



SLOVENSKI STANDARD

SIST EN 1561:2011

01-december-2011

Nadomešča:

SIST EN 1561:1997/prA1:2007

SIST EN 1561:1998

Livarstvo - Siva litina (z lamelastim grafitom)

Founding - Grey cast irons

Gießereiwesen - Gusseisen mit Lamellengraphit

Fonderie - Fontes à graphite lamellaire

ITEH STANDARD PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: EN 1561:2011
SIST EN 1561:2011
<https://standards.iteh.ai/catalog/standards/itc-8487-526-a77c-4842-9d0f-5e5c3e7662cb/sist-en-1561-2011>

ICS:

77.140.80 Železni in jekleni ulitki Iron and steel castings

SIST EN 1561:2011

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 1561:2011

<https://standards.iteh.ai/catalog/standards/sist/3487e526-a77c-4842-9d0f-5e5c3e7662cb/sist-en-1561-2011>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1561

October 2011

ICS 77.080.10

Supersedes EN 1561:1997

English Version

Founding - Grey cast irons

Fonderie - Fontes à graphite lamellaire

Gießereiwesen - Gusseisen mit Lamellengraphit

This European Standard was approved by CEN on 17 September 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

(standards.iteh.ai)

SIST EN 1561:2011

<https://standards.iteh.ai/catalog/standards/sist/3487e526-a77c-4842-9d0f-5e5c3e7662cb/sist-en-1561-2011>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

	Page
Foreword.....	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Designation	6
5 Order information	6
6 Manufacture.....	7
7 Requirements	7
7.1 Characterizing properties	7
7.2 Tensile properties	7
7.3 Hardness properties	8
7.4 Graphite structure.....	9
8 Sampling	9
8.1 General.....	9
8.2 Samples for tensile test.....	10
8.3 Samples for hardness test.....	15
9 Test methods.....	15
9.1 Tensile test	15
9.2 Brinell hardness test	16
9.3 Graphite structure	16
9.4 Alternative test procedures	17
10 Retests	17
10.1 Need for retests.....	17
10.2 Test validity	17
10.3 Nonconforming test results	17
10.4 Heat treatment of samples and castings.....	17
11 Inspection documentation	18
Annex A (informative) Additional information on mechanical and physical properties	19
Annex B (informative) Comparison of grey cast iron material designations according to EN 1560 and ISO/TR 15931 [13]	21
Annex C (informative) Additional information on the relationship between hardness and tensile strength.....	22
Annex D (informative) Guidance values for tensile strength for test pieces machined from samples cut from a casting	24
Annex E (informative) Additional information on the relationship between tensile strength, hardness and wall thickness of grey iron castings	25
Annex F (informative) Wedge penetration test.....	28
Annex G (informative) Significant technical changes between this European standard and the previous edition	31
Bibliography.....	32

Foreword

This document (EN 1561:2011) 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 April 2012, and conflicting national standards shall be withdrawn at the latest by April 2012.

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 1561:1997.

Within its programme of work, Technical Committee CEN/TC 190 requested CEN/TC 190/WG 5 "Grey cast iron and compacted graphite cast iron" to revise EN 1561:1997.

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

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.

[SIST EN 1561:2011](https://standards.iteh.ai/catalog/standards/sist/3487e526-a77c-4842-9d0f-5e5c3e7662cb/sist-en-1561-2011)

<https://standards.iteh.ai/catalog/standards/sist/3487e526-a77c-4842-9d0f-5e5c3e7662cb/sist-en-1561-2011>

EN 1561:2011 (E)**Introduction**

This European Standard deals with the classification of grey cast irons, subdivided into two groups, specified by their tensile strength or hardness, respectively.

The properties of grey cast iron depend on the form and distribution of the graphite and the structure of the matrix.

In the previous edition of EN 1561, the designation by symbol was based on the minimum tensile strength to be obtained in the separately cast sample with 30 mm diameter. In Table 1 of this previous edition, the corresponding mandatory minimum tensile strength values, which should be obtained for relevant wall thicknesses up to 300 mm, in a cast-on sample were given.

For castings which have been designed before the date of issue of this standard, it is furthermore possible to determine the tensile strength of the specified grey cast iron grade by using separately cast samples with a diameter of 30 mm, irrespective of the relevant wall thickness.

In this case, the mandatory minimum values for the tensile strength, as specified in the previous edition (EN 1561:1997) of this standard, are given in Annex A, Table A.1 (bold figure in the material designation).

