TECHNICAL REPORT

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Designation system for cast irons and pig irons

Système de désignation pour la fonte et la fonte brute

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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.

ISO/TR 15931 was prepared by Technical Committee ISO/TC 25, *Cast iron and pig iron*.

Introduction

This Technical Report does not strictly meet the criteria for such a report, but was agreed upon by the Member Bodies of ISO/TC 25. This Technical Report will be subject to review in accordance with ISO Directives.

This Technical Report reflects the guidance given in ISO/TR 7003. It also takes into account the particular nomenclature requirements of cast irons and pig irons and diverges in certain aspects from the guidance given in ISO/TR 7003. For instance, it only concentrates on the primary distinguishing features required for the particular designation and relies on specific international materials standards to expand on the primary designation for contracts and other purposes.

It takes account of the comments received from member bodies during the consulting stages of the project.

The ISO/TC 25 Plenary Meeting has agreed by resolution that each Subcommittee and Working Group of ISO/TC 25 shall adopt the designation system detailed in this Technical Report for the designation of the specific cast iron(s) or pig iron(s) for which they are responsible.

Designation system for cast irons and pig irons

1 Scope

The aims of this Technical Report are:

— to make the designation of cast irons and pig irons as simple and as understandable as possible, bearing in mind language barriers world-wide;

— to define cast iron and pig iron designations by a simple code consisting of relevant letters and numbers only, taking into account the guidance given in Technical Report ISO/TR 7003;

— to ensure that the agreed system is user-friendly from the point of view of the casting designer, the manufacturer (founder) and the user;

— to ensure that the designation system clearly defines the materials described by standards and details all of the important attributes of mechanical properties, chemical composition and additional features that need to be described.

2 Normative references

The following referenced documents are indispensable for the application 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 185, *Grey (lamellar graphite) cast irons — Classification*

ISO 1083, *Spheroidal graphite cast irons — Classification*

ISO 2892, *Austenitic cast iron*

ISO 5922, *Malleable cast iron*

ISO/TR 7003, *Unified format for the designation of metals*

ISO 9147, *Pig-irons — Definition and classification*

ISO 16112, *Compacted (vermicular) graphite cast irons — Classification*

ISO 17804, *Founding — Ausferritic spheroidal graphite cast irons — Classification*

ISO 21988, *Abrasion resisting cast irons*

3 Use of designation systems

The designation system has four (4) positions (see Clause 4).

Positions 1, 2 and 3 are obligatory. Position 4 is optional.

The decision to specify the content of positions 3 and 4 is the responsibility of the relevant subcommittee of ISO/TC 25.

The symbols contained in one position shall be separated from the next position by a solidus (oblique stroke).

The symbols to be used in position 2 of this designation system are detailed in Table 1.

Table 1 — Explanation of symbols in position 2

1st letter Base material	2nd letter Graphite structure	3rd letter (optional) Matrix structure
J iron	L lamellar (grey)	A austenite
	M malleable	B blackheart (malleable iron)
	N no graphite	F ferrite
	S spheroidal (nodular)	P pearlite
	V vermicular (compacted)	L ledeburite
	Y pig iron	M martensite
		Q quenched
		T tempered
		W whiteheart (malleable iron)

Chemical elements are defined by their accepted international symbols, e.g. chromium = Cr.

Other symbols which are used in this designation system are defined in the body of the text, where relevant.

When a cast iron material is defined on a manufacturing drawing, the designation is written in full without abbreviation, e.g. ISO185/JL/200/SH.

When there is a requirement to denote a material specification on a cast component, it is permissible to use the relevant material grade designation in abbreviated form, e.g. JMB/350-10.

4 Designation system for cast irons and pig irons

Table 2 shows the positions within the designation system.

