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(JGMA/JSA)

**Vocabulary of gear terms—Part 1:
Definitions related to geometry**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by Japan Gear Manufacturers Association (JGMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law. Consequently **JIS B 0102**:1999 has been withdrawn and partially replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

JIS B 0102 series consists of the following 2 parts under the general title “*Vocabulary of gear terms*”:

Part 1: Definitions related to geometry

Part 2: Definitions related to worm gear geometry

Vocabulary of gear terms—Part 1: Definitions related to geometry

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **ISO 1122-1** published in 1998 with some modifications of the technical contents.

The portions given continuous sidelines or dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the definitions of geometrical terms related to gears.

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 1122-1:1998 *Vocabulary of gear terms—Part 1: Definitions related to geometry* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 General definitions

2.1 Kinematic definitions

2.1.1 Relative position of axis

2.1.1.1 gear, toothed gear

toothed member designed to transit motion to, or receive motion from, another toothed member, by means of successively engaging teeth (see figure 1)

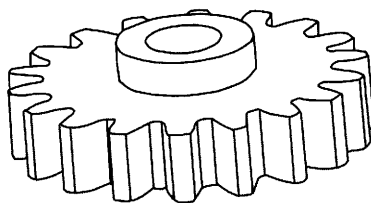


Figure 1 Example of gear

2.1.1.2 gear pair

mechanism consisting of two gears rotatable around axes relative positions of which are fixed and one gear turns the other by the action of teeth successively in contact (see figure 2)

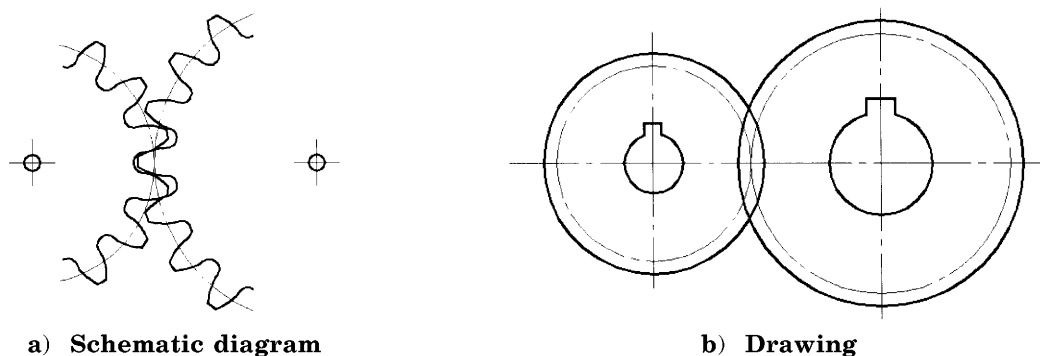


Figure 2 Example of gear pair

2.1.1.3 gear train, train of gears

any combination of gear pairs (see figure 3)

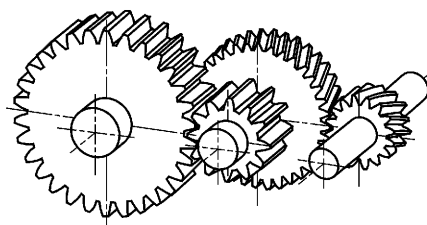


Figure 3 Example of gear train

2.1.1.4 paralleled gears

gear pair whose axes are parallel (see figure 4)

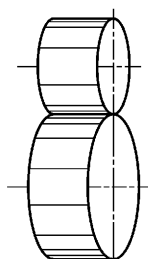


Figure 4 Example of paralleled gear

2.1.1.5 intersected gears

gear pair whose axes intersect (see figure 5)

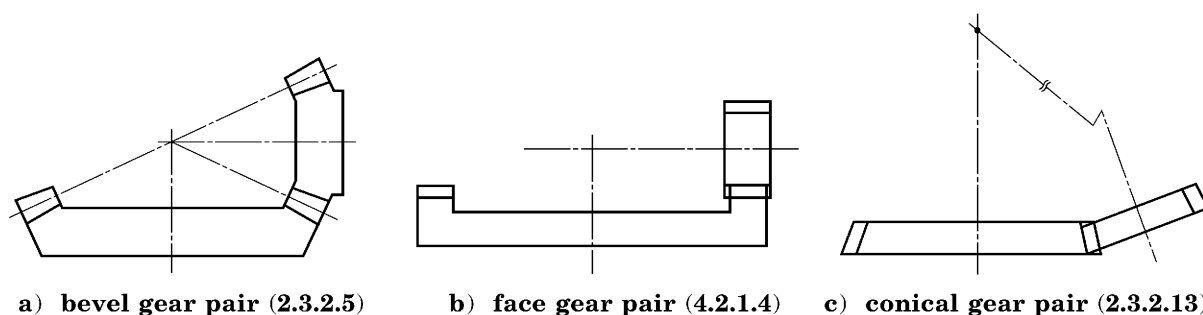
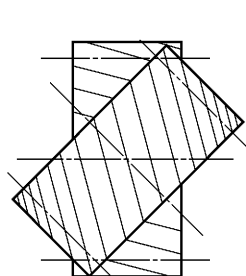


