AMERICAN NATIONAL STANDARD

ENGINEERING DRAWING AND RELATED DOCUMENTATION PRACTICES

Gear and Spline Drawing Standards Part 2 - Bevel and Hypoid Gears

ANSI Y14.7.2 - 1978

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FOREWORD

For many years there was a growing desire for a national standard for engineering drawings, and as far back as December 1914 ASME approved and published the report of its Committee on Standards for Cross-Sections.

The subject of standard practice was laid before the ASME Standardization Committee in April 1925 and in May the ASME Council voted to approve the recommendation of the Committee that the American Standards Association be requested to authorize the organization of a nationally representative committee under its procedures to develop standards for drawings and drafting room practice. This recommendation was considered favorably and a preliminary conference was called by the ASA for October 14, 1925, and a general conference for December 4, 1925.

At the meeting of the ASA Standards Council, December 1925, the project was finally approved, its scope was outlined, and the Society for the Promotion of Engineering Education and the American Society of Mechanical Engineers were designated as joint sponsors. The organization meeting of the sectional committee was held September 24, 1926, at which Dean Franklin deR. Furman was elected chairman. Subsequently six subcommittees were appointed. These subcommittees undertook the formulation of tentative drafts of the several sections of the final report which were distributed for criticism and comment.

In the spring of 1931 an Editing Committee, Dr. Thomas E. French, Chairman, combined and harmonized the final reports of the several subcommittees. The proposed standard was approved by the sectional committee and was subsequently approved by the sponsor societies and transmitted to the American Standards Association for approval and designation as an American Standard, a status which was granted in May, 1935.

The sectional committee authorized the revision of the American Standard in December, 1940, and the Subcommittee on Revision was appointed in September, 1941. A draft dated August, 1944 received the approval of the sectional committee. The proposal was subsequently submitted to the sponsors and to the American Standards Association for their approval. This approval with designation as an American Standard was received on April 12, 1946.

In 1948, the scope of the project was enlarged, and a revision was begun in view of the increased drafting standardization work in Great Britain and Canada. An Executive Committee was formed in 1949 to supervise the work. It was decided to publish the eventual revision in separate sections. Upon completion and sectional committee approval of the last of the first six sections, they were sent to sponsors and to ASA for approval. Succeeding sections, as approved by the sectional committee were subsequently submitted to sponsors and ASA.

A section, Gears, Splines and Serrations, Y14.7, was approved and published as an American Standard on April 8, 1958.

Recognizing the need for a universal gear drafting standard, a COR Committee was organized, in December 1961, for the purpose of coordinating the views of the SAE, Y14, the Military and the AGMA on a drafting standard for gears which could provide a fundamental document for wide national use of all interested parties.

It was recommended by the SAE Drawing Standards Committee and concurred in by the members of the COR committee that this section be divided into parts with Part 1 covering spur, helical, double-helical, and rack gears, Part 2 covering bevel and hypoid gears, Part 3 covering crossed helical gears, worm gears, Spiroid and Helicon gears, and Part 4 covering splines.

After eight meetings, the COR Committee was incorporated into Subcommittee 7 of Standards Committee Y14. Many drafts were circulated among the members of AGMA, AOA, SAE, Y14 and the Military for suggestions and criticisms.

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During this time the American Standards Association became the United States of America Standards Institute and, as of October 6, 1969, the American National Standards Institute, Inc. In addition, the Society of Automotive Engineers became a cosponsor, along with the ASEE and the ASME of all Y14 Drafting Practices.

Part 1 was designated an American National Standard on November 1, 1971. This section covering Part 2 received the approval of the Y14 Standards Committee and was subsequently approved by the sponsor societies and submitted to the American National Standards Institute. It was designated an American National Standard on 17 January, 1978.

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AMERICAN NATIONAL STANDARD

ENGINEERING DRAWING AND RELATED DOCUMENTATION PRACTICES

Gear and Spline Drawing Standard
Part 2 for Bevel and Hypoid Gears

1 SCOPE. This standard establishes methods to be followed in specifying drawing data for gears with intersecting axes (bevel gears), and non-parallel, non-intersecting axes (hypoid gears). It also discusses the method of specifying matched sets on a gear drawing.

2 PURPOSE. The purpose of this standard is to establish engineering drawing standards which define the finished product for the following types of gears: straight bevel, spiral bevel, and hypoid.

3 GENERAL DRAWING PRACTICES. General drawing practices are covered in ANSI Y14.1 through ANSI Y14.5 of these American National Standards for Engineering Drawing and Related Documentation Practices. For the particular practices, refer to the applicable standard.

4 GEAR DRAWING PRACTICES. Illustrations of various gear configurations are provided for guidance only and are not mandatory.

4.1 Dimensioning. Illustrations show only those dimensions which control the gear teeth and their relation to the mounting surfaces. Dimensional values are indicated by X's to show the number of decimal places recommended in each instance.

4.2 Angular Dimensions. All angular dimensions are expressed in degrees and decimal portions thereof. Specification of angles in degrees, minutes, and seconds is optional.

4.3 Drawing Format. A gear drawing consists of a side view or axial section illustrating the general configuration and tabulated gear tooth data. A front view is used where necessary to show relationship of the gear teeth to other features. Location of tabulated gear tooth data is optional.

4.4 Drawing Title. For identification purposes, the title should include the word pinion or gear as applicable.

4.5 Straight Bevel Gear Teeth

4.5.1 Straight bevel gear and pinion teeth are drawn as shown in Figure 1. The mounting distance shown on the drawing is an assembly dimension and is specified as a reference dimension.

4.5.2 Gear data not included in Figure 1 are tabulated on the drawing as shown in Figure 2. The drawing must also show material and heat treatment specifications.

4.6 Spiral Bevel Gear Teeth

4.6.1 Spiral bevel gear and pinion teeth are drawn as shown in Figure 3.

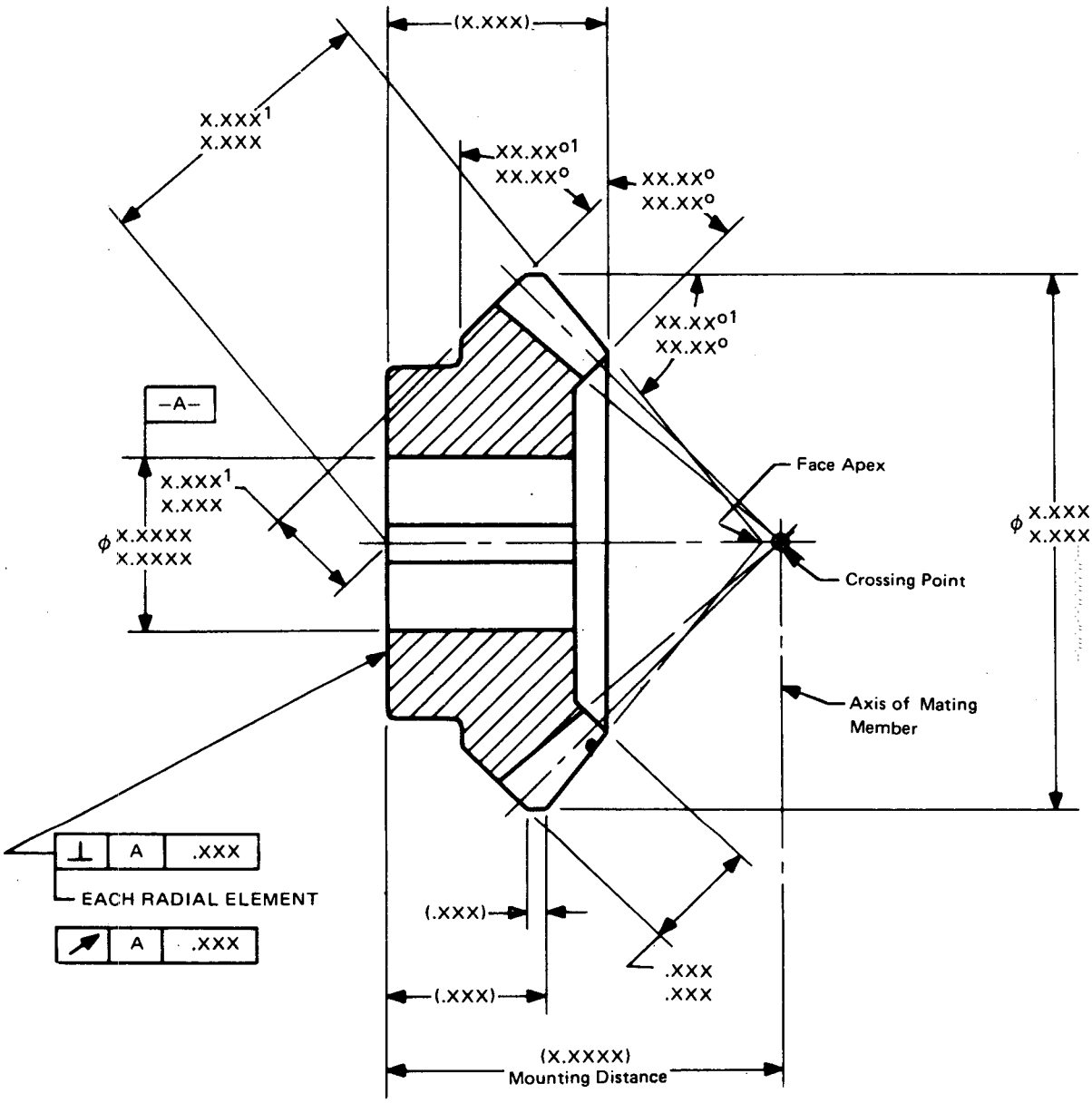
4.6.2 Gear data not illustrated in Figure 3 are tabulated on the drawing as shown in Figure 4. The drawing must also show material and heat treatment specifications.

