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Methods of sampling for size analysis of ferroalloys and size determination

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently **JIS G 1641:1985** is replaced with **JIS G 1641:1998**.

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Methods of sampling for size analysis of ferroalloys and size determination

Introduction This revision is made for conformity with the corresponding International Standard.

This Standard has been prepared based on **ISO 4551, *Ferroalloys—Sampling and sieve analysis***, published in 1987 as the first edition, without modifying its technical content. The items not specified in the corresponding International Standard have been additionally contained herein as Japanese Industrial Standard.

The parts underlined with dots in this Standard are the matters not specified in the original International Standard.

1 Scope This Japanese Industrial Standard specifies the methods of sampling and size determination by sieving for determination of the average value of particle size (referred to as the “average grade”) of one consignment of ferroalloys specified in JIS G 2301, JIS G 2302, JIS G 2303, JIS G 2304, JIS G 2306, JIS G 2307, JIS G 2308, JIS G 2309, JIS G 2310, JIS G 2311, JIS G 2312, JIS G 2313, JIS G 2314, JIS G 2315, JIS G 2316, JIS G 2318 and JIS G 2319.

Remarks : This Standard shall be in accordance with **JIS M 8100**.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS G 1501 *General rules for sampling of ferroalloys*

JIS G 2301 *Ferromanganese*

JIS G 2302 *Ferrosilicon*

JIS G 2303 *Ferrochromium*

JIS G 2304 *Silicon-Manganese*

JIS G 2306 *Ferrotungsten*

JIS G 2307 *Ferromolybdenum*

JIS G 2308 *Ferrovandium*

JIS G 2309 *Ferrotitanium*

JIS G 2310 *Ferrophosphorus*

JIS G 2311 *Manganese metal*

JIS G 2312 *Silicon metal*

JIS G 2313 *Chromium metal*

JIS G 2314 *Calcium silicon*

JIS G 2315 *Silicon-Chromium*

JIS G 2316 *Ferronickel*

JIS G 2318 *Ferroboration*

JIS G 2319 *Ferroniobium*

JIS M 8100 *Particulate materials—General rules for methods of sampling*

JIS Z 8401 *Rules for rounding off of numerical values*

JIS Z 8801 *Test sieves*

3 Definitions The definition of the main terms used in this Standard shall be as follows. However, the definition of terms as to sampling such as consignment, increment, sub-sample, gross sample, test sample, sample for particle size, maximum particle size, etc. shall be in accordance with **JIS G 1501**.

- a) **measuring sample** All samples provided for the determination of particle size.
- b) **charging sample** All or a part of measuring samples which can be treated at one time by using an individual sieve or a nest of sieves.
- c) **oversize** A portion of the sample retained on a sieve of opening size X mm. It is generally designated as +X mm.
- d) **undersize** A portion of the sample that is passed through a sieve of opening size Y mm. It is generally designated as –Y mm.
- e) **size fractions** A portion of the measuring sample separated with an individual sieve or paired sieves having different opening sizes. It is designated as, for example, –X+Y mm. The mass percentage of the size fraction to all measuring sample is called the particle size (%).
- f) **sieving** A process of separating a mixture of particles according to their specified sizes with one or more sieves.
- g) **hand sieving** An operation in which one or more sieves are supported and agitated manually.
Remarks: There is also an assisted hand sieving in which one or more sieves are supported mechanically but agitated manually.
- h) **manual single body sieving** A sieving in which each sample is contacted to the opening of sieve manually and the particles which do not pass through are clearly classified into oversize. This method shall be carried out for the ferroalloy lumps of 50 mm min.
- i) **mechanical sieving** An operation in which one or more sieves are supported and agitated mechanically.
- j) **batch sieving** A sieving in which the sample of a specific mass is charged onto one or more sieves and shaken manually or mechanically.
- k) **continuous sieving** An operation in which the sample is continuously fed on to one or more sieves and sieved by the shaking, rotation or inclination of sieving surfaces.

