
International Standard



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Ferrochromium — Specification and conditions of delivery

Ferro-chrome — Spécifications et conditions de livraison

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5448 was developed by Technical Committee ISO/TC 132, *Ferroalloys*, and was circulated to the member bodies in July 1980.

It has been approved by the member bodies of the following countries :

| | | |
|----------------|----------------|-----------------------|
| Australia | Germany, F.R. | Norway |
| Austria | India | Poland |
| Brazil | Iran | Romania |
| Bulgaria | Ireland | South Africa, Rep. of |
| Canada | Italy | Sweden |
| Czechoslovakia | Japan | USA |
| France | Korea, Rep. of | USSR |

The member body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

Ferrochromium — Specification and conditions of delivery

1 Scope and field of application

This International Standard specifies requirements and conditions of delivery for ferrochromium usually supplied for steel-making and foundry use.

2 References

ISO 565, *Test sieves — Woven metal wire cloth and perforated plate — Nominal sizes of apertures.*

ISO 3713, *Ferroalloys — Sampling and preparation of samples — General rules.*¹⁾

ISO 4140, *Ferrochromium and ferrosilicochromium — Determination of chromium content — Potentiometric method.*

3 Definition

3.1 ferrochromium : A master alloy of iron and chromium with a minimum chromium content of 45,0 % by mass, and a maximum chromium content of 95,0 % by mass, obtained by reduction from the corresponding raw materials or their concentrates.

4 Information for ordering

Orders for ferrochromium shall include the following information.

- a) Quantity.
- b) Constitution of consignment.
- c) Standard chromium range in accordance with table 1.
- d) Chemical composition in accordance with the designations given in tables 2 to 9.

e) Particle size ranges in accordance with the designations given in table 10.

f) Necessary requirements for analysis reports, packing, etc., as appropriate.

5 Requirements

5.1 Constitution of consignment

Ferrochromium shall be delivered in consignments constituted by one of the following methods.

5.1.1 Tapped lot method

A consignment constituted by the tapped lot method consists of a ferrochromium mass of one melt (or one part of a continuous tap).

5.1.2 Graded lot method

A consignment constituted by the graded lot method consists of a number of melts (or parts of continuous taps) of one ferrochromium designation.

The chromium content of the melts (or parts of continuous taps) constituting the consignment shall not differ from each other by more than 4 % absolute.

5.1.3 Blended lot method

A consignment constituted by the blended lot method consists of a number of melts (or parts of continuous taps) of one ferrochromium designation, which have been crushed to a particle size less than x mm²⁾ and thoroughly mixed.

The content of the main constituent of the melts (or parts of continuous taps) constituting the consignment shall not differ from each other by more than 10 % absolute.

1) At present at the stage of draft.

2) To be defined after further investigation.

5.2 Chemical composition

5.2.1 The standard chromium ranges specified in table 1 and their designations cover the whole range of chromium contents from 45,0 to 95,0 % (*m/m*) as defined for ferrochromium in clause 3.

They are valid for the qualities of ferrochromium specified in tables 2 to 9 and shall be indicated by the appropriate designations.

Table 1 — Standard chromium ranges

| Chromium range % | Designation* |
|---------------------|--------------|
| 45,0 to 55,0 | FeCr50... |
| 55,0 to 65,0 | FeCr60... |
| 65,0 to 75,0 | FeCr70... |
| 75,0 to 85,0 | FeCr80... |
| 85,0 to 95,0 | FeCr90... |

* The designations shall be completed by the designation for the carbon content, and other elements if necessary, as indicated in tables 2 to 9 for the required grade.

5.2.2 The chemical composition of ferrochromium shall be as specified in tables 2 to 9. The limits stated correspond to particle size ranges in classes 1 to 7 in accordance with table 10.

5.2.3 The chemical compositions given in tables 2 to 9 show only the main constituent elements and usual impurities. If the purchaser requires closer ranges for the main element contents and/or different limits for specified elements and/or limits for non-specified elements, this shall be agreed upon between supplier and purchaser.