4.7 Hypoid Gear Teeth

4.7.1 Hypoid pinion and gear teeth are drawn as shown in Figures 5 and 6, respectively.

4.7.2 Gear data not included in Figures 5 and 6 are tabulated on the drawing as shown in Figure 7. The drawing must also show material and heat treatment specifications. Distances from the pitch apex for the gear member only, face apex, and root apex to the crossing point (centerline of the mating member) are included as reference dimensions. Values are positive when the apex is beyond the crossing point and negative when the apex lies between the gear and crossing point. The pitch diameter and pitch angle are specified on the gear member only.

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1. When face angle distance and back angle distance (see FIG. 9) are used for dimensioning the gear blank, the face angle and the back angle should be given as reference dimensions on the drawing, without a tolerance.

FIG. 1 STRAIGHT BEVEL GEAR/PINION

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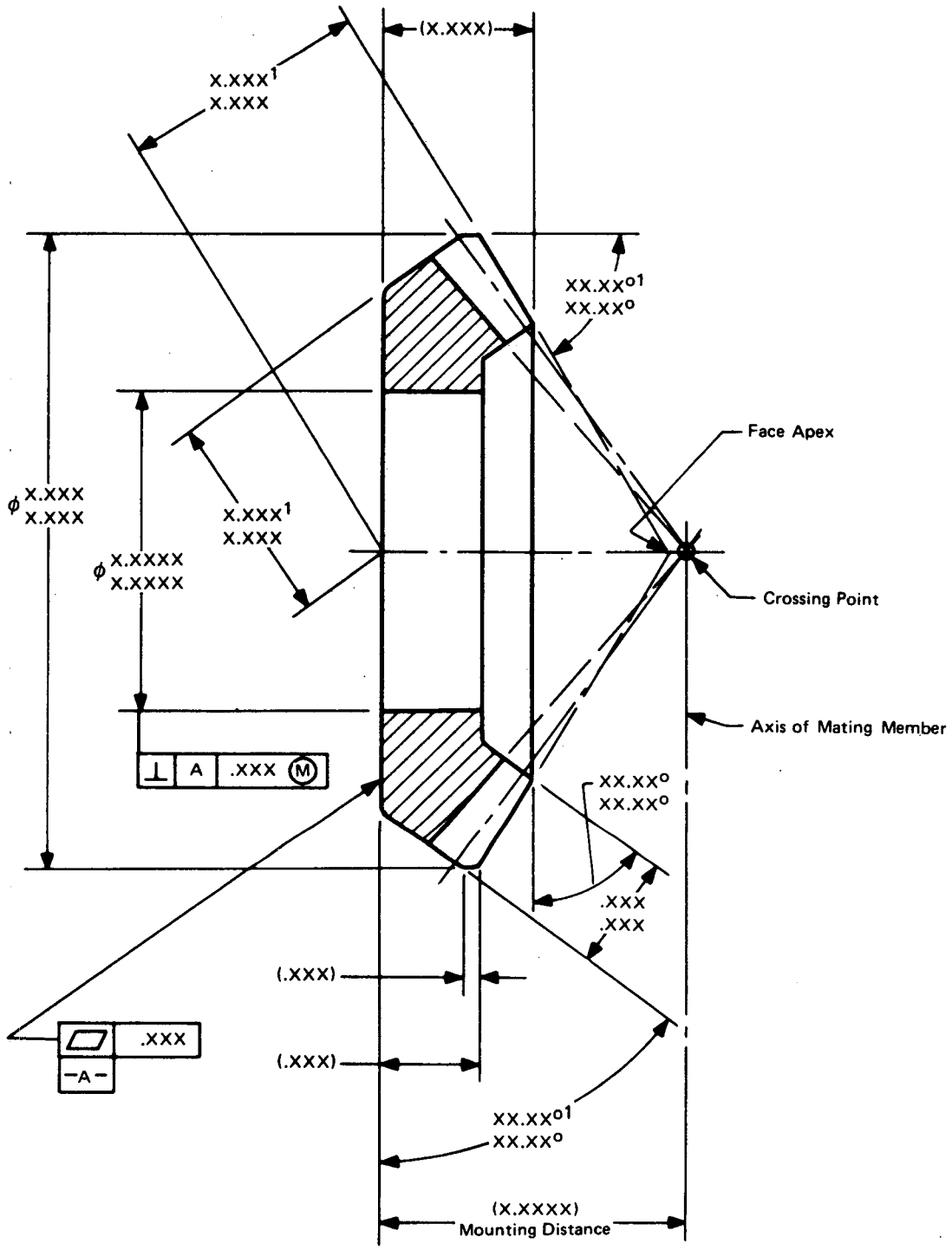
NUMBER OF TEETH	XX
DIAMETRAL PITCH[1]	(XX.XXX)
PRESSURE ANGLE	(XX.XX°)
PITCH DIAMETER	(X.XXXX)
ADDENDUM	(.XXX)[2]
WORKING DEPTH	(.XXX)[2]
WHOLE DEPTH	.XXX-.XXX[2]
THEORETICAL OUTSIDE DIAMETER	(X.XXX)[2]
THEORETICAL CROWN TO BACK	(X.XXX)[2]
PITCH ANGLE	(XX.XX°)[2]
ROOT ANGLE	(XX.XX°)
CIRCULAR THICKNESS	(.XXXX)[2]
MEAN MEASURING ADDENDUM	.XXX[2]
MEAN MEASURING THICKNESS	.XXX-.XXX[2]
NORMAL BACKLASH WITH MATE	.XXX-.XXX[2]
BACKLASH VARIATION TOLERANCE[3]	.XXXX
SHAFT ANGLE	(XX.XX°)
FILLET RADIUS	.XXX-.XXX[2]
RUNOUT TOLERANCE[3]	.XXXX
PITCH TOLERANCE[3]	.XXXX
INDEX TOLERANCE[3]	.XXXX
TOOTH SURFACE TEXTURE	XX AA OR R_a
AGMA QUALITY CLASS	XX
TOOTH FORM	CONIFLEX® OR REVACYCLE®
DRIVING MEMBER	PINION OR GEAR
DIRECTION OF ROTATION	CW AND/OR CCW
MFG SUMMARY NUMBER	XXXXXX
PART NUMBER OF MATE	XXXXXX
NUMBER OF TEETH IN MATE	XX

1. For metric drawings, specify module in place of diametral pitch. (See 5.9).
2. For metric drawings, the number of decimal places to the right of the decimal point should be reduced by one.
3. See 5.18.3, 5.23, 5.24, 5.25 and 5.26 concerning when to specify these values on the gear drawing.