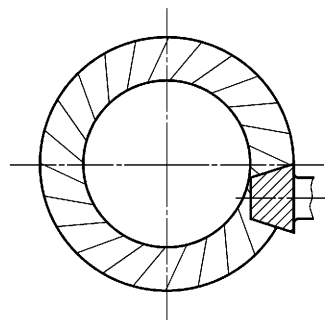
Figure 5 Examples of intersected gears

2.1.1.6 crossed gears

gear pair having skewed axes (see figure 6)



a) crossed helical gears (3.2.1.5)

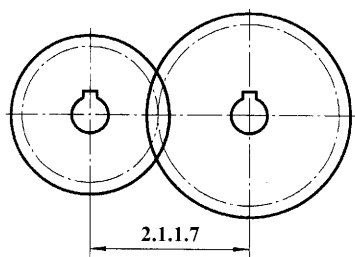


b) hypoid gear pair (2.3.2.9)

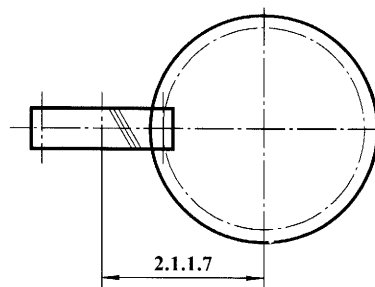
Figure 6 Examples of crossed gears

2.1.1.7 centre distance

shortest distance between the axes of a gear pair (see figure 7)



a) parallel gears

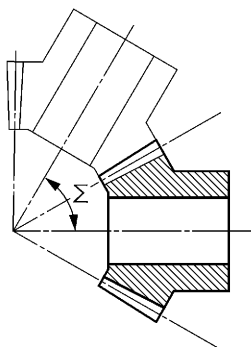


b) crossed helical gears (3.2.1.5)

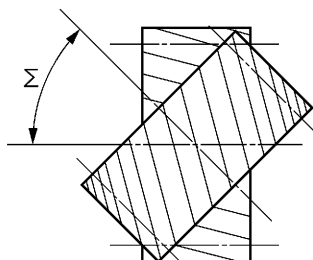
Figure 7 Examples of centre distance

2.1.1.8 shaft angle

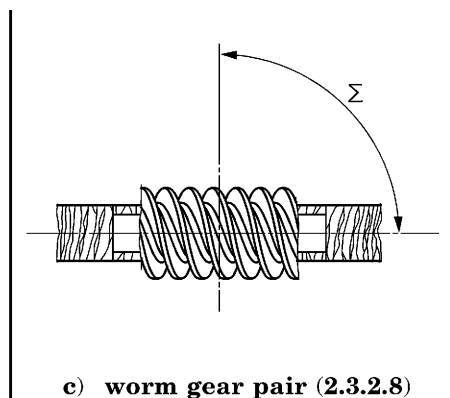
angle formed between shafts of a gear pair (see figure 8)



a) intersected gears



b) crossed helical gears (3.2.1.5)



c) worm gear pair (2.3.2.8)

Figure 8 Examples of shaft angle

2.1.1.9 epicyclic gear, epicyclic gear train, planetary gear, planetary gear train

combination of coaxial elements, of which one or more are annulus gears (2.1.2.8) and one or more are planet carriers (2.1.2.10) which turn around the common axes and support one or more planet gears (2.1.2.9) which mesh with the annulus gears and one or more sun gears (2.1.2.7) (see figure 9)

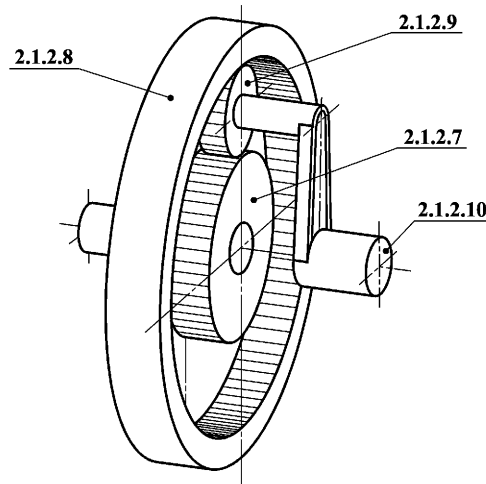


Figure 9 Example of planetary gear

2.1.2 Mating gears

2.1.2.1 mating gear

either one of the two gears of a pair, considered in relation to the other

2.1.2.2 pinion

that gear of a pair which has the smaller number of teeth (2.1.2.12)

2.1.2.3 wheel, gear

that gear of a pair, which has the larger number of teeth (2.1.2.12)

NOTE : Wheel or gear is a simplification of “conjugate gear wheel of pinion”, when the term is clearly used in opposition to “pinion”.