5.2.4 The chemical compositions given in tables 2 to 9 are subject to the precision of the methods of sampling and analysis for ferrochromium (see clause 6).

5.3 Particle size ranges

5.3.1 Ferrochromium is supplied in lumps or as crushed and screened particles. The particle size ranges and tolerances shall be in accordance with table 10. The undersize values shall be valid at the point of delivery to the purchaser.¹⁾

The particle sizes specified refer to screening on a steel sieve with square openings; see ISO 565.

5.3.2 Ferrochromium is also supplied in the form of granules of maximum size 50 mm. A specific granule size shall be agreed upon between supplier and purchaser.

5.3.3 If the purchaser requires particle size ranges and/or tolerances other than those given in table 10, these shall be agreed upon between supplier and purchaser.

5.4 Extraneous contamination

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

6 Testing

6.1 Sampling for chemical analysis and sieve analysis

6.1.1 Sampling for chemical analysis and sieve analysis²⁾ shall preferably be carried out by the method specified in ISO 3713³⁾, but other methods of sampling having similar precision may also be used.

6.1.2 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.

6.1.3 If required, arbitration sampling shall be carried out by an arbitrator chosen by mutual agreement between supplier and purchaser. Sampling shall be carried out by the method specified in ISO 3713³⁾, but other methods of sampling having similar precision may be agreed upon between supplier, purchaser and arbitrator.

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

6.2 Analysis

6.2.1 The chemical analysis of ferrochromium shall preferably be carried out by the method specified in ISO 4140, but other methods of chemical analysis having similar precision may also be used.

6.2.2 Ferrochromium shall be furnished with an analysis certificate, established by the supplier, for the chromium content and, if agreed, the contents of other elements either specified in tables 2 to 9 or additionally agreed and, upon request of the purchaser, with a sample representative of the consignment.

1) 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 shall be agreed upon.

2) Sieve analysis of ferroalloys will form the subject of ISO 4551.

3) A method of sampling specific to ferrochromium will form the subject of ISO 4556.

6.2.3 In case of dispute, one of the following two procedures may be used.

6.2.3.1 Contradictory analysis

The chemical analysis shall be carried out on the same sample and preferably by the method specified in ISO 4140. Other methods of chemical analysis having similar precision may be used, but shall be agreed upon between supplier and purchaser.

If the difference between the results of the two analyses is within $x\%$ ¹⁾, the mean value shall apply. If the difference exceeds $x\%$, then, provided that no other agreement is reached, arbitration analysis shall be carried out by an arbitrator chosen by mutual agreement between supplier and purchaser.

6.2.3.2 Arbitration analysis

Arbitration analysis shall preferably be carried out by the method specified in ISO 4140. Other methods of chemical analysis having similar precision may be used, but shall be agreed upon between supplier, purchaser and arbitrator.

The arbitrator's result is final, provided it is within the two disputed values or not more than $y\%$ ²⁾ outside one of these values.

7 Despatch and storage

Ferrochromium shall be packed, stored and transported according to international regulations.³⁾

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1) The value of x will be specified later. In the meantime, the value should be agreed upon between purchaser and supplier.

2) This value, as an overall precision, will be specified as β_{SDM} .

3) Examples of appropriate international regulations are :

- a) RID, Règlement international concernant le transport des marchandises dangereuses par chemin de fer, Annexe C.
- b) IMCO, International maritime dangerous goods code.
- c) ADR, Accord européen relatif au transport international des marchandises dangereuses par route.

