

CONFIRMED
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Specification for

Spur and helical gears —

**Part 1: Basic rack form, pitches and
accuracy (diametral pitch series)**

UDC 621.833.1

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The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this standard:

Institute of British Foundrymen	Navy and Vickers Gearing Research Association
Institute of Marine Engineers	North East Coast Institution of Engineers and Shipbuilders
Institution of Engineering Inspection	Sheffield University
Institution of Engineers and Shipbuilders in Scotland	Society of Motor Manufacturers and Traders Ltd.
Ministry of Defence, Army Department	
Ministry of Defence, Navy Department	
Ministry of Technology	

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Foreword

This standard makes reference to the following British Standards:

BS 308, *Engineering drawing practice*.

BS 1134, *Centre-line-average height method for the assessment of surface texture*.

BS 1916, *Limits and fits for engineering*.

BS 2519, *Glossary of terms for toothed gearing*.

BS 3696, *Master gears*.

This British Standard forms the first part of the revision of BS 436, first published in 1932 and revised in 1940 under the title "*Machine cut gears. A. Helical and straight spur*". This further revision, which takes into consideration the latest developments in gear design, manufacture and measurement, has been prepared under the authority of the Mechanical Engineering Industry Standards Committee.

Part 1 of the specification is presented in sections concerned with the basic requirements for general tooth form, standard pitches, accuracy and accuracy testing procedures, and the presentation of this information on engineering drawings in order to ensure that the gear manufacturer receives the required data. Part 2 will provide similar information relative to metric modules in the 1 to 50 range of ISO Recommendation R 54, "*Modules and diametral pitches of cylindrical gears for general and heavy engineering*". Subsequent parts will take the form of recommendations for the application of accuracy grades, accuracy testing procedures, addendum modification, loading of gears and assembly requirements.

Throughout the work of revision, cognizance has been taken of the agreement reached to date within the International Organization for Standardization (ISO). The standard pitches are in accordance with ISO/R 54, mentioned above, and the basic rack form and the extent of its modification is generally in accord with ISO Recommendation R 53, "*Basic rack of cylindrical gears for general engineering and for heavy engineering*". This recommendation, through the work of the Comité Européen de Coordination des Normes (CEN), has already been adopted as the basis of the national standards of Belgium, Denmark, Finland, France, Germany, Netherlands, Sweden and the United Kingdom. It is expected that other countries will follow this lead. Also, instead of the five grades of gear accuracy hitherto contained in BS 436, the revision contains grades 3 to 12 of the Draft ISO Recommendation on gear accuracy (grades 1 and 2 are master gears which do not come within the scope of this specification).

The standard is a companion work to the following:

BS 235, *Gears for traction*.

BS 545, *Bevel gears (machine cut)*.

BS 721, *Worm gearing*.

BS 821, *Iron casting for gears and gear blanks (ordinary, medium and high grade)*.

BS 978, *Fine pitch gears*.

BS 978-1, *Involute spur and helical gears*.

BS 978-2, *Cycloidal type gears* (with Addendum No. 1, PD 3376: Double circular arc type gears).

BS 978-3, *Bevel gears*.

BS 1807, *Gears for turbines and similar drives*.

BS 1807-1, *Accuracy*.

BS 1807-2, *Tooth form and pitches*.

BS 2519, *Glossary of terms for toothed gearing*.

BS 3027, *Dimensions for worm gear units*.

BS 3696, *Master gears*.

NOTE For information, a table of related diametral pitches and metric modules is given in an appendix.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover 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.

1 General

1.1 Scope

Part 1 of this British Standard applies to external and internal, involute spur and helical gears for use with parallel shafts, and having normal diametral pitches equal to, or coarser than, 20.

The basic rack and tooth form are specified, together with requirements for terminology and notation, first and second preference standard pitches and fundamental tolerances which determine the grades of gear accuracy.

Ten grades of accuracy are applied to each gear element and thus the standard can be applied to meet requirements ranging from coarse commercial applications to precision gears for high-speed and/or high-load applications.

1.2 Terminology, definitions and notation

As the first step towards achieving international understanding of gears terminology, the terms and definitions of the Draft ISO Recommendation No. 888, “*International vocabulary of gears*” have been applied, together with corresponding notation derived from ISO Recommendation No. 701, “*International gear notation, symbols for geometrical data*¹⁾”.

a	Centre distance
d	Reference circle diameter
d_1	Reference circle diameter, pinion
d_2	Reference circle diameter, wheel
d_a	Tip diameter
d_{a1}	Tip diameter, pinion
d_{a2}	Tip diameter, wheel
y	Centre distance modification coefficient
b	Face width
b_1	Face width, pinion
b_2	Face width, wheel
x	Addendum modification coefficient
x_1	Addendum modification coefficient, pinion
x_2	Addendum modification coefficient, wheel
l	Length of arc
P_t	Diametral pitch
P_n	Normal diametral pitch
P_t	Transverse pitch
z	Number of teeth
z_1	Number of teeth, pinion

z_2 Number of teeth, wheel

β Helix angle at reference cylinder

α Pressure angle at reference cylinder

α_n Normal pressure angle at reference cylinder

α_t Transverse pressure angle at reference cylinder

α_{t_w} Transverse pressure angle, working

2 Basic rack tooth profile

For the purposes of this British Standard, the basic rack tooth profile, having a pressure angle of 20° and the form as shown in Figure 1, has been adopted.

In practice, the basic rack is usually modified. The extent of modification shall be in accordance with the following:

- 1) Variation of the total depth within the limits 2.25 to 2.40 which permits an increase in root clearance within the limits 0.25 to 0.40 to allow for different manufacturing processes.
- 2) Variation of the root radius within the limits 0.25 to 0.39.
- 3) Application of tip relief within the limits shown in Figure 2.

3 Normal diametral pitches

The normal diametral pitch shall be selected from Table 1. Wherever possible, selection should be made from the values given in column 1.

Table 1 — Normal diametral pitches

(in accordance with ISO/R 54, “Modules and diametral pitches of cylindrical gears for general and heavy engineering”)

1	2
Normal diametral pitch P_n (in)	
Preferred pitches	Second choice pitches
20	18
16	14
12	11
10	9
8	7
6	5.5
5	4.5
4	3.5
3	2.75
2.5	2.25
2	1.75
1.5	
1.25	
1	

¹⁾ This information will be incorporated in BS 2519, “*Glossary of terms for toothed gearing*”, now being revised.

