
Specification for

Marine main propulsion gears and similar drives : metric module

Spécification pour les mécanismes principaux de propulsion maritime
et entraînements analogues : module métrique

Spezifikation für Schiffshauptantriebsräder und ähnliche Triebe : metrisches Modul

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Foreword

This revision of this British Standard has been prepared under the direction of the Mechanical Engineering Standards Committee.

It incorporates a complete revision of the accuracy classes, which now do not strictly correlate with any of the accuracy grades in previous editions of this standard.

Where practicable, appropriate accuracy grades from BS 436 : Part 2 have been adopted for individual elements.

The scope of the standard has been widened from the original turbine drive application to the more general field of marine propulsion gearing.

This revision supersedes BS 1807 : 1976, which is now withdrawn.

British Standard Specification for

Marine main propulsion gears and similar drives : metric module

1. Scope

This British Standard specifies basic tooth forms, modules and accuracy requirements for high-grade gears. It is applicable to marine main propulsion gears and similar drives in the range 2 to 25 normal module.

The accuracy requirements refer to gears supplied as mating pairs or sets with or without gearbox. Individual gears in isolation are not covered by this standard.

Four classes of gear are specified, designated Class A0, A1, A2 and A3 respectively.

Class A0 is for highly loaded high speed applications where noise and vibration have to be kept to a minimum. It is appropriate for naval turbine drives.

Class A1 is appropriate for high speed drives with pitch line speeds over 60 m/s, e.g. for turbine first reduction gears.

Class A2 is appropriate for medium speed drives with pitch line speeds of from 20 m/s to 60 m/s, e.g. for high speed diesel drives or for the higher speed turbine secondary gears.

Class A3 is appropriate for low speed drives with pitch line speeds of up to 20 m/s, e.g. for medium speed diesel drives or low speed turbine secondary gearing.

Gear loading is not covered by this standard.

However, requirements for tooth contact marking following service load test running are specified.

2. References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

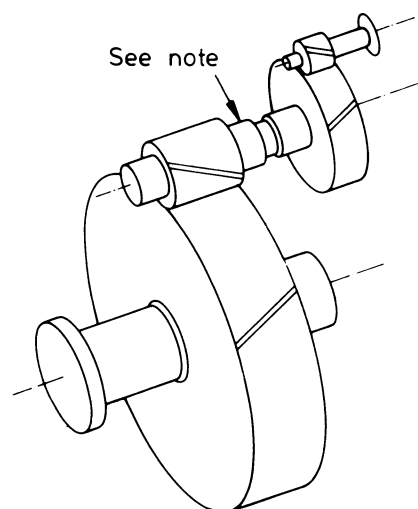


Figure 1. Tandem gear train

NOTE to figures 1 and 2. If a flexible coupling is used between primary and secondary gears, the drive is described as a tandem articulated gear train.

3. Terminology

3.1 General. The terms and definitions given in BS 2519 : Parts 1 and 2 have been used, together with corresponding notation. Symbols used in this standard include the following.

a	Centre distance
b	Facewidth
d	Reference circle diameter
d_j	Journal diameter
d_r	Mean diameter of reference surface
F_a	Axial runout
F_r	Radial runout
L_m	Length of arc (selected measurement length)
L_s	Bearing span (to mid points of bearing lengths)
m_n	Normal module
α_n	Normal pressure angle in degrees

All dimensions used in this standard are in millimetres unless otherwise stated.

3.2 Double-reduction gear trains. The descriptions used for double-reduction gear trains shall be those given in figures 1 to 7 inclusive. In these figures only one gear train is shown for convenience, but the terminology used is equally applicable to systems having more than one gear train.