2.1.2.4 driving gear

that gear of a pair which turns the other

2.1.2.5 driven gear

that gear of a pair which is turned by the other

2.1.2.6 idler gear

gear that meshes with two other gears and which is driven by one and drives the other

2.1.2.7 sun gear

in planetary gear, innermost gear with external teeth (see figure 9)

2.1.2.8 annulus gear

in planetary gear, outermost gear with internal teeth (see figure 9)

2.1.2.9 planet gear

in planetary gear, one of the idler gears mounted in a planet carrier (2.1.2.10) (see figure 9)

2.1.2.10 carrier

in planetary gear, coaxial member which supports one or more planet gears (see figure 9)

2.1.2.11 gear segment

gear with teeth covering less than 360°

2.1.2.12 number of teeth

number of the full complement of teeth of a gear

2.1.2.13 sector of a gear

part of a gear with teeth

2.1.3 Relative speeds

2.1.3.1 gear ratio

quotient of the number of teeth of the wheel divided by the number of teeth of the pinion

2.1.3.2 transmission ratio

quotient of the angular speed of the first driving gear divided by the angular speed of last driven gear of a gear train

NOTE : When necessary, a plus sign should be added to the transmission ratio when the rotation directions are the same and a minus sign added when they are opposite.

2.1.3.3 speed reducing gears

pair or train of gears, of which the angular velocity of the last driven gear is less than that of the first driving gear

2.1.3.4 speed increasing gears

pair or train of gears, of which the angular velocity of the last driven gear is greater than that of the first driving gear

2.1.3.5 speed reducing ratio

transmission ratio of speed reducing gears

2.1.3.6 speed increasing ratio

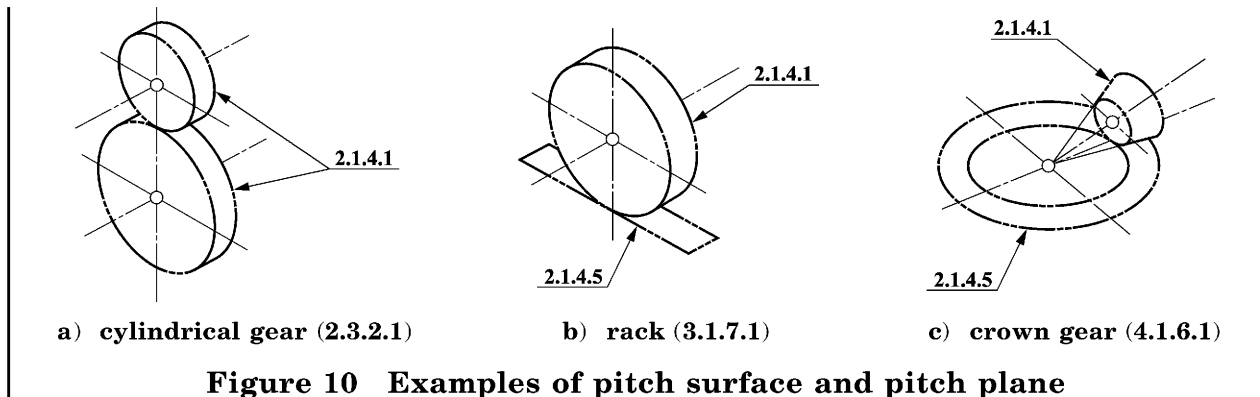
inverse of the transmission ratio of speed reducing gears

2.1.4 Pitch and reference surface

2.1.4.1 pitch surface

in a given gear pair, the geometrical surface described by the instantaneous axis of relative movement of the mating gear, in relation to the gear under consideration (figure 10)

NOTE : The pitch surfaces of parallel and intersected gear pairs roll together without slip. Pitch surfaces of crossed (cylindrical and hypoid) gear pairs have a sliding component along their tooth flanks.



2.1.4.2 reference surface

imaginary conventional surface relative to which the dimensions of the teeth of a gear are defined (see figure 11)

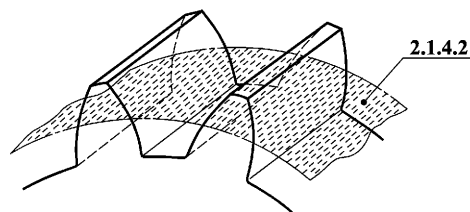


Figure 11 Example of reference surface

2.1.4.3 reference ...

qualification applicable to terms defined in relation to the reference surface of a gear

NOTE : By convention, the qualification “reference” may be implied, unless a clear distinction between “reference” and “operating” is necessary. Use the qualification “tooth reference” when there may otherwise be a risk of confusion with specially machined datum surfaces which are also termed “reference surfaces”.

2.1.4.4 operating ...

qualification applicable to terms defined in relation to the pitch surface of a gear

NOTE : By convention, the qualification “reference” may be implied, unless a clear distinction between “reference” and “operating” is necessary. Use the qualification “tooth reference” when there may otherwise be a risk of confusion with specially machined datum surfaces which are also termed “reference surfaces”.

