BRITISH STANDARD

BS 3876-2: 1990

Rope rollers, pulleys, mountings and assemblies for colliery track haulage —

Part 2: Specification for vertical spindle pulleys, mountings and assemblies

Confirmed January 2011

UDC 622.33.005:622.625.5:622.673.3:006.3/.8

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Mining and Quarrying Requisites Standards Policy Committee (MQE/-) to Technical Committee MQE/18, upon which the following bodies were represented:

Association of British Mining Equipment Companies
British Foundry Association
British Steel Industry
Federation of Wire Rope Manufacturers of Great Britain
Health and Safety Executive
Institution of Mining Electrical and Mining Mechanical Engineers

This British Standard, having been prepared under the direction of the Mining and Quarrying Requisites Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 May 1990

First published August 1965
Second edition May 1990

The following BSI references relate to the work on this standard:
Committee reference MQE/18
Draft for comment 88/74303 DC

ISBN 0 580 17991 5

Amendments issued since publication

Amd. No.	Date	Comments

Contents

		Page
Committees responsible		Inside front cover
Foreword		ii
1	Scope	1
2	Definitions	1
3	General	1
4	Shape and dimensions of pulley components and mountings	1
5	Materials	1
6	Manufacture	4
7	Marking	5
Appendix A Information to be supplied by the purchaser		6
Appendix B Information to be provided by the supplier		6
Appendix C General recommendations for the design and operating speeds of pulleys		6
Appendix D Typical clause relating to inspection that the purchaser may choose to write into his order or contract for the supply of pulleys, mountings and assemblies to this Part of BS 3876		6
Figure 1 — Typical vertical spindle pulley type 1		3
Figure 2 — Typical vertical spindle pulley types 2 and 3		3
Table 1 — Dimensions of vertical spindle pulleys		2
Table 2 — Bearing characteristics and designations for vertical spindle pulleys		4
Publications referred to		Inside back cover

Foreword

This Part of BS 3876 has been prepared under the direction of the Mining and Quarrying Requisites Standards Policy Committee (MQE/-) and is a full technical revision of BS 3876-2:1965 which is withdrawn.

The other Parts in the revised edition of BS 3876, are as follows:

— *Part 1: Specification for parallel barrel rollers, mountings and assemblies;*

— *Part 3:* (Withdrawn);

— *Part 4:* (Withdrawn);

— *Part 5: Specification for suspended pulley assemblies and clamps.*

In the revised Parts, the following points should be noted:

a) tapered rollers, covered in the 1965 edition of Part 2 are now omitted from the revised Part 2;

b) vertical rollers, which were included in the 1965 edition of Part 2, are now omitted as it is considered the parallel barrel rollers specified in Part 1 can be used in the vertical mode;

c) horizontal spindle pulleys, covered in the 1965 edition of Part 2, are relocated in Part 5 of the revised edition;

d) Part 3:1965 has been withdrawn because there is no longer any requirement for rollers with non-metallic rope bearing surfaces;

e) the requirements for mountings for parallel barrel rollers, previously specified in BS 3876-4:1966, have been revised and incorporated into the expanded edition of Part 1; there is therefore no need for retention or revision of a separate Part 4.

During the revision of this Part of BS 3876 all dimensions have been metricated and these are not necessarily straight conversions from the imperial dimensions previously adopted.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not exist, users should consider approaching an appropriate body from the list of Association members.

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 and ii, pages 1 to 6, 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 Part of BS 3876 specifies requirements for vertical spindle rope pulleys, mountings and assemblies intended for use in colliery track haulage.

NOTE 1 Where the word "vertical" is used in this Part it refers to the installed position of the spindle.

This Part of BS 3876 applies to:

a) pulleys, supplied without mountings, with throat diameters less than 300 mm;

b) mountings; and

c) pulley assemblies that comprise both the pulleys and the mountings.

The pulleys to which this Part applies are those intended to be used to deflect the haulage rope horizontally through small angles around each pulley (i.e. up to about 10°, see Appendix C) from its straight line direction of travel.

NOTE 2 Appendix A gives the information which should be supplied by the purchaser, in his enquiry and/or order for pulleys, mountings and assemblies in accordance with this Part of BS 3876.

NOTE 3 Appendix B gives the information that will be required by the purchaser, to be supplied by the supplier, prior to the supply of pulleys, mountings and assemblies in accordance with this Part of BS 3876.

