BRITISH STANDARD

BS 6200-1: 1991

Sampling and analysis of iron, steel and other ferrous metals —

Part 1: Introduction and contents

Committees responsible for this British Standard

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

BCIRA
British Forging Industry Association
British Steel Industry
Department of Trade and Industry (Laboratory of the Government Chemist)
Ferro Alloys and Metals Producers' Association
Ministry of Defence

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Contents

Foreword

This Part of BS 6200 has been prepared under the direction of the Iron and Steel Standards Policy Committee.

BS 6200 is a multipart British Standard covering all aspects of the sampling and analysis of ferrous metals. This Part provides a general introduction to the Standard and includes a list giving details of all the existing and projected Parts, Sections and Subsections.

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 6200 gives the contents of BS 6200 and provides general information relating to the development and use of succeeding Parts.

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

2 Description of the contents of the BS 6200 series

Appendix A lists the contents of BS 6200 and gives an indication of which Parts, Sections and Subsections have already been published and which are currently in preparation or envisaged for future development. Further details of the Subsections in Part 3, including ranges of application and correspondence with International or European Standards may be found in BS 6200-3.0.

3 General information

3.1 Background

BS 6200 is being developed as a replacement for BSI Handbook No 19, with the intention of providing a complete manual covering all aspects of the sampling and analysis of iron, steel and other ferrous metals under one BS number. Handbook No 19, which was published in 1970, was a compilation of methods for the chemical analysis of ferrous metals which in turn superseded the separate Parts of BS 1121. It also included methods for sampling which were identical to those given in BS 1837.

The scope of BS 6200 is wider, in that as well as expanding the Parts relating to chemical analysis and sampling methods, it will also include general guidelines on modern analytical techniques, such as atomic absorption spectrometry, and on the use of statistics in relation to analytical methods.

3.2 Part 2 Methods for sampling and sample preparation

This Part will supersede BS 1837, revising the methods described in it in the light of the best industrial practice and taking into account the provisions contained in relevant international standards.

3.3 Part 3 Methods of analysis

3.3.1 *Format*

Part 3 is divided into separate Sections which have been allocated in alphabetical order to each element for which methods of analysis might be required. Within each Section, individual Subsections cover, as necessary, different techniques and/or different ranges of application. In a few cases, Sections have been reserved for future development.

Although in the past Handbook No 19 methods were developed almost entirely within a national forum, in recent years there has been considerable international and regional, specifically European, activity in the preparation of standard methods for the analysis of iron and steel. The UK has taken a major part in this work and in many cases has implemented the resultant standards as dual-numbered British Standards. An indication of the origin of each method is given in Section 3.0.

For a number of years European Standards for iron and steel, known as “Euronorms”, were produced under the auspices of the European Iron and Steel Community. However, following the “New approach to technical harmonization and standards” adopted by the Council of Ministers of the European Community in 1985 to support the establishment of the Single European Market, the European Committee for Iron and Steel Standardization, (ECISS), was set up in 1986 to prepare European Standards (ENs) for iron and steel. The main difference between Euronorms and ENs is that there is now an obligation on Member States to adopt the latter as national standards. Further to this, in April 1990 it was decided by the Iron and Steel Standards Policy Committee (ISM/-) to follow the normal European practice of implementing European Standards under their EN numbers, i.e. EN 12345 would become BS EN 12345. Thus, from that time, except in cases where the European Standard simply adopted the text of a Euronorm or ISO standard which had already been dual-numbered, ENs relating to chemical analysis of iron and steel have been issued as separate BS ENs and not as dual-numbered Subsections of BS 6200-3. The position which such standards would have occupied in the structure of Part 3 is indicated in Appendix A and also in BS 6200-3.0.

3.3.2 *Use*

The methods incorporated in Part 3 are intended primarily for use as referee methods. At the same time, however, they include a variety of different techniques so as to reflect, as far as possible, modern laboratory practice, and many are suitable for use on a routine day-to-day basis.

