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## **Ferromanganese — Specification and conditions of delivery**

*Ferro-manganèse — 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](http://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](http://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 on 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 the following URL: [www.iso.org/iso/foreword.html](http://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 5446:1980), which has been technically revised to update the chemical composition and the particle size of ferromanganese.

# Ferromanganese — Specification and conditions of delivery

## 1 Scope

This document specifies requirements and conditions of delivery for ferromanganese 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 4552-1, *Ferroalloys — Sampling and sample preparation for chemical analysis — Part 1: Ferrochromium, ferrosilicochromium, ferrosilicon, ferrosilicomanganese, ferromanganese*

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

## 3 Terms and definitions

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

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

## 4 Information for ordering

Orders for ferromanganese shall include the following information:

- a) quantity;
- b) constitution of consignment;
- c) chemical composition in accordance with the designations given in [Tables 1 to 6](#);
- d) particle size ranges in accordance with the classes given in [Table 7](#);
- e) necessary requirements for analysis reports packing, etc., as appropriate.

## 5 Requirements

### 5.1 Constitution of consignment

A consignment of a ferromanganese may 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.

## 5.2 Chemical composition

**5.2.1** The chemical composition of ferromanganese shall be as specified in [Tables 1](#) to [6](#). The limits stated correspond to particle size ranges in [Tables 1](#) to [6](#) in accordance with [Table 7](#).

**5.2.2** Special requirements, such as special ranges for the specified elements, or other requirements for unspecified elements, should be agreed upon between the purchaser and the supplier.

**5.2.3** The content of manganese, which is given in [Tables 1](#) to [6](#), corresponds to the precision of sampling and analysis for ferromanganese (see [Clause 6](#)).

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** Ferromanganese is supplied in lumps or as crushed and screened particles. The particle size ranges and tolerances shall be in accordance with [Table 7](#). 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.

**5.3.2** If the purchaser requires particle size ranges and/or tolerances other than those given in [Table 7](#), 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 ferromanganese an analysis certificate for the manganese content and, if agreed with the purchaser, for the contents of the other elements either specified in [Tables 1](#) to [6](#) 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 party. 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 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 4552-1, 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 the supplier and the 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 4552-1, 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 ferromanganese should be carried out by the method specified in ISO 4159, but other methods of chemical analysis having similar precision may also be used.

**6.3.2** In case of dispute, one of the 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 \(1\)](#):

$$|X_1 - X_2| < R \quad (1)$$

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 \(2\)](#):

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

where  $\beta_{SDM}$  is the overall precision and control of quality in accordance with ISO 4552-1.

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

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

**6.4.4** If the conditions of [Formula \(1\)](#) or [\(2\)](#) 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 4159. 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 Dispatch and storage

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

**Table 1 — High carbon FeMn**

| Designation  | Chemical composition, %            |     |     |      |      |
|--------------|------------------------------------|-----|-----|------|------|
|              | Mn                                 | C   | Si  | P    | S    |
|              | ≤                                  |     |     |      |      |
| FeMn68C80HP  | From 65,0 up to and including 75,0 | 8,0 | 3,0 | 0,50 | 0,03 |
| FeMn68C80MP  |                                    | 8,0 | 3,0 | 0,35 | 0,03 |
| FeMn68C80LP  |                                    | 8,0 | 3,0 | 0,20 | 0,03 |
| FeMn68C80VLP |                                    | 8,0 | 3,0 | 0,10 | 0,03 |
| FeMn78C80HP  | From 75,0 up to and including 85,0 | 8,0 | 3,0 | 0,50 | 0,03 |
| FeMn78C80MP  |                                    | 8,0 | 3,0 | 0,35 | 0,03 |
| FeMn78C80LP  |                                    | 8,0 | 3,0 | 0,20 | 0,03 |
| FeMn78C80VLP |                                    | 8,0 | 3,0 | 0,10 | 0,03 |

**Table 2 — Medium carbon FeMn**

| Designation  | Chemical composition, %            |     |     |      |      |
|--------------|------------------------------------|-----|-----|------|------|
|              | Mn                                 | C   | Si  | P    | S    |
|              | ≤                                  |     |     |      |      |
| FeMn78C20    | From 75,0 up to and including 82,0 | 2,0 | 2,5 | 0,35 | 0,03 |
| FeMn78C20LP  |                                    | 2,0 | 2,5 | 0,20 | 0,03 |
| FeMn78C20VLP |                                    | 2,0 | 2,5 | 0,10 | 0,03 |
| FeMn78C15    |                                    | 1,5 | 2,5 | 0,35 | 0,03 |
| FeMn78C15LP  |                                    | 1,5 | 2,5 | 0,20 | 0,03 |
| FeMn78C15VLP |                                    | 1,5 | 2,5 | 0,10 | 0,03 |
| FeMn78C10    |                                    | 1,0 | 2,5 | 0,35 | 0,03 |
| FeMn78C10LP  |                                    | 1,0 | 2,5 | 0,20 | 0,03 |
| FeMn78C10VLP |                                    | 1,0 | 2,5 | 0,10 | 0,03 |