In this edition of EN 1561, the designation by symbol is based on the minimum tensile strength to be obtained in a cast sample, which diameter corresponds to the relevant wall thickness of the casting. This applies to a maximum relevant wall thickness of 50 mm.

Compared with the previous edition of this standard, for relevant wall thicknesses from 50 mm to 200 mm, the relationship with the 30 mm separately cast sample has been abandoned and instead of that, cast-on samples with a size corresponding to the relevant wall thickness ranges are specified. Additionally the minimum tensile properties to be obtained in these cast-on samples, are increased.

In this standard a new designation system by number, as established in EN 1560 [1], is given.

NOTE This designation system by number is based on the structure and rules of EN 10027-2 [2] and so corresponds with the European numbering system for steel and other materials.

The mechanical properties of the material can be evaluated on machined test pieces prepared from:

- separately cast samples;
- side by side cast samples;
- cast-on samples;
- samples cut from a casting.

Hardness of the material can also be evaluated on the casting.

However, for many applications tensile strength or hardness are not the only interesting or determining properties. Other mechanical or physical properties can be decisive for the use of grey cast irons, for example: thermal capacity, thermal diffusivity, damping capacity or thermo-cycle fatigue.

Therefore, Annex A (informative) provides additional information of interest to casting designers.

1 Scope

This European Standard specifies the properties of unalloyed and low-alloyed grey cast irons used for castings, which have been manufactured in sand moulds or in moulds with comparable thermal behaviour.

This European Standard specifies the characterizing properties of grey cast irons by either

- a) the tensile strength of cast samples, or
- b) the hardness measured on the castings or on a cast-on knob.

If agreed by the manufacturer and the purchaser, the combination of both tensile strength from option a) and hardness from option b) may be specified.

This European Standard specifies six grades of grey cast iron by a classification based on tensile strength measured on machined test pieces prepared from cast samples (see Table 1) and six grades of grey cast iron by a classification based on Brinell hardness (see Table 2).

This European Standard does not cover technical delivery conditions for iron castings; see EN 1559-1 [3] and EN 1559-3 [4].

This European Standard does not apply to grey cast irons used for pipes and fittings according to EN 877 [5].

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.

EN 10204, *Metallic products — Types of inspection documents*

<https://standards.iteh.ai/catalog/standards/sist/3487e526-a77c-4842-9d0f-3307c0b/sist-en-10204>

EN ISO 945-1, *Microstructure of cast irons — Part 1: Graphite classification by visual analysis (ISO 945-1:2008)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2005)*

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2009)*

3 Terms and definitions

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

3.1

grey cast iron

cast material, mainly iron and carbon based, carbon being present mainly in the form of flake (lamellar) graphite particles

NOTE 1 Grey cast iron is also known as flake graphite cast iron, and less commonly as lamellar graphite cast iron.

NOTE 2 Graphite form, distribution and size are specified in EN ISO 945-1.

3.2

cast sample

quantity of material cast to represent the cast material, including separately cast sample, side by side cast sample and cast-on sample

EN 1561:2011 (E)**3.3****separately cast sample**

sample cast in a separate sand mould under representative manufacturing conditions and material grade

3.4**side-by-side cast sample**

sample cast in the mould alongside the casting, with a joint running system

3.5**cast-on sample**

sample attached directly to the casting

3.6**relevant wall thickness**

wall thickness representative of the casting, defined for the determination of the size of the cast samples to which the mechanical properties apply

4 Designation

The material shall be designated either by symbol or by number as given in either Table 1 or Table 2.

In the case of samples cut from the casting the letter C is added at the end of the designation by symbol.

NOTE Comparison of EN 1561 grade designations to the grades from the ISO standard for grey cast irons (ISO 185:2005) [6] is given in Annex B.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

5 Order information

The order shall specify, in an unambiguous manner, whether the tensile strength measured on cast samples, or the Brinell hardness measured on the casting, is the characterizing property. If it does not do so, then the manufacturer shall characterize the material according to tensile strength.

The following information shall be supplied by the purchaser:

- a) the number of this European Standard;
- b) the designation of the material;
- c) the relevant wall thickness;

NOTE 1 For castings which have been designed before the date of issue of this standard, the information regarding the relevant wall thickness can be omitted.

- d) any special requirements.

All requirements shall be agreed between the manufacturer and the purchaser by the time of acceptance of the order e.g. technical delivery conditions according to EN 1559-1 and EN 1559-3.