NOTE 4 Appendix C gives general recommendations for the design and operating speeds for colliery track haulage pulleys with vertical spindles.

NOTE 5 No inspection requirements are specified in this Part of BS 3876. However, a typical requirement that a purchaser may choose to write into his order or contract for pulleys, mountings and assemblies to this Part is given in Appendix D.

NOTE 6 The titles of the publications referred to in this Part of BS 3876 are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 3876 the following definitions apply.

2.1
barrel

that part of the pulley on which the rope runs

2.2
pulley

a drum having a curved or V-shaped barrel, complete with spindle and bearings

2.3
mounting

the frame to which the pulley is, or is to be attached

2.4
pulley assembly

the pulley and its mounting

3 General

The pulley components and mountings shall comply with the requirements specified in clauses **4** to **7** as appropriate.

The design of the spindle shall be such that it is a fixture in the mounting, the bearings being contained within the pulley.

4 Shape and dimensions of pulley components and mountings

4.1 Dimensions

The dimensions of the vertical pulley components and mountings shall be as given in Table 1.

NOTE For convenience, typical vertical pulleys are illustrated in Figure 1 and Figure 2. These illustrations identify the dimensions referred to in Table 1.

For vertical spindle pulleys, the bearing face or boss shall be recessed to a maximum depth of 3 min. Headed stub spindles, when used, shall have a minimum head diameter of 40 mm and a head thickness not less than 6 mm.

4.2 Eccentricity of the pulley barrel

The eccentricity of the barrel, determined as the radial run out measured normal to the surface at any point on the barrel when the pulley is rotated about its spindle through one revolution, shall not exceed 2 mm.

5 Materials

5.1 General

Subject to the requirements of **5.2** the materials used in the construction of the pulleys and mountings shall be in accordance with **5.3** and **5.4** respectively.

5.2 Light metals

In the construction of the pulleys, mountings and assemblies, no metal shall be used that contains more than:

a) 15 % (*m*/*m*) in total of aluminium, magnesium and titanium;

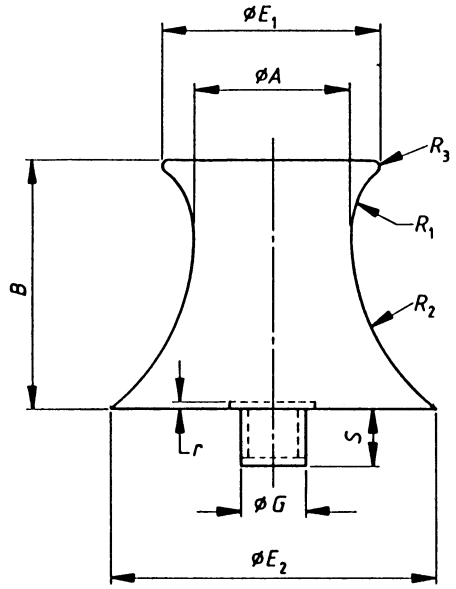
b) 6 % (*m*/*m*) in total of magnesium and titanium.

Paints and coatings containing any of the metals aluminium, magnesium and titanium shall not be used.

Table 1 — Dimensions of vertical spindle pulleys (see also Figure 1 and Figure 2)

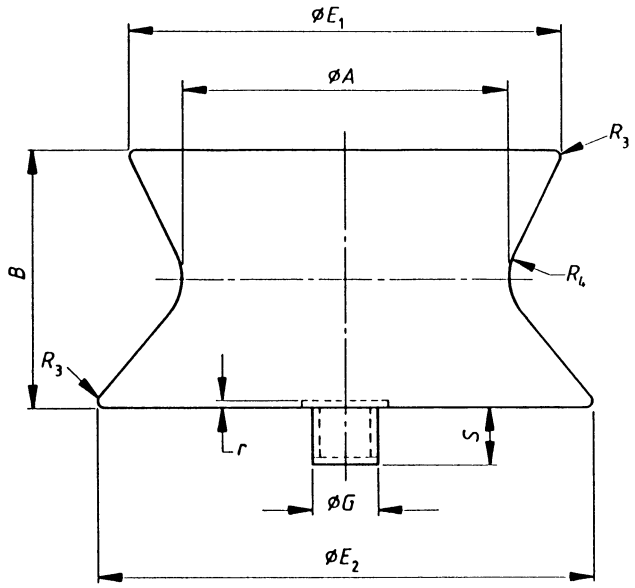
Pulley type	*A* (± 1.5 mm)	*B* (± 1.5 mm)	E_1 (± 1.5 mm)	E_2 (± 1.5 mm)	[a] *G* min.	*r* max.	R_1 (± 1.5 mm)	R_2 (± 1.5 mm)	R_3 (± 1.5 mm)	R_4 (± 1.5 mm)	*S* min.
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
Type 1	75	115	100	150	30	3	30	100	3	—	20
Type 2	150	120	200	230	30	3	—	—	3	25	20
Type 3	150	120	200	300	30	3	—	—	3	25	20

[a] Where a headed stub spindle is used the head is required to have a minimum diameter of 40 mm, see **4.1**.