FIG. 2 DATA SPECIFICATIONS FOR STRAIGHT BEVEL GEARS

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1. When face angle distance and back angle distance (see FIG. 9) are used for dimensioning the gear blank, the face angle and the back angle should be given as reference dimensions on the drawing, without a tolerance.

FIG. 3 SPIRAL BEVEL GEAR/PINION

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NUMBER OF TEETH	XX
DIAMETRAL PITCH[1]	(XX.XXX)
NORMAL PRESSURE ANGLE	(XX.XX°)
MEAN SPIRAL ANGLE	(XX.XX°)
HAND OF SPIRAL	LH OR RH
PITCH DIAMETER	(X.XXXX)
ADDENDUM	(.XXX)[2]
WORKING DEPTH	(.XXX)[2]
WHOLE DEPTH	(.XXX)[2]
THEORETICAL OUTSIDE DIAMETER	(X.XXX)[2]
THEORETICAL CROWN TO BACK	(X.XXX)[2]
PITCH ANGLE	(XX.XX°)
ROOT ANGLE	(XX.XX°)
CIRCULAR THICKNESS	(.XXXX)[2]
MEAN MEASURING ADDENDUM	.XXX[2]
MEAN MEASURING THICKNESS	.XXX-.XXX[2]
MEAN MEASURING DEPTH	.XXX-.XXX[2]
NORMAL BACKLASH WITH MATE	.XXX-.XXX[2]
BACKLASH VARIATION TOLERANCE[3]	.XXXX[2]
SHAFT ANGLE	(XX.XX°)
FILLET RADIUS	.XXX-.XXX[2]
RUNOUT TOLERANCE[3]	.XXXX
PITCH TOLERANCE[3]	.XXXX
INDEX TOLERANCE[3]	.XXXX
TOOTH SURFACE TEXTURE	XX AA OR R_a
AGMA QUALITY CLASS	XX
TOOTH FORM	GENERATED OR FORMATE® OR HELIXFORM®
DRIVING MEMBER	PINION OR GEAR
DIRECTION OF ROTATION	CW AND/OR CCW
MFG SUMMARY NUMBER	XXXXXX
PART NUMBER OF MATE	XXXXXX
NUMBER OF TEETH IN MATE	XX

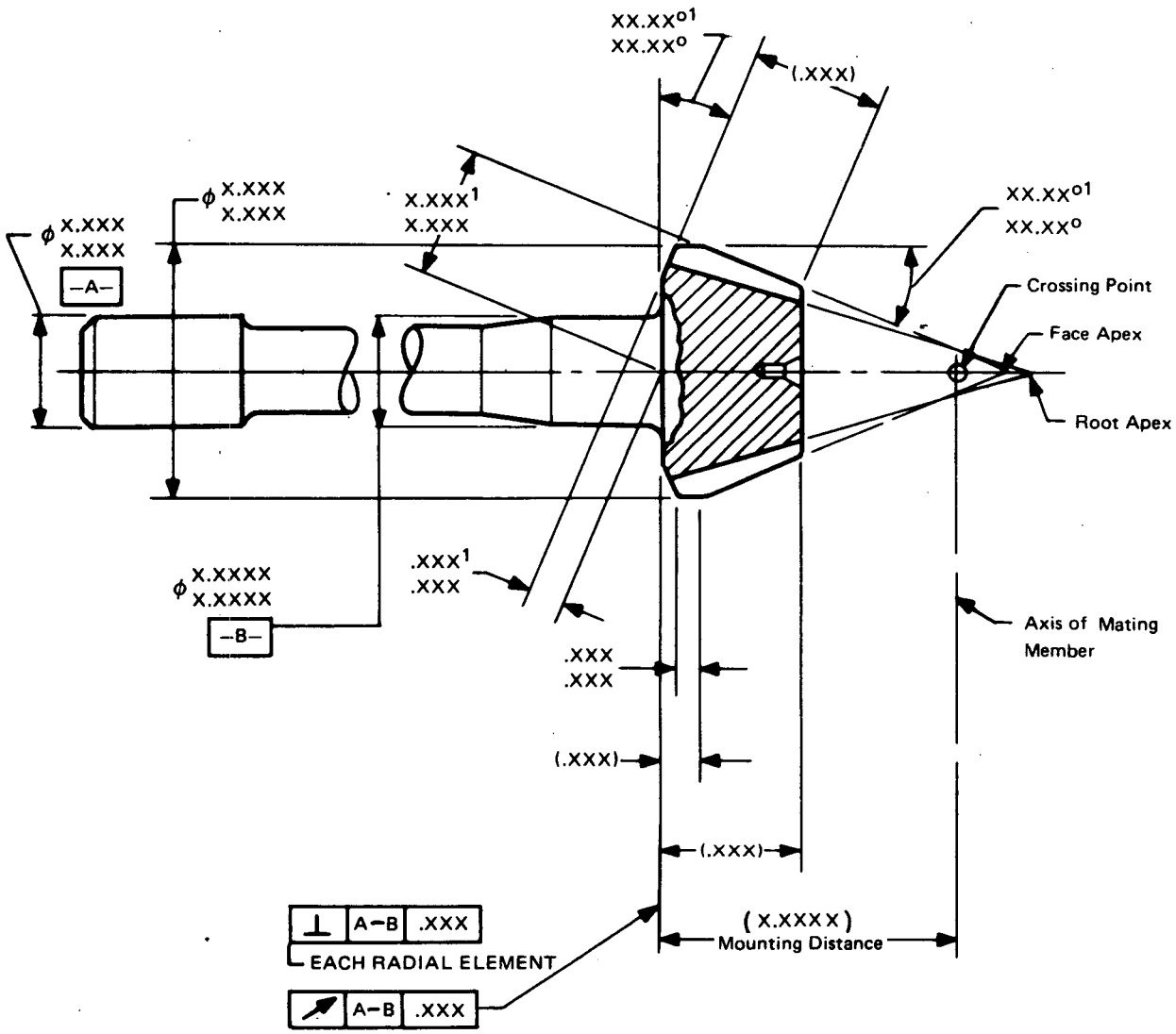
V AND H CHECK IN THOUSANDTHS OF AN INCH (OR HUNDREDTHS OF A MILLIMETER) FOR FINISHED GEARS[4]

GEAR CONVEX	TOE	HEEL	TOTAL		GEAR CONCAVE	TOE	HEEL	TOTAL
V	XX	XX	XX		V	XX	XX	XX
H	XX	XX	XX		H	XX	XX	XX

1. For metric drawings, specify module in place of diametral pitch. (See 5.9).
2. For metric drawings, the number of decimal places to the right of the decimal point should be reduced by one.
3. See 5.18.3, 5.23, 5.24, 5.25 and 5.26 concerning when to specify these values on the gear drawing.
4. May be optional for matched sets. Specify on matched set drawing. See FIG. 8.