Table 2 — High carbon FeCr, normal phosphorus content

| Designation ¹⁾ | Chemical composition, % | | | | | |
|---------------------------|---|-----------------------------------|------|---------------------|--------|--------|
| | Cr ²⁾ | C | Si | | P max. | S max. |
| | | | over | up to and including | | |
| FeCr...C50 | From 4,0 up to and including 6,0 | From 4,0 up to and including 6,0 | — | 1,5 | 0,050 | 0,10 |
| FeCr...C50LS | | | — | 1,5 | | 0,05 |
| FeCr...C50Si2 | | | 1,5 | 3,0 | | 0,10 |
| FeCr...C50Si2LS | | | 1,5 | 3,0 | | 0,05 |
| FeCr...C50Si4 | | | 3,0 | 5,0 | | 0,10 |
| FeCr...C50Si4LS | | | 3,0 | 5,0 | | 0,05 |
| FeCr...C50Si7 | | | 5,0 | 10,0 | | 0,05 |
| FeCr...C70 | Within the range from 45,0 up to and including 75,0. One of the standard chromium ranges specified in table 1 shall be selected, as required, and designated accordingly. | Over 6,0 up to and including 8,0 | — | 1,5 | 0,050 | 0,10 |
| FeCr...C70LS | | | — | 1,5 | | 0,05 |
| FeCr...C70Si2 | | | 1,5 | 3,0 | | 0,10 |
| FeCr...C70Si2LS | | | 1,5 | 3,0 | | 0,05 |
| FeCr...C70Si4 | | | 3,0 | 5,0 | | 0,10 |
| FeCr...C70Si4LS | | | 3,0 | 5,0 | | 0,05 |
| FeCr...C70Si6 | | | 5,0 | 8,0 | | 0,05 |
| FeCr...C90 | Over 8,0 up to and including 10,0 | Over 8,0 up to and including 10,0 | — | 1,5 | 0,050 | 0,10 |
| FeCr...C90LS | | | — | 1,5 | | 0,05 |
| FeCr...C90Si2 | | | 1,5 | 3,0 | | 0,10 |
| FeCr...C90Si2LS | | | 1,5 | 3,0 | | 0,05 |
| FeCr...C90Si4 | | | 3,0 | 5,0 | | 0,10 |
| FeCr...C90Si4LS | | | 3,0 | 5,0 | | 0,05 |

1) The designations shall be completed by the figure for the required standard chromium range selected from table 1.

Examples : Quality FeCr...C70Si2

- a) In the case of a required standard chromium range from 45,0 to 55,0 %, the designation would read FeCr50C70Si2.
 - b) In the case of a required standard chromium range from 65,0 to 75,0 %, the designation would read FeCr70C70Si2.
- 2) For the deviation, within a lot, of the chromium content from the mean value, see clause 5.

Table 3 — High carbon FeCr, low phosphorus content

| Designation ¹⁾ | Chemical composition, % | | | | |
|---------------------------|--|-----------------------------------|------------|------------------------------|-----------|
| | Cr ²⁾ | C | Si over | Si up to and including | P max. |
| FeCr...C50LP | Within the range from 45,0 up to and including 75,0. One of the standard chromium ranges specified in table 1 shall be selected, as required, and designated accordingly. | From 4,0 up to and including 6,0 | — | 1,5 | 0,030 |
| FeCr...C50LSLP | | | — | 1,5 | |
| FeCr...C50Si2LP | | | 1,5 | 3,0 | |
| FeCr...C50Si2LSLP | | | 1,5 | 3,0 | |
| FeCr...C50Si4LP | | | 3,0 | 5,0 | |
| FeCr...C50Si4LSLP | | | 3,0 | 5,0 | |
| FeCr...C50Si7LP | | | 5,0 | 10,0 | |
| FeCr...C70LP | | Over 6,0 up to and including 8,0 | — | 1,5 | 0,030 |
| FeCr...C70LSLP | | | — | 1,5 | |
| FeCr...C70Si2LP | | | 1,5 | 3,0 | |
| FeCr...C70Si2LSLP | | | 1,5 | 3,0 | |
| FeCr...C70Si4LP | | | 3,0 | 5,0 | |
| FeCr...C70Si4LSLP | | | 3,0 | 5,0 | |
| FeCr...C70Si6LP | | | 5,0 | 8,0 | |
| FeCr...C90LP | | Over 8,0 up to and including 10,0 | — | 1,5 | 0,030 |
| FeCr...C90LSLP | | | — | 1,5 | |
| FeCr...C90Si2LP | | | 1,5 | 3,0 | |
| FeCr...C90Si2LSLP | | | 1,5 | 3,0 | |
| FeCr...C90Si4LP | | | 3,0 | 5,0 | |
| FeCr...C90Si4LSLP | | | 3,0 | 5,0 | |

1) The designations shall be completed by the figure for the required standard chromium range selected from table 1.

