BS EN 1560:2011

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Founding — Designation system for cast iron — Material symbols and material numbers

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee ISE/111, Steel Castings and Forgings.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Fonderie - Système de désignation pour la fonte - Désignation symbolique et numérique

Gießereiwesen - Bezeichnungssystem für Gusseisen - Werkstoffkurzzeichen und Werkstoffnummern

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Foreword

This document (EN 1560:2011) has been prepared by Technical Committee CEN/TC 190 “Foundry technology”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2011, and conflicting national standards shall be withdrawn at the latest by August 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1560:1997.

Annex C provides details of significant technical changes between this European Standard and the previous edition.

Within its programme of work, Technical Committee CEN/TC 190 requested CEN/TC 190/WG 1 “Technical conditions of delivery and cast iron designation” to revise EN 1560:1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Cast iron materials can be designated either by symbols or by numbers for all grades. The material number is based on principles and the structure set out in EN 10027-2.

1 Scope

This European Standard establishes a material designation system either by symbols or by numbers for cast iron.

The designation system by symbols is applicable to:

a) standardized cast iron materials (see 2.1);

b) non-standardized cast iron materials (see 2.2).

The designation system by numbers is only applicable to standardized cast iron materials (see 2.1).

NOTE The use of a designation system by symbols does not necessarily imply that the material is standardized.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
standardized cast iron material
cast iron material which has been specified in a European Standard

2.2
non-standardized cast iron material
cast iron material which has not been specified in a European Standard, but is manufactured and/or used in CEN member countries

3 Designation of cast iron materials by symbols

3.1 General

There shall be only one designation by symbols for each cast iron material.

3.2 Material symbol structure

3.2.1 Overall structure

The designation by symbols shall occupy a maximum of six positions. There shall be no spaces between any of the used positions.

— Position 1: EN- (see 3.2.2);

— Position 2: Symbol for cast iron (see 3.2.3);

— Position 3: Symbol for graphite structure (see 3.2.4);

— Position 4: Symbol for microstructure or macrostructure (see 3.2.5);

— Position 5: Symbol for classification either by mechanical properties or by chemical composition (see 3.2.6);

— Position 6: Symbol for additional requirements (see 3.2.7).

The overall structure of the designation system by symbols is shown in Annex A.

3.2.2 Position 1

The prefix EN- shall only be used for standardized materials.

NOTE If the European material standard (e.g. EN 1561) is presented in association with the material symbol (e.g. EN-GJL-150), then the prefix EN of the symbol designation may be omitted (e.g. EN 1561-GJL-150).

3.2.3 Position 2

The symbol GJ with G for cast and J for iron shall be used.

3.2.4 Position 3

If the graphite structure is to be specified, then the appropriate letter given in Table 1 shall be used.

Table 1 — Graphite structure

L	Lamellar
S	Spheroidal
M	Temper carbon (malleable) [a]
V	Vermicular
N	Free of graphite (hard), ledeburitic
Y	Special structure, identified in the relevant material standard
[a] Including whiteheart malleable cast irons.	

3.2.5 Position 4

If it is necessary to identify cast iron materials additionally by the microstructure or the macrostructure the supplementary letters given in Table 2 shall suffix the letters given in Table 1 as appropriate.

Table 2 — Microstructure or macrostructure

A	Austenite
R	Ausferrite
F	Ferrite
P	Pearlite
M	Martensite
L	Ledeburite
Q	Quenched
T	Quenched and tempered
B	Blackheart [a]
W	Whiteheart [a]
[a] Only for malleable cast irons.	

3.2.6 Position 5

3.2.6.1 General

Position 5 shall be used to classify the material either by mechanical properties or by chemical composition. It shall be separated from the last used position by a hyphen.

3.2.6.2 Classification by mechanical properties

3.2.6.2.1 General

Cast iron materials classified by their mechanical properties shall be designated by figures relating to one of the following options:

— tensile strength, optionally with elongation followed by the letter C if the material standard permits the use of a sample cut from a casting (see Table 3) and/or impact energy followed by letters RT or LT relating to the test temperature (see Table 4);

Table 3 — Letter describing the production of the sample

C	Sample cut from a casting
(blank)	Cast sample

NOTE The former designation differentiated between separately cast samples and cast on samples. Cast sample now include separately cast samples, cast on sample and side-by-side cast sample thus reflecting the material properties in the relevant wall thickness of the casting.

Table 4 — Test temperature range used to determine the impact energy value

RT	Room temperature
LT	Low temperature

— hardness.

3.2.6.2.2 Tensile strength

The tensile strength shall be indicated by the appropriate minimum value of the grade in megapascals, e.g.:

EN-GJL-150C;

EN-GJL-150.

If required, the elongation shall be indicated by the appropriate minimum value of the grade in percent, which follows the indication of the minimum tensile strength. It shall be separated from the other symbols in position 5 by a hyphen, e.g.:

EN-GJS-350-22C;

EN-GJMW-450-7.