It is also assumed that the methods will be carried out by competent analysts and that all necessary safety procedures are observed.

3.3.3 *Precision*

Most of the methods included in Handbook 19 were developed following extensive "round robin" testing carried out in the UK and statements relating to the precision that can be expected from them are given in the revised versions incorporated in Part 3. In some cases it has been possible to submit the original results to statistical analysis in accordance with the guidelines given in BS 5497-1.

Some of the earlier ISO and European methods do not include any precision data, but later ones were prepared following more rigorous interlaboratory tests and these methods include detailed precision statements.

A full explanation of the various statistical parameters used in the methods of Part 3 will be given in BS 6200-5.

3.3.4 *Reagents and apparatus*

All of the methods require that only reagents of recognized analytical grade should be used and that in general water should comply with the requirements for grade 2 specified in BS 3978. The water may be prepared by distillation or by demineralization, but the latter process may be unsuitable for some methods, for example in the determination of low concentrations of silicon. It may also be necessary to prepare it in an isolated laboratory, for example when intended for use in determinations of nitrogen, or to avoid the use of glass storage vessels. Full details are given in the appropriate Subsections.

A number of liquid reagents are available in more than one concentration, for example ammonia solution, perchloric, hydrochloric and hydrofluoric acids. Where the concentration is critical to the method, quantities for alternative strengths are specified.

For determinations of elements at very low levels, it may be necessary to test several batches of reagent and select one of adequate purity, for example sulphuric acid used in the determination of nitrogen. In some cases there is a requirement to avoid the use of glass storage vessels for reagent solutions, or to use previously unopened containers, and these precautions should be scrupulously observed.

Most methods require that a parallel "blank" determination should be carried out along with each batch of tests. When abnormal values of blank are encountered the corresponding test results should be discarded. Corrective steps should be taken to identify and remedy the causative conditions or to select purer reagents before repeating the determinations.

Although not explicitly stated in some of the earlier methods, all volumetric glassware used should be class A in accordance with BS 846, BS 1583 or BS 1792, as appropriate.

Requirements for particular items of equipment, for example, atomic absorption spectrometers, are specified in the individual Subsections. In addition, it is advisable that balances and other apparatus for physical measurements should be serviced regularly in order to ensure that there is no gradual deterioration in performance. Balances and weights should also be calibrated at regular intervals using reference weights which in turn have been calibrated so as to provide an unbroken chain of traceability to national measurement standards held by the National Physical Laboratory. Reference weights should always be kept secure in a suitable environment separate from working weights.

3.4 Part 4 Recommendations for the order of listing elements in the chemical analysis of steel

This Part is based on ISO/TR 6306 and follows the order originally given in BS 5259, which it supersedes.

3.5 Part 5 Statistics

This Part will give a detailed explanation of the various statistical parameters which have been used to determine the precision of the methods given in Part 3 and will include appropriate information from relevant International and European documents.

3.6 Part 6 Guidelines on atomic absorption spectrometric techniques

Sections 6.1 and 6.2 are based, respectively, on the European Information Circulars No 8 and No 9, published by the Commission of the European Communities. Many of the later ISO and European standard methods involving flame atomic absorption spectrometry have been prepared in accordance with the recommendations given in these documents.

Appendix A List of contents of the BS 6200 series

The following is a list of the Parts, Sections and Subsections of BS 6200 which are published, in preparation or to be the subject of future development.