4. Basic rack tooth profile

The tooth profile normal to the helix shall correspond to figure 8 for a 20° pressure angle or to figure 9 for a 16° pressure angle. The basic rack form for both the 20° and

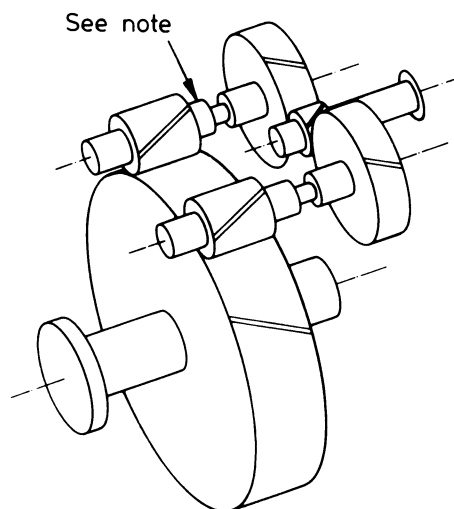


Figure 2. Dual tandem gear train

16° pressure angle teeth is straight-sided except that a slight relieving of the tip of the tooth is permissible. The amount of this profile relief shall not exceed that shown in figures 8 and 9 respectively.

Where a pressure angle other than 20° or 16° is chosen, the basic rack profile shall be agreed between the purchaser

and the manufacturer.

Undercutting in the root of the generated tooth is permitted to a small extent to allow a finishing process to be applied to the tooth flanks, e.g. shaving or profile grinding such that the transition from finished flank to as-hobbed root is free from significant stress-raisers.

