniform depth, duplex taper and tilted root so that Gleason, Klingelnberg and Oerlikon machine tools are covered. Also included are drawing format, inspection, materials, lubrication, mountings and assembly.

Published by

**American Gear Manufacturers Association  
500 Montgomery Street, Suite 350, Alexandria, Virginia 22314**

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Printed in the United States of America

ISBN: 1-55589-818-1

## Contents

	Page
Foreword .....	vi
1 Scope .....	1
2 References .....	1
3 Symbols, terms and definitions .....	1
4 General design considerations .....	8
5 Preliminary design .....	10
6 Tooth geometry and cutting considerations .....	17
7 Gear tooth design .....	22
8 Rating .....	32
9 Blank considerations .....	32
10 Tolerance requirements .....	37
11 Drawing format for bevel gears .....	42
12 Bevel gear inspection .....	42
13 Materials and heat treatment .....	49
14 Lubrication .....	50
15 Design of bevel gear mountings .....	53
16 Assembly .....	57

## Tables

1 Symbols and terms .....	5
2 Material factors .....	12
3 Suggested minimum numbers of pinion teeth (spiral bevels and hypoids) ...	14
4 Suggested depth factor, $k_1$ .....	23
5 Mean addendum factor, $c_1$ .....	23
6 Sum of dedendum angles, $\Sigma\delta$ .....	23
7 Dedendum angles, $\delta_P$ and $\delta_G$ .....	24
8 Minimum normal backlash allowance (measured at the outer cone) .....	25
9 Straight, zerol and spiral bevel formulas .....	25
10 Hypoid design formulas .....	27
11 Face angle and back angle distance tolerances .....	37
12 Suggested tolerances for bore or shank diameter .....	38
13 Suggested tolerances for outside diameter, crown to back, face angle and back angle .....	39
14 Suggested normal backlash tolerance at tightest point of mesh .....	41
15 Drawing format basic outline for bevel gears .....	43
16 Example of E, P and G values .....	47
17 Typical oil flows per gear mesh .....	53
18 Typical oil jet location .....	53
19 Load face .....	54

## Figures

1	Bevel gear nomenclature – axial plane . . . . .	2
2	Bevel gear nomenclature – mean section (A-A in figure 1) . . . . .	3
3	Hypoid nomenclature . . . . .	3
4	Straight bevel . . . . .	9
5	Spiral bevel . . . . .	9
6	Zerol bevel . . . . .	9
7	Hypoid . . . . .	9
8	Pinion pitch diameter versus pinion torque – pitting resistance . . . . .	11
9	Pinion pitch diameter versus pinion torque – bending strength . . . . .	11
10	Suggested number of teeth in pinion for spiral bevel and hypoid gears (non-automotive) . . . . .	13
11	Suggested number of teeth in pinion for straight bevel and zerol bevel gears . . . . .	13
12	Hypoid direction of offset . . . . .	14
13	Face width of spiral bevel gears operating at 90 degree shaft angle . . . . .	15
14	Face contact ratio for spiral bevel gears . . . . .	16
15	Bevel gear tooth tapers . . . . .	18
16	Root line tilt . . . . .	18
17	Bevel gear depthwise tapers . . . . .	19
18	Tooth tip chamfering on the pinion . . . . .	19
19	Angle modification required because of extension in pinion shaft . . . . .	20
20	Geometry of face hobbing process . . . . .	21
21	Circular thickness factor, $k_3$ . . . . .	24
22	Recommended proportioning of the blank . . . . .	33
23	Tooth backing . . . . .	33
24	Webless miter gear – counterbored type . . . . .	33
25	Suggested locating surfaces . . . . .	34
26	Shank type pinion with tapped hole . . . . .	34
27	Shank type pinion with external threads . . . . .	34
28	Spline mounting . . . . .	35
29	Typical bevel ring gears mounted on hubs . . . . .	35
30	Method of centering counterbored-type gear on gear center . . . . .	36
31	Method of mounting gear when thrust is inward . . . . .	36
32	Use of bolt with castellated nut . . . . .	36
33	Example of required cutter clearance . . . . .	36
34	Method 1 for specifying blank tolerances on bevel gears . . . . .	37
35	Method 2 for specifying blank tolerances on bevel gears . . . . .	38
36	Typical light load contact patterns . . . . .	40
37	Desired tooth contact pattern under full load . . . . .	41
38	Tooth contact patterns . . . . .	45
39	Explanation of E and P movements . . . . .	47
40	Toe/heel contact nomenclature . . . . .	47
41	Single flank inspection chart . . . . .	48
42	Housing tolerances . . . . .	54
43	Direction of rotation . . . . .	55

## Figures (concluded)

44	Resultant gear tooth forces	56
45	Typical straddle mounting for both members	57
46	Typical overhung mounting	57
47	Typical gear marking	58
48	Measurement of normal backlash	59
49	Hypoid pinion mounting gage	60
50	Pinion setup gage for angular bevel gears	60
51	Photograph of pinion setup gage	61
52	Mounted bevel gears	61
53	Gears shown in figure 52	61
54	Typical assembly	62
55	Shimming procedure for bevel pinion with 90° shaft angle	62
56	Vertical sub-assembly	63
57	Housing-vertical mounting distance	63
58	Horizontal sub-assembly	64
59	Housing-horizontal mounting distance	64
60	Shimming procedure for bevel pinion with other than 90° shaft angle	65
61	Angular bevel gear box housing mounting distance measurements and calculations	65
62	Positioning of bevel gears	66
63	Bevel gear backlash, normal and transverse	66
64	Axial movement per 0.001 inch change in backlash	67