Table 2 — Positions within the designation

Position 1	Position 2	Position 3	Position 4
Relevant ISO standard	**Code letter(s) for the material**	**Codes for primary properties**	**Additional requirements**
Position 1 shall contain the number of the relevant ISO Standard only (see Table 3)	Position 2 shall contain the code letters for the material only (see Table 4)	Position 3 shall contain the code letters and/or numbers for the mechanical properties or alternatively for the chemical composition of the material (see Table 5)	Position 4 shall contain any other qualifying features unique to the specific material or material grade (see Table 6)

Table 3 — Details of the possible contents of Position 1

Cast iron material	ISO standard number
Grey (lamellar graphite) cast iron	ISO 185
Malleable cast iron	ISO 5922
Spheroidal graphite cast iron	ISO 1083
Compacted (vermicular) graphite cast iron	ISO 16112
Ausferritic spheroidal graphite cast iron	ISO 17804
Austenitic cast iron	ISO 2892
Abrasion resistant cast iron	ISO 21988
Pig iron	ISO 9147

Table 4 — Details of the possible contents of Position 2

Cast iron material	Code letter(s) for the material
Grey (lamellar graphite) cast iron	JL
Malleable cast iron	JMB for blackheart JMW for whiteheart
Spheroidal graphite cast iron	JS[a]
Compacted (vermicular) graphite cast iron	JV
Ausferritic spheroidal graphite cast iron	JS
Austenitic cast iron	JLA or JSA[b, c]
Abrasion resistant cast iron	JN[c]
Pig iron	JY

a High silicon spheroidal graphite cast irons are designated by XSi plus silicon content (mass fraction), e.g.: JS/XSi4. The “XSi4” part of the designation is placed in position 3.

b The graphite structure of the grades covered by this Technical Report can be either lamellar (JL) or spheroidal (JS).

c The grades are further defined by X for higher contents of alloying elements.

Table 5 — Details of values of the primary properties of the material of Position 3

Cast iron material	Codes for primary properties
Grey (lamellar graphite) cast iron	Tensile strength in N/mm^2 (3 digits) or alternatively Brinell hardness (HBW then 3 digits)
Malleable cast iron	Tensile strength in N/mm^2 (3 digits) followed by a hyphen and then the elongation after fracture in % (1 or 2 digits) — if applicable, indication of an impact resistance test[a]
Spheroidal graphite cast iron	Either tensile strength in N/mm^2 (3 digits) followed by a hyphen and then the elongation after fracture in % (1 or 2 digits) — if applicable, indication of an impact resistance test[a] or alternatively — Brinell hardness (HBW then 3 digits)
Compacted (vermicular) graphite cast iron	Tensile strength in N/mm^2 (3 digits)
Ausferritic spheroidal graphite cast iron	Either tensile strength in N/mm^2 (3 or 4 digits) followed by a hyphen and then the elongation after fracture in % (1 or 2 digits) — if applicable, indication of an impact resistance test[b] or alternatively — Brinell hardness (HBW then 3 digits)
Austenitic cast iron	For each major chemical element, its symbol, followed by the mass fraction (average) of each element in % [b]
Abrasion resistant cast iron	For high chromium alloys:[b, c] Brinell hardness (HBW then 3 digits) chromium content (average): XCr then its mass fraction in % (2 digits) For all other material grades:[b, c] Brinell hardness (HBW then 3 digits) chromium content (average): Cr then its mass fraction in % (2 digits)
Pig iron	For each major chemical element, its symbol, followed by the mass fraction of each element in order[b]

NOTE 1 Each property is separated by a hyphen within any position.

NOTE 2 1 N/mm^2 = 1 MPa.

a For certain grades, impact resistance can be specified as LT or RT:
- LT impact strength is determined at low temperature;
- RT impact strength is determined at room temperature.

b Chemical composition shall be given as follows: major chemical element(s) followed by the mass fraction(s).

