

Glossary for Gears —

Part 1: Geometrical definitions

[ISO title: Glossary of gears — Geometrical definitions]

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British Railways Board	Precision Gear Association (BEAMA)
Electronic Engineering Association	Individual experts
Institute of British Foundrymen	
Milling Cutter and Reamer Association	
Navy and Vickers Gearing Research Association	

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Foreword

This Part of this British Standard has been prepared under the authority of the Mechanical Engineering Standards Committee. It is identical with ISO/R 1122 “*Glossary of gears — Geometrical definitions*” and Addendum 2 “Worm gears” to ISO/R 1122 and is complementary to the British Standards for gears and allied subjects.

As regards the section on worm gears (i.e. section 4, originally published as Addendum 2 to ISO/R 1122), it should be noted that the ISO scope is as follows:

“This Addendum deals with worm gears which are gear pairs with non-parallel non-intersecting axes comprising a worm of cylindrical or toric form and a mating wheel, with *line contact* between flanks near to the line of centres (as opposed to crossed helical gear pairs which are gear pairs with point contact).

“Except for terms and definitions associated with double enveloping worm gears (4.1.2.4 to 4.1.2.6), it is devoted to the terms appropriate to the case which occurs most frequently, that of *cylindrical worm* gear pairs with a shaft angle of 90°.”

Alphabetical indexes of equivalent terms in English-French-Russian, French-English-Russian and Russian-English-French are published by ISO and may be purchased from the BSI Sales Department.

For the purposes of this British Standard the texts of ISO/R 1122 and Addendum 2 to ISO/R 1122 should be modified as follows.

Terminology. The words “British Standard” should replace “International Recommendation” wherever they appear.

Proposed amendments to ISO/R 1122. It is the intention of the United Kingdom to submit the following comments to ISO/TC 60 “*Gears*” with a view to obtaining appropriate amendments to ISO/R 1122.

Definition 1.1.4.2. This does not need an asterisk after the heading.

Definition 2.1.2.3. The reference “(see 2.1.7.4)” would appear to have been left in error.

Definitions 2.2.4.2 and 2.2.4.6. These definitions have their diagrams transposed.

The drawing up of a vocabulary of gears may be conceived in many different ways, depending on the aim: in its most simplified form, the vocabulary may have the sole aim of fixing the terminology, which sometimes varies from one workshop to another, that is to say, it may consist of a simple list of recommended terms, possibly completed by corresponding terms in other languages, but without definitions, on the assumption that these are already familiar to the people dealing with gears. On the other hand, the glossary may be a proper document of instruction, containing both the definition of each term and all useful comments to make it readily intelligible to young people and to enable them to understand better the various mathematical and practical consequences which may result from it in connection with the range of other definitions.

Since we are here dealing with International Standardization, it seems essential to enable men who deal with gears to understand one another, without error or ambiguity, by placing at their disposal the standard terms in each language which have exactly the same significance between one country and another.

This ISO Recommendation must not therefore be regarded as aiming directly at teaching, which would necessitate longer explanations, nor as intended specifically for workshop technicians who would doubtless prefer shortened and perhaps less rigorous definitions which could easily be assimilated in the light of their long experience. This ISO Recommendation has been drawn up for general use in the sense of a dictionary which may confidently be consulted in case of doubt or disagreement.

For this reason, the ISO Recommendation gives as rigorous a geometrical definition as possible for each term, since this is an indispensable factor in eliminating uncertainty in the interpretation of difficult passages, especially as regards dealings between countries where different languages are used.

If certain definitions are found to be somewhat abstract in character, it is nevertheless true that the work was carried out taking account solely of practical necessities, deliberately leaving aside all purely theoretical and historical considerations. (Thus it is, for example, that only ordinary gears with constant ratio are considered, to the exclusion of elliptical or other types of gears, and that no reference is made to working hyperboloids, which have their place in kinematic theories but are not actually used in the study, cutting or use of gear wheels).

For the same reason, in the case of two equivalent definitions which would be equally possible for the same term, but one of which is a consequence of the other, only the more general definition has been retained as a basic definition, even if, in some cases, it would have been more convenient to use the other. (For example, the module may be defined in terms of the pitch or the diameter and the number of teeth; here, the first definition, which is more general and is applicable even in the case of the rack, must be considered to be the basic definition).

Comparison of the proposal drawn up in this way with the standards and proposals which were taken as a starting point shows great similarity as regards subject matter; this similarity is clearly imposed by gear engineering itself, which is the same in all countries.

As regards form, the following should be noted:

- on the one hand, the addition of certain terms which did not exist in older standards (e.g. constant chord);
- on the other hand, the elimination of some other terms, which have either secondary or no interest in practice, and which actually belong, not to a vocabulary of gears, but to a vocabulary of geometrical or kinematic sciences, and which have already been adequately defined in this respect;
- lastly, certain French terms did not have corresponding terms in English; in the English version, these terms appear as translations of the French terms and have been put between square brackets.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 33 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Scope

This ISO Recommendation contains the part of the international glossary of gears which is devoted solely to geometrical definitions.

