# British Standard

BRITISH STANDARD

BS 1591:1975

*Incorporating*
*Amendment No. 1*

## Specification for

# Corrosion resisting high silicon iron castings

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# Co-operating organizations

The Iron and Steel Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

British Cast Iron Research Association*
British Constructional Steelwork Association
British Ironfounders' Association
British Mechanical Engineering Confederation
British Steel Industry*
Concrete Society
Council of Ironfoundry Associations*
Council of Iron Producers
Department of Employment
Department of Trade (Marine Division)*
Engineering Equipment Users' Association*
Federation of Civil Engineering Contractors
Greater London Council
Institute of British Foundrymen*
Institute of Iron and Steel Wire Manufacturers
Institute of Marine Engineers
Institution of Mechanical Engineers (Automobile Division)*
Institution of Production Engineers*
Institution of Structural Engineers
Lloyd's Register of Shipping*
Ministry of Defence
National Association of Drop Forgers and Stampers
National Physical Laboratory — Department of Industry
Oil Companies Materials Association
Process Plant Association*
Royal Institute of British Architects
Shipbuilders and Repairers' National Association
Society of Motor Manufacturers and Traders Ltd.*
Steel Castings Research and Trade Association
Tin Research Institute

The Government department 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 British Standard:

British Malleable Tube Fittings Association
British Railways Board
British Valve Manufacturers Association
Meehanite Research Institute of Great Britain
National Association of Malleable Ironfounders
North East Coast Institution of Engineers and Shipbuilders
Individual firms

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# Foreword

This revised British Standard, prepared under the authority of the Iron and Steel Industry Standards Committee, specifies requirements for high silicon iron castings for use where highly corrosive media are to be handled, such as in the chemical, petrochemical, textile and other such industries. High silicon iron is also used for the manufacture of anodes used in cathodic protection.

It is generally accepted that the protective properties of high silicon iron against strong aggressive liquids results from a thin surface film of hydrated oxides of silicon which forms when strong oxidizing media are being handled. Initially there may be a relatively high rate of the attack which takes place until the film is formed, after which, the rate will reduce to a negligible amount, usually after a period of several hours. On occasions when the film is disrupted, corrosion resistance is then dependent on the metallic material of the iron itself and losses will be evident until film healing has occurred.

High silicon iron is more brittle than grey cast iron and, in consequence, greater care and precautions in handling and transporting to avoid accidental breakages are necessary. Since, however, mechanical strength is of secondary importance with this material, no mechanical properties or tests are specified.

A method of stress relieving has been added as a precaution to eliminate tendencies to failures on castings of poor design. Heat treatment is dependent on the size and nature of the casting being such as to allow stress relieving to be carried out as described in clause **6**.

Grades are designated by the chemical symbols of the main alloying elements and figures indicating their approximate minimum levels, e.g. Si 14, Si Cr 14 4.

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 and 2, 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 corrosion resisting high silicon iron castings for chemical engineering purposes and for cathodic protection anodes.

## 2 Reference

The title of the British Standard publication referred to in this standard is given on the inside back cover.

## 3 Information to be supplied by the purchaser

The purchaser shall state the following information on the enquiry and order:

a) the grade required, e.g. BS 1591 Grade Si 14;

b) whether the castings are required to be pressure tested (see clause **10**);

c) whether the castings are to be inspected during manufacture and tested in the presence of the purchaser's representative (see clause **12**);

d) whether a manufacturer's certificate is required and, if so, which of the types specified in clause **14**:

e) any special requirements, e.g. penetrant testing and packing of castings.

## 4 Manufacture

The castings may be made by any process at the option of the manufacturer, who shall ensure that the requirements defined in this standard, or as agreed between the purchaser and the manufacturer, are complied with for the grade of iron required by the order. The castings shall be accurately moulded in accordance with the pattern or working drawings supplied by the purchaser, and properly fettled and dressed.

## 5 Chemical composition

The chemical composition of castings shall be in accordance with the requirements in Table 1.

## 6 Heat treatment

Heat treatment shall be carried out at the discretion of the manufacturer.

The procedure, if necessary, shall be as follows.

The castings shall be stripped from the mould while hot, and, as soon as possible after solidification and with the least possible delay, the hot castings shall be charged direct to a furnace previously heated to a temperature of approximately 600 °C and maintained at that temperature during the period of charging the castings. When the furnace is finally charged, the castings shall be uniformly heated to a temperature of not less than 750 °C and not more than 850 °C. They shall be soaked at this temperature for a period varying from 2 h for small castings of simple form and maximum thickness of 18 mm, to 8 h for heavy castings of intricate design. After soaking, the castings shall be slowly cooled in the furnace and not removed until the temperature has fallen below 300 °C.

## 7 Freedom from defects

The castings, as delivered to the purchaser, shall be free from defects which may impair the performance of the finished component. Rectification of defects shall not be carried out except with the approval of the purchaser.

## 8 Provision of samples for chemical analysis

Material for chemical analysis shall be obtained from gates or risers of actual castings or a test sample representing all the castings made from a cast.

A cast shall be understood to mean the full content of a batch furnace whether tapped into one or more ladles.

## 9 Method of analysis

The method of analysis shall be as described in BS Handbook No. 19.

## 10 Pressure testing

If specified by the purchaser on the enquiry and order castings shall be subjected to an air or hydraulic test. The pressure and medium shall be specified by the purchaser on the enquiry and order.

Castings showing leakage under this test shall be rejected.

**Table 1 — Chemical composition**

| Grade | Chemical composition % | | | | | |
|---|---|---|---|---|---|---|
| | C max. | Si | Mn max. | P max. | S max. | Cr |
| Si 10 | 1.2 | 10.00–12.00 | 1.0 | 0.25 | 0.1 | — |
| Si 14 | 1.0 | 14.25–15.25 | 1.0 | 0.25 | 0.1 | — |
| Si Cr 14 4 | 1.4 | 14.25–15.25 | 1.0 | 0.25 | 0.1 | 4.0–5.0 |
| Si 16 | 0.8 | 16.00–18.00 | 1.0 | 0.25 | 0.1 | — |

NOTE Grade Si 14 is recommended for general applications involving corrosion resistance. Grade Si 10 has greater tensile strength than grade Si 14 but a reduced corrosion resistance. Grade Si 16 is recommended where greater corrosion resistance is required at the expense of tensile strength. Grade Si Cr 14 4 is normally used for the manufacture of cathodic protection anodes.

## 11 Marking and packing

The method of marking and packing shall be agreed between the purchaser and the manufacturer.

## 12 Inspection

If castings are to be inspected during manufacture and tested in the presence of the purchaser's representative it shall be so stated in the enquiry and order.

In such cases the purchaser or his representative shall have access at all reasonable times to those parts of the manufacturer's works 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 requirements of this British Standard.

## 13 Testing facilities

The manufacturer shall supply the material required for testing, furnish and prepare the necessary test pieces and supply labour and appliances for such testing as may be carried out at his works.

If facilities for making the prescribed tests are not available at his own works, the manufacturer shall arrange for the tests to be carried out elsewhere.

## 14 Manufacturer's certificate

When requested by the purchaser, the manufacturer shall supply one of the following types of certificate as agreed with the purchaser:

a) a certificate stating that the castings comply with requirements of this British Standard or

b) as for a) above but giving, in addition, the results of the chemical analysis for the elements specified.

# Publication referred to

This standard makes reference to the following BSI publication:
BS Handbook No 19, *Methods for the sampling and analysis of iron, steel and other ferrous metals.*

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