FIG. 4 DATA SPECIFICATIONS FOR SPIRAL BEVEL GEARS

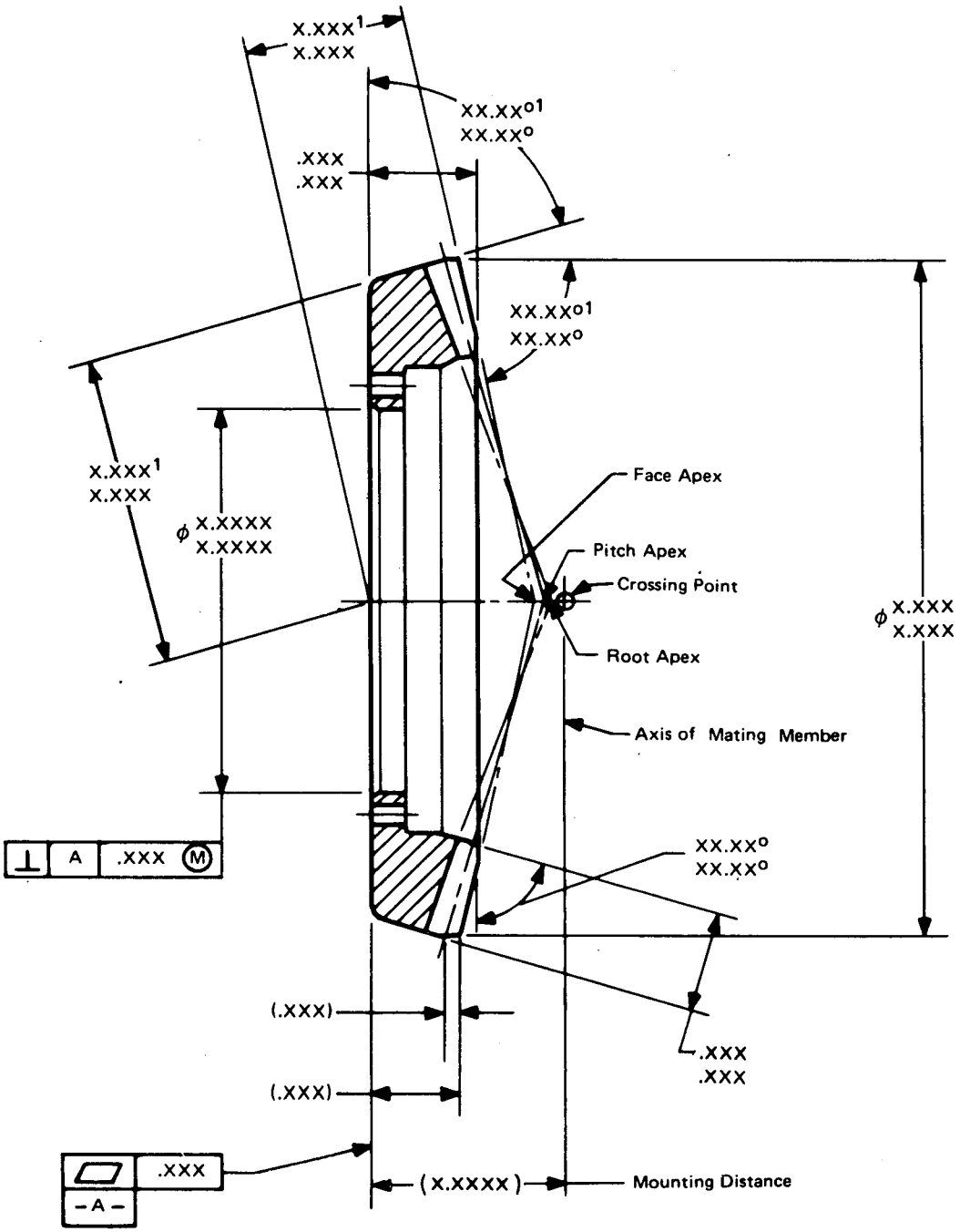
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1. When face angle distance and back angle distance (see FIG. 9) are used for dimensioning the gear blank, the face angle and the back angle should be given as reference dimensions on the drawing, without a tolerance.

FIG. 5 HYPOID PINION

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1. When face angle distance and back angle distance (see FIG. 9) are used for dimensioning the gear blank, the face angle and the back angle should be given as reference dimensions on the drawing, without a tolerance.

FIG. 6 HYPOID GEAR

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NUMBER OF TEETH	XX
DIAMETRAL PITCH[1]	(XX.XXX)
NORMAL PRESSURE ANGLE-GEAR CONVEX	(XX.XX°)
GEAR CONCAVE	(XX.XX°)
MEAN SPIRAL ANGLE	(XX.XX°)
HAND OF SPIRAL	LH OR RH
PINION OFFSET	(X.XXX)
DIRECTION OF OFFSET	AC OR BC
PITCH DIAMETER (GEAR ONLY)	(X.XXXX)
ADDENDUM (GEAR ONLY)	(.XXX)[2]
WORKING DEPTH	(.XXX)[2]
WHOLE DEPTH	(.XXX)[2]
THEORETICAL OUTSIDE DIAMETER	(X.XXX)[2]
THEORETICAL CROWN TO BACK	(X.XXX)[2]
PITCH ANGLE (GEAR ONLY)	(XX.XX°)
ROOT ANGLE	(XX.XX°)
FACE APEX TO CROSSING POINT	(.XXX)[2]
PITCH APEX TO CROSSING POINT (GEAR ONLY)	(.XXX)[2]
ROOT APEX TO CROSSING POINT	(.XXX)[2]
MEAN MEASURING ADDENDUM	.XXX [2]
MEAN MEASURING THICKNESS	.XXX-.XXX [2]
MEAN MEASURING DEPTH	.XXX-.XXX [2]
NORMAL BACKLASH WITH MATE	.XXX-.XXX [2]
BACKLASH VARIATION TOLERANCE[3]	.XXXX [2]
SHAFT ANGLE	(XX.XX°)
FILLET RADIUS	.XXX-.XXX [2]
RUNOUT TOLERANCE[3]	.XXXX
PITCH TOLERANCE[3]	.XXXX
INDEX TOLERANCE[3]	.XXXX
TOOTH SURFACE TEXTURE	XX AA OR R_a
AGMA QUALITY CLASS	XX
TOOTH FORM	GENERATED OR FORMATE® OR HELIXFORM®
DRIVING MEMBER	PINION OR GEAR
DIRECTION OF ROTATION	CW AND/OR CCW
MFG SUMMARY NUMBER	XXXXXX
PART NUMBER OF MATE	XXXXXX
NUMBER OF TEETH IN MATE	XX

V AND H CHECK IN THOUSANDTHS OF AN INCH (OR HUNDREDTHS OF A MILLIMETER) FOR FINISHED GEARS[4]

GEAR CONVEX	TOE	HEEL	TOTAL		GEAR CONCAVE	TOE	HEEL	TOTAL
V	XX	XX	XX		V	XX	XX	XX
H	XX	XX	XX		H	XX	XX	XX

1. For metric drawings, specify module in place of diametral pitch. (See 5.9).
2. For metric drawings, the number of decimal places to the right of the decimal point should be reduced by one.
3. See 5.18.3, 5.23, 5.24, 5.25 and 5.26 concerning when to specify these values on the gear drawing.
4. May be optional for matched sets. Specify on matched set drawing. See FIG. 8.

FIG. 7 DATA SPECIFICATIONS FOR HYPOID GEARS

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4.8 Matched Sets.

4.8.1 Bevel and hypoid gears are frequently matched in sets or pairs during sequence of the manufacturing process. They are maintained as a matched set in assembly. See Figure 8.

4.8.2 Gear sets which have a common factor in the tooth numbers of pinion and mating gear have a specific marking on mating teeth to assure reassembly of the gears as originally matched. See Figure 8.

4.8.3 Drawings for gears which operate as matched sets shall contain the following note:

> THIS GEAR IS PART OF A MATCHED SET WITH MATE NO. XXXXXX. EACH MATCHED SET IS TO BE MAINTAINED AS A SET AFTER IDENTITY IS DETERMINED. MARKED TEETH (NON-HUNTING) MUST BE ASSEMBLED AS SHOWN.