Examples : Quality FeCr...C70Si2LP

a) In the case of a required standard chromium range from 45,0 to 55,0 %, the designation would read FeCr50C70Si2LP.

b) In the case of a required standard chromium range from 65,0 to 75,0 %, the designation would read FeCr70C70Si2LP.

2) For the deviation, within a lot, of the chromium content from the mean value, see clause 5.

Table 4 — Medium carbon FeCr, normal phosphorus content

| Designation ¹⁾ | Chemical composition, % | | | | |
|---------------------------|--|------|---------------------|------|-------|
| | Cr ²⁾ | C | Si | P | S |
| | | over | up to and including | max. | max. |
| FeCr...C10 | Within the range from 45,0 up to and including 75,0. One of the standard chromium ranges specified in table 1 shall be selected, as required, and designated accordingly. | 0,5 | 1,0 | 1,5 | 0,050 |
| FeCr...C20 | | 1,0 | 2,0 | | |
| FeCr...C40 | | 2,0 | 4,0 | | |

1) The designations shall be completed by the figure for the required standard chromium range selected from table 1.

Examples : Quality FeCr...C20

- In the case of a required standard chromium range from 45,0 to 55,0 %, the designation would read FeCr50C20.
- In the case of a required standard chromium range from 65,0 to 75,0 %, the designation would read FeCr70C20.

2) For the deviation, within a lot, of the chromium content from the mean value, see clause 5.

Table 5 — Medium carbon FeCr, low phosphorus content

| Designation ¹⁾ | Chemical composition, % | | | | |
|---------------------------|--|------|---------------------|------|-------|
| | Cr ²⁾ | C | Si | P | S |
| | | over | up to and including | max. | max. |
| FeCr...C10LP | Within the range from 45,0 up to and including 75,0. One of the standard chromium ranges specified in table 1 shall be selected, as required, and designated accordingly. | 0,5 | 1,0 | 1,5 | 0,030 |
| FeCr...C20LP | | 1,0 | 2,0 | | |
| FeCr...C40LP | | 2,0 | 4,0 | | |

1) The designations shall be completed by the figure for the required standard chromium range selected from table 1.

Examples : Quality FeCr...C20LP

- In the case of a required standard chromium range from 45,0 to 55,0 %, the designation would read FeCr50C20LP.
- In the case of a required standard chromium range from 65,0 to 75,0 %, the designation would read FeCr70C20LP.

2) For the deviation, within a lot, of the chromium content from the mean value, see clause 5.

Table 6 — Low carbon FeCr, normal phosphorus content

| Designation ¹⁾ | Chemical composition, % | | | | | |
|---------------------------|--|-------|---------------------|------|-------|------|
| | Cr ²⁾ | C | Si | P | S | N |
| | | over | up to and including | max. | max. | max. |
| FeCr...C01 | Within the range from 45,0 up to and including 75,0. One of the standard chromium ranges specified in table 1 shall be selected, as required, and designated accordingly. | — | 0,015 | 1,5 | 0,050 | 0,15 |
| FeCr...C03 | | 0,015 | 0,030 | | | |
| FeCr...C05 | | 0,030 | 0,050 | | | |
| FeCr...C1 | | 0,050 | 0,10 | | | |
| FeCr...C2 | | 0,10 | 0,25 | | | |
| FeCr...C5 | | 0,25 | 0,50 | | | |

1) The designations shall be completed by the figure for the required standard chromium range selected from table 1.