## Annexes

A	Bevel gear sample calculations	69
B	Hypoid gear sample calculations	73
C	Machine tool vendor data	81
D	Hypoid geometry	83
E	Tabulation of bevel and hypoid gear tolerances	85
F	Loaded tooth contact patterns	91
G	Bibliography	93

## Foreword

[The foreword, footnotes, and appendices, if any, are provided for information purposes only and should not be construed as a part of ANSI/AGMA 2005–D03, *Design Manual for Bevel Gears*.]

Because of the widespread use of bevel gearing in industry and because of the many special problems associated with this type of gearing, it was felt there was a need for technical information relating to this field of gearing, which would provide the designers with useful information. A committee of bevel gear experts was asked to develop a Design Manual for Bevel Gearing.

The first draft of the Design Manual for Bevel Gears was prepared by the Bevel Gearing Committee in March, 1962. The Committee completed and approved the manual in November, 1964. It was approved by the AGMA Membership by letter ballot as of February, 1965.

The Bevel Gearing Committee believed that they could best serve the Association and the users of AGMA Standards by consolidating the engineering design information for all forms of bevel gearing into one document. This task was undertaken in 1982 and this revision includes design information for straight bevel, spiral bevel, and hypoid gearing. The standard included the pertinent data from, and superseded the following standards:

AGMA 202.03 1965, *System for ZEROL<sup>®</sup> Bevel Gears*  
AGMA 208.03 1979, *System for Straight Bevel Gears*  
AGMA 209.04 1982, *System for Spiral Bevel Gears*  
AGMA 330.01 1972, *Design Manual for Bevel Gears*

The standard was revised in 1994 to include all currently used hypoid design methods, refine some calculations, expand the section on lubrication and update all sections with the latest material. At the same time the clauses concerning ratings were edited so as not to conflict with AGMA 2003–A86, *Rating the Pitting Resistance and Bending Strength of Generated Straight Bevel, Zerol Bevel and Spiral Bevel Gear Teeth*. ANSI/AGMA 2005–C96 was approved by the AGMA membership in October 1994 and by the American National Standard Institute as a National Standard on October 8, 1996.

This edition, ANSI/AGMA 2005–D03, was to revise and edit clause 7.14, Table 10, and the Annex B example for hypoid gear design, only.

ANSI/AGMA 2005–D03 was approved by the AGMA membership on July 10, 2003 and by the American National Standards Institute as a National Standard on September 30, 2003.

AGMA Standards are subject to constant improvement, revision, or withdrawal as dictated by experience. Any person who refers to an AGMA technical publication should be sure that the publication is the latest available from the Association on the subject matter.

Suggestions for improvement of this standard 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 National Standard - Design Manual for Bevel Gears

## 1 Scope

This standard contains information for the design, fabrication, inspection and mounting of bevel gears.

The term bevel gears is used to mean straight, spiral, zerol bevel and hypoid gear designs. If the text pertains to one or more but not all, the specific forms are identified.

The manufacturing process of forming the desired tooth form is not intended to imply any specific process, but rather to be general in nature and applicable to all methods of manufacture.

Precision finish, as used in this standard, refers to a machine finishing operation which includes grinding, skiving, and hard cut finishing. However, the common form of finishing known as lapping is specifically excluded as a form of precision finishing.

Users should determine the cutting methods available from their gear manufacturer prior to proceeding. Cutting systems used by bevel gear manufacturers are heavily dependent upon the type of machine tool that will be used.

This standard is intended for use by an experienced gear designer capable of selecting reasonable values for the factors based on his knowledge and background. It is not intended for use by the engineering public at large.

## 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the standard. All publications are subject to revision, and the users of this manual are encouraged to investigate the possibility of applying the most recent editions of the publications listed.

AGMA 390.03a - 1980, *Gear Handbook - Gear Classification, Materials and Measuring Methods for Bevel, Hypoid, Fine Pitch Wormgearing and Racks Only as Unassembled Gears.*

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 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 9005-E02, *Industrial Gear Lubricants.*

## 3 Symbols, terms and definitions

The symbols, terms, and definitions used in this standard are, wherever possible, consistent with other approved AGMA documents. It is known, because of certain limitations, that some symbols, their titles, and their definitions, as used in this document, are different than in similar literature pertaining to spur and helical gearing.

Bevel gear nomenclature used throughout this standard is illustrated in figure 1, the axial section of a bevel gear, and in figure 2, the mean transverse section. Hypoid nomenclature is illustrated in figure 3.

### 3.1 Symbols

Table 1 is a list of the symbols used in this standard, along with the associated terms. The "Where first used" column gives the clause or equation number where the particular symbol is first used.

### 3.2 Definition of terms

**addendum of gear, mean,  $a_G$ :** The height by which the gear tooth projects above the pitch cone at the mean cone distance.

**addendum of pinion, mean,  $a_P$ :** The height by which the pinion tooth projects above the pitch cone at the mean cone distance.