NOTE 2 When specifying a combination of tensile strength and hardness, it is recommended to consult the information in Annex E.

In case of castings which have been designed before the date of issue of this standard, for the verification of the minimum tensile strength of the specified grey cast iron grade, separately cast samples with a diameter of 30 mm are used. The order shall specify the number and year of the previous edition (EN 1561:1997) of this European Standard.

6 Manufacture

Unless otherwise specified by the purchaser, the method of manufacture of grey cast irons to obtain the specified mechanical properties shall be left to the discretion of the manufacturer.

The manufacturer shall ensure that the requirements defined in this standard are met for the material grade specified in the order.

All agreements between the manufacturer and the purchaser shall be made by the time of acceptance of the order.

NOTE For grey cast irons to be used in special applications, the chemical composition and heat treatment may be the subject of an agreement between the manufacturer and the purchaser at the time of acceptance of the order.

7 Requirements

7.1 Characterizing properties

The order should specify in an unambiguous manner whether the tensile strength measured on a test piece machined from a cast sample or the Brinell hardness measured on the casting is the characterizing property. If it does not do so, then the manufacturer shall characterize the material according to tensile strength.

7.2 Tensile properties

7.2.1 General

The property values apply to grey cast irons cast in sand moulds or moulds of comparable thermal behaviour. Subject to amendments to be agreed upon in the order, they can apply to castings obtained by alternative methods.

Tensile properties are wall thickness dependant as shown in Table 1.

NOTE Tensile testing requires sound test pieces in order to guarantee pure uni-axial stress during the test.

7.2.2 Test pieces machined from cast samples

The tensile properties of the six grades of grey cast irons specified by tensile strength, when measured according to 9.1 using test pieces machined from cast samples according to Table 3, shall be in accordance with the requirements of Table 1. The maximum tensile strength of the grade is the minimum value plus 100 MPa.

7.2.3 Test pieces machined from samples cut from a casting

If applicable, the manufacturer and the purchaser shall agree on:

- the location(s) on a casting where the sample(s) shall be taken;
- the minimum value, or allowable range of values, for the tensile properties (for information, see Table D.1).

NOTE 1 The properties and the structure of castings are not uniform, depending on the complexity of the castings and variation in their section thickness.

NOTE 2 Tensile properties for test pieces cut from a casting are affected not only by material properties (subject of this standard) but also by the local casting soundness (not subject of this standard).

EN 1561:2011 (E)

Table 1 — Tensile properties of grey cast irons measured on test pieces machined from cast samples

Material designation		Relevant wall thickness t mm		Tensile strength ^a R_m mandatory values in cast sample MPa min.
Symbol	Number	>	≤	
EN-GJL-100	5.1100	5	40	100
EN-GJL-150	5.1200	2,5 ^b	50	150
		50	100	130
		100	200	110
EN-GJL-200	5.1300	2,5 ^b	50	200
		50	100	180
		100	200	160
EN-GJL-250	5.1301	5 ^b	50	250
		50	100	220
		100	200	200
EN-GJL-300	5.1302	10 ^b	50	300
		50	100	260
		100	200	240
EN-GJL-350	5.1303	10 ^b	50	350
		50	100	310
		100	200	280

NOTE 1 The designation is irrespective of the type of cast sample.

NOTE 2 For high damping capacity and thermal conductivity, EN-GJL-100 (5.1100) is the most suitable material.

NOTE 3 The figures given in bold indicate the minimum tensile strength to which the material designation of the grade is related. The values relate to an as-cast sample diameter corresponding to the applicable relevant wall thickness range according to Table 3.

NOTE 4 For relevant wall thicknesses more than 200 mm, the manufacturer and the purchaser shall agree on the type and size of cast sample and the minimum values to be obtained.

^a If tensile strength is specified as a characterizing property, the type of the sample (see 8.2) should also be stated in the order. If not stated in the order, the type of sample is left to the discretion of the manufacturer.

^b This value is included as the lower limit of the relevant wall-thickness range.

7.3 Hardness properties

The Brinell hardness of the six grades of grey cast iron specified by hardness, when measured according to 9.2, shall be as given in Table 2. This classification is applicable principally where machinability or wear resistance are of importance.

If a casting is ordered on the basis of hardness, the relevant wall thickness and the position of the test shall be agreed.

Minimum and maximum Brinell hardness values, for the relevant wall thickness specified by the purchaser, shall be mandatory for the castings covered by the order.