Table 3 — Medium carbon FeMn

| Designation  | Chemical composition, %            |     |     |      |      |
|--------------|------------------------------------|-----|-----|------|------|
|              | Mn                                 | C   | Si  | P    | S    |
|              |                                    | ≤   |     |      |      |
| FeMn85C20    | From 80,0 up to and including 88,0 | 2,0 | 2,5 | 0,35 | 0,03 |
| FeMn85C20LP  |                                    | 2,0 | 2,5 | 0,20 | 0,03 |
| FeMn85C20VLP |                                    | 2,0 | 2,5 | 0,10 | 0,03 |
| FeMn85C15    |                                    | 1,5 | 2,5 | 0,35 | 0,03 |
| FeMn85C15LP  |                                    | 1,5 | 2,5 | 0,20 | 0,03 |
| FeMn85C15VLP |                                    | 1,5 | 2,5 | 0,10 | 0,03 |
| FeMn85C10    |                                    | 1,0 | 2,5 | 0,35 | 0,03 |
| FeMn85C10LP  |                                    | 1,0 | 2,5 | 0,20 | 0,03 |
| FeMn85C10VLP |                                    | 1,0 | 2,5 | 0,10 | 0,03 |

Table 4 — Medium carbon FeMn

| Designation  | Chemical composition, %            |     |     |      |      |
|--------------|------------------------------------|-----|-----|------|------|
|              | Mn                                 | C   | Si  | P    | S    |
|              |                                    | ≤   |     |      |      |
| FeMn90C20    | From 88,0 up to and including 95,0 | 2,0 | 2,5 | 0,35 | 0,03 |
| FeMn90C20LP  |                                    | 2,0 | 2,5 | 0,20 | 0,03 |
| FeMn90C20VLP |                                    | 2,0 | 2,5 | 0,10 | 0,03 |
| FeMn90C15    |                                    | 1,5 | 2,5 | 0,35 | 0,03 |
| FeMn90C15LP  |                                    | 1,5 | 2,5 | 0,20 | 0,03 |
| FeMn90C15VLP |                                    | 1,5 | 2,5 | 0,10 | 0,03 |
| FeMn90C10    |                                    | 1,0 | 2,5 | 0,35 | 0,03 |
| FeMn90C10LP  |                                    | 1,0 | 2,5 | 0,20 | 0,03 |
| FeMn90C10VLP |                                    | 1,0 | 2,5 | 0,10 | 0,03 |

Table 5 — Low carbon FeMn

| Designation  | Chemical composition, %            |     |     |      |      |
|--------------|------------------------------------|-----|-----|------|------|
|              | Mn                                 | C   | Si  | P    | S    |
|              |                                    | ≤   |     |      |      |
| FeMn80C05    | From 75,0 up to and including 88,0 | 0,5 | 2,0 | 0,30 | 0,03 |
| FeMn80C05LP  |                                    | 0,5 | 2,0 | 0,20 | 0,03 |
| FeMn80C05VLP |                                    | 0,5 | 2,0 | 0,10 | 0,03 |
| FeMn80C01MP  |                                    | 0,1 | 2,0 | 0,30 | 0,03 |
| FeMn80C01LP  |                                    | 0,1 | 2,0 | 0,20 | 0,03 |
| FeMn80C01VLP |                                    | 0,1 | 2,0 | 0,10 | 0,03 |

Table 6 — Low carbon FeMn

| Designation  | Chemical composition, %            |     |     |      |      |
|--------------|------------------------------------|-----|-----|------|------|
|              | Mn                                 | C   | Si  | P    | S    |
|              | ≤                                  |     |     |      |      |
| FeMn90C05    | From 88,0 up to and including 95,0 | 0,5 | 2,0 | 0,30 | 0,03 |
| FeMn90C05LP  |                                    | 0,5 | 2,0 | 0,20 | 0,03 |
| FeMn90C05VLP |                                    | 0,5 | 2,0 | 0,10 | 0,03 |
| FeMn90C01MP  |                                    | 0,1 | 2,0 | 0,30 | 0,03 |
| FeMn90C01LP  |                                    | 0,1 | 2,0 | 0,20 | 0,03 |
| FeMn90C01VLP |                                    | 0,1 | 2,0 | 0,10 | 0,03 |

