

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

Part 2: Sampling and sample preparation —

Section 2.2 Methods for ferroalloys and other alloying additives

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- 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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Foreword

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

BS 6200 is a British Standard series covering all aspects of the sampling and analysis of iron, steel and other ferrous metals. A general introduction is given in Part 1, which lists the contents of all the existing and projected Parts, Sections and Subsections.

Part 2 of BS 6200 supersedes BS 1837:1970, which is withdrawn. Methods of sampling identical to those given in BS 1837 were included in BSI Handbook No 19:1970, which has also been withdrawn.

This Section of BS 6200 describes methods for the sampling and sample preparation of ferroalloys and molybdenum oxide used in the manufacture of iron and steel. Section 2.1 of BS 6200 describes methods for iron and steel.

This Section of BS 6200 incorporates parts of international standard ISO 3713:1987 which gives general rules for the sampling and sample preparation of ferroalloys, and also ISO 4552 which specifies methods for particular ferroalloys. ISO 4552-1:1987 specifies methods for ferrochromium, ferrosilicochromium, ferrosilicon, ferrosilicomanganese and ferromanganese. ISO 4552-2:1987 specifies methods for ferrotitanium, ferromolybdenum, ferrotungsten, ferroniobium and ferrovanadium. A method for ferroboron is in course of preparation by Technical Committee ISO/TC 132.

In addition, information was obtained from ASTM standard practices for sampling ferroalloys and steel additives [1].

International standards for methods for the sampling and preparation of ferronickel are available as British Standards BS EN 28049:1992 and BS EN 28050:1992.

It has been assumed in the drafting of this Section of BS 6200 that the execution of its provisions is entrusted to appropriately qualified and experienced people.

This Section of BS 6200 calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Assessed capability. Users of this British Standard are advised to consider the desirability of quality system assessment and registration against the appropriate Part of BS 5750 by a third party certification body.

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 16, 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.

Subsection 1. General

1.1 Scope

This Section of BS 6200 describes methods for the incremental sampling and sample preparation of ferroalloys used in the manufacture of iron and steel. It does not include methods of sampling from a liquid metal. Methods are described for use with ferroboron, ferrochromium, ferromanganese, ferrosilicon, ferrosilicochromium, ferrosilicomanganese, ferroniobium, ferromolybdenum, ferrotitanium, ferrotungsten, ferrovanadium, and molybdenum oxide.

For the purposes of this Section of BS 6200, ferroalloys are divided into two groups:

- a) ferroalloys supplied mainly in bulk quantities, that is, ferrochromium, ferromanganese, ferrosilicon, ferrosilicochromium and ferrosilicomanganese;
- b) ferroalloys supplied in packed units, that is, ferroboron, ferromolybdenum, ferroniobium, ferrotitanium, ferrotungsten and ferrovanadium.

As a supplement to the list of contents, the methods for a particular ferroalloy are listed in Table 1 with reference to the relevant subsection in this Section of BS 6200.

1.2 References

1.2.1 Normative references

This Section of BS 6200 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on page 16. Subsequent amendments to, or revisions of, any of these publications apply to this Section of BS 6200 only when incorporated in it by updating or revision.

1.2.2 Informative references

This Section of BS 6200 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue are listed on page 16, but reference should be made to the latest editions.

1.3 Definitions

For the purposes of this Section of BS 6200 the following definitions apply.

1.3.1

chemical method of analysis

method for the determination of chemical composition in which the sample is submitted to chemical reaction

1.3.2

physical method of analysis

method for the determination of chemical composition in which the determination of composition is carried out without submitting the sample to chemical reaction, for example, an optical emission spectrometric method, an X-ray fluorescence spectrometric method

1.3.3

thermal method of analysis

method for the determination of chemical composition in which the sample is submitted to a heating, combustion or fusion process

1.3.4

lot

quantity of material produced and processed under conditions which are presumed uniform

Table 1 — List of methods in this Section of BS 6200 for the sampling and sample preparation of a particular ferroalloy

Alloy	Subsection			
	Sampling from a bulk consignment	Sampling during the packing of units	Sampling from packed units	Sample preparation
FeCr (crushable)	3.2		3.3	3.4
FeMn	3.2		3.3	3.4
FeSi	3.2		3.3	3.4
FeSiCr	3.2		3.3	3.4
FeSiMn	3.2		3.3	3.4
FeCr (non-crushable)	3.5			3.5
FeB		4.2	4.3	4.4
FeMo		4.2	4.3	4.4
FeNb		4.2	4.3	4.4
FeTi		4.2	4.3	4.4
FeW			4.3	4.4
FeV		4.2	4.3	4.4

**1.3.5
consignment**

quantity of material delivered at one time. A consignment may consist of one or more lots or parts of a lot

**1.3.6
packed unit**

part of a consignment of material definitely separated and placed in a pallet box, a bag, a drum, etc.; also material in the form of briquettes bundled on a pallet

**1.3.7
increment**

quantity of material obtained by a sampling device at one time from a consignment supplied in bulk or in a packed form

**1.3.8
subsample**

quantity of material consisting of several increments taken from part of a consignment; also a composite of several increments after having been crushed and/or divided as necessary

**1.3.9
gross sample**

quantity of material consisting of all the increments taken from a consignment; also a composite of all the increments or all the subsamples after having been individually crushed and/or divided as necessary

**1.3.10
division**

process of decreasing the mass of the sample for the purposes of obtaining the required mass of a test sample

**1.3.11
divided sample**

sample obtained by the method of division

**1.3.12
test sample**

sample for the determination of chemical composition which is prepared from an increment, a subsample or a gross sample in a condition for submission to analysis

NOTE The term "test sample" is used in international standards for ferroalloys; it is synonymous with "sample for analysis" (see BS 6200-2.1).

