INTERNATIONAL STANDARD

ISO 9147

First edition
1987-09-15

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Pig-irons — Definition and classification

Fontes brutes — Définition et classification

Reference number
ISO 9147 : 1987 (E)

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.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 9147 was prepared by Technical Committee ISO/TC 25, *Cast iron and pig iron*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Printed in Switzerland

Pig-irons — Definition and classification

1 Scope and field of application

This International Standard defines pig-irons and the sub-division of pig-irons into different classes.

2 Definition

pig-iron: An iron-carbon alloy with more than 2 % carbon and with contents of other elements equal to or less than the limit values given for them in table 1.

It is intended for further processing in the molten condition into steel or cast-iron. Pig-iron is delivered either in the molten state or in the solid state in primary forms such as pigs or similar solid pieces, and granulates.

3 Sub-division of pig-irons

3.1 Pig-iron is sub-divided into the classes indicated in table 2 on the basis of its chemical composition.

3.2 In cases of doubt, the correct classification of the pig-iron into one of the classes indicated in table 2 shall be determined by check analysis. The conditions for sampling, including the conditions for the number of tests, shall correspond to the conditions usually applied in cases of dispute for deliveries of disputed chemical composition (see annex).

Table 1 — Limits of alloy elements for pig-iron

Element	Limit[1] %
Manganese	⩽ 30,0
Silicon	⩽ 8,0
Phosphorus	⩽ 3,0
Chromium	⩽ 10,0
Other alloying elements in total[2]	⩽ 10,0

1) Materials with higher contents are ferro-alloys.

2) In cases of doubt, all elements for which a minimum content is specified or whose content exceeds the lower limit given in table 2, footnote 8, paragraph d), are, in accordance with table 2, footnote 8, paragraphs c) and d), regarded as "other alloying elements" with the exception of carbon, silicon, manganese, phosphorus and chromium.

Table 2 — Classification and designation of pig-iron according to its chemical composition[1)]

(1)	(2)			(3)	(4)	(5)	(6)	(7)	(8)	(9)
No.	Pig-iron class Designation			Abbreviation	% C_{total}	% Si	% Mn	% P	% S max.	Other
1.1	Unalloyed	Steel-making pig-iron	Low phosphorus	Pig-P2	(3,3 to 4,8)	⩽ 1,0[2)]	0,4 to 6,0 (0,5 to 1,5)	⩽ 0,25	0,06	3)
1.2			High phosphorus	Pig-P20	(3,0 to 4,0)		⩽ 1,5	1,5 to 2,5	0,08	
2.1		Foundry pig-iron	4)	Pig-P1 Si	(3,3 to 4,5)	1,0 to 4,0[2)] (1,5 to 3,5)	0,4 to 1,5[2)]	⩽ 0,12	0,06	
2.2				Pig-P3 Si				> 0,12 to 0,5		
2.3				Pig-P6 Si				> 0,5 to 1,0 (> 0,5 to 0,7)		
2.4				Pig-P12 Si				> 1,0 to 1,4		
2.5				Pig-P17 Si				> 1,4 to 2,0		
3.1			Spheroidal graphite (nodular) base	Pig-Nod	(3,5 to 4,6)	⩽ 3,0[2)]	⩽ 0,1	⩽ 0,08	0,03	3), 6)
3.2			Spheroidal graphite (nodular) base higher manganese[5)]	Pig-Nod Mn		⩽ 4,0[2)]	> 0,1 to 0,4[2)]			
3.3			Low carbon	Pig-LC	> 2,0 to 3,5	⩽ 3,0[2)]	> 0,4 to 1,5	⩽ 0,30	0,06	3)
4.0			Other unalloyed pig-iron	Pig-SPU	7)					
5.1	Alloyed		Spiegel iron	Pig-Mn	(4,0 to 6,5)	max. 1,5	> 6,0 to 30,0[2)]	⩽ 0,30 (⩽ 0,20)	0,05	3)
5.2			Other alloyed pig-iron	Pig-SPA	8)					

1) The unbracketed values are those which determine the classification of the pig-iron. Values given in brackets indicate, for information only, the ranges in which actual contents of the elements concerned normally lie.

2) By sub-dividing this range into various sub-ranges, the class of pig-iron concerned is normally further sub-divided into different grades.

3) No minimum values are specified for other elements. Depending, for example, on the raw materials used, the pig-iron may unintentionally contain elements other than those indicated in columns 4 to 8 and in percentages, which, for some elements, may reach a value of about 0,5 %. The contents of these indicated elements should not be used in the classification of the pig-iron.

