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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

English Version

Founding - Ausferritic spheroidal graphite cast irons

Fonderie - Fontes ausferritiques à graphite sphéroïdal

Gießereiwesen - Ausferritisches Gusseisen mit Kugelgraphit

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 190.

If this draft becomes a European Standard, 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.

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COMITÉ EUROPÉEN DE NORMALISATION
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Contents

	Page
European foreword	5
Introduction	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions.....	7
4 Designation	8
5 Order information	9
6 Manufacture.....	9
7 Requirements.....	9
7.1 General.....	9
7.2 Test pieces machined from cast samples	9
7.2.1 General.....	9
7.2.2 Impact energy.....	10
7.3 Test pieces machined from samples cut from a casting.....	11
7.4 Hardness	11
7.5 Graphite structure	11
7.6 Matrix structure	12
8 Sampling.....	12
8.1 General.....	12
8.2 Cast samples	12
8.2.1 Size of cast samples	12
8.2.2 Frequency and number of tests	13
8.2.3 Separately cast samples.....	13
8.2.4 Side-by-side cast samples	13
8.2.5 Cast-on samples.....	13
8.2.6 Test pieces machined from cast samples	14
8.3 Samples cut from a casting	14
9 Test methods	17
9.1 Tensile test	17
9.2 Impact test.....	19
9.3 Hardness test.....	19
9.4 Graphite and matrix structure examination.....	19
10 Retests.....	20
10.1 Need for retest	20
10.2 Test validity	20
10.3 Non-conforming test results	20
10.4 Heat treatment of samples and castings.....	20
11 Inspection documentation.....	20
12 Additional information	20

Annex A (normative) Abrasion resistant grades of ausferritic spheroidal graphite cast irons	21
A.1 General	21
A.2 Requirements	21
A.3 Sampling	21
A.4 Hardness test	21
A.5 Retests	22
Annex B (informative) Comparison of ausferritic spheroidal graphite cast iron material designations according to EN 1560 and ISO/TR 15931 [2] [7]	23
Annex C (informative) Values for tensile strength and elongation for test pieces machined from samples cut from a casting	24
Annex D (informative) Values for Brinell hardness	25
Annex E (informative) Determination of the hardness range	26
E.1 General	26
E.2 Procedure	26
Annex F (informative) Nodularity	28
Annex G (normative) Sectioning procedure for cast samples	29
Annex H (informative) Un-notched impact test	30
H.1 General	30
H.2 Requirements	30
H.3 Sampling	30
H.4 Test method	30
H.5 Retests	31
Annex I (informative) Additional information on mechanical and physical properties	32
Annex J (informative) Fracture mechanical approach to spheroidal graphite cast irons	35
J.1 General	35
J.2 Fracture mechanics concept	35
J.3 Determination of fracture mechanical properties	35
J.4 Influences on fracture mechanical properties	36
J.5 Publications	36
J.6 Literature	37
Annex K (informative) Machinability of ausferritic spheroidal graphite cast irons	40
K.1 Introduction	40
K.2 Chip form	40
K.3 Surface quality	40
K.4 Cutting forces	40
K.5 Tool wear and tool life	41

K.6 Other considerations.....41

Annex L (informative) Significant technical changes between this document and the previous edition..... 42

Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2014/68/EU aimed to be covered 43

Bibliography 44

European foreword

This document (prEN 1564:2025) has been prepared by Technical Committee CEN/TC 190 “Foundry technology”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1564:2011.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

Annex L provides details of significant technical changes between this document and the previous edition.

Introduction

Ausferritic spheroidal graphite cast iron is a cast alloy, iron, carbon and silicon based, the carbon being present mainly in the form of spheroidal graphite particles.

NOTE 1 Ausferritic spheroidal graphite cast iron is also known as austempered ductile iron (ADI).

Compared with the spheroidal graphite cast irons as specified in EN 1563 [1], this material combines higher strength and toughness properties as a result of the ausferritic matrix structure.

This document classifies ausferritic spheroidal graphite cast irons in accordance with the mechanical properties of the material.

The mechanical properties of these ausferritic spheroidal graphite cast irons depend on the graphite and the matrix structure.

The required structure is obtained by selecting the appropriate composition and subsequent processing.

The mechanical properties of the material can be evaluated on machined test pieces prepared from cast samples or samples cut from a casting.

Five grades of ausferritic spheroidal graphite cast iron are defined by the mechanical properties measured on machined test pieces prepared from cast samples. When, for these grades, hardness is a requirement of the purchaser as being important for the application, Annex C provides guidance values for hardness.