5 GEAR TOOTH NOMENCLATURE. The following gear tooth nomenclature is intended to familiarize the draftsman with general terms used on the gear drawing. A more complete explanation of terms, definitions and illustrations is given in American National Standard for Gear Nomenclature, ANSI/AGMA 112.05-1976, published by the American Gear Manufacturers Association, 1330 Massachusetts Avenue, N.W. Washington, D.C.

5.1 Axial Plane. A plane which contains the gear axis. Figure 9 illustrates the gear nomenclature in the axial plane of a bevel gear and Figure 10 (lower view) illustrates a view in the axial plane of a hypoid gear.

5.2 Pitch Plane. A plane tangent to the gear pitch surface. For bevel gears, the pitch plane is tangent to the pitch cone.

5.3 Transverse Plane. A plane perpendicular to both the axial plane and the pitch plane. Figure 11 illustrates the gear nomenclature in the transverse plane of a bevel gear.

5.4 Normal Plane. A plane perpendicular to the pitch plane and containing a line normal to the tooth surface at the pitch point. On bevel gears, it usually refers to the plane which passes through the mean point (the section at the center of the face width). Figure 12 illustrates the gear nomenclature in the normal plane of a bevel gear.

5.5 Tangent Plane. A plane tangent to the tooth surface at a point of contact. As used in the standard, the tangent plane is taken at the mean point.

5.6 Mean Point. The point on the intersection of the tooth surface with the pitch surface at the middle of the theoretical face width of a bevel or hypoid gear. See Figures 9 and 13.

5.7 Tooth Trace. The curve of intersection between the pitch surface and the tooth surface. See Figure 13.

5.8 Diametral Pitch. The ratio of the number of teeth to the pitch diameter in inches. Unless otherwise specified, the transverse diametral pitch (specified in the transverse plane) is implied. For hypoid gears, it is the transverse diametral pitch of the gear member.

5.9 Module (Metric). The ratio of the pitch diameter in millimeters to the number of teeth. Unless otherwise specified, the transverse module (specified in the transverse plane) is implied. For hypoid gears, it is the transverse module of the gear member.

5.10 Pressure Angle. The angle at the pitch point between a line normal to the tooth profile and the pitch plane. See Figure 14. Unless otherwise specified for bevel and hypoid gears, the normal pressure angle (measured in the normal plane at the mean point) is implied. The normal pressure angle is that angle in the normal plane at the pitch point between the tangent plane and a radial line to the gear center. On most types of gears the pressure angles on both sides of the gear tooth profile are equal. An exception to this is in designs of gears with buttress teeth such as hypoids. Hypoid gear teeth, because of their asymmetric relationship, do not naturally have equal pressure angles on their two sides. With spiral bevel gears, the designer may deliberately unbalance the pressure angles to produce a buttressed tooth. On spiral bevel and hypoid gears, the teeth are cut with lengthwise curvature. One tooth surface is concave; the other is convex. These two terms are used to identify the two sides of the gear teeth. See Figure 13.

5.11 Spiral Angle. The angle between the tooth trace and an element of the pitch cone. See Figure 13. Unless otherwise specified, the spiral angle is at the mean point. On hypoid gears, the spiral angles on gear and mating pinion are unequal.

5.12 Hand of Spiral. The direction of inclination of the teeth as viewed by an observer looking at the face of the gear. A left-hand spiral is one in which the

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outer half of the teeth are inclined in a counterclockwise direction; a right-hand spiral is one in which the outer half of the teeth are inclined in a clockwise direction. See Figure 15. With the exception of a few relatively rare hypoid gear designs, a gear and mating pinion have opposite hands of spiral.

5.13 Hypoid Pinion Offset. The perpendicular distance between the axes of a hypoid gear set. Hypoid gears and pinions, in Figure 15(a) and (b) are referred to as having a pinion offset "below center," while those in Figure 15(c) and (d) have a pinion offset "above center." The direction of pinion offset is determined where viewing the face of the gear with the pinion at the right.

5.14 Direction of Rotation. The direction of rotation is determined where viewing the gear or pinion from its back. The direction of rotation of gear and mating pinion are either clockwise or counterclockwise and always opposite to each other.

5.15 Tooth Form. The shape of the tooth profile. Since bevel and hypoid gears are manufactured with a variety of tooth forms, it is essential to specify the desired form on the gear drawing.

5.15.1 Generated. A tooth form where both members have tooth profiles produced with a relative motion between the cutting tool and the work in addition to the cutting action.

5.15.2 Non-Generated. A tooth form where the gear tooth profile is produced without a generating motion between the cutting tool and the work. The mating pinion must be generated.

5.15.3 CONIFLEX®. A trade name applied to generated straight bevel gears whose teeth have lengthwise crowning.

5.15.4 REVACYCLE®. A trade name applied to straight bevel gears produced with circular arc tooth profiles.

5.15.5 FORMATE®. A trade name applied to non-generated spiral and hypoid gears in which the tooth profiles are straight. The mating pinions are generated to be conjugate to the gears.

5.15.6 HELIXFORM®. A trade name applied to non-generated spiral bevel and hypoid gears in which the tooth surfaces are helicoidal in form.

5.15.7 ZEROL®. A trade name applied to spiral bevel gears with zero spiral angle at some point along the tooth length.

5.16 Depthwise Tooth Taper. The difference in tooth depth at the inner and outer ends of the teeth. Standard depthwise tooth taper refers to gears in which the tooth depth is proportional to the distance from the pitch apex. Zero depthwise taper refers to teeth with constant depth. Frequently conical gears are designed with "tilted root lines". This generally refers to a depthwise tooth taper which is deeper at the outer end of the tooth and shallower at the inner end of the tooth than that resulting from standard taper. Tilting the root lines is done to improve the point width of the cutting tools.

5.17 Clearance. The space between the top land of the tooth of one gear and the root land of the mating gear. See Figures 11 and 12.

5.18 Backlash. The space between mating tooth surfaces. For purposes of measurement and calculation, backlash is the amount by which the width of a tooth space exceeds the thickness of an engaging tooth. Numerical values of backlash on bevel and hypoid gears are measured at the tightest point of mesh on the pitch circle at the outer end of the tooth with gears assembled at their specified mounting distances. See Figure 12. Unless otherwise specified, the term backlash denotes normal backlash; that is, backlash measured in a direction perpendicular to the tooth surface.

5.18.1 Backlash Tolerance. The allowable variation in the backlash measured at the tightest point of mesh among all pairs of gears of a given population as a result of tooth size variation. Backlash tolerance is used as a control of tooth size in production and is specified on the drawing.

5.18.2 Backlash Variation. The difference in backlash between the tightest and loosest points of mesh in one pair of gears as a result of runout, index variation, and profile variation.

5.18.3 Backlash Variation Tolerance. The allowable variation in backlash in a single pair of gears. Backlash variation tolerance is only specified if backlash variation is critical.

5.19 Circular Thickness. The length of arc between the two sides of a gear tooth on the pitch circle. Unless otherwise specified, it is the transverse circular thickness at the outer ends of the teeth. See Figure 11.

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5.20 Measuring Addendum. The height from the top of the tooth to the chord subtending the circular-thickness arc in the normal plane. The mean measuring addendum is the value at the center of the tooth length.

5.21 Measuring Thickness. The length of the chord subtending a circular-thickness arc in the normal plane. The mean measuring thickness is the value used at the center of the tooth length.

5.22 Mean Measuring Depth. The depth of the tooth at the center of the tooth length.

5.23 Runout Tolerance. The total allowable variation of the distance between a surface of revolution and an indicated surface measured perpendicular to the surface of revolution. Unless otherwise specified, it refers to radial runout of the gear teeth; that is, in a direction perpendicular to the axis of gear rotation. This value is specified on the drawing when AGMA quality class numbers are not available.

5.24 Pitch Tolerance. The allowable difference between the pitch and the measured distance between any two adjacent teeth. This value is specified on the drawing for gears of high accuracy requirement.

5.25 Index Tolerance. The allowable displacement of any tooth from its theoretical angular or linear position relative to a datum tooth. This value is specified on the drawing for gears used for accurate positioning, such as index drives.