2.1.4.5 pitch plane

pitch surface of a rack (3.1.7.1) or crown wheel (4.1.6.1), also any plane tangent to the pitch surface of an individual gear (see figure 10)

2.2 Tooth characteristics

2.2.1 Dimensions and coefficients

2.2.1.1 tooth, gear tooth

each of those elements of a gear which enter spaces between the corresponding elements of a mating gear and which, by virtue of their shape, ensure that one gear turns the other

2.2.1.2 tooth space

space between two adjacent teeth of a gear

2.2.1.3 toothing

complete set of teeth of a toothed component

2.2.1.4 pitch

dimension defining the uniform spacing, in any specified direction, of adjacent corresponding tooth flanks (2.2.4.4)

2.2.1.5 module

quotient of the pitch at the reference surface, divided by π

2.2.1.6 diametral pitch

quotient of π divided by the pitch at the reference surface, expressed in inches

2.2.1.7 unity value of dimension

quotient of the dimension under consideration divided by the module, expressed in millimetres

NOTE : When the dimension under consideration is the profile shift (3.1.8.6), the value is called “coefficient”.

2.2.1.8 effective facewidth

that part of the facewidth (3.1.1.14) deemed to be bearing load

2.2.2 Tip and root surfaces

2.2.2.1 tip surface

coaxial surface of revolution bounding the outer extremities of external gear teeth (2.2.2.7) or the inner extremities of internal gear teeth (2.2.2.8) (see figure 12)

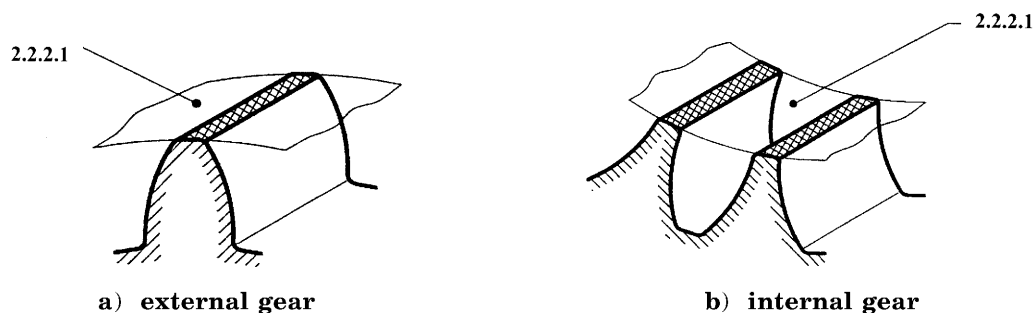


Figure 12 Examples of tip surface

2.2.2.2 addendum

part of a gear tooth between the reference surface and the tip surface (see figure 13)

2.2.2.3 top land

portion of the tip surface between opposite flanks of a tooth (see figure 13)

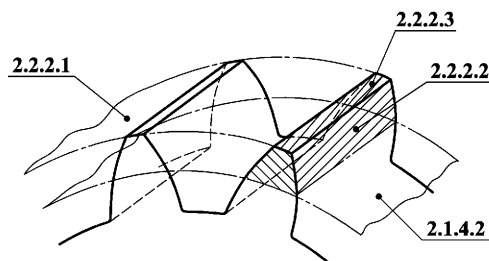


Figure 13 Example of designations of parts of tooth (1)

2.2.2.4 root surface

coaxial surface of revolution bounding the inner extremities of external gear tooth spaces or the outer extremities of internal gear tooth spaces (see figure 14)

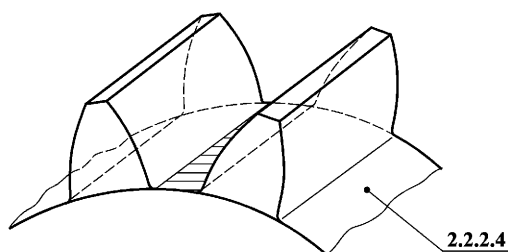


Figure 14 Example of root surface

2.2.2.5 dedendum

part of a gear tooth between the reference surface and the root surface (see figure 15)

2.2.2.6 bottom land

part of the root surface between fillets (2.2.5.5) (see figure 15)

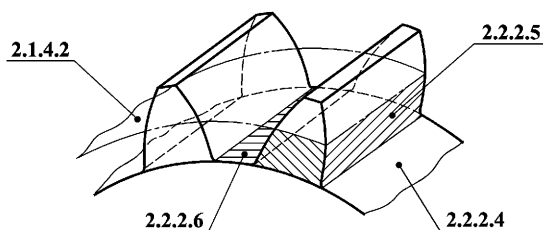


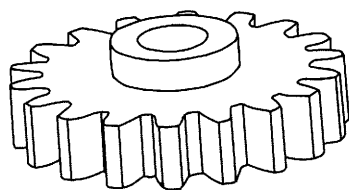
Figure 15 Examples of designations of parts of tooth (2)

2.2.2.7 external gear

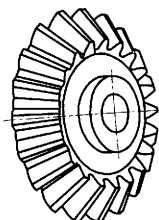
gear of which the tip surface is external to the root surface (see figure 16)

NOTE 1 In order to avoid any ambiguity, especially in the case of bevel gears, consider the section of both surfaces by a plane perpendicular to the axis of the gears.