Two grades of ausferritic spheroidal graphite cast iron are defined in Annex A in accordance with their hardness. These cast irons are used in applications (e.g. mining, earth moving) where high abrasion resistance is required.

NOTE 2 This designation system by number is based on the principles and the structure as set out in EN 10027-2:2015 [4] and so corresponds with the European numbering system for steel and other materials.

Some ausferritic spheroidal graphite cast iron grades can be used for pressure equipment up to and including EN-GJS-1050-6.

The permitted material grades of ausferritic spheroidal graphite cast iron for pressure applications and the conditions for their use are given in specific product or application standards.

For the design of pressure equipment, specific design rules apply.

1 Scope

This document defines the grades and the corresponding requirements for ausferritic spheroidal graphite cast irons.

This document specifies five grades of ausferritic spheroidal graphite cast iron by a classification based on mechanical properties measured on machined test pieces prepared from cast samples. One grade also has additional but optional requirements for room temperature and notched-impact.

This document also specifies two grades by a classification as a function of hardness.

This document does not cover technical delivery conditions for iron castings.

NOTE For further details, see EN 1559-1:2011 and EN 1559-3:2011.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 764-5:2014, *Pressure equipment — Part 5: Inspection documentation of metallic materials and compliance with the material specification*

EN 1559-1:2011, *Founding — Technical conditions of delivery — Part 1: General*

EN 1559-3:2011, *Founding — Technical conditions of delivery — Part 3: Additional requirements for iron castings*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN ISO 148-1:2016, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2016)*

EN ISO 945-1:2019, *Microstructure of cast irons — Part 1: Graphite classification by visual analysis (ISO 945-1:2019)*

EN ISO 6506-1:2014, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2014)*

EN ISO 6892-1:2019, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2019)*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

ausferritic spheroidal graphite cast iron

cast material, iron, carbon and silicon based with the carbon being present mainly in the form of spheroidal graphite particles, with an ausferritic matrix structure

3.2

graphite spheroidizing treatment

operation that brings the liquid iron into contact with a substance to produce graphite in the predominantly spheroidal (nodular) form during solidification

Note 1 to entry: This operation is often followed by a second one called inoculation.

3.3

austemper heat treatment of spheroidal graphite cast iron

process, consisting of heating the castings above the A_{C1} temperature and holding a sufficient time to increase the carbon content of the austenite, followed by cooling at a rate sufficient to avoid the formation of pearlite and transforming the matrix structure for a time and a temperature (above the martensite start temperature) sufficient to produce the desired properties

Note 1 to entry: This process produces a microstructure that consists predominantly of ferrite and austenite. This microstructure is called ausferrite.

3.4

cast sample

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

3.5

separately cast sample

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

3.6

side-by-side cast sample

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

3.7

cast-on sample

sample attached directly to the casting

3.8

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 Tables 1, 2 or Table A.1.

In the case of samples cut from the casting the letter C is added at the end of the designation by symbol, as given in EN 1560:2011 [2].

NOTE The comparison of this document grade designations with the grades from the ISO standard for ausferritic spheroidal graphite cast irons, ISO 17804:2020 [6], is given in Annex B.

5 Order information

The following information shall be specified in the order:

- a) the reference of this document;
- b) the designation of the material;
- c) the relevant wall thickness of the casting;
- d) any special requirements, such as dimensions of test pieces, casting defects, types of test samples.

All requirements shall be agreed at the time of acceptance of the order, such as technical delivery conditions according to EN 1559-1:2011 and EN 1559-3:2011.

6 Manufacture

Unless otherwise agreed at the time of order, the method of manufacture of ausferritic spheroidal graphite cast irons and heat treatment shall ensure that the requirements of this document are met.

7 Requirements

7.1 General

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

The material designation shall be based on the minimum mechanical properties obtained in cast samples with a thickness or diameter of 25 mm. The designation shall be irrespective of the type of cast sample.

Mechanical properties shall be 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 Test pieces machined from cast samples

7.2.1 General

The mechanical properties of ausferritic spheroidal graphite cast iron test pieces shall be as specified in Table 1. For the additional but optional unnotched impact requirement, refer to Table 2.

