BRITISH STANDARD

BS 2772-3:
1987

Colliery haulage and winding equipment —

Part 3: Specification for 1.5 % manganese steel castings

UDC 669.14:622.67

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Iron and Steel Standards Committee (ISM/-) to Technical Committee ISM/6, upon which the following bodies were represented:

Associated Offices Technical Committee
BEAMA Ltd.
British Gas Corporation
British Railways Board
British Steel Industry
British Valve Manufacturers' Association Ltd.
Electricity Supply Industry in England and Wales
Engineering Equipment and Materials Users' Association
Institute of British Foundrymen
Institution of Mechanical Engineers
Lloyds Register of Shipping
Ministry of Defence
Process Plant Association
Steel Casting Research and Trade Association

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Contents

Foreword

This revision of this Part of BS 2772 was prepared under the Iron and Steel Standards Committee. It supersedes BS 2772-3:1957, which is withdrawn. Since 1957 many developments have taken place both in the steel foundry industry and in mining operations which have made necessary a revision of this Part of BS 2772.

A number of changes from the previous edition have been made. These include the use of Charpy V-notch impact values instead of the Izod values previously specified, as is now also the case with BS 2772-2. The British requirement for notch ductility at – 10 °C is considered necessary in view of the operational conditions likely to be encountered in service. The procedure for welding given in Appendix B of the 1957 edition has been omitted and all welding requirements now refer to the appropriate British Standard, BS 4570-1.

The test values obtained on the test pieces do not necessarily represent the properties of the castings themselves, which may be affected by solidification conditions and rate of cooling during heat treatment, which in turn are influenced by casting thickness, size and shape. Purchasers are therefore advised to consult the manufacturer regarding the properties that can be expected in the castings being ordered.

The other Part of BS 2772 is Part 2, which covers wrought steel. Part 1 on wrought iron was withdrawn in 1973.

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 4, 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 2772 specifies requirements for 1.5 % manganese steel castings to be used for colliery haulage and winding equipment, more particularly mine car couplings, manriding car couplings and rope sockets.

NOTE 1 Information which the purchaser is strongly recommended to provide is given in Appendix A.
NOTE 2 The standard is for steel castings and thus the purchaser referred to is the purchaser of the steel castings and not the purchaser of the components made from these castings.
NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Steel making process

The steel shall be made by an electric process, the AOD (argon oxygen decarburization) process or the acid converter process.

3 Chemical composition

The chemical composition of each cast of the material shall be determined. Analysis shall be carried out on a test sample made from the same cast as the castings represented. In cases of dispute, compliance with this standard shall be decided on the basis of an independent analysis using the methods described in BS 6200 or BS Handbook no. 19.

The steel shall comply with Table 1.

Table 1 — Chemical composition

Element	Minimum content	Maximum content
	%	%
Carbon	0.12	0.22
Silicon	—	0.60
Manganese	1.30	1.70
Phosphorus	—	0.050
Sulphur	—	0.050

4 Heat treatment

Castings shall be heat treated by normalizing and tempering or hardening and tempering as appropriate to section size, to give the mechanical properties specified in clause **10**.

5 Surface finish

All castings shall be fettled and dressed, and all surfaces shall be cleaned for inspection purposes.

NOTE Any specific requirements for surface dressing should be agreed by the manufacturer and the purchaser.

6 Non-destructive examination

All castings shall be visually inspected and, if stated on the enquiry and order, shall be subjected to further non-destructive testing in accordance with BS 4080 or BS 6208 (see Appendix A).

NOTE The choice of BS 4080 or BS 6208 and the acceptance criteria should be agreed, bearing in mind the service conditions to which the castings will be subjected.

7 Rectification of castings

7.1 Where present, defects of a severity level greater than the acceptance criteria shall be removed and the excavation blended out or repaired by welding.

NOTE 1 The purchaser may require that he be informed of the extent and position of weld rectification (see Appendix A).
NOTE 2 The purchaser may require that no rectification be carried out without prior sanction in writing (see Appendix A).

7.2 When rectification by welding is carried out the welding shall be performed in accordance with BS 4570-1. The excavated cavity shall be checked by magnetic particle inspection prior to repair welding, to ensure that the defect has been fully removed.

7.3 In cases where castings are required to be subjected to non-destructive testing, in accordance with BS 4080 or BS 6208, they shall be re-examined in the area of the rectification (see clause **6**).

8 Provision of material for testing

If the purchaser does not specify whether test samples are to be either

a) separately cast, or

b) in the form of cast-on test blocks,

then separately cast test blocks shall be produced.

NOTE Cast-on test blocks should only be specified where practicable and should be located in positions that do not affect the soundness of the casting.

The separately cast test blocks shall be cast in moulds of the same moulding material as is used for the castings and shall be poured from the same ladle of steel.