NOTE 2 A rack (3.1.7.1) is considered to be an external gear.



a) cylindrical gear (2.3.2.1)



b) bevel gear (2.3.2.2)

Figure 16 Examples of external gear

2.2.2.8 internal gear

gear of which the tip surface is internal to the root surface (see figure 17)

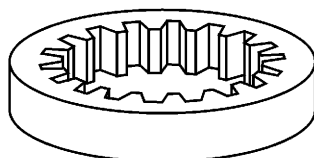
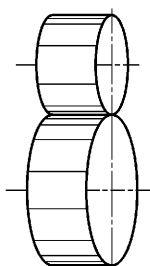


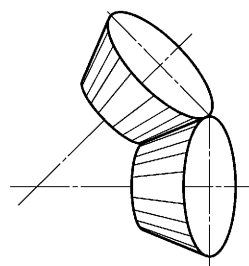
Figure 17 Example of internal gear

2.2.2.9 external gear pair

gear pair in which both gears are external gears (see figure 18)



a) cylindrical gear (2.3.2.1)



b) bevel gear (2.3.2.2)

Figure 18 Examples of external gear pair

2.2.2.10 internal gear pair

gear pair in which one of the gears is an internal gear (see figure 19)

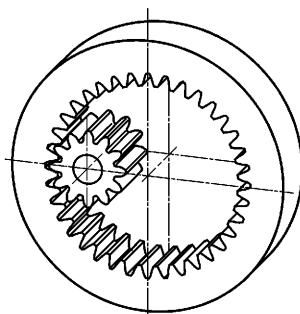


Figure 19 Example of internal gear pair

2.2.3 Flanks and profiles

2.2.3.1 tooth flank

part of the surface of a tooth which lies between the tip surface and the roof surface (see figure 20)

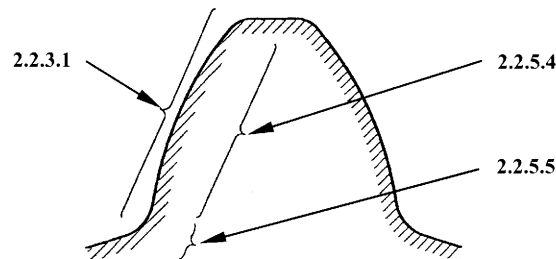


Figure 20 Example of tooth flank definition

2.2.3.2 tooth trace

line of intersection of a tooth flank with the reference surface (see figure 21)

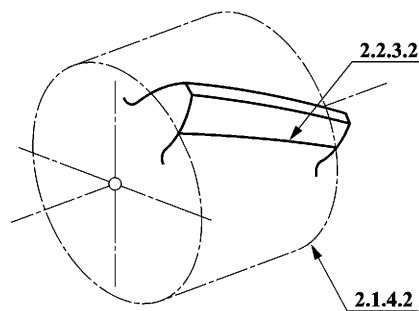


Figure 21 Example of tooth trace

2.2.3.3 flank line

line of intersection of a tooth flank with a coaxial surface of revolution

2.2.3.4 tooth profile

line of intersection of a tooth flank with any defined surface which also cuts the reference surface (see figure 22)

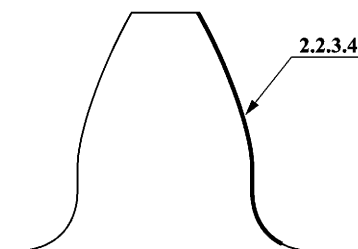


Figure 22 Example of tooth profile

2.2.3.5 transverse profile

line of intersection of a tooth flank with a surface which is perpendicular to the straight generators of the reference surface (see figure 23)

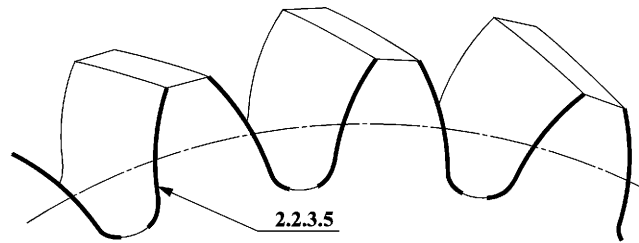


Figure 23 Example of transverse profile

2.2.3.6 normal profile

line of intersection of a tooth flank with a surface orthogonal to the tooth traces

2.2.3.7 axial profile

line of intersection of a tooth flank with a plane containing the axis of the gear

2.2.3.8 design profile

preferred profile defined by the designer

2.2.4 Flank qualifications

2.2.4.1 mating flank

in gear pair, either one of the two flanks in contact, considered in relation to the other (see figure 24)