4) For these classes of foundry pig-iron, different terms such as low, medium, intermediate and high phosphorus, normal haematite and semi-haematite Cleveland, etc. are used in the various parts of the world and this partly in a very different sense. Consequently, it is recommended that on the international level such terms be abandoned and that in these cases only the abbreviations given in column 3 be applied as designations.

5) Normally used for either pearlitic nodular cast-iron or for malleable cast-iron.

6) A further characteristic of these pig-iron grades is that the contents of elements prejudicing the formation of nodular graphite and promoting the formation of carbide are low according to the intended use of the grade concerned.

7) This class includes pig-iron that cannot be classified either in classes 1.1 to 3.3 or in classes 5.1 and 5.2.

8) Other alloyed pig-iron includes:

a) pig-iron with a silicon content between > 4,0 and 8,0 %;

b) pig-iron with a manganese content between > 6,0 and 30,0 %, provided that it cannot be classified as Spiegel iron (see class 5.1);

c) pig-iron for which a minimum content is specified for at least one of the elements not specified in columns 4 to 8;

d) pig-iron whose content of at least one of the following elements is within the limits indicated below:

Cr > 0,3 to 10,0 %
Mo > 0,1
Ni > 0,3
Ti > 0,2
V > 0,1
W > 0,1

} up to the total content of 10,0 % of "other" elements resulting from table 1.

Annex

Sampling and preparation of samples intended for the determination of the chemical composition of pig-irons

(This annex forms an integral part of the Standard.)

A.1 Field of application

This annex is applicable to pig-iron in the solid state.

NOTE — In the case of pig-iron in the liquid state, special regulations are to be agreed between the producer and the purchaser.

A.2 Number of pigs to be taken

The number of pigs to be taken shall be representative of the batch. In cases of dispute, and if there has been no other agreement between the parties, the minimum number of pigs to be taken from each batch is given in table 3.

Table 3 — Number of pigs to be taken

Mass of batch t	Minimum number of pigs to be taken
≤ 10	9
> 10 ≤ 20	11
> 20 ≤ 40	12
> 40 ≤ 80	14
> 80 ≤ 160	16
> 160 ≤ 300	18
> 300 ≤ 600	21
> 600	24

A.3 Selection of samples

The samples shall be taken at random, preferably in accordance with one of the procedures described below.

A.3.1 Pigs arranged in piles

Throw a rope having a certain number of knots onto the pile. Take as samples the pigs touched by these knots. Repeat the operation until a sufficient number of pigs is obtained.

A.3.2 Pigs being loaded or unloaded

Throughout the loading or unloading operations, take pigs as samples so that the time intervals between taking pigs are approximately equal.

A.4 Preparation of the sample for analysis

A.4.1 Chemical analysis

A.4.1.1 Machineable pig-iron

A.4.1.1.1 Determination of elements other than carbon

In the centre of each pig taken from the batch, drill a hole 12 to 14 mm in diameter. Remove the first chips, which may contain surface scale and other impurities. For the same reason, cease drilling approximately 2 mm from the opposite face of the pig (see figure, point 1).

Then treat the chips in accordance with A.4.1.3.

A.4.1.1.2 Determination of carbon

Apply one of the two procedures A or B below. In cases of dispute, apply procedure A.

Procedure A

In the centre of each pig taken from the batch, and on each side, drill a hole 12 to 14 mm in diameter (where appropriate, use the hole drilled in accordance with A.4.1.1.1). Remove the scale and other impurities around the holes on both sides of the pig. Then drill another hole coaxial with the first hole, 20 to 24 mm in diameter, in such a way that large chips are obtained and collected in a suitable container [see figure, point 2 a)].

Then treat these chips in accordance with A.4.1.3.

Procedure B

Using a gouge or a chisel, remove from the pigs small chips of suitable size (see A.4.1.3) from the lower bulging face in the skin zone, which solidifies rapidly and is in practice free from segregation to a thickness of 5 mm [see figure, point 2b)]. Check that the chips are taken from a fractured surface or, if the pigs have not been broken, that the surface impurities have been previously removed, e.g. by grinding.

Then treat these chips in accordance with A.4.1.3.

A.4.1.2 Non-machineable pig-iron

Break up each pig taken from the batch, for example with a pneumatic hammer, then reduce further until pieces of a suitable size for further reduction as in A.4.1.3 are obtained.