5.26 Composite Tolerance. Tooth-to-tooth composite tolerance and total composite tolerance may be specified in place of runout tolerance and pitch tolerance for gears of 20 diametral pitch and finer. These values are specified on the drawing when AGMA quality class numbers are not available.

5.27 Tooth Surface Texture. The texture of the finish on the working tooth surface of a gear tooth; expressed either as an arithmetical average deviation (AA) or an arithmetical mean deviation (Ra).

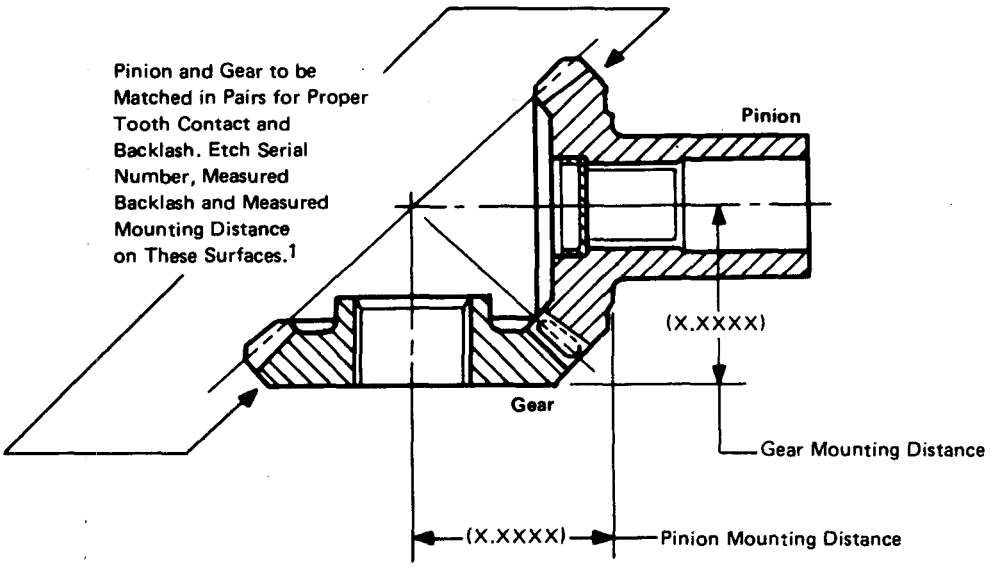
5.28 AGMA Quality Class. The classification number established by the American Gear Manufacturers Association to designate the quality requirements of a gear. See AGMA 390.03 JAN., 1973-AGMA GEAR HANDBOOK, VOLUME 1, GEAR CLASSIFICATION, MATERIALS AND MEASURING METHODS FOR UNASSEMBLED GEARS.

5.29 V and H Check. A check used for production control of the tooth contact pattern on gears after sample gears have been established which are known to function properly in the application. The V and H check gives the relative vertical (V) and horizontal (H) displacements on a testing machine to position the tooth contact pattern at both the inner (toe) and outer (heel) end of the tooth while maintaining the contact pattern in the middle of the tooth profile. For control purposes, the tooth contact pattern should duplicate the pattern on the sample pair of gears when similarly positioned in the testing machine. These data are optional on a gear drawing and should only be specified when a satisfactory development has been achieved. See Figures 4 and 7.

5.30 Face Angle Distance. The perpendicular distance from the intersection of the gear axis with the locating surface at the back of a bevel or hypoid gear to the face cone element. See Figures 9 and 10.

5.31 Back Angle Distance. The perpendicular distance from the intersection of the gear axis with the locating surface at the back of a bevel or hypoid gear to the back cone element. See Figures 9 and 10.

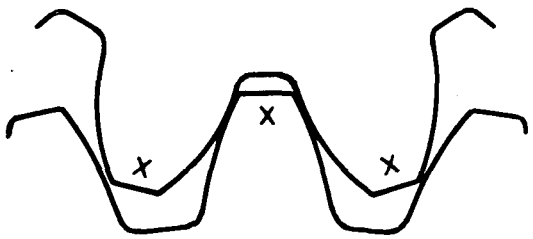
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DRIVING MEMBER	PINION OR GEAR
DIRECTION OF ROTATION	CW AND/OR CCW
MFG SUMMARY NUMBER	XXXXXX
PART NUMBER OF DRIVER	XXXXXX
PART NUMBER OF DRIVEN	XXXXXX

V AND H CHECK IN THOUSANDTHS OF AN INCH (OR HUNDREDTHS OF A MILLIMETER) FOR FINISHED GEAR SET

GEAR CONVEX	TOE	HEEL	TOTAL		GEAR CONCAVE	TOE	HEEL	TOTAL
V	XX	XX	XX		V	XX	XX	XX
H	XX	XX	XX		H	XX	XX	XX

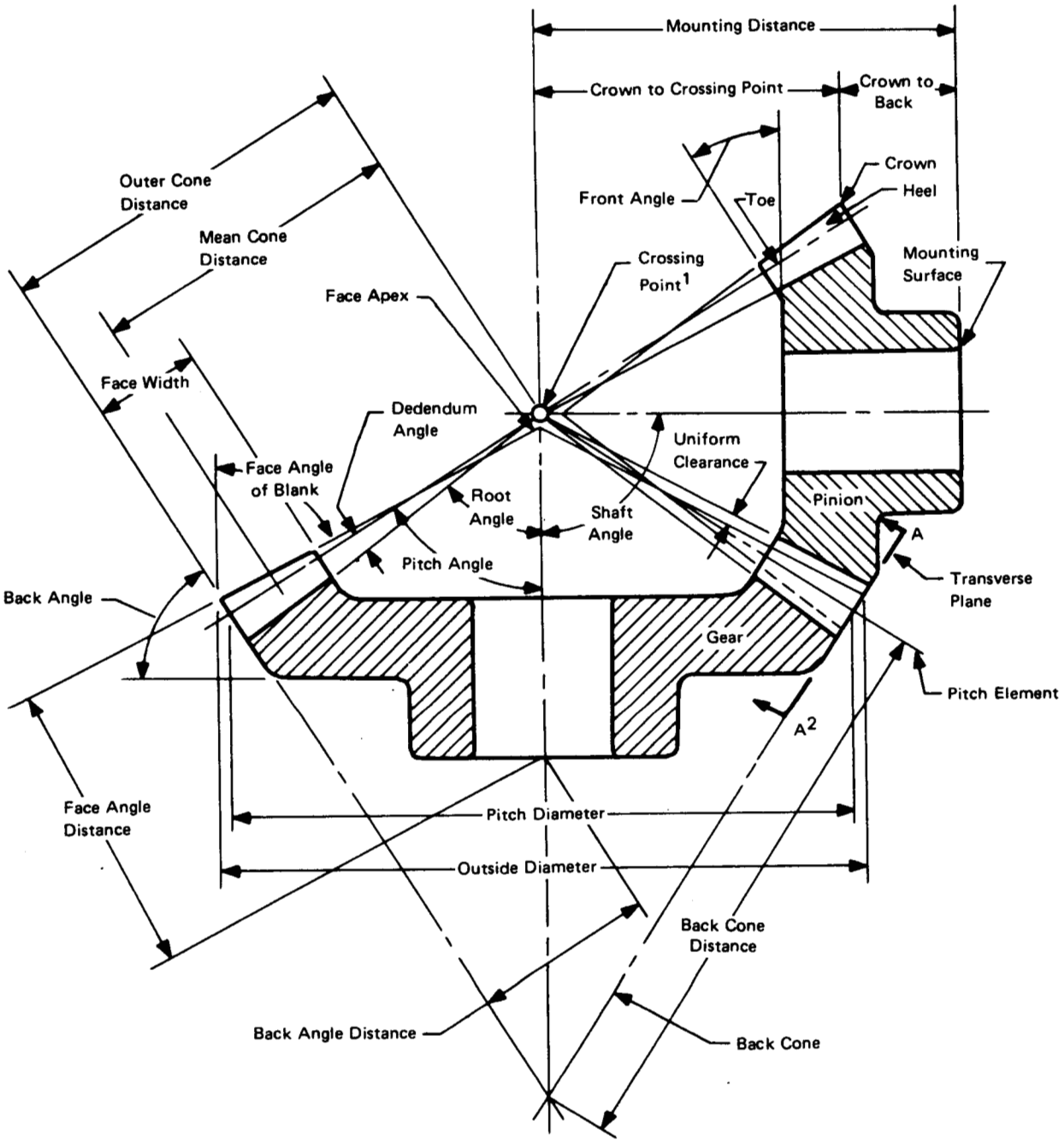


MARKED TEETH MUST BE ASSEMBLED AS SHOWN

1. On even or multiple ratios, a pair of meshing teeth should be etched "X" when in mesh in order that they may be assembled in the same running position as when manufactured. See Para. 4.8.2.
2. For metric drawings, the number of places to the right of the decimal point should be reduced by one.