Title	Year of publication
Part 1 Introduction and contents	1991
Part 2 Methods of sampling and sample preparation	[a]
Part 3 Methods of analysis	1991
Section 3.0 Summary of methods	
Section 3.1 Determination of aluminium	
3.1.1 Steel, cast iron and low carbon ferrochromium: volumetric method	[a]
3.1.2 Steel and cast iron: spectrophotometric method	[a]
3.1.3 Steel: plasma atomization spectrometric method	[b]
3.1.4 Non-alloyed steel: flame atomic absorption spectrometric method	1990
3.1.5 Ferrosilicon: flame atomic absorption spectrometric method	1985
3.1.6 Permanent magnet alloys: volumetric method	[a]
Section 3.2 Determination of antimony	[b]
Section 3.3 Determination of arsenic	
3.3.1 Steel and cast iron: spectrophotometric method	[a]
Section 3.4 Determination of bismuth	[b]
Section 3.5 Determination of boron	
3.5.1 Steel: spectrophotometric method	[a]
3.5.2 Ferroboron: volumetric method	[a]
Section 3.6 Determination of cadmium	[b]
Section 3.7 Determination of calcium	
3.7.1 Steel: flame atomic absorption spectrometric method	1987
Section 3.8 Determination of carbon	
3.8.1 See BS EN 10036	1991
3.8.2 Steel and cast iron: non-aqueous titrimetric method after combustion	[a]
3.8.3 Steel and cast iron: infra-red absorption method after combustion in an induction furnace	1990
3.8.4 Steel: coulometric method	[b]
3.8.5 Cast iron and pig iron: gravimetric method for the determination of non-combined carbon	[a]
Section 3.9 Determination of cerium	[b]
Section 3.10 Determination of chromium	1991
3.10.1 See BS EN 24937	
3.10.2 Steel and cast iron: flame atomic absorption spectrometric method	1990
3.10.3 Steel: plasma atomization spectrometric method	[b]
3.10.4 Ferrochromium and ferrosilico chromium: potentiometric method	1985
3.10.5 Ferrochromium: volumetric method	[a]
Section 3.11 Determination of cobalt	
3.11.1 Steel and cast iron: spectrophotometric method	[a]
3.11.2 Steel and cast iron: spectrophotometric method for trace amounts	[a]

[a] In preparation.
[b] Future development.

Title	Year of publication
Section 3.12 Determination of copper	
3.12.1 Steel and cast iron: volumetric method	1986
3.12.2 Steel and cast iron: spectrophotometric method	1985
3.12.3 Steel and cast iron: flame atomic absorption spectrometric method	1986
3.12.4 Cast iron: volumetric method	1986
3.12.5 Permanent magnet alloys: volumetric method	1986
Section 3.13 Determination of hydrogen	[b]
Section 3.14 Determination of iron	[b]
Section 3.15 Determination of lanthanum	[b]
Section 3.16 Determination of lead	
3.16.1 Carbon steel and low alloy steel: gravimetric method	1986
3.16.2 Steel: spectrophotometric method	1986
3.16.3 Steel: spectrophotometric method for trace amounts	[a]
3.16.4 Steel: flame atomic absorption spectrometric method	1987
Section 3.17 Determination of magnesium	
3.17.1 Cast iron: volumetric method	[a]
Section 3.18 Determination of manganese	
3.18.1 See BS EN 10071	1991
3.18.2 Steel: spectrophotometric method	1985
3.18.3 Ferromanganese and ferrosilicomanganese: potentiometric method	1985
3.18.4 Steel and cast iron: volumetric method	[a]
3.18.5 Steel and cast iron: flame atomic absorption spectrometric method	[a]
Section 3.19 Determination of molybdenum	
3.19.1 Steel and cast iron: spectrophotometric method	1985
3.19.2 Ferromolybdenum: gravimetric method	[a]
3.19.3 Molybdenum oxide and molybdenite ores: gravimetric method	[a]
Section 3.20 Determination of nickel	
3.20.1 Steel and cast iron: gravimetric or titrimetric method	1989
3.20.3 Steel and cast iron: spectrophotometric method	1985
3.20.4 See BS EN 10136	1991
Section 3.21 Determination of niobium	
3.21.1 Steel: spectrophotometric method	1986
Section 3.22 Determination of nitrogen	
3.22.1 Steel: volumetric method	[a]
3.22.2 Steel: spectrophotometric method	1985
3.22.3 Steel (trace amounts): spectrophotometric method	1986
Section 3.23 Determination of oxygen	[b]
Section 3.24 Determination of phosphorus	
3.24.1 Steel and cast iron: spectrophotometric method	1985
3.24.2 Ferrochromium, ferromanganese and ferromolybdenum: spectrophotometric method	[a]
Section 3.25 Determination of selenium	[b]

[a] In preparation.
[b] Future development.