Identified test blocks shall be provided to permit tests and, if necessary, retests, that are representative of each heat treatment batch from every cast.

One tensile and three impact test pieces shall be prepared from test blocks representative of each heat treatment batch.

9 Mechanical tests

9.1 Tensile test

The tensile test shall be carried out in accordance with BS 18-2.

9.2 Impact test

The Charpy V-notch impact test shall be carried out in accordance with BS 131-2. The test temperature shall be – 10 °C.

9.3 Brinell hardness test

The Brinell hardness test shall be carried out in accordance with BS 240 on a representative sample of castings from each cast/heat treatment batch combination.

NOTE 1 It is imperative that the purchaser state the number and location of hardness tests required on the enquiry and order (see Appendix A).
NOTE 2 It is recommended that, whenever practicable, a 10 mm diameter ball and a load of 3 000 kgf be used.

10 Mechanical properties

10.1 Tensile and impact properties

The mechanical properties of test pieces prepared and tested in accordance with clauses **8**, **9.1**, **9.2** and, where appropriate, clause **11** shall comply with Table 2.

The average of the three impact test values shall be not less than the value specified in Table 2. No single value shall be lower than 70 % of the specified value in Table 2.

10.2 Brinell hardness

The hardness values obtained on testing in accordance with **9.3** shall comply with Table 2.

11 Retests

11.1 If the results of any mechanical test carried out on the test pieces or castings fail to comply with clause **10**, the manufacturer shall follow procedure a) or b), as appropriate.

a) *Failure to comply with tensile and/or impact requirements:* repeat on two additional test pieces the mechanical test in which failure occurred.

b) *Failure to comply with tensile and/or impact and/or Brinell hardness requirements:* submit the castings, together with the test blocks, to further heat treatment, after which the test pieces prepared therefrom or castings shall be submitted to all mechanical tests specified in clause **9**.

Table 2 — Mechanical properties

Mechanical property	Value
Tensile strength, R_m	495 N/mm^2 min.[a]
Lower yield stress, R_e, or 0.2 % proof stress, $LR_{p0.2}$	310 N/mm^2 min.[a]
Elongation, A on gauge length $L_o = 5.65\sqrt{S_o}$	22 % min.
Charpy V-notch impact value, KV (– 10 °C)	25 J min. (see note)
Brinell hardness, HB	140 HB to 179 HB

NOTE The Charpy V-notch impact value of 25 J is applicable only to separately cast test blocks. Where test blocks are cast on, the Charpy V-notch impact value should be agreed.
[a] 1 N/mm^2 = 1 MPa.

11.2 In the case of further failure the castings, together with the test blocks shall be submitted to further heat treatment, after which the test pieces prepared therefrom or castings shall be subjected to all the mechanical tests specified in clause **9**. The castings and test blocks shall not be subjected to more than two additional austenitizing heat treatments.

12 Traceability

A means of traceability to the cast shall be provided.

NOTE 1 It is permissible for this identification to be stamped on the castings using low stress stamps.
NOTE 2 Where practicable the manufacturer's identity mark should be cast or stamped on each casting.

13 Manufacturer's certificate

The manufacturer shall supply a manufacturer's certificate. It shall state the cast analysis, the heat treatment given and the results of the mechanical tests.

Appendix A Information to be supplied by the purchaser

It is essential that the purchaser provide the following information:

a) the number and Part of this British Standard, i.e. BS 2772-3;

b) whether the purchaser wishes to be informed of the extent and position of weld rectification (see clause **7**);

c) whether rectification can be carried out without prior sanction in writing (see clause **7**);

d) the number and location of Brinell hardness tests required (see **9.3**);

e) the acceptance criteria for visual inspection[1)];

f) if non-destructive testing is to be carried out, the inspection procedure required and the acceptance criteria (see clause **6**)[1)];

g) whether cast-on test blocks are required[1)] (see clause **8**).

[1)] This will subsequently be agreed with the manufacturer.

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Publications referred to

BS 18, *Methods for tensile testing of metals.*
BS 18-2, *Steel (general).*
BS 131, *Methods for notched bar tests.*
BS 131-2, *The Charpy V-notch impact test on metals.*
BS 240, *Method for Brinell hardness test and for verification of Brinell hardness testing machines.*
BS 4080, *Methods for non-destructive testing of steel castings.*
BS 4570, *Fusion welding of steel castings.*
BS 4570-1, *Production, rectification and repair.*
BS 6200, *Sampling and analysis of iron, steel and other ferrous metals.*
BS 6208, *Methods for ultrasonic testing and for specifying quality levels of ferritic steel castings.*
BS Handbook no. 19 Methods for the sampling and analysis of iron, steel and other ferrous metals

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