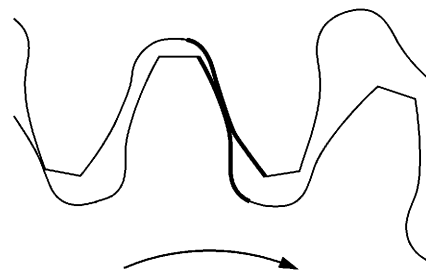
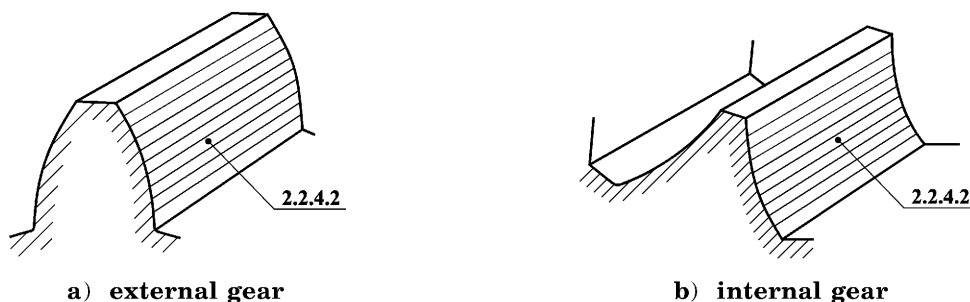


Figure 24 Example of mating flank

2.2.4.2 right flank

with observer looking at that end-face chosen as the reference face of the gear, that flank of a tooth which is to the right of the uppermost tooth when the gear is vertical (see figure 25)



a) external gear

b) internal gear

Figure 25 Examples of right flank

2.2.4.3 left flank

with observer looking at that end-face chosen as the reference face of the gear, flank of a tooth which is to the left of the uppermost tooth when the gear is vertical (see figure 26)

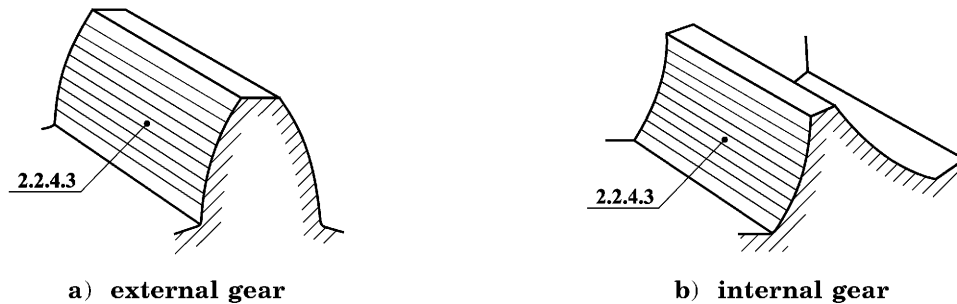


Figure 26 Examples of left flank

2.2.4.4 corresponding flanks

flanks which are all right flanks or all left flanks (see figure 27)

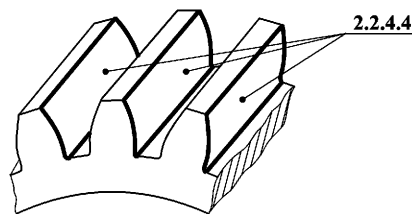


Figure 27 Example of corresponding flanks

2.2.4.5 opposite flanks

one or more right flank in relation to one or more left flank (see figure 28)

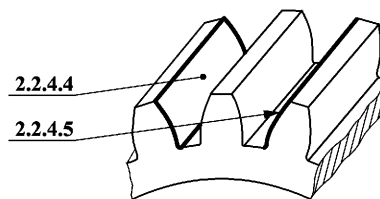


Figure 28 Example of opposite flanks

2.2.4.6 operating flank

tooth flank by which motion is transmitted to, or received from, a mating gear (see figure 29)

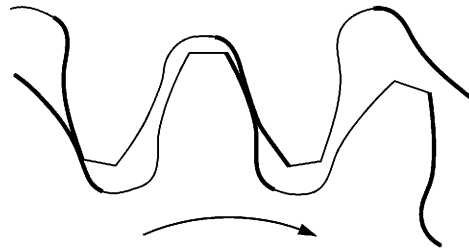


Figure 29 Example of operating flank

2.2.4.7 non-operating flank

opposite flank of an operating flank (see figure 30)

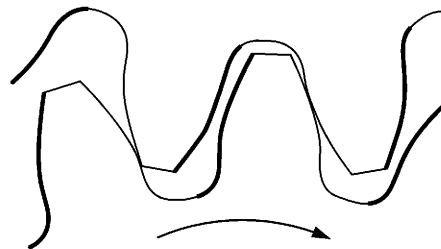


Figure 30 Example of non-operating flank

2.2.5 Parts of flanks

2.2.5.1 addendum flank

part of a flank lying between the tip surface and the reference surface of a gear (see figure 31)

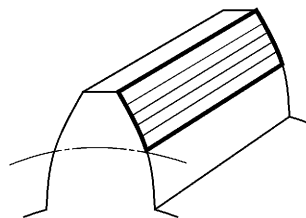


Figure 31 Example of addendum flank

2.2.5.2 dedendum flank

part of a flank lying between the root surface and the reference surface of a gear (see figure 32)