It gives, for each of the geometrical terms relative to gears, a standard definition which will be valid internationally, the corresponding term being chosen as far as possible in each language in such a way as to be a direct reflection of the meaning of the definition.

Since the latter condition can only be partially fulfilled in any particular language, as a result of the necessity of respecting certain established conventions, it is advisable, as far as translation into other languages is concerned, to refer always to the meaning of the definition itself, rather than to a simple transposition of the original term.

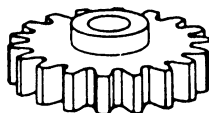
1 General definitions

1.1 Kinematic definitions

1.1.1 Relative position of axes

1.1.1.1 toothed gear

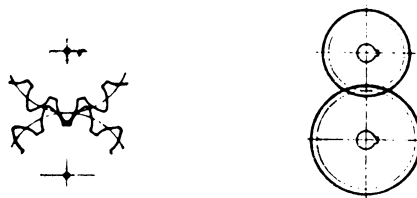
any toothed member designed to transmit motion to another one, or receive motion from it, by means of successively engaging teeth



1.1.1.2 [gear pair]¹⁾

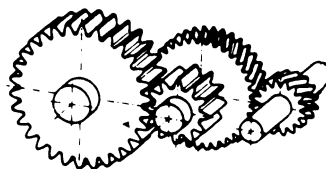
an elementary mechanism consisting of two gears mobile around axes of invariable relative position, and one of which turns the other by the action of teeth successively in contact

(French term: “Engrenage”)

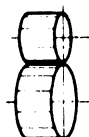


1.1.1.3 train of gears

any combination of gear pairs



1.1.1.4 [gear pair with parallel axes]¹⁾ a gear pair whose axes are parallel (French term: “Engrenage parallèle”)



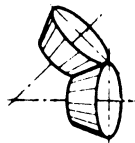
¹⁾ Between brackets is a translation of the French term for which there is no corresponding special term in English.

1.1.1.5

[gear pair with intersecting axes]²⁾

a gear pair whose axes intersect

(French term: “Engrenage concourant”)



1.1.1.6

[gear pair with non-parallel, non-intersecting axes]²⁾

a gear pair whose axes are non-parallel, non-intersecting axes

(French term: “Engrenage gauche”)



1.1.1.7

centre distance

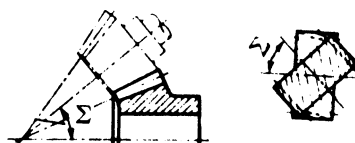
the shortest distance between the axes of a gear pair with parallel axes or with non-parallel, non-intersecting axes



1.1.1.8

shaft angle

the smallest angle through which one of the axes must be rotated in order to bring the axes into coincidence (gear pair with intersecting axes) or must be swivelled in order to bring the axes parallel (gear pair with non-parallel, non-intersecting axes) so as to cause their direction of rotation to be opposite

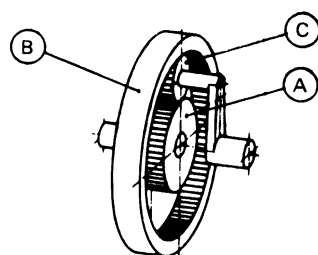


1.1.1.9

epicyclic or planetary gear train

a) **[Single planetary gear train].²⁾** A gear train comprising three co-axial elements, two of which are extreme gears with fixed axes, the third being a chassis which may or may not turn around the common axis of the two gears and which contains one or more intermediate gears.

(French term: “Train planétaire simple”)



A : Sun gear
B : Ring gear
C : Planet gear

²⁾ Between brackets is a translation of the French term for which there is no corresponding special term in English.

b) **[Compound planetary gear train].**³⁾ A planetary gear train consisting of several coupled single planetary gear trains.

(French term: “Train planétaire composé”)

1.1.2 Mating gears

1.1.2.1

mating gear

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

1.1.2.2

pinion

that one of the two gears of a pair which has the smaller number of teeth

1.1.2.3

wheel or gear

that one of the two gears of a pair which has the larger number of teeth

1.1.2.4

driving gear

that gear, of a pair, which turns the other

1.1.2.5

driven gear

that gear, of a pair, which is turned by the other

1.1.2.6

sun gear

in a planetary gear train, the extreme gear with external teeth

1.1.2.7

ring gear

in a planetary gear train, the extreme gear with internal teeth

1.1.2.8

planet gear

in a planetary gear train, the (or one of the) intermediate gear(s)

1.1.3 Relative speeds

1.1.3.1

gear ratio

the ratio of the number of teeth of the wheel to that of the pinion

1.1.3.2

transmission ratio

the ratio of the angular speed of the first driving gear of a train of gears to that of the last driven gear

NOTE When it is necessary, it is agreed to give to the transmission ratio the sign + when these angular speeds are of the same direction and the sign – when they are of opposite direction.