NOTE This figure does not purport to show design details.

Figure 1 — Typical vertical spindle pulley type 1



NOTE This figure does not purport to show design details.

Figure 2 — Typical vertical spindle pulley types 2 and 3

5.3 Materials for pulleys

5.3.1 *Pulley barrels*

Pulley barrels shall be made from one of the following materials.

a) Spheroidal graphite iron having a minimum hardness of 200 HB throughout any section.

b) Carbon steel in accordance with BS 3100, steel A3.

c) Low alloy (1 % chromium) steel in accordance with BS 3100, steel BW4.

5.3.2 *Spindles*

Spindles shall be made from wrought steel in accordance with BS 970 grade 070 M20, with a minimum tensile strength of 430 N/mm^2.

5.3.3 *Bearings*

Bearings shall be double sealed, grease filled, single row ball journal bearings of the metric series in accordance with BS 292-1.

NOTE 1 The use of seize-resistant bearings having polyamide cages is preferred.

The types of bearings to be used for each application shall be as given in Table 2.

The bearings shall be sealed on both sides with an elastomeric material suitably reinforced.

NOTE 2 Plain metal covers are not sufficient.

The elastomeric material shall meet the fire resistant requirements of BS 3790 and the antistatic requirements of BS 2050.

Table 2 — Bearing characteristics and designations for vertical spindle pulleys

Pulley type	Pulley speed	Bearing location	Bearing designation
Type 1	r/min Up to 800	Top	6304-2 RS
		Bottom	6306-2 RS
	Over 800	Top	6404-2 RS
		Bottom	6406-2 RS
Type 2 and Type 3	Up to 800	Top and bottom	6306-2 RS
	Over 800	Top and bottom	6306-2 RS

5.4 Materials for mounting plates

Mountings, when supplied, shall be fabricated from steel in accordance with either of the following:

a) carbon steel in accordance with BS 970, grade 070 M20;

b) weldable structural steel in accordance with BS 4360, grade 43A.

6 Manufacture

6.1 General

Pulley components and mountings shall comply with **6.2** and **6.3**.

NOTE It is important that:

a) all pulley components and mountings should be free from harmful defects;

b) the barrels of pulleys should be smooth and free from all projections cross-jointing and defects that may be injurious to ropes;

c) all machined parts should be free from sharp corners, edges and undercuts, tool marks and scoring that are likely to cause excessive concentrations of stress;

d) all welds should be free from the imperfections described in section 6 of BS 499-1:1983 and all defects (e.g. rough edges, weld spatter) likely to be injurious to persons or equipment, or to interfere with mating parts should be removed.

The attention of the supplier is drawn to the fact that the purchaser may reject pulleys, mountings and assemblies as being unsatisfactory on any of these grounds, notwithstanding that the requirements of this Part of BS 3876 are complied with, subject to discussion in accordance with normal commercial practice.

6.2 Welding

Welding techniques shall be in accordance with BS 5135.

NOTE 1 Details of each welded joint should be agreed between the supplier and the purchaser and shown in detailed drawings, copies of which are held by both the supplier and the purchaser [see Appendix B e)].

NOTE 2 Minor defects in castings, that will not affect the mechanical strength or performance of any pulley, may be rectified by welding when the manufacturer is able by so doing to provide a satisfactory casting.

When repairs to cast steel are to be undertaken then they shall be in accordance with BS 4570.

6.3 Machining tolerances

The machining tolerances for the outer diameter of the bearing shall be M7 and the machining tolerances on the spindle diameter shall be g6, as specified in BS 4500-1.

7 Marking

Each pulley and mounting shall be marked[1)] with an etched, stamped or cast identity, giving the following information which shall be readily visible during normal operation of the pulley:

a) the manufacturer's name, identification mark or trademark;

b) the number of this Part of this British Standard i.e. BS 3876-2;

c) in the case of pulley drums, an indication of the material using the following code:

S — carbon steel

SA — cast steel alloy

SG — spheroidal graphite iron

d) in the case of mountings, the reference type (see Table 1) of the pulley for which the mounting is intended.