FIG. 8 DATA SPECIFICATIONS FOR BEVEL GEAR MATCHED SET

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1. The pitch apex and the root apex may or may not coincide depending on individual gear design.
2. See Figure 11 for developed view of A-A.

FIG. 9 BEVEL GEAR NOMENCLATURE–AXIAL PLANE

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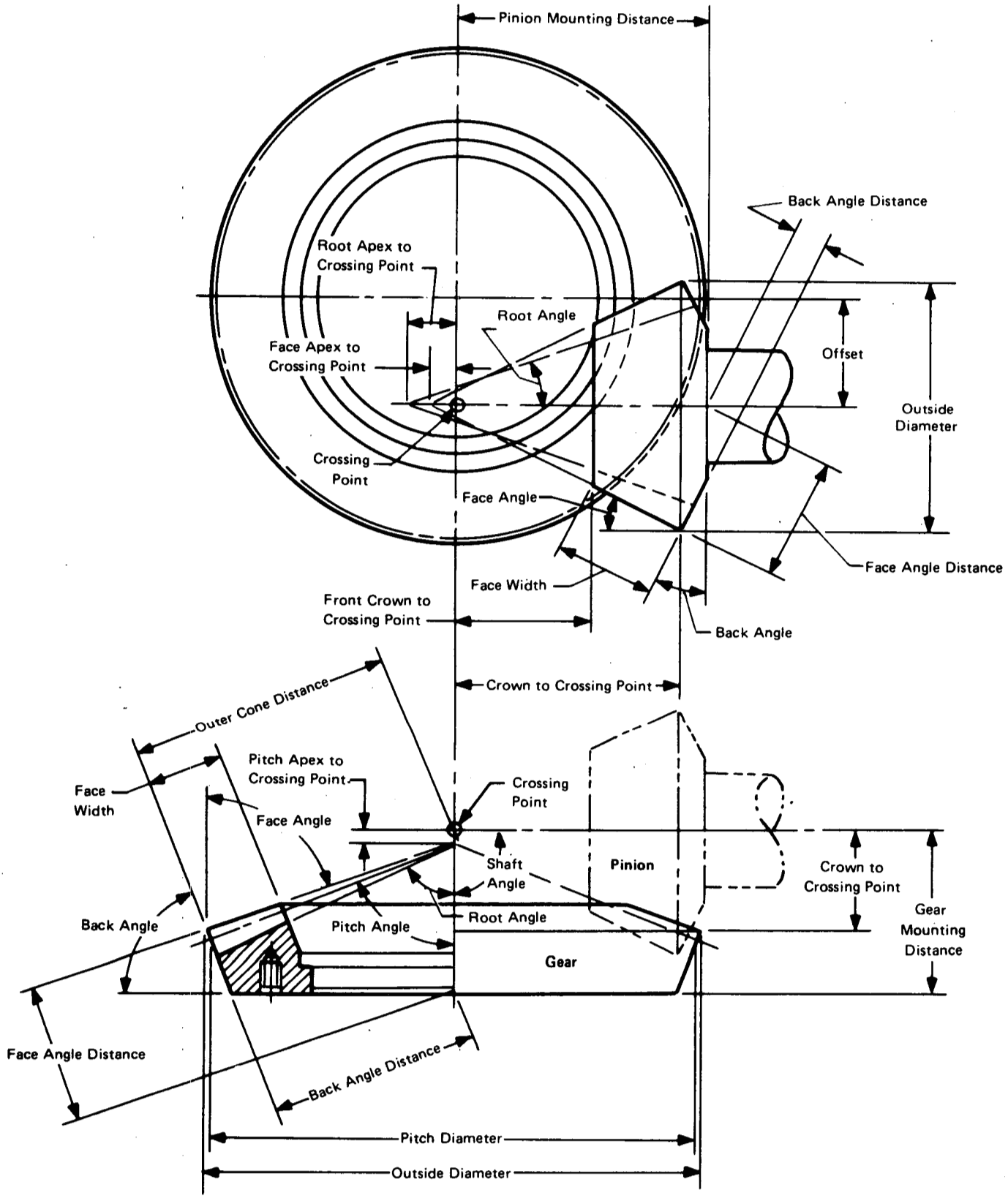


FIG. 10 HYPOID GEAR NOMENCLATURE–AXIAL PLANE

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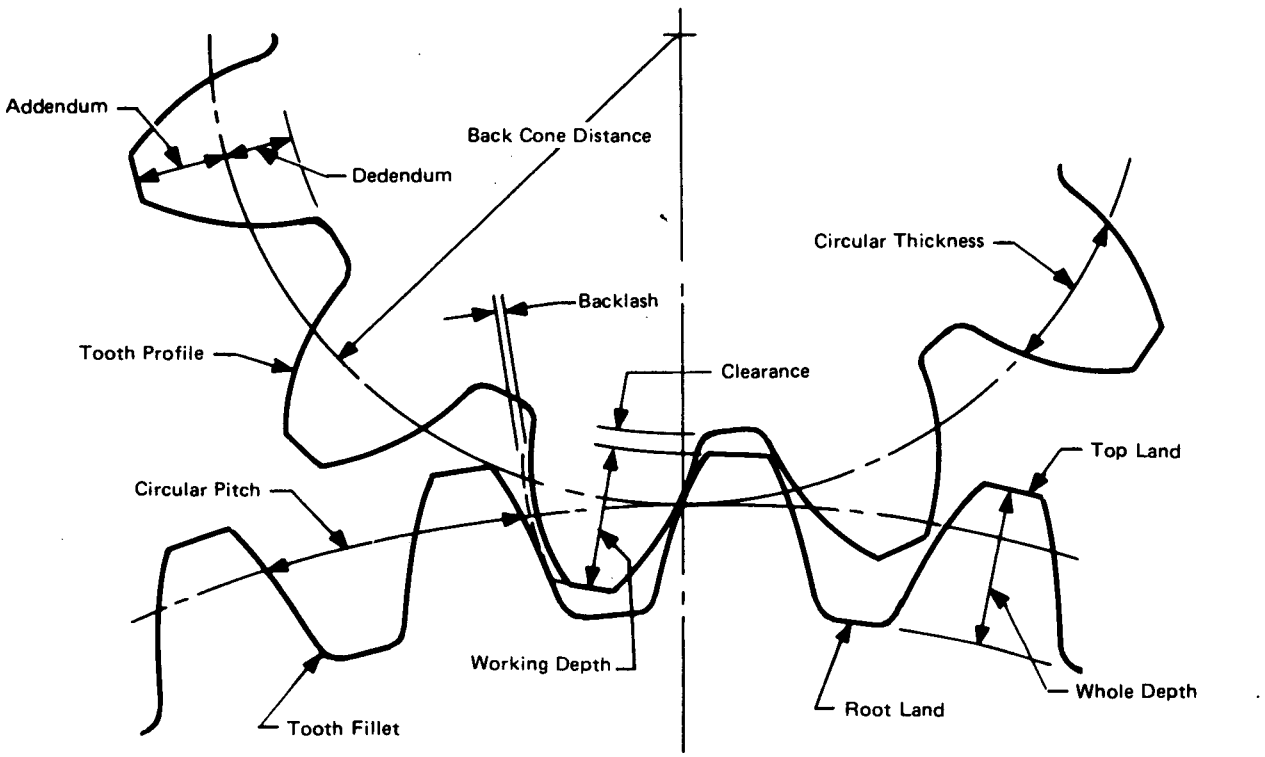