If impact energy is required the test temperature used to determine its value shall be indicated by the letters given in Table 4.

The letters given in Table 4, if required, shall follow the figures of mechanical properties. It shall be separated from the other symbols in position 5 by a hyphen, e.g.:

EN-GJS-400-18-RT;

EN-GJS-350-22-LT.

3.2.6.2.3 Hardness

When cast iron materials are classified by hardness this shall be indicated by one of the three following symbols:

a) HB for Brinell hardness;

b) HV for Vickers hardness;

c) HR for Rockwell hardness.

These letters shall be followed by two or three figures representing the hardness range, e.g.:

EN-GJL-HB155;

EN-GJS-HB230;

EN-GJN-HV350;

EN-GJN-HRC34.

3.2.6.3 Classification by chemical composition

3.2.6.3.1 Low alloyed grades

When there is a need to specify the chemical elements with one decimal digit, then the symbols in position 5 shall be as follows:

a) Classification without indication of carbon content

Chemical symbols of significant alloying elements in the sequence of falling contents of the elements. The average contents of these elements shall be indicated in percentage multiplied by the factor 10. The digits for these values shall be separated from each other by a hyphen, e.g.:

EN-GJS-SiMo35-7

b) Classification with indication of the carbon content

When the indication of the carbon content is required, it shall be indicated by its percentage times 100 (e.g. 300 for 3 %), preceding the chemical symbols in position 5.

All other indications of chemical composition shall follow the system according to 3.2.6.3 1, a), e.g.:

EN-GJS-320SiMo45-10

3.2.6.3.2 High alloyed grades

When the average content of at least one alloying element is ≥ 5 % and there is no need to classify one of the chemical elements with one decimal digit, then the letter X shall be the first symbol in position 5. The remaining symbols in position 5 shall be as follows:

a) Classification without indication of carbon content

The letter X shall be followed by the chemical symbols of significant alloying elements in the sequence of falling contents of the elements. The average contents of these elements shall be indicated in percentage without multiplying factor, rounded to the nearest integer. The digits for the percentages shall be separated from each other by a hyphen, e.g.:

EN-GJL-XNiMn13-7

b) Classification with indication of the carbon content

When the indication of the carbon content is required, it shall be indicated by its percentage times 100 (e.g. 300 for 3 %), following the letter X.

All other indications of chemical composition shall follow the system according to 3.2.6.3.2, a), e.g.:

EN-GJN-X300CrNiSi9-5-2

3.2.7 Position 6

When cast iron materials need to be classified according to additional requirements, then the symbols given in Table 5, as applicable, shall be placed in position 6. They shall be separated from position 5 by a hyphen, e.g.:

EN-GJMW-360-12S-W

Table 5 — Additional requirements

D	As-cast casting
H	Heat-treated casting
W	Weldability for joint welds (see EN 1559-1)
Z	Additional requirements specified in the order

4 Designation of cast iron materials by numbers

4.1 General

There shall be only one designation by numbers for each cast iron material.

The designation system by numbers for cast irons is based on the principles and the structure as set out in EN 10027-2.

4.2 Material number structure

4.2.1 Overall structure

The designation by numbers shall comprise six characters.

The positions shall be in accordance with Figure 1.

Position	1	2	3	4	5	6
Character	n	.	n	n	n	n
n: Arabic number						

Figure 1 — Number structure

The overall structure of the designation by numbers is shown in Annex B.

4.2.2 Position 1 and 2

Position 1 is the material group number, which is **5** for cast iron, followed by a **dot** in position 2.

4.2.3 Position 3

To specify graphite structure the appropriate number given in Table 6 shall be used.

Table 6 — Graphite structure

1	Lamellar
2	Vermicular
3	Spheroidal
4	Temper carbon
5	Free of graphite
6	Reserve
7	Reserve
8	Reserve
9	Others

4.2.4 Position 4

To specify matrix structure the appropriate number given in Table 7 shall be used.

Table 7 — Matrix structure

1	Ferrite
2	Ferrite/Pearlite
3	Pearlite
4	Ausferrite
5	Austenite
6	Ledeburite
7	Reserve
8	Reserve
9	Others

4.2.5 Position 5 and 6

A 2-digit character from 00 to 99 representing the individual material shall be used.

These numbers will be allocated by the CEN/TC 190 - Working Groups, to be concerned with the applicable material standards, e.g. EN 1560, EN 1561, EN 1562, EN 1563, EN 1564, EN 12513, EN 13835, prEN 16079 and prEN 16124.

Annex A
(normative)

Overall structure for designation of cast iron materials by symbols

This annex shows the overall structure of the material symbols in accordance with Clause 3.