Examples : Quality FeCr...C1

- In the case of a required standard chromium range from 45,0 to 55,0 %, the designation would read FeCr50C1.
- In the case of a required standard chromium range from 65,0 to 75,0 %, the designation would read FeCr70C1.

2) For the deviation, within a lot, of the chromium content from the mean value, see clause 5.

Table 7 — Low carbon FeCr, low phosphorus content

| Designation ¹⁾ | Chemical composition, % | | | | | | |
|---------------------------|--|-------|------------------------|------------|-----------|-----------|-----------|
| | Cr ²⁾ | C | | Si max. | P max. | S max. | N max. |
| | | over | up to and including | | | | |
| FeCr...C01LP | Within the range from 45,0 up to and including 75,0. One of the standard chromium ranges specified in table 1 shall be selected, as required, and desig- nated accordingly. | — | 0,015 | 1,5 | 0,030 | 0,030 | 0,15 |
| FeCr...C03LP | | 0,015 | 0,030 | | | | |
| FeCr...C05LP | | 0,030 | 0,050 | | | | |
| FeCr...C1LP | | 0,050 | 0,10 | | | | |
| FeCr...C2LP | | 0,10 | 0,25 | | | | |
| FeCr...C5LP | | 0,25 | 0,50 | | | | |

1) The designations shall be completed by the figure for the required standard chromium range selected from table 1.

Examples : Quality FeCr...C1LP

- In the case of a required standard chromium range from 45,0 to 55,0 %, the designation would read FeCr50C1LP.
 - In the case of a required standard chromium range from 65,0 to 75,0 %, the designation would read FeCr70C1LP.
- 2) For the deviation, within a lot, of the chromium content from the mean value, see clause 5.

Table 8 — Low carbon FeCr, high chromium content

| Designation ¹⁾ | Chemical composition, % | | | | | | | | |
|---------------------------|--|-----------|-----------------------------|------------|-----------|-----------|------------|------------|-----------|
| | Cr ²⁾ | C over | C up to and including | Si max. | P max. | S max. | Ni max. | Co max. | N max. |
| FeCr...C01 | Within the range from 75,0 up to and including 95,0. One of the standard chromium ranges specified in table 1 shall be selected, as required, and designated accordingly. | — | 0,015 | 1,5 | 0,020 | 0,030 | 0,15 | 0,02 | 0,20 |
| FeCr...C03 | | 0,015 | 0,030 | | | | | | |
| FeCr...C05 | | 0,030 | 0,050 | | | | | | |

1) The designations shall be completed by the figure for the required standard chromium range selected from table 1.

Example : Quality FeCr...C03

In the case of a required standard chromium range from 75,0 to 85,0 %, the designation would read FeCr80C03.

- 2) For the deviation, within a lot, of the chromium content from the mean value, see clause 5.

Table 9 — Low carbon FeCr, nitrogen containing

| Designation ¹⁾ | Chemical composition, % | | | | | | |
|---------------------------|--|--------|----------|--------|--------|------|---------------------|
| | Cr ²⁾ | C max. | Si | P max. | S max. | N | |
| Smelted FeCr...C1N3 | Within the range from 45,0 up to and including 75,0. One of the standard chromium ranges specified in table 1 shall be selected, as required, and designated accordingly. | 0,10 | 1,5 max. | 0,030 | 0,025 | over | up to and including |
| Sintered FeCr...C1N7 | | | 1,5 max. | | | 4,0 | 10,0 |
| Sintered FeCr...C1N7Si | | | over 1,5 | | | | |

1) The designations shall be completed by the figure for the required standard chromium range selected from table 1.

Examples : Quality FeCr...C1N3

- In the case of a required standard chromium range from 45,0 to 55,0 %, the designation would read FeCr50C1N3.
 - In the case of a required standard chromium range from 65,0 to 75,0 %, the designation would read FeCr70C1N3.
- 2) For the deviation, within a lot, of the chromium content from the mean value, see clause 5.