X denotes that the mass fraction in % of all major elements except carbon is to be multiplied by the factor 1, followed by chemical symbol(s) of the element(s) followed by its (their) mass fraction(s) in % to nearest whole number (1 or 2 digits).

c Hardness value can be specified for certain grades with hardness value agreed upon by the time of the order and specified as follows:

HBW Brinell hardness followed by the hardness value (3 digits);
HV Vickers hardness followed by the hardness value (3 digits);
HRC Rockwell hardness followed by the hardness value (3 digits).

Table 6 — Details of the possible contents of Position 4

Cast iron material	Additional requirements
Grey (lamellar graphite) cast iron	a, b
Malleable cast iron	a, b
Spheroidal graphite cast iron	a, b
Compacted (vermicular) graphite cast iron	a, b
Ausferritic spheroidal graphite cast iron	a, b
Austenitic cast iron	a, b
Abrasion resistant cast iron	a, b
Pig iron	None

NOTE Space is left blank if the feature does not exist.

Other qualifying features may exist that have not been covered in this table. These are defined by the subcommittee responsible for the relevant standard.

a Position of the sample for the tensile test is defined by one of the following symbols:

- S for separately cast samples;
- U for cast-on samples;
- C for samples cut from the casting.

b Additional features are denoted by one or more of the following symbols which can follow the symbol for the sample position:

- — no additional requirements;
- D as-cast condition;
- H heat-treated condition;
- W weldability;
- Z any other requirement specified at the time of the order.

5 Examples of designation

5.1 Grey (lamellar graphite) cast iron with tensile strength 200 N/mm^2, separately cast sample, given a stress-relieving heat treatment

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 185	JL	200	S, H

EXAMPLE

ISO185/JL/200/SH

5.2 Grey (lamellar graphite) cast iron with Brinell hardness HBW 195 for the relevant wall thickness 40 mm, separately cast sample

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 185	JL	HBW 195	S

EXAMPLE

ISO185/JL/HBW195/S

5.3 Spheroidal graphite cast iron with tensile strength 400 N/mm^2, elongation after fracture 18 %, impact resistance 12 J at – 20 °C, cast-on sample

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 1083	JS	400-18 LT	U

EXAMPLE

ISO1083/JS/400-18LT/U

5.4 Ausferritic spheroidal graphite cast iron with tensile strength 800 N/mm^2 and 10 % elongation after fracture and impact resistance 10 J at + 23 °C, separately cast sample

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 17804	JS	800-10 RT	S

EXAMPLE

ISO17804/JS/800-10RT/S

5.5 Blackheart malleable cast iron with tensile strength 350 N/mm^2 and 10 % elongation after fracture

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 5922	JMB	350-10	—

EXAMPLE

ISO5922/JMB/350-10

5.6 Whiteheart malleable cast iron with tensile strength 360 N/mm^2 and 12 % elongation after fracture, weldable

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 5922	JMW	360-12	W

EXAMPLE

ISO5922/JMW/360-12/W

5.7 Compacted (vermicular) graphite cast iron with tensile strength 450 N/mm^2, separately cast sample

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 16112	JV	450	S

EXAMPLE

ISO16112/JV/450/S

5.8 Austenitic cast iron with lamellar graphite and max. 3,0 % C, 1,0 % to 2,8 % Si, 0,5 % to 1,5 % Mn, 13,5 % to 17,5 % Ni, 1,0 % to 3,5 % Cr, max. 0,25 % P and 5,5 % to 7,5 % Cu, separately cast sample

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 2892	JLA	XNi15Cu6Cr2	S

EXAMPLE

ISO2892/JLA/XNi15Cu6Cr2/S

5.9 High chromium (14 % to 18 % Cr) abrasion resistant cast iron with Brinell hardness HBW 555, separately cast sample, other requirements at the time of the order

Position 1	Position 2	Position 3	Position 4
Relevant ISO Standard	Code letter for the material	Code numbers for primary property(ies)	Additional requirements
ISO 21988	JN	HBW 555XCr16	S, Z

EXAMPLE

ISO21988/JN/HBW555XCr16/SZ