1.1.3.3

speed reducing gear pair (or train)

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

1.1.3.4

speed increasing gear pair (or train)

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

1.1.3.5

speed reducing ratio

the transmission ratio of a speed reducing gear pair or train of gears

³⁾ Between brackets is a translation of the French term for which there is no corresponding special term in English.

1.1.3.6**speed increasing ratio**

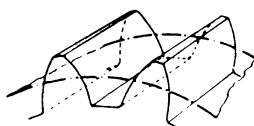
the inverse of the transmission ratio of a speed increasing gear pair or train of gears

1.1.4 Pitch and reference surfaces**1.1.4.1****pitch surface**

the geometrical surface described by the instantaneous axis of the movement of the mating gear in relation to the gear under consideration in a given gear pair

1.1.4.2**reference surface⁴⁾**

a conventional surface with reference to which the tooth dimensions of a gear, considered alone, are defined. It is the pitch surface of engagement with the basic rack

**1.1.4.3****reference ⁴⁾**

a qualification applicable to every term defined from the reference surface of a gear

1.1.4.4**working ⁴⁾**

a qualification applicable to every term defined from the pitch surface of a gear in a gear pair

1.2 Teeth characteristics**1.2.1 Dimensions and coefficients****1.2.1.1****gear tooth**

each of the projecting parts of a gear which are intended to ensure, by contact with the teeth of another gear, that one of the gears turns the other

NOTE In French, the teeth of a gear are collectively named "denture".

1.2.1.2**tooth space**

the space between two adjacent teeth of a gear

1.2.1.3**dimensions**

for teeth dimensions (tooth depth, addendum, dedendum, pitch, thickness, spacewidth, chord, addendum modification) see following sections

1.2.1.4**module and diametral pitch**

see following sections

1.2.1.5**reduced value of a dimension**

the quotient of the dimension under consideration, expressed in millimetres, by the module; or the product of the dimension under consideration, expressed in inches, by the diametral pitch. When the dimension under consideration is the addendum modification or the shaft angle modification, the reduced value is called "coefficient"

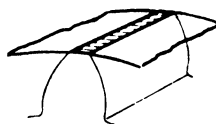
⁴⁾ By convention, the qualification "reference" may always be omitted, as understood, except when in express opposition to the qualification "working". Write the word "tooth" before "reference" when there is a risk of confusion with specially machined datum surface, also termed reference surface.

1.2.2 Tip and root surfaces

1.2.2.1

tip surface

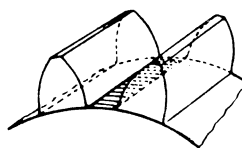
surface, coaxial with the gear, containing the crests of the teeth



1.2.2.2

root surface

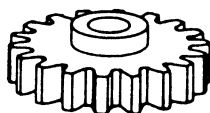
surface, coaxial with the gear, tangential to the bottom of the tooth spaces



1.2.2.3

external gear

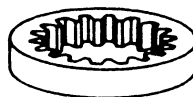
a gear whose tip surface is external to the root surface⁵⁾



1.2.2.4

internal gear

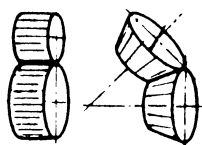
a gear whose tip surface is internal to the root surface⁵⁾



1.2.2.5

external gear pair

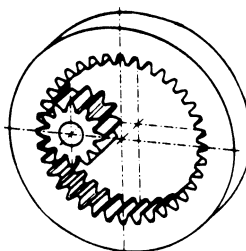
a gear pair of which both gears are external gears



1.2.2.6

internal gear pair

a gear pair of which one gear is an internal gear



⁵⁾ 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 gear.

1.2.3 Flanks and profiles

1.2.3.1

tooth flank

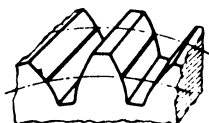
that portion of the surface of a tooth lying between the tip surface and the root surface



1.2.3.2

tooth trace⁶⁾

the intersection of a tooth flank with the reference surface



1.2.3.3

tooth profile⁶⁾

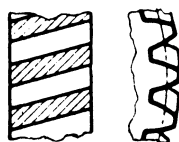
the section of a tooth flank by any defined surface cutting the reference surface



1.2.3.4

transverse profile⁶⁾

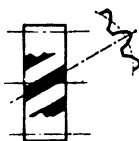
the section of a tooth flank by a surface perpendicular to the straight generators of the reference surface



1.2.3.5

normal profile

the section of a tooth flank by a surface orthogonal to the tooth traces



1.2.3.6

axial profile

the section of a tooth flank by a plane containing the axis of the gear

1.2.4 Flanks — qualifications

1.2.4.1

mating flank

in a gear pair, either one of the two flanks in contact considered in relation to the other



⁶⁾ Term defined with respect to the reference surface (qualification “reference” understood). Add the qualification “working” for the corresponding term defined with respect to the pitch surface.