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Ferrovanadium — Specification and conditions of delivery

Ferro-vanadium — Spécifications et conditions de livraison

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 132, *Ferroalloys*.

This second edition cancels and replaces the first edition (ISO 5451:1980), which has been technically revised.

The main changes are as follows:

— the normative references have been updated;

— the designation and chemical composition of ferrovanadium have been revised;

— the particle size of ferrovanadium has been revised;

— the constitution of consignment has been revised;

— the contradictory analysis and arbitral analysis procedures have been revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Ferrovanadium is an alloy containing vanadium and iron obtained by reduction. It is usually used as vanadium additive in steelmaking and casting process.

This document was developed in response to worldwide demand for minimum specifications for ferrovanadium traded internationally. The requirements of the previous edition (ISO 5451:1980) such as chemical composition and particle size specifications are revised to meet the demand of different uses, promote the rational utilization of resources, reduce carbon emissions and create wealth for the society.

Ferrovanadium — Specification and conditions of delivery

1 Scope

This document defines the specification and conditions of delivery for ferrovanadium usually supplied for steelmaking and foundry use.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4552-2, *Ferroalloys — Sampling and sample preparation for chemical analysis — Part 2: Ferrotitanium, ferromolybdenum, ferrotungsten, ferroniobium, ferrovanadium*

ISO 8954-1, *Ferroalloys — Vocabulary — Part 1: Materials*

ISO 8954-2, *Ferroalloys — Vocabulary — Part 2: Sampling and sample preparation*

ISO 8954-3, *Ferroalloys — Vocabulary — Part 3: Sieve analysis*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8954-1, ISO 8954-2 and ISO 8954-3 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Information for ordering

Orders for ferrovanadium shall include the following information:

a) quantity;

b) constitution of consignment;

c) chemical composition in accordance with the designations given in Table 1;

d) particle size ranges in accordance with the classes given in Table 2;

e) necessary requirements for analysis reports, packing, etc., as appropriate.

5 Requirements

5.1 Constitution of consignment

A consignment of a ferrovanadium can consist of one or more lots or parts of a lot, which are defined in ISO 8954-1. In one consignment, one of the following types of lots may be used:

a) tapped lot;

b) graded lot;

c) blended lot.

The vanadium content of the melts (or parts of continuous taps) constituting the consignment shall not differ from each other by more than 2 % absolute.

5.2 Designation and chemical composition

5.2.1 The chemical composition of ferrovanadium shall be as specified in Table 1. The limits stated correspond to particle size ranges in classes 1 to 4 in accordance with Table 2.

5.2.2 The chemical compositions given in Table 1 show only the main constituent elements and usual impurities. Special requirements, such as special ranges for specified elements, or other requirements for unspecified elements, shall be agreed upon between the purchaser and the supplier.

5.2.3 The content of vanadium given in Table 1, corresponds to the precision of sampling and analysis for ferrovanadium (see Clause 6).

5.2.4 For other elements, the number of significant digits is set, taking into account the existing methods of analysis and may be agreed upon between the supplier and the purchaser.

5.3 Particle size ranges

5.3.1 Ferrovanadium is supplied in lumps or as crushed and screened particles. The particle size ranges and tolerances shall be in accordance with Table 2. The undersize values shall be valid at the point of delivery to the purchaser. The particle sizes specified refer to screening on a steel sieve with square openings, see ISO 565.

Note The point of delivery is defined as that point where the responsibility for the consignment passes from supplier to purchaser. If neither the supplier nor the purchaser is responsible for the transportation, then the point at which the values become valid is agreed upon.

5.3.2 If the purchaser requires particle size ranges and/or tolerances other than those given in Table 2, those shall be agreed upon between the supplier and the purchaser.

5.4 Extraneous contamination

The material shall be as free as possible from extraneous contamination.

6 Testing

6.1 General

6.1.1 The supplier shall establish and supply with the ferrovanadium an analysis certificate for the vanadium content and, if agreed with the purchaser, for the contents of the other elements either

specified in Table 1 or additionally agreed. Upon the request of the purchaser, a sample representative of the consignment shall also be provided.

6.1.2 If necessary, the purchaser may conduct routine tests of the chemical and granulometric composition of the consignment. The following two options can be used when controlling the chemical composition:

a) carry out the analysis of samples provided by the supplier along with the consignment;

b) conduct independent sampling of the consignment.

6.2 Sampling for chemical analysis and sieve analysis

6.2.1 Sampling for chemical analysis and sieve analysis should be carried out by the methods specified in ISO 3713, ISO 4551 and ISO 4552-2, but other methods of sampling having similar precision may also be used.

6.2.2 Sampling is usually carried out at the supplier's stockyard, unless otherwise agreed. Wherever sampling is carried out, representatives of both supplier and purchaser may be present.

6.2.3 If required, arbitration sampling shall be carried out by an arbitrator chosen by mutual agreement between the supplier and the purchaser. Sampling should be carried out by the method specified in ISO 3713, ISO 4551 and ISO 4552-2, but other methods of sampling having similar precision may be agreed upon between the supplier, the purchaser and the arbitrator.

The sample obtained by arbitration shall be accepted by both parties.

6.3 Analysis

6.3.1 The chemical analysis of ferrovanadium should be carried out by the method specified in ISO 6467, but other methods of chemical analysis having similar precision may also be used.

6.3.2 The chemical analysis methods of all elements except vanadium shall be agreed upon by the supplier and the purchaser.

6.3.3 In case of dispute, one of the following two procedures described in 6.4 and 6.5 may be used.

6.4 Contradictory analysis

6.4.1 When carrying out the analysis of samples provided by the supplier along with the consignment, the result shall be satisfied using Formula (1):

$$|X_1 - X_2| \prec R \tag{1}$$

where

X_1 is the value of the quality provided by the supplier;

X_2 is the result of the analysis by the purchaser;

R is the reproducibility limit of used methods.