**1.3.13
test portion**

part of the test sample actually submitted to analysis

**1.3.14
top size**

particle size of a ferroalloy expressed by the aperture size of a sieve on which not more than 1 % *m/m* of a sample is retained

**1.3.15
nominal top size**

upper level of the particle size range of a consignment

NOTE Particle size ranges are specified in international standards for the technical requirements and conditions of delivery of individual types of ferroalloys. Such standards include ISO 5445:1980, ISO 5446:1980, ISO 5447:1980, ISO 5448:1981, ISO 5449:1980, ISO 5450:1980, ISO 5451:1980, ISO 5452:1980, ISO 5453:1980 and ISO 5454:1980.

**1.3.16
representative quality characteristic**

content of an element or elements specified in international standards, the quality variation of which determines the parameters of sampling of a given ferroalloy and which is liable to contractual agreement in accordance with technical requirements for a given ferroalloy

NOTE In international standards, the quality characteristic of a ferroalloy is normally the principal element or elements of the ferroalloy, for example, chromium in ferrochromium, silicon and manganese in ferrosilicomanganese.

**1.3.17
random sampling**

method of incremental sampling in which each part of a ferroalloy sampled has equal probability of being taken

**1.3.18
two-stage sampling**

method of random sampling by two stages. Selection of primary units of sampling, for example, packed units of a consignment, is carried out at the first stage

1.4 Quality systems

Sampling procedures have to provide adequate protection for the purchaser, it being recognized that any sampling procedure has limitations. For the purpose of demonstrating the fulfilment of contractual requirements the supplier is obliged to provide valid confidence that the required quality will be achieved.

NOTE Requirements for quality systems are specified in BS 5750-2:1987 for use when a contract requires demonstration of a suppliers' capability,¹⁾ to control the processes that determine the acceptability of the product supplied. BS 5750-3:1987 specifies requirements for use when a contract requires demonstration of capability to detect and control the disposition of any product nonconformity during final inspection and test.

¹⁾ See foreword.

Subsection 2. Requirements for sampling and sample preparation

2.1 Test sample

2.1.1 Quality

Sampling practices shall be designed to provide a test sample that is representative of the chemical composition of the consignment of the ferroalloy.

Particular care is required when obtaining representative samples from ferroalloys; many alloys segregate to an appreciable extent.

The test sample shall, wherever practicable, be sufficiently homogeneous with respect to chemical composition such that inhomogeneity does not appreciably contribute to the error variability of the analysis. Where inhomogeneity of the sample contributes significantly to error variability, a detailed study should be made of the individual components of variability to determine the parameters of sampling (see 2.4).

In cases where segregation is expected to occur, if it is not practicable to crush the whole of the sample to pass through the specified sieve, the quantities of oversize and undersize particles may be weighed separately and proportionate parts taken to constitute the test sample.

Care shall be taken to avoid atmospheric contamination at each stage of sample preparation and especially during comminution procedures used to produce the test sample.

2.1.2 Identification

A test sample shall be assigned a unique identification to distinguish the lot, consignment, increment, subsample or gross sample from which it was taken. Labelling or some equivalent method of marking shall be used to ensure that the assigned identification remains associated with the test sample.

The identification, status and condition of the sample shall be recorded to ensure that confusion cannot arise as to the identity of the item to which analysis and records refer.

2.1.3 Size

The quantity of the test sample shall be sufficient to provide for re-analysis, where necessary. Generally a mass of 50 g will be sufficient.

Unless otherwise agreed between parties, a minimum of four samples shall be prepared from each consignment, one each for the supplier, the purchaser and an arbitration organization and one for reserve. A record shall be kept of the procedures used for preparing the samples.

2.1.4 Conservation

During and after preparation, the test sample shall be stored in such a way as to prevent contamination or chemical change.

The container used for storage shall be completely dry and made from material that is chemically inert and resistant to abrasion by hard metals.

NOTE Finely-powdered test samples may be subject to problems associated with the build-up of static electricity; the use of plastics containers should be avoided.

Containers with test samples intended for any arbitration shall be sealed jointly by each party or their representatives. Unless agreed to the contrary, these containers shall be kept by each party responsible for the preparation of the samples.

The reserved sample shall be kept for a sufficient period of time to protect the integrity of the test laboratory.

2.2 Sampling

2.2.1 Types of sampling

Depending on the condition of the ferroalloy, sampling may be of the following types:

- a) sampling from a liquid metal;
- b) sampling from a bulk consignment during unloading or loading, or from a bulk consignment in a stationary state;
- c) sampling from a lot during the packing of units by the producer;
- d) sampling from a consignment supplied in packed units.

NOTE Sampling from a liquid metal is not covered in this Section of BS 6200.

2.2.2 Equipment for sampling

The following equipment is used for manual incremental sampling.

- a) a scoop or a shovel of dimensions corresponding to the required increment volume;

NOTE 1 Recommended dimensions of scoops and an example of a procedure for selecting a scoop based on the bulk density of the particular grade of ferroalloy are given in ISO 3713:1987.

- b) a probe, commonly known as a spear, of a construction that will ensure sampling from the whole layer of the ferroalloy; the diameter of the opening of a probe for sampling a consignment of less than 5 mm in particle size shall be not less than three times the nominal top size of the ferroalloy;

NOTE 2 Examples of probe constructions are given in ISO 3713:1987.

- c) a container of a size selected on the basis of the volume of the sample.