4 Symbols The symbols used in this Standard shall be in accordance with **JIS G 1501**.

5 Fundamentals Fundamentals shall be as follows.

- (a) The sampling for determination of the particle size (%) of a consignment shall be carried out separately from the sampling for determination of the average grade of chemical composition of a consignment.
- (b) General requirements for the sampling of the size samples shall be according to **JIS G 1501**.
- (c) The prepared increment shall be used as the measuring sample without crushing and reduction. If necessary, a sub-sample or a gross sample is formed by gathering of increments and may be used as the measuring sample.
- (d) The sieving shall be carried out by shipment or arrival standard (¹).

Note (¹) It means the state as it is in which the products are shipped or received (drying, washing, etc. shall not be carried out).

- (e) General procedures of sampling and sieving.

1) **Sampling** The sampling shall be as follows.

- 1.1) The consignment shall be clarified.
- 1.2) The minimum mass of an increment shall be determined according to the maximum particle size of a consignment.
- 1.3) The minimum number of increments shall be determined.
- 1.4) Increments shall be taken from a consignment and used as the measuring samples.

2) **Sieving** The sieving shall be as follows.

- 2.1) The state of a measuring sample shall be confirmed.
- 2.2) The sieving method shall be determined.
- 2.3) The sieving apparatus shall be determined.
- 2.4) Sieving shall be carried out.
- 2.5) The mass of measuring sample of each size fraction shall be measured.
- 2.6) The particle size (%) of a consignment shall be obtained according to **10**.

- (f) The particle size (%) of a consignment obtained in this Standard shall have the overall precision of about 95 % in confidence coefficient. The overall precision (β_{SM}) contains the precision of the sampling and measurement of sample, which is the value of 2 times the precision (σ_{SM}) expressed by standard deviation, and is expressed by absolute percentage. That is

$$\beta_{SM} = 2\sigma_{SM} = 2\sqrt{\sigma_S^2 + \sigma_M^2}$$

The overall precision is given in Tables 1.1 and 1.2.

Table 1.1 Overall precision

(For ferromanganese, ferrosilicon, ferrochromium, silicomanganese and silicochromium)

Unit: absolute percentage

Mass of consignment (t)		Overall precision (β_{SM}) % (m/m)			
		Oversize	Undersize		
Over	Up to and incl.	Over 5 up to and incl. 10	Up to and incl. 5	Over 5 up to and incl. 10	Over 10 up to and incl. 20
5 000	10 000	3.1	1.1	1.9	2.5
2 500	5 000	3.2	1.2	2.0	2.6
1 000	2 500	3.2	1.2	2.0	2.6
500	1 000	3.4	1.2	2.1	2.7
250	500	3.5	1.2	2.1	2.8
100	250	3.6	1.3	2.2	2.9
50	100	3.8	1.3	2.3	3.0
25	50	4.1	1.4	2.4	3.3
10	25	4.8	1.7	2.8	3.8
5	10	5.3	1.8	3.0	4.2
—	5	6.1	2.0	3.4	4.8

Table 1.2 Overall precision

(For ferrotungsten, ferromolybdenum, ferrovanadium, ferrotitanium, ferrophosphorus, manganese metal, silicon metal, chromium metal, calcium silicon, ferronickel, ferroboron and ferroniobium)

Unit: absolute percentage

Mass of consignment (t)		Overall precision (β_{SM}) % (m/m)			
		Oversize	Undersize		
Over	Up to and incl.	Over 5 up to and incl. 10	Up to and incl. 5	Over 5 up to and incl. 10	Over 10 up to and incl. 20
40	64	3.2	1.2	2.0	2.6
25	40	3.4	1.2	2.1	2.8
16	25	3.6	1.3	2.2	2.9
10	16	3.9	1.4	2.3	3.1
5	10	4.2	1.5	2.5	3.3
3	5	4.6	1.6	2.7	3.7
1	3	5.1	1.7	2.9	4.0
0.5	1	5.7	1.9	3.2	4.5
—	0.5	6.6	2.2	3.7	5.2

6 Sampling method Sampling Method shall be as follows.**6.1 General requirements** The sampling method shall be according to JIS G 1501.