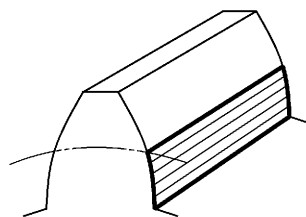


Figure 32 Example of dedendum flank

2.2.5.3 active flank

part of a tooth flank which contacts the tooth flanks of a mating gear (see figure 33)

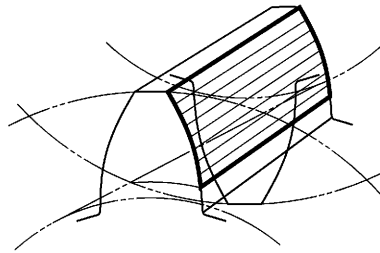


Figure 33 Example of active flank

2.2.5.4 usable flank

largest part of a tooth flank which may be used as active flank (see figure 20)

2.2.5.5 fillet

curved surface between the usable flank and the root surface (see figure 20 and figure 34)

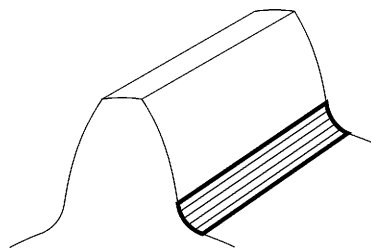


Figure 34 Example of fillet

2.2.5.6 usable-contact radius

radius of an imaginary coaxial surface, containing the junctions of the usable gear-flanks and fillets

2.2.5.7 active-contact radius

radius of an imaginary coaxial surface, containing the flank line at which effective contact ends

2.2.5.8 tooth tip

intersection of the prolongation of the tooth flank with the tip surface (see figure 35)

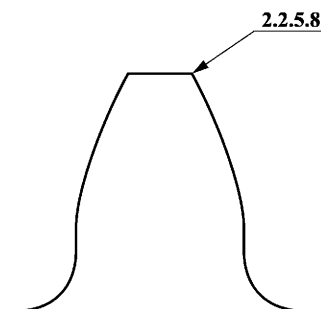


Figure 35 Example of tooth tip

2.2.6 Definitions in terms of tooth traces

2.2.6.1 spur gear

cylindrical gear (2.3.2.1) whose tooth traces are straight line generators of the reference cylinder (3.1.1.1) (see figure 36)

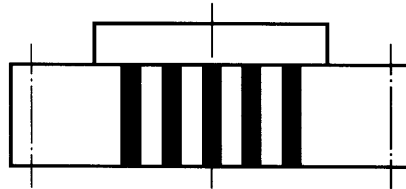


Figure 36 Example of spur gear

2.2.6.2 straight bevel gear

bevel gear (2.3.2.2) whose tooth traces are straight line generators of the reference cone (4.1.1.1) (see figure 37)



Figure 37 Example of straight bevel gear

2.2.6.3 helical gear

cylindrical gear (2.3.2.1) whose tooth traces are helices (2.4.1.1) (see figure 38)

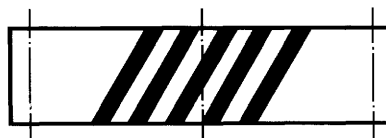


Figure 38 Example of helical gear

2.2.6.4 right-hand teeth

teeth whose successive transverse profiles show clockwise displacement with increasing distance from an observer looking along the straight line generators of the reference surface (see figure 39)

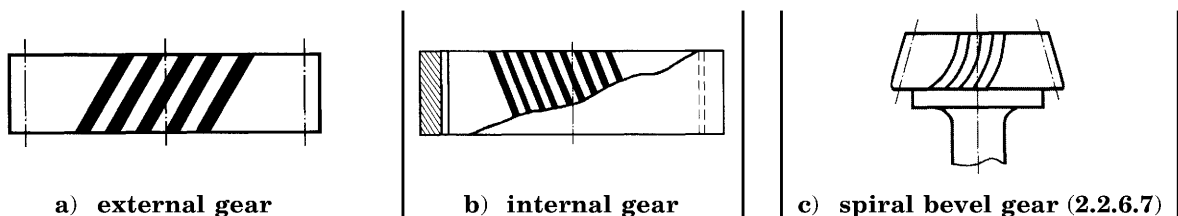


Figure 39 Examples of right-hand teeth

2.2.6.5 left-hand teeth

teeth whose successive transverse profiles show anti-clockwise displacement with increasing distance from an observer looking along the straight line generators of the reference surface (see figure 40)

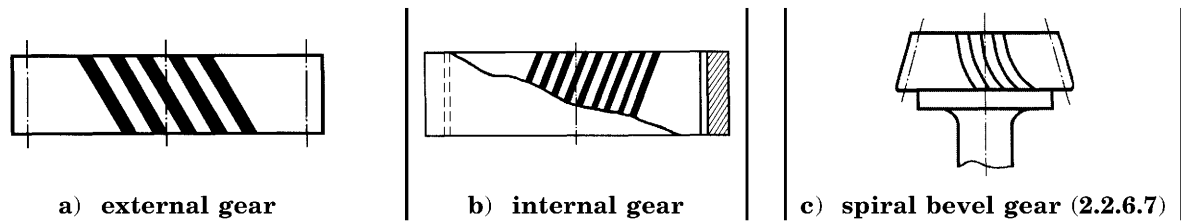


Figure 40 Examples of left-hand teeth

2.2.6.6 double helical gear

cylindrical gear (2.3.2.1) having part of the facewidth with right-hand teeth and part with left-hand teeth, with or without a gap between them (see figure 41)