Table 1 — Mechanical properties measured on test pieces machined from cast samples

Material designation		Relevant wall thickness ^a <i>t</i> mm	0,2 % proof strength <i>R</i> _{p0,2} MPa min.	Tensile strength <i>R</i> _m MPa min.	Elongation <i>A</i> % min.
Symbol	Number				
EN-GJS-800-10 EN-GJS-800-10-RT ^b	5.3400	<i>t</i> ≤ 30	500	800	10
	5.3401	30 < <i>t</i> ≤ 60		750	6
		60 < <i>t</i> ≤ 100		720	5
EN-GJS-900-8	5.3402	<i>t</i> ≤ 30	600	900	8
		30 < <i>t</i> ≤ 60		850	5
		60 < <i>t</i> ≤ 100		820	4
EN-GJS-1050-6	5.3403	<i>t</i> ≤ 30	700	1 050	6
		30 < <i>t</i> ≤ 60		1 000	4
		60 < <i>t</i> ≤ 100		970	3
EN-GJS-1200-3	5.3404	<i>t</i> ≤ 30	850	1 200	3
		30 < <i>t</i> ≤ 60		1 170	2
		60 < <i>t</i> ≤ 100		1 140	1
EN-GJS-1400-1	5.3405	<i>t</i> ≤ 30	1 100	1 400	1
		30 < <i>t</i> ≤ 60		To be specified in the order.	
		60 < <i>t</i> ≤ 100			
NOTE 1 The relevant wall thickness does not affect the minimum 0,2 % proof strength provided the heat treatment parameters and alloying are adjusted as a function of the relevant wall thickness.					
NOTE 2 Guidance values for Brinell hardness for these grades are given in Annex D.					
^a For relevant wall thicknesses more than 100 mm, the type and size of the cast sample and the minimum values to be obtained shall be specified.					
^b RT corresponds to Room temperature					

7.2.2 Impact energy

The impact energy values given in Table 2 at room temperature shall be applicable to EN-GJS-800-10-RT only.

Table 2 — Minimum impact energy values measured on V-notched test pieces machined from cast samples

Material designation		Relevant wall thickness ^a	Impact energy value at room temperature 23 °C ± 5 °C	
Symbol	Number		Mean value of 3 tests J min.	Individual value J min.
EN-GJS-800-10-RT	5.3401	$t \leq 30$	10	9
		$30 < t \leq 60$	9	8
		$60 < t \leq 100$	8	7
^a For relevant wall thicknesses more than 100 mm, the type and size of the cast sample and the minimum values to be obtained shall be specified.				

NOTE The use of impact energy is currently being reassessed regarding its limited relevance as an assessment of the resistance to brittle fracture in castings subject to application loads. Annex J gives information about the fracture mechanical approach to spheroidal graphite cast irons.

7.3 Test pieces machined from samples cut from a casting

Information regarding test pieces machined from samples cut from a casting shall comprise:

- the location(s) on a casting where the sample(s) shall be taken;
- the mechanical properties that shall be measured;
- the minimum values, or allowable range of values, for these mechanical properties (for information, see Annex C).

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

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

7.4 Hardness

Brinell hardness and its range values for the grades listed in Table 1 shall only be specified by the time of acceptance of the order.

For the five grades listed in Table 1, information regarding hardness is given in accordance with Annex D and Annex E.

For the two grades defined by hardness properties, Annex A shall apply.

7.5 Graphite structure

The graphite structure shall be mainly of form V and VI in accordance with EN ISO 945-1:2019.

NOTE Annex F gives more information regarding nodularity.

7.6 Matrix structure

The matrix structure of the various grades of ausferritic spheroidal graphite cast iron consists predominantly of ferrite and austenite, otherwise known as ausferrite. Other matrix constituents (e.g. martensite, carbides) may be present at a level that will not affect the required mechanical properties.

Intercritical austenitization may be used to produce EN 1564/JS/800-10 or 800-10/RT. This will result in the formation of a mixed microstructure that includes the presence of proeutectoid ferrite. Intercritical austenitization requires a higher hardenability than the grades specified in Table 1.

The cooling rate within some sections might not be sufficient to avoid the formation of pearlite or other transformation products. In such cases, the maximum acceptable quantities of these microconstituents, the locations within the casting, and the mechanical properties in these locations may be specified in the order.

8 Sampling

8.1 General

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

NOTE 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.

The type of sample shall be specified in the order.

When the mass of the casting exceeds 2 000 kg and its relevant wall thickness exceeds 60 mm, cast-on samples or side-by-side samples shall preferably be used; the dimensions and the location of the sample shall be specified by the time of acceptance of the order.

If the spheroidizing treatment is carried out in the mould (in-mould process), the separately cast sample shall be avoided.

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.

Tensile and impact test pieces shall be finally machined from the samples after the heat treatment.

8.2 Cast samples

8.2.1 Size of cast samples

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

NOTE Other sizes can be used or to be specified in the order.