NOTE For a relevant wall thickness $t > 100$ mm, grades are not classified by hardness.

If it is not possible to use the Brinell test method in accordance with EN ISO 6506-1, alternative test methods may be used, which shall have correlated values with Brinell hardness.

Table 2 — Brinell hardness of castings of grey cast irons

Material designation		Relevant wall thickness t mm		Brinell hardness ^{a, b} HBW	
Symbol	Number	>	≤	min.	max.
EN-GJL-HB155	5.1101	2,5 ^c	50	–	155
EN-GJL-HB175	5.1201	2,5 ^c	50	115	175
		50	100	105	165
EN-GJL-HB195	5.1304	5 ^c	50	135	195
		50	100	125	185
EN-GJL-HB215	5.1305	5 ^c	50	155	215
		50	100	145	205
EN-GJL-HB235	5.1306	10 ^c	50	175	235
		50	100	160	220
EN-GJL-HB255	5.1307	20 ^c	50	195	255
		50	100	180	240

NOTE 1 Information on the relationship between Brinell hardness and tensile strength is indicated in Annex C, and on the relationship between Brinell hardness and wall thickness is indicated in Annex E.

NOTE 2 The figures given in bold indicate the maximum Brinell hardness, to which the material designation of the grade is related.

^a For each grade, Brinell hardness decreases with increasing wall thickness.

^b By agreement between the manufacturer and the purchaser, a narrower hardness range may be adopted at the agreed position on the casting, provided that this is not less than 40 HBW. An example of such a circumstance could be castings for long-series production.

^c This value is included as the lower limit of the relevant wall-thickness range.

7.4 Graphite structure

If the graphite structure is agreed upon, the determination shall be carried out in accordance with 9.3.

8 Sampling

8.1 General

Samples shall be made from the same material as that used to produce the casting(s) which they represent.

Several types of samples (separately cast samples, cast-on samples, side-by-side cast samples, samples cut from a casting) can be used, depending on the mass and wall thickness of the casting.

When relevant, the type of sample should be agreed between the manufacturer and the purchaser. Unless otherwise agreed, the choice of option is left to the discretion of the manufacturer.

When the mass of the casting exceeds 1 000 kg and its thickness exceeds 50 mm, cast-on samples should preferably be used; the dimensions and the location of the sample shall be agreed between the manufacturer and the purchaser by the time of acceptance of the order.

EN 1561:2011 (E)

All samples shall be adequately marked to guarantee full traceability to the castings which they represent.

The samples shall be subject to the same heat treatment, as that of the castings they represent, if any.

8.2 Samples for tensile test

8.2.1 Size of cast samples

The size of the sample shall be in correspondence with the relevant wall thickness of the casting as shown in Table 3.

If other sizes are used, this, and the minimum tensile value to be obtained, shall be agreed between the manufacturer and purchaser.

Table 3 — Types and size of cast sample and size of tensile test pieces in relation to relevant wall thickness of the casting

Relevant wall thickness t mm		Type of cast sample				Preferred diameter of tensile test piece ^a d mm
>	≤	Separately (see Figure 1)	Side by side (see Figure 1)	Cast-on Type 1 (see Figure 2)	Cast-on Type 2 (see Figure 3)	
–	10	I	I	b	b	10
10	20	II	II			20
20	35	III	III			32
35	50	IV	IV			32
50	100	c	c	30 mm	30 mm	20
100	200			50 mm	50 mm	32

^a Other diameters, in accordance with Table 4, may be agreed between the manufacturer and the purchaser. Unless otherwise agreed, the preferred diameter for the test piece shall be used.

^b Not to be used.

^c Diameter of cast sample, diameter of tensile test piece and minimum tensile strength to be obtained shall be agreed between manufacturer and purchaser.

Unless otherwise agreed, the choice of the type is left to the discretion of the manufacturer.

8.2.2 Frequency and number of tests

Samples representative of the material shall be produced at a frequency in accordance with the process quality assurance procedures adopted by the manufacturer or as agreed with the purchaser.

In the absence of a process quality assurance procedure or any other agreement between the manufacturer and the purchaser, a minimum of one cast sample for the tensile test shall be produced to confirm the material grade, at a frequency to be agreed between the manufacturer and the purchaser.

8.2.3 Separately cast samples

The samples shall be cast separately in sand moulds and under representative manufacturing conditions.

The moulds used to cast the separately cast samples shall have comparable thermal behaviour to the moulding material used to cast the castings. The moulds may be made for casting several samples simultaneously.