Figure 41 Examples of double helical gear

2.2.6.7 spiral bevel gear

bevel gear (2.3.2.2) whose tooth traces are curves other than helices (2.4.1.1) (see figure 42)

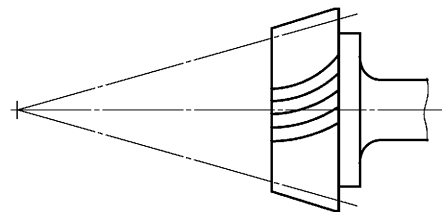


Figure 42 Example of spiral bevel gear

2.2.6.8 helical bevel gear, skew bevel gear

bevel gear whose tooth traces are non-cylindrical helices (2.4.1.1) (see figure 43)

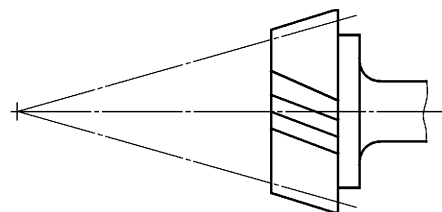


Figure 43 Example of helical bevel gear

2.3 Flank and flank shape

2.3.1 Definitions in terms of flank shape

2.3.1.1 gear action

action of rotatably mounted, meshing gears when one is turned by another, and which have angular speeds in a specified ratio

2.3.1.2 generating gear

real or imaginary gear, used for defining the toothing of the gear under consideration

NOTE : The usable flanks of this gear consist of the envelope of those of its generating gear, under specified conditions of position and relative motion.

2.3.1.3 tip interference, meshing interference

in operating gear pair, non-tangential contact between the tooth tips of one gear and the flanks of the other

2.3.1.4 tip relief

intentional modification of the profiles of gear teeth for obtaining smooth meshing of teeth without tip interference, involving removal of material near their tips (see figure 44)

2.3.1.5 root relief

intentional modification of the profiles of gear teeth for obtaining smooth meshing of teeth without tip interference, involving removal of material near their roots (see figure 44)

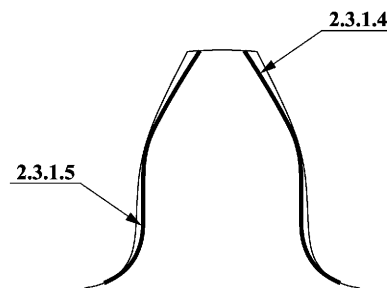


Figure 44 Example of tip relief and root relief

2.3.1.6 undercut

intentional modification of the root fillet by removal of material using a protuberance type of gear cutting tool, in order to facilitate subsequent machining operations (see figure 45)

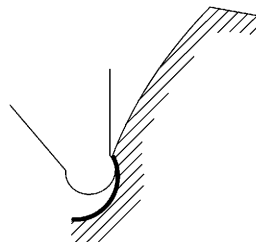


Figure 45 Example of undercut

2.3.1.7 natural undercut

phenomenon in which the dedendum of a usable flank is cut off by a cutter tip (see figure 46)

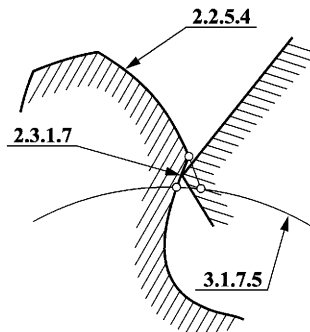


Figure 46 Example of natural undercut

2.3.1.8 crowning

progressive reduction of tooth thickness over the facewidth, (3.1.1.14 and 4.1.3.1) towards each end face of a gear (see figure 47)

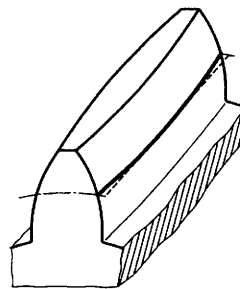


Figure 47 Example of crowning

2.3.1.9 end relief

linear or progressive reduction of tooth thickness over a small part of the facewidth (3.1.1.14 and 4.1.3.1), towards each end face of a gear (see figure 48)

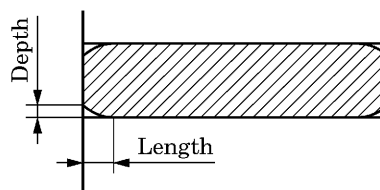


Figure 48 Example of end relief

2.3.2 Definitions in terms of gear shape

2.3.2.1 cylindrical gear

gear whose reference surface is a cylinder

2.3.2.2 bevel gear

gear whose reference surface is a cone