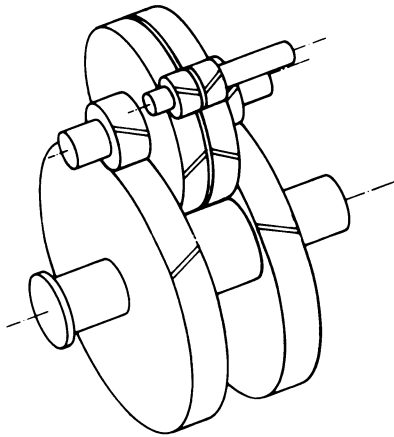


Figure 3. Split secondary gear train

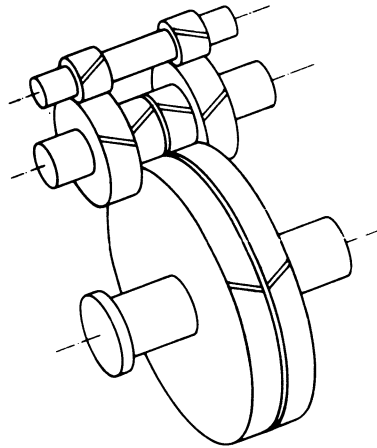


Figure 4. Split primary gear train

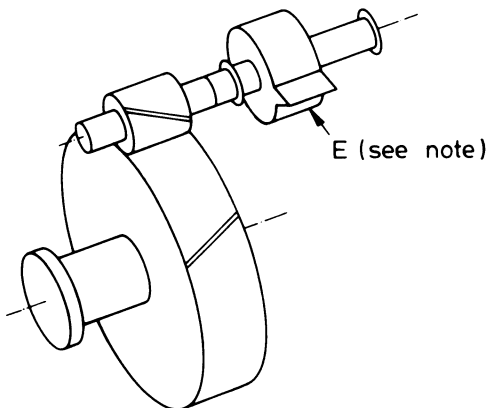


Figure 5. Epicyclic primary gear train

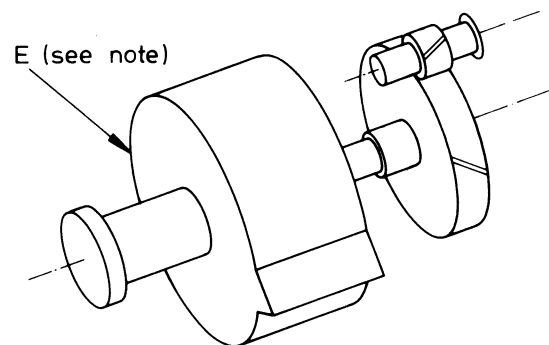


Figure 6. Epicyclic secondary gear train

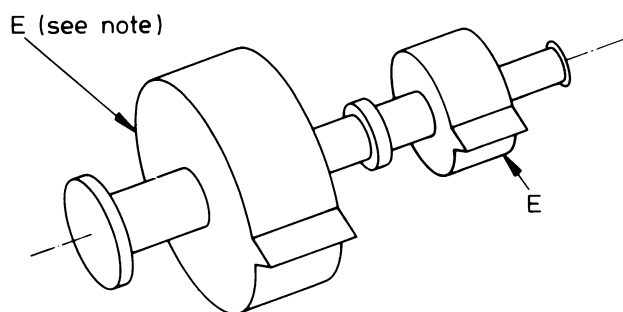


Figure 7. Double epicyclic gear train

NOTE to figures 5-7. 'E' is a single reduction epicyclic train of the planetary or star type. The full nomenclature, e.g. for figure 6, is 'Double reduction, epicyclic secondary, gear train'.

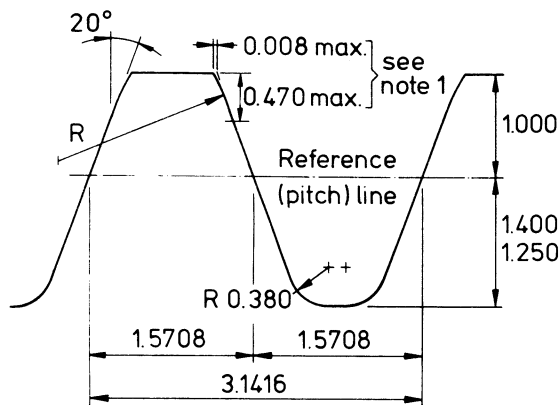


Figure 8. 20° pressure angle basic rack tooth profile in terms of unit normal metric module

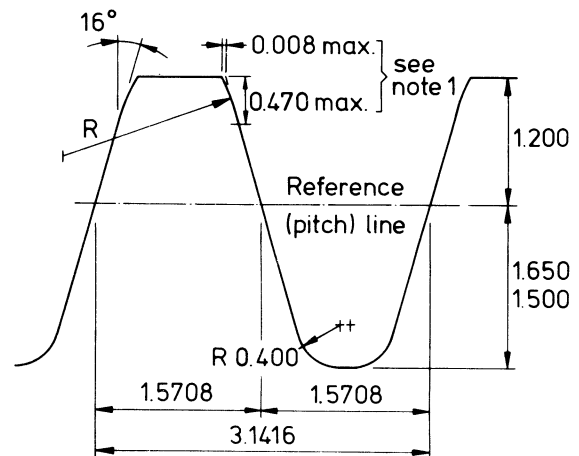


Figure 9. 16° pressure angle basic rack tooth profile in terms of unit normal metric module

NOTE 1. If preferred by the manufacturer, the profile relief may be carried out on the lower part of the teeth near the root. If the teeth of the mating gears are relieved at the tips and the roots, the tip relief of either, added to the root relief of its mate, shall not exceed the amount given in figure 8 or 9.

NOTE 2. The 20° α_n basic rack form is consistent with that given in BS 436 : Part 2 but the extent to which modification can be incorporated has been restricted in this standard.

5. Standard normal modules

The normal modules shall be selected from table 1, giving preference to the first-choice values. Table 1 gives a selection from BS 436 : Part 2.

Table 1. Standard normal modules

Normal module m_n	
First choice	Second choice
2	2.25
2.5	2.75
3	3.5
4	4.5
5	5.5
6	7
8	9
10	11
12	14
16	18
20	22
25	

6. Accuracy requirements for gear blanks

NOTE. Unless otherwise stated, all tolerances in this clause are in micrometres.

6.1 Reference surfaces. To facilitate setting-up for gear cutting or subsequent measurement, cylindrical reference surfaces and/or transverse (side face) reference surfaces and/or reference surfaces on the periphery of the blank at a specific axial position shall be provided. See figures 10 and 11.