FIG. 11 BEVEL GEAR NOMENCLATURE–TRANSVERSE PLANE AT OUTSIDE DIAMETER

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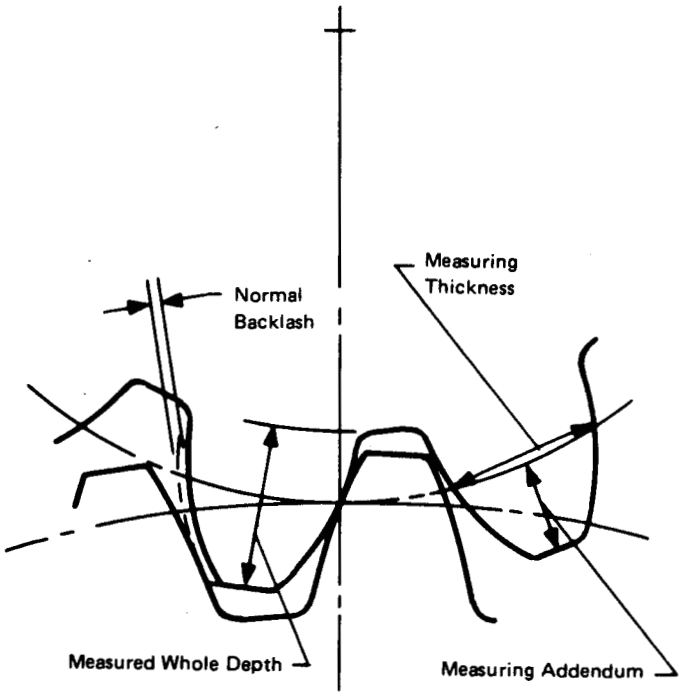


FIG. 12 BEVEL GEAR NOMENCLATURE–NORMAL PLANE AT THE MEAN POINT

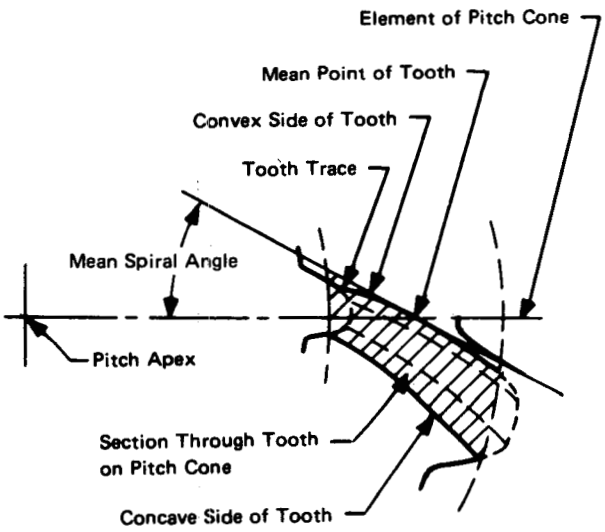


FIG. 13 MEAN SPIRAL ANGLE

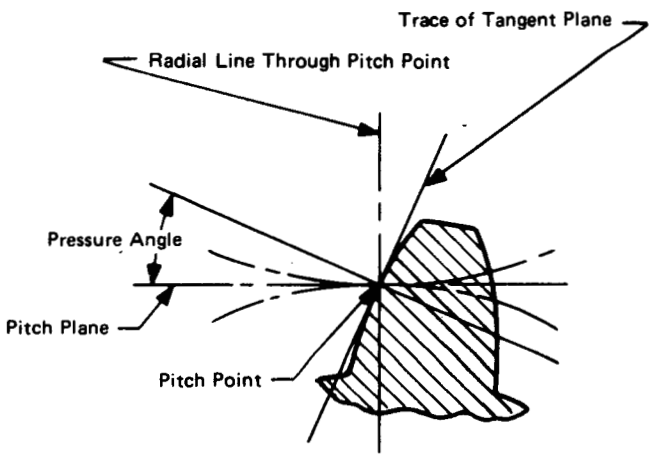
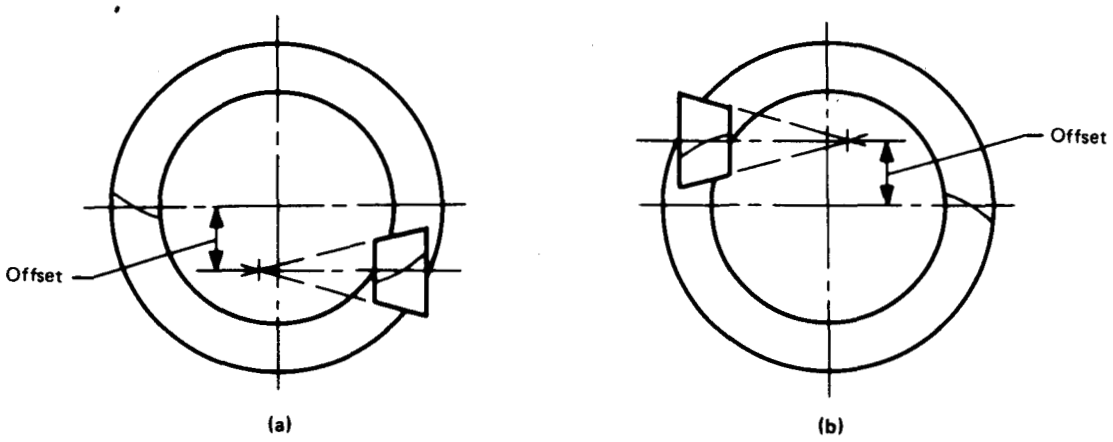
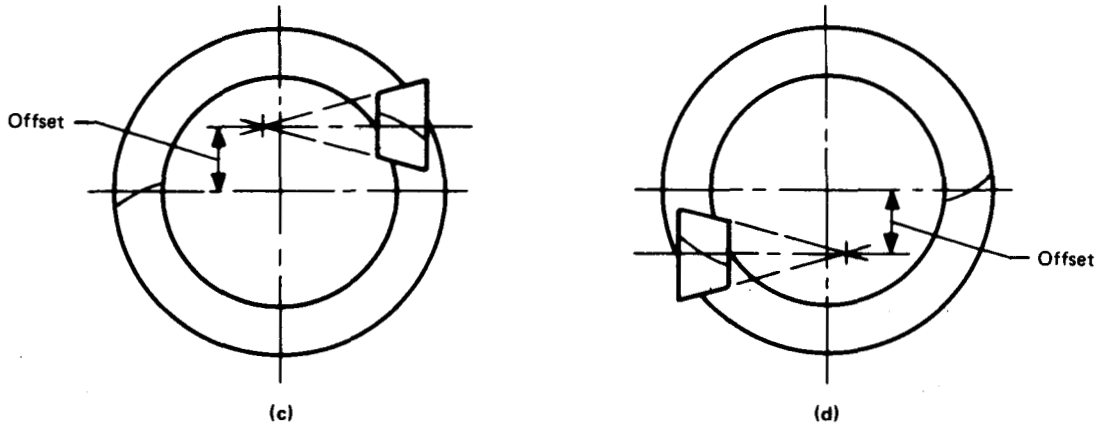


FIG. 14 PRESSURE ANGLE

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Offset Below Center LH Pinion RH Gear



Offset Above Center RH Pinion LH Gear

FIG. 15 HAND OF SPIRAL AND PINION OFFSET

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