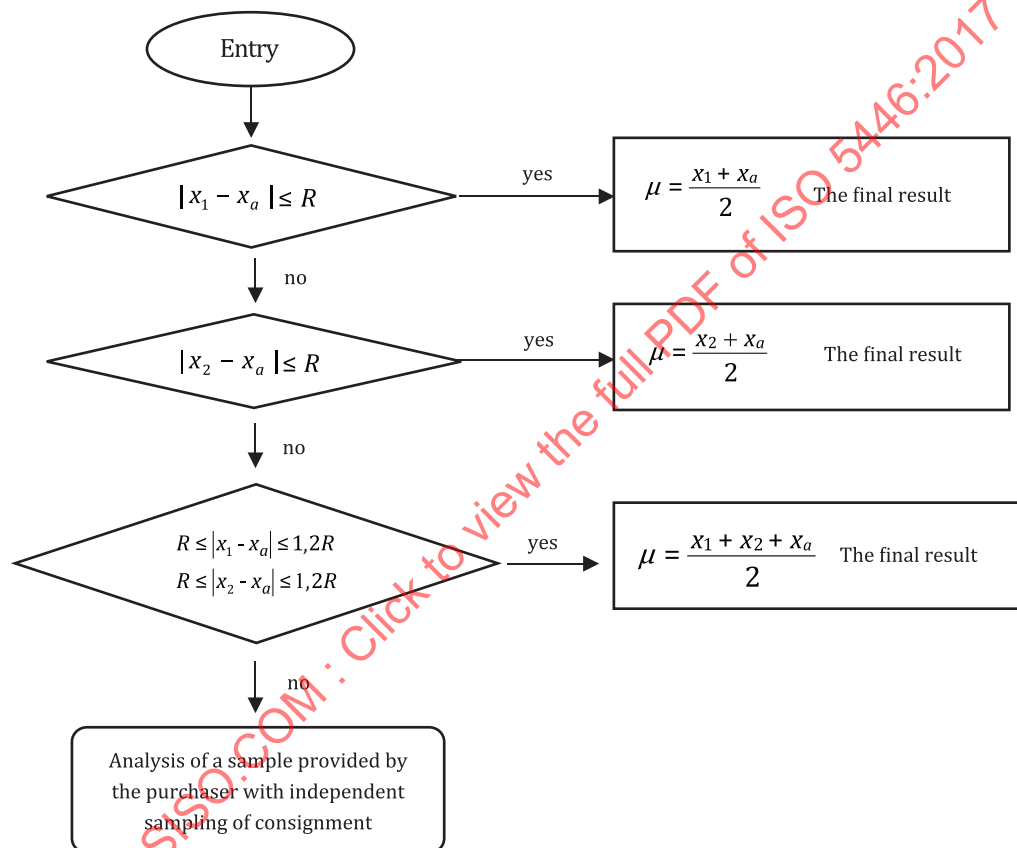
Table 7 — Particle size

| Class                                                                           | Particle size range<br>mm | Under size, max. % by mass |                | Oversize,<br>max. % by mass                                                                                                   |
|---------------------------------------------------------------------------------|---------------------------|----------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------|
|                                                                                 |                           | Total                      | Below 3,15 mm  |                                                                                                                               |
| 1                                                                               | 100 to 315                | 14                         | 6 <sup>a</sup> | 8<br><br>No piece to exceed<br>1,15 × the maxi-<br>mum limit of the<br>size range specified<br>in two or three<br>directions. |
| 2                                                                               | 25 to 200                 | 15                         | 7 <sup>a</sup> |                                                                                                                               |
| 3                                                                               | 10 to 100                 | 15                         | 7 <sup>a</sup> |                                                                                                                               |
| 4                                                                               | 3,15 to 50                | 7                          |                |                                                                                                                               |
| 5                                                                               | 3,15 to 25                | 7                          |                |                                                                                                                               |
| 6                                                                               | up to 3,15                | —                          |                |                                                                                                                               |
| <sup>a</sup> If not otherwise specified, these values are for information only. |                           |                            |                |                                                                                                                               |

## 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, presented by the supplier
- $x_2$  value of the index of quality, presented by the purchaser
- $x_a$  value of the index of arbitral analysis

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