

Specification for

Gears for electric traction

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The preparation of this British Standard was entrusted by the Machinery and Components Standards Committee (MCE/-) to Technical Committee MCE/5, upon which the following bodies were represented:

- Advanced Manufacturing Technology Research Institute
- Association of Consulting Engineers
- British Clock and Watch Manufacturers' Association
- British Coal
- British Gear Association
- British Horological Institute
- British Railways Board
- Engineering Equipment and Materials Users' Association
- Federation of Manufacturers of Construction Equipment and Cranes
- Gauge and Tool Makers' Association
- Institution of Mechanical Engineers
- Institution of Production Engineers
- Lloyd's Register of Shipping
- Milling Cutter Association
- Ministry of Defence
- Power Generation Association (BEAMA Ltd.)
- Society of Motor Manufacturers and Traders Limited

The following bodies were also represented in the drafting of the standard through subcommittees and panels:

- Brush Electrical Machines Ltd.
- London Regional Transport
- Railway Industry Association of Great Britain

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Foreword

This revision of this British Standard has been prepared under the direction of the Machinery and Components Standards Committee. The main changes incorporated are the inclusion of metric module gears and the deletion of diametral pitch gears, the relating of gear accuracy grades to pitch surface velocity, reference to a method of calculating gear loading and the addition of a list of ordering instructions.

This revision of BS 235 supersedes BS 235:1972, which is withdrawn.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, 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 Scope

This British Standard specifies requirements for spur and helical gears in accuracy grades 5, 6, 7 and 8 of BS 436-2, for the drive between the electric motors and the axles of vehicles running on rails. It also specifies requirements for the permissible deviations and tolerances of tooth form and dimensions, hardness and the fitting surfaces, keys and keyways of wheels and pinions.

NOTE 1 Appendix A lists the instructions that should be supplied by the customer to the gear designer. Guidance is given in Appendix B on the materials for the manufacture of gears. Appendix C recommends a method for determining the bedding surface of taper bored pinions. Appendix D gives guidance on the choice of gear tooth accuracy grades.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the definitions given in BS 2519-1 apply, together with the following.

case depth of a surface hardened gear

the depth measured normal to the surface of the gear at which the hardness is 550 HV 1 for carburized and hardened gears and 80 % of surface hardness HV 1 for all other surface hardened gears

3 Gear tooth accuracy grades

Gears for electric traction shall belong to accuracy grades 5, 6, 7 or 8 of BS 436-2.

4 Symbols

For the purposes of this British Standard the symbols shown in BS 2519-2 apply. For convenience the list of symbols used in this standard is as follows:

a	Centre distance
b	Face width
b_1	Face width, pinion
b_2	Face width, wheel
d	Reference circle diameter
d_1	Reference diameter, pinion
d_2	Reference diameter, wheel
d_a	Tip diameter
d_{a1}	Tip diameter, pinion
d_{a2}	Tip diameter, wheel
d_b	Base diameter
h_a	Addendum
K_A	Application factor
k	Number of teeth over which base tangent span is measured
l	Length of arc

m_n	Normal module
s	Arc tooth thickness
W_k	Base tangent span
x	Addendum modification coefficient
x_1	Addendum modification coefficient, pinion
x_2	Addendum modification coefficient, wheel
y	Centre distance modification coefficient
z	Number of teeth
z_1	Number of teeth, pinion
z_2	Number of teeth, wheel
α_n	Normal pressure angle at reference cylinder
α_t	Transverse pressure angle at reference cylinder
α_{tw}	Transverse pressure angle, working
β	Helix angle at reference cylinder
β_b	Base helix angle
ϕ_f	Tolerance factor for tooth profile deviation
ϕ_p	Tolerance factor for total composite deviation

5 Normal modules

Normal modules, m_n , for traction gears shall be within the following range:

4, 4.5, **5**, 5.5, **6**, 7, 8, 9, **10**, 11, **12**, 14 mm.

NOTE Preferred values are given in bold type face.

6 Form of gear tooth

6.1 Basic rack profile

Any modifications to the basic rack tooth profile as specified in BS 436-2 and shown in Figure 1 shall be within the following limits:

- variation of the total depth within the limits 2.25 to 2.40, permitting an increase in root clearance within the limits 0.25 to 0.40 to allow for different manufacturing processes;
- variation of the root radius within the limits 0.25 to 0.39;
- variation of the pressure angle.

NOTE 1 The basic rack tooth profile has a pressure angle of 20°.

NOTE 2 Protuberance cutters should be used to ensure that root fillets are free from grinding or other mechanical damage post-heat treatment operations.

6.2 Tooth dimensions

The teeth of wheels and pinions shall have the dimensions calculated from the formulae given in Table 1.

NOTE Unless precluded by design considerations, pinion helix angles should be right hand.