Title	Year of publication
Section 3.26 Determination of silicon	
3.26.1 Steel and cast iron: gravimetric method	[a]
3.26.2 Acid resisting high silicon iron: gravimetric method	[a]
3.26.3 Steel: spectrophotometric method for silicon contents from 0.05 % to 1.0 %	1987
3.26.4 Steel: spectrophotometric method for silicon contents from 0.01 % to 0.05 %	1989
3.26.5 Ferrosilicon, ferrosilicomanganese and ferrosilicochromium: gravimetric method	1985
Section 3.27 Determination of silver	[b]
Section 3.28 Determination of sulphur	
3.28.1 Steel and cast iron: gravimetric method	1985
3.28.2 Steel and cast iron: infra-red absorption method after combustion in an induction furnace	1990
Section 3.29 Determination of tantalum	
3.29.1 Steel (trace amounts): spectrophotometric method	1986
Section 3.30 Determination of tellurium	[b]
Section 3.31 Determination of tin	
3.31.1 Steel and cast iron: volumetric method	[a]
3.31.2 Ferrotungsten and tungsten metal: volumetric method	[a]
Section 3.32 Determination of titanium	
3.32.1 Steel and cast iron: spectrophotometric method	1986
3.32.4 Ferrotitanium: volumetric method	1985
Section 3.33 Determination of tungsten	
3.33.1 Steel: gravimetric method	[a]
3.33.2 Steel: spectrophotometric method	[a]
3.33.3 Ferrotungsten: gravimetric method	1985
Section 3.34 Determination of vanadium	
3.34.1 Steel and cast iron: potentiometric method	1987
3.34.2 Steel and cast iron: spectrophotometric method	1989
3.34.3 Steel and cast iron: flame atomic absorption spectrometric method	1990
3.34.4 Ferrovanadium: potentiometric method	1985
Section 3.35 Determination of yttrium	[b]
Section 3.36 Determination of zinc	[b]
Section 3.37 Determination of zirconium	
3.37.1 Steel: gravimetric method	1986
Part 4 Recommendations for the order of listing elements in the chemical analysis of steel	1989
Part 5 Statistics	[b]
Part 6 Guidelines on atomic absorption techniques	
Section 6.1 Recommendations for the drafting of standard methods for the chemical analysis of iron and steel by flame atomic absorption spectrometry	1990
Section 6.2 Recommendations for the application of flame atomic absorption spectrometry in standard methods for the chemical analysis of iron and steel	1990

[a] In preparation.
[b] Future development.

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Publication(s) referred to

BS 846, *Specification for burettes.*

BS 1583, *Specification for one-mark pipettes.*

BS 1792, *Specification for one-mark volumetric flasks.*

BS 1837, *Methods for the sampling of iron, steel, permanent magnet alloys and ferro-alloys.*

BS 3978, *Specification for water for laboratory use.*

BS 5497, *Precision of test methods.*

BS 5497-1, *Guide for the determination of repeatability and reproducibility for a standard test method by inter-laboratory tests.*

BS EN 10036, *Chemical analysis of ferrous materials — Determination of total carbon in steels and irons — Gravimetric method after combustion in a stream of oxygen.*

BS EN 10071, *Chemical analysis of ferrous materials — Determination of manganese in steels and irons — Electrometric titration method.*

BS EN 10136, *Chemical analysis of ferrous materials — Determination of nickel in steels and irons — Flame atomic absorption spectrometric method.*

BS EN 24937, *Steel and iron — Determination of chromium content — Potentiometric or visual titration method.*

BSI Handbook No 19, Methods for the sampling and analysis of iron, steel and other ferrous metals.

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London
W4 4AL