[1)] Marking BS 3876-2 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Appendix A Information to be supplied by the purchaser

The purchaser should supply the following items of information at the time of enquiry or order:

a) the number of this British Standard, i.e. BS 3876-2;

b) the type reference of the pulley required (see Table 1);

c) the material of the pulley barrel (see **5.3.1**);

d) whether castings are to be inspected and tested during manufacture (see also Appendix D);

e) details of any tests which are required to be carried out on the pulley assembly during manufacture (see also Appendix D);

f) the type of mounting to be supplied, if required.

Appendix B Information to be provided by the supplier

Prior to supply, the supplier is to provide a detailed drawing, or drawings, including the following particulars.

a) *Pulley barrels*. Material specification and full dimensional details.

b) *Spindles*. Material specification and full dimensional details.

c) *Bearings*. Manufacturer and identification reference.

d) *Mountings*. Material and dimensional details.

e) *Welding*. Details of any welding, i.e. preparation, weld lengths and size, the welding material and operation used.

Appendix C General recommendations for the design and operating speeds of pulleys

The design of haulage pulleys depends basically on the rope speed and the loading. Several characteristics of the pulley itself affect the choice when considering a particular duty, as follows.

a) Eccentricity and ovality of pulley, since eccentricity results in a hammer blow being imparted to both rope and bearing.

b) Hardness and wear resistance.

c) Type of bearing.

d) Ease of and need for maintenance.

e) Pulley revolutions per minute.

f) Loading on the pulley.

The haulage system should be designed such that at the nominal speed of the haulage rope the pulley revolutions do not exceed 500 r/min. This should ensure that a pulley speed of 800 r/min is not exceeded due to rope surges which are usually experienced during system start up and acceleration.

Where due to installation limitations the recommended pulley speed of 500 r/min has to be exceeded on a continuous basis then consideration should be given to the use of the heavier duty bearing as given in Table 2.

No system should be designed based on pulley speeds in excess of 800 r/min continuously unless the appropriate bearings given in Table 2 are utilized.

To ensure that the loading on the pulley remains within safe limits and that damage to the rope does not occur it is recommended that the total rope deflection across any one pulley does not exceed 10°. Multiple pulley clusters may be utilized to achieve angles of deflection greater than 10°, provided that the deflection around any one pulley in the cluster does not exceed 10°.

Appendix D Typical clause relating to inspection that the purchaser may choose to write into his order or contract for the supply of pulleys, mountings and assemblies to this Part of BS 3876

(See also Appendix A.)

For inspection purposes, the purchaser may choose to include the following clause in his order or contract:

> "The purchaser or his representative shall have access at all reasonable times to those parts of the manufacturer's works or the works of sub-contractors engaged on the order; he shall be at liberty to inspect the manufacture at any stage to witness the required tests and to reject any material that does not comply with the relevant specification."

Publications referred to

BS 292, *Rolling bearings: ball bearings, cylindrical and spherical roller bearings.*

BS 292-1, *Specification for dimensions of ball bearings, cylindrical and spherical roller bearings (metric series).*

BS 499, *Welding terms and symbols.*

BS 499-1, *Glossary for welding, brazing and thermal cutting.*

BS 970, *Specification for wrought steels for mechanical and allied engineering purposes.*

BS 970-1, *General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels.*

BS 2050, *Specification for electrical resistance of conducting and antistatic products made from flexible polymeric material.*

BS 3100, *Specification for steel castings for general engineering purposes.*

BS 3790, *Specification for endless wedge belt drives and endless V-belt drives.*

BS 3876, *Rope rollers, pulleys, mountings and assemblies for colliery track haulage.*

BS 3876-1, *Specification for parallel barrel rollers, mountings and assemblies*[2)].

BS 3876-5, *Specification for suspended pulley assemblies and clamps*[2)].

BS 4360, *Specification for weldable structural steels.*

BS 4500, *ISO limits and fits.*

BS 4500-1, *General, tolerances and deviations.*

BS 4570, *Specification for fusion welding of steel castings.*

BS 5135, *Specification for arc welding of carbon and carbon manganese steels.*

BS 5750, *Quality systems*[2)].

[2)] Referred to in the foreword only.

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