6.4.2 When carrying out the analysis of samples provided by the purchaser with an independent sampling of consignment, the result shall be satisfied using Formula (2):

$$|X_1 - X_2| \prec 1{,}4\beta_{SDM} \quad (2)$$

where β_{SDM} is the overall precision and control of quality in accordance with ISO 4552-2.

6.4.3 If the results of the contradictory analysis are consistent with the conditions of Formula (1) or Formula (2), the final value of the quality (X) can be specified by the Formula (3):

$$X = \frac{(X_1 + X_2)}{2} \quad (3)$$

6.4.4 If the conditions of Formula (1) or Formula (2) are not satisfied, then, provided that no other agreement is reached, arbitral analysis shall be carried out by an arbitrator chosen by mutual agreement between the supplier and the purchaser.

6.5 Arbitral analysis

6.5.1 Arbitral analysis should be carried out by the method specified in ISO 6467. Other methods of chemical analysis with a similar accuracy may be used, but should be agreed between the supplier, the purchaser and the arbitrator.

6.5.2 Possible procedures used in the arbitral analysis are given in Annex A.

7 Inspection

The analysis results consist of chemical composition and particle size shall be satisfied with the requirements of Clause 5. In the case of the results failure, the lot which is represented by the sample shall be rejected.

8 Despatch and storage

Ferrovanadium should be packed, stored and transported according to international regulations.

Unless otherwise requested or agreed upon, packaging, marking, labelling, storage and transportation shall be at the supplier's discretion.

Table 1 — Chemical composition

Designation	Chemical composition % (mass fraction)						
	V	Al max.	Si max.	C max.	P max.	S max.	Mn max.
FeV50	48,0 to 55,0	1,5	2,0	0,30	0,06	0,05	-
FeV50Al2.5	45,0 to 55,0	2,5	2,5	0,40	0,10	0,08	-
FeV60	58,0 to 65,0	1,5	2,0	0,30	0,06	0,05	-
FeV60Al2.5	55,0 to 65,0	2,5	2,5	0,40	0,10	0,08	-
FeV80	77,0 to 83,0	1,5	1,5	0,15	0,05	0,05	0,50
FeV80Al2.5	75,0 to 83,0	2,5	1,5	0,30	0,08	0,08	0,50

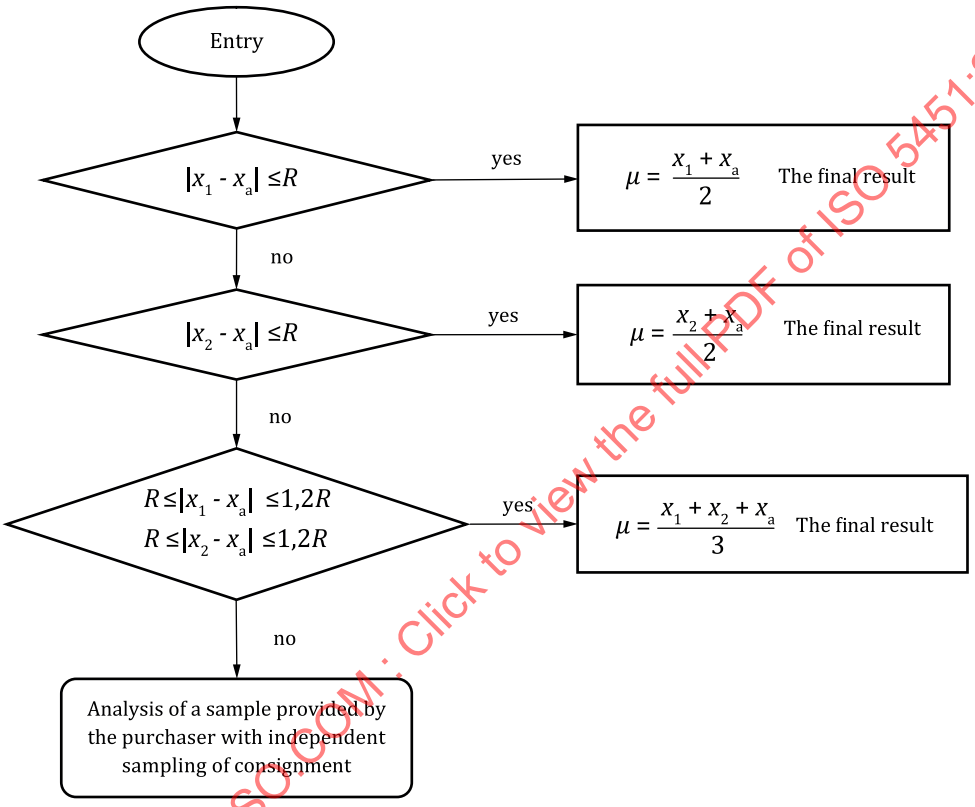
Table 2 — Particle size

Class	Particle size range mm	Undersize max. % by mass	Oversize max. % by mass
1	10 to 100	5	5 No piece to exceed 1,15 × the maximum limit of the size range specified in two or three directions.
2	10 to 50		
3	2 to 10		
4	up to 2	—	—

Annex A
(informative)

Arbitral analysis

A.1 In an arbitral analysis of samples, submitted along with the consignment, for the result of the arbitral analysis, x_a, check the conditions as shown in Figure A.1.



Key

x_1 value of the index of quality, provided by the supplier
x_2 value of the index of quality, provided by the purchaser
x_a value of the index of arbitral analysis

Figure A.1 — Arbitral analysis of a sample submitted by the supplier