A.4.1.3 Sample for analysis for determination of average composition

Reduce the chips or fragments taken according to A.4.1.1 or A.4.1.2, using appropriate equipment, i.e. wear-resistant and, if necessary, dust-tight, to a size appropriate for chemical analysis.

The appropriate size is:

— for determination of carbon, about 1 to 2 mm,

— for determination of other elements, < 0,20 mm.

Mix equal quantities of the material originating from each of the pigs taken. From this mixture it is possible to obtain a sample for analysis by the usual quartering method.

A.4.2 Spectrographic analysis

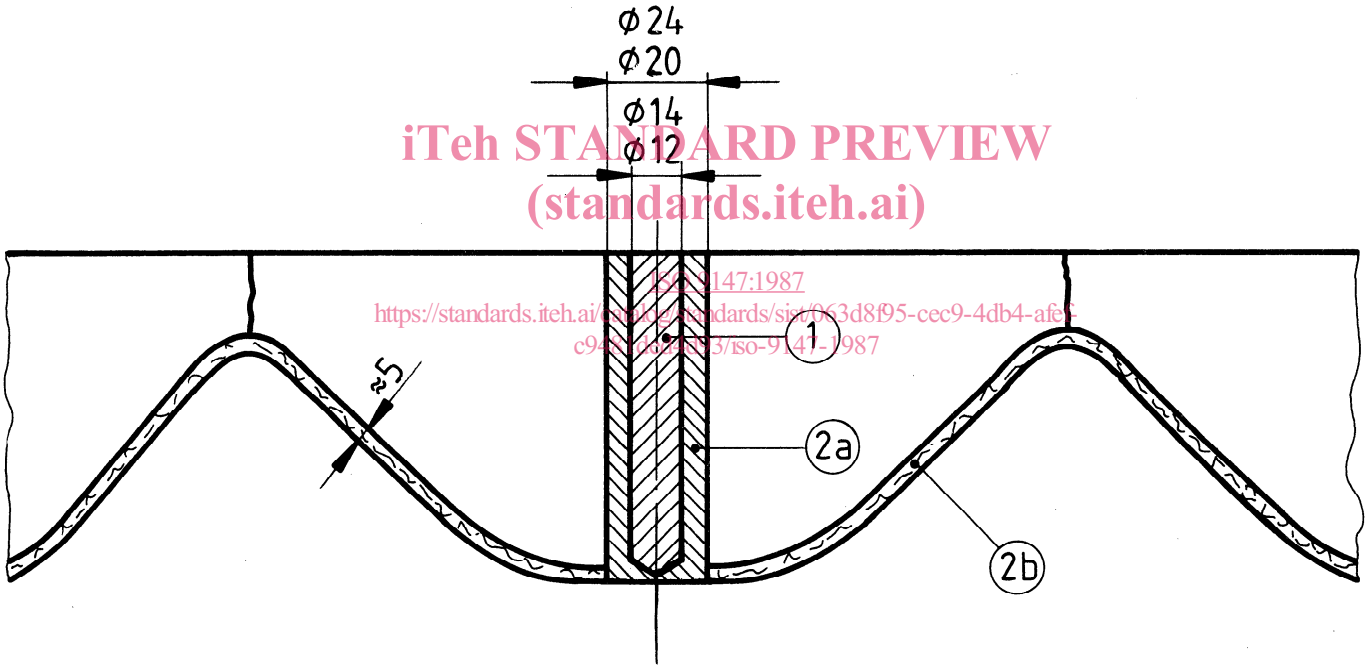
If it is intended to make use of spectrographic methods of analysis, the preparation of samples shall be carried out in accordance with methods giving identical results to those used for the chemical analysis.

A.5 Methods of analysis

A.5.1 Use either chemical or spectrographic methods of analysis.

A.5.2 Apply the appropriate International Standards for chemical analysis as far as possible.

Dimensions in millimetres



1 First hole for taking chips for the determination of elements other than carbon (see A.4.1.1.1).

2a) Second hole for taking chips for the determination of the carbon content when using procedure A (see A.4.1.1.2).

2b) Rapid solidification zone from which fragments are to be taken for the determination of the carbon content when using procedure B in accordance with A.4.1.1.2.

Figure — Taking samples from machineable pig-iron

This page intentionally left blank

UDC 669.162.275.12.001.33

Descriptors : iron- and steel products, pigs (castings), classification, sampling.

Price based on 4 pages