Table A.1 — Overall structure for the designation of cast iron materials by symbols

Position 1 mandatory except 3.2.2	**Position 2 mandatory**		**Position 3 mandatory**		**Position 4 optional**		**Position 5 mandatory, choose a) or b)**				**Position 6 optional**	
Prefix	Type of metal		Graphite structure		Microstructure or macrostructure		a) mechanical properties		b) chemical composition		Additional requirements	
		Symbol		Symbol		Symbol		Symbol		symbol		symbol
EN-	Cast iron	GJ	Lamellar	L	Austenite	A	aa) tensile strength: 3 or 4 digits,	e.g. 350	ba) letter as symbol for high alloyed grades	X	as-cast casting	D
			Spheroidal	S	Ausferrite	R	ab) elongation: a hyphen and 1 or 2 digits	e.g. -19	bb) carbon content in percent × 100, but only if the carbon content is significant	e.g. 300	heat-treated casting	H
			Temper carbon (malleable) [a]	M	Ferrite	F					weldability for joint welds	W
			Vermicular	V	Pearlite	P					additional require-ments specified in the order	Z
			Free of graphite (hard), ledeburitic	N	Martensite	M						
			Special structure, identified in the relevant material standard	Y	Ledeburite	L						
					Quenched	Q						
					Quenched and tempered	T						
					Black-heart [b]	B						
					White-heart [b]	W						

Table A.1 (*continued*)

Position 1 mandatory except 3.2.2	**Position 2 mandatory**		**Position 3 mandatory**		**Position 4 optional**		**Position 5 mandatory, choose a) or b)**				**Position 6 optional**	
Prefix	Type of metal		Graphite structure		Microstructure or macrostructure		a) mechanical properties		b) chemical composition		Additional requirements	
		Symbol		Symbol		Symbol		Symbol		symbol		symbol
							ac) 1 letter, representing the production of samples cut from a casting	C	bc) chemical symbols of the alloying elements bd) percent-tages × 10, or for high alloyed grades percentages × 1, of the alloying elements, separated from each other by hyphens	e.g. Cr e.g. 45-10 e.g. 9-5-2		

Table A.1 (*continued*)

Position 1 mandatory except 3.2.2	**Position 2 mandatory**		**Position 3 mandatory**		**Position 4 optional**		**Position 5 mandatory, choose a) or b)**				**Position 6 optional**	
Prefix	Type of metal		Graphite structure		Microstructure or macrostructure		a) mechanical properties		b) chemical composition		Additional requirements	
		Symbol		Symbol		Symbol		Symbol		symbol		symbol
							ad) hardness: 2 letters and 2 or 3 digits,	e.g. HB 155				
							ae) impact energy: a hyphen and 2 letters, representing the test temperature:					
							– room temperature	-RT				
							– low temperature	-LT				

NOTE The free combination of individual items in this annex is not possible for each cast iron grade.

[a] Including whiteheart malleable cast irons.

[b] Only for malleable cast irons.

Annex B
(normative)

Overall structure for designation of cast iron materials by numbers

This annex shows the overall structure of the material numbers according to Clause 4. All of the positions are mandatory.

Table B.1 — Overall structure for the designation of cast iron materials by numbers

Position 1 and 2		**Position 3**		**Position 4**		**Positions 5 and 6**	
Material group number		Graphite structure		Matrix structure		Individual material	
	Number		Number		Number		number
Cast iron	5.	Lamellar	1	Ferrite	1	These numbers will be allocated by the CEN/TC 190 - Working Groups, to be concerned with the applicable material standards, e.g. EN 1560, EN 1561, EN 1562, EN 1563, EN 1564, EN 12513, EN 13835, prEN 16079 and prEN 16124.	00 to 99
		Vermicular	2	Ferrite/pearlite	2		
		Spheroidal	3	Pearlite	3		
		Temper carbon [a]	4	Ausferrite	4		
		Free of graphite	5	Austenite	5		
		Reserve	6	Ledeburite	6		
		Reserve	7	Reserve	7		
		Reserve	8	Reserve	8		
		Others	9	Others	9		

[a] Including whiteheart malleable cast iron.

Annex C
(informative)

Significant technical changes between this European Standard and the previous edition

Table C.1

Clause/Paragraph/Table/Figure	Change
3.2.6, Table 3	Letters S and U, describing the production of cast samples, are obsolete
4	New system, based on the principles and the structure set out in EN 10027-2, for the designation of cast iron materials by numbers introduced.
NOTE The technical changes referred to include the significant technical changes from the EN revised but are not an exhaustive list of all modifications from the previous version.	

Bibliography

[1] EN 1559-1, *Founding — Technical conditions of delivery — Part 1: General*

[2] EN 1561, *Founding — Grey cast irons*

[3] EN 10027-2, *Designation system for steels — Part 2: Numerical system*

[4] EN 1562, *Founding — Malleable cast irons*

[5] EN 1563, *Founding — Spheroidal graphite cast irons*

[6] EN 1564, *Founding — Austempered ductile cast irons*

[7] EN 12513, *Founding — Abrasion resistant cast irons*

[8] EN 13835, *Founding — Austenitic cast irons*

[9] prEN 16079, *Founding — Compacted (vermicular) graphite cast irons*

[10] prEN 16124, *Founding — Low alloyed ferritic spheroidal graphite cast iron for elevated temperature applications*

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