6.2 Runout of reference surfaces with relation to journals. Radial or axial runout of reference surfaces shall be measured in the appropriate direction with dial or similar gauges at two positions 180° apart. The full indicator measurement (FIM), for rotation through one revolution, shall not exceed the following values:

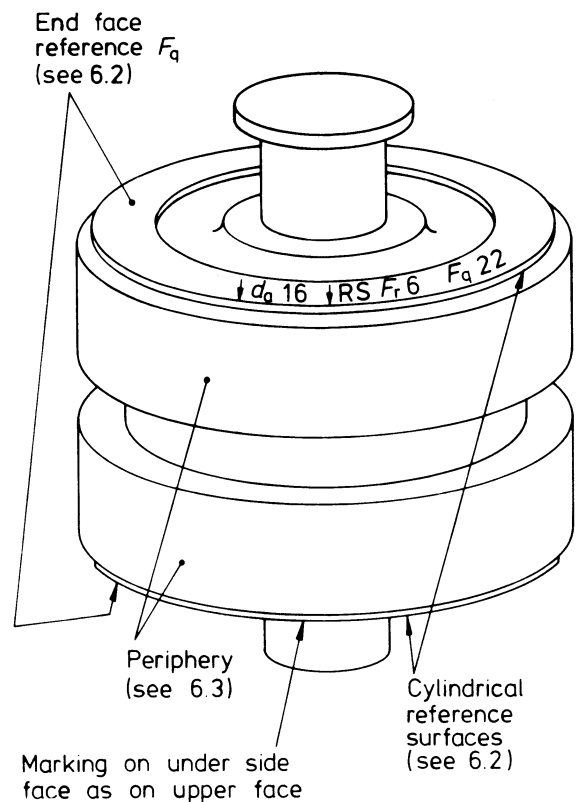
Classes A0, A1 and A2	0.015 $d_r + 5$
Class A3	0.020 $d_r + 10$

This verification shall be carried out by the manufacturer, and the values in micrometres of the readings obtained shall be permanently marked, preceded by the letters F_q or F_r , on the end faces of the blank adjacent to the reference surfaces at the points of maximum reading. See figures 10 and 11.

When the periphery is designated a reference surface, the word 'TIP' shall precede F_r .

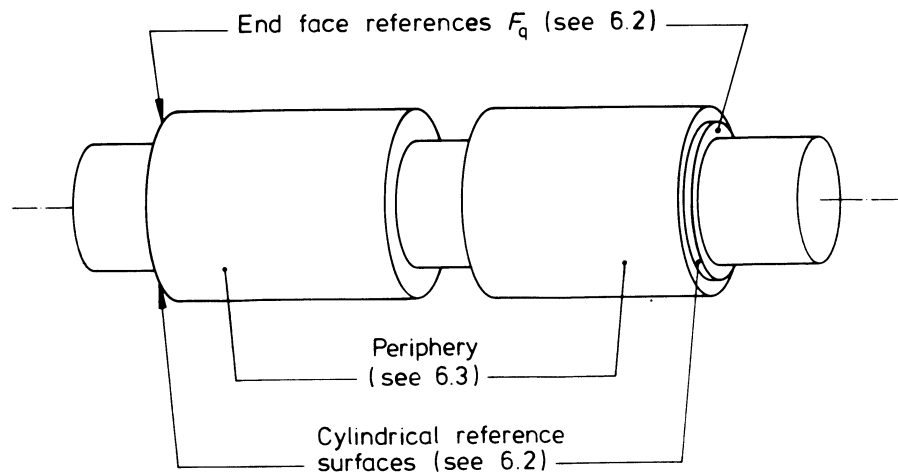
6.3 Outside diameter of blank. The tolerance on diameter for all classes shall be $^{+0}_{-(31 m_n + 0.05 d)}$.

For convenience of subsequent gear cutting and inspection operations, the actual diameter of the blank at each end shall be recorded in at least two planes at right angles. In the case of a double helical gear, the diameter shall be measured at each end of each facewidth.



NOTE. The markings, e.g. TIP $F_r 16$, should be in characters about 3 mm high and any burrs raised by marking should be carefully removed so as not to interfere with the accuracy of the surface.

Figure 10. Position of marking on reference surfaces on a wheel



NOTE. The markings, e.g. TIP $F_r 12$, should be in characters about 3 mm high and any burrs raised by marking should be carefully removed so as not to interfere with the accuracy of the surface.

Figure 11. Position of marking on reference surfaces on a pinion