BS EN 1562:2012

BSI Standards Publication

Founding — Malleable cast irons

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National foreword

This British Standard is the UK implementation of EN 1562:2012. It supersedes BS EN 1562:1997 which is withdrawn.

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.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Gießereiwesen - Temperguss

This European Standard was approved by CEN on 14 January 2012.

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Foreword

This document (EN 1562:2012) 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of an identical text or by endorsement, at the latest by September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.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 1562:1997.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

Within its programme of work, Technical Committee CEN/TC 190 requested CEN/TC 190/WG 6 “Malleable cast iron” to revise EN 1562:1997.

Annex C 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, Turkey and the United Kingdom.

Introduction

This European Standard classifies malleable cast irons into two groups. The first group is concerned with decarburized irons referred to as whiteheart malleable cast iron. The second group is non-decarburized irons referred to as blackheart malleable cast iron. Both groups, except completely decarburized whiteheart malleable cast iron, contain free carbon as graphite, called temper carbon. Both groups have grades with structures that can range from ferrite to pearlite and/or other transformation products of austenite.

Materials are designated in terms of tensile strength and percentage elongation.

Weldablility is an important property of malleable cast irons.

Malleable cast irons have good impact resistance and ductility at low temperatures.

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 principles and the structure as set out in EN 10027-2 [2] and so corresponds with the European numbering system for steel and other materials.

Some malleable cast iron grades can be used for pressure equipment.

The permitted material grades of malleable 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.

Annex ZA gives information relating to the conformance of permitted malleable cast iron grades to the Pressure Equipment Directive 97/23/EC.

1 Scope

This European Standard defines grades and the corresponding requirements for malleable cast irons.

This European standard specifies five grades of whiteheart malleable cast iron and nine grades of blackheart malleable cast iron, based on mechanical properties measured on cast samples (which are test pieces).

This European Standard specifies Brinell hardness values determined only when these values are requested by the purchaser.

This European Standard does not cover technical delivery conditions for malleable cast iron castings. Reference should be made to EN 1559-1 [3] and EN 1559-3 [4].

This European Standard does not cover chemical composition, except phosphorous (see Clause 6).

Grade EN-GJMB-300-6 (5.4100) malleable cast iron shall not be used for any pressure application, e. g. also pressure applications not covered by the Pressure Equipment Directive 97/23/EC.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 764-5:2002, *Pressure equipment — Part 5: Compliance and inspection — Documentation of materials*

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

EN ISO 148-1:2010, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2009)*

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

EN ISO 6892-1:2009, *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
malleable cast iron
cast material, mainly iron and carbon based, which solidifies in the as-cast condition with a graphite-free (white) structure and achieves its final properties after a heat treatment

3.2
whiteheart malleable cast iron
cast material, mainly iron and carbon based, which is cast white and then given a heat treatment in a decarburizing atmosphere to produce a material which is partially or entirely decarburized. Any remaining graphite is in the form of temper carbon

3.3
blackheart malleable cast iron
cast material, mainly iron and carbon based, which is cast white and then given a non-decarburizing heat treatment, to produce a material in which all graphite is in the form of temper carbon

3.4
primary graphite
graphite which precipitates in the flake form during solidification

Note 1 to entry: Primary graphite is more correctly referred to as eutectic graphite.

3.5
cast sample
quantity of material cast to represent the cast material, including separately cast sample and side-by-side cast sample

3.6
separately cast sample
sample cast in a separate sand mould under representative manufacturing conditions and material grade

3.7
side-by-side cast sample
sample cast in the mould alongside the casting, with a joint running system

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 Table 1 or Table 2.

NOTE Comparison of EN 1562 grade designations to the grades from ISO 5922:2005 [5], is given in Annex A.

5 Order information

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 of the casting;

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.

6 Manufacture

The method of manufacture of malleable cast iron as well as its chemical composition and heat treatment shall be left to the discretion of the manufacturer, who shall ensure compliance with the property requirements given in this European Standard for the material ordered.

NOTE To produce structures such as ferrite, pearlite or other transformation products of austenite, both material types (groups) depend upon either the malleablising heat treatment or the subsequent additional heat treatment and/or additions of alloying elements.

For castings intended to be given additional treatment (such as galvanizing) and/or in the case of castings for use at low temperatures to optimize the impact energy of the material, the phosphorous content should not exceed 0,10 %.

For malleable cast iron materials to be used in special applications, the chemical composition and any special heat treatment may be the subject of an agreement between the manufacturer and the purchaser by the time of acceptance of the order.

7 Requirements

7.1 General

The property values apply to malleable 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, when agreed between the manufacturer and purchaser by the time of acceptance of the order.

The material designation is based on the minimum mechanical properties obtained in cast samples with a diameter of 12 mm.

Mechanical properties are wall thickness dependent as shown in Tables 1, 2 and 3.

7.2 Tensile strength and elongation

When tested in accordance with 9.1, the values of tensile strength and percentage elongation after fracture (hereafter referred to as elongation) shall be in accordance with the requirements specified in Tables 1, 2 and 3.

7.3 0,2 % Proof strength

When requested by the purchaser and agreed at the time of acceptance of the order, 0,2 % proof strength shall be determined in accordance with 9.2 and the values shall be in accordance with the requirements specified in Tables 1, 2 and 3.

7.4 Brinell hardness

Brinell hardness and its range values shall only be specified when agreed between the manufacturer and the purchaser by the time of acceptance of the order. Guidance values for Brinell hardness are listed in Tables 1, 2 and 3.

The method of testing and sampling shall be agreed in accordance with the method specified in 9.3.

7.5 Impact energy

The minimum impact energy values measured on V-notched test pieces machined from cast samples given in Table 3 at room temperature, if applicable, shall only be determined if specified by the purchaser by the time of acceptance of the order.

Impact energy testing is normally requested for EN-GJMB-350-10 only.

The method of testing shall be in accordance with 9.4.

NOTE If the purchaser requires impact testing to be performed on whiteheart malleable cast iron or other grades of blackheart malleable cast irons, then the Charpy un-notched test should be used (see informative Annex B).

Table 1 — Mechanical properties of whiteheart malleable cast irons

Material designation		Relevant wall thickness	Nominal diameter of test piece	Tensile strength	Elongation	0,2 % proof strength	Brinell hardness (for information only)
		t	d	R_m	$A_{3,4}$	$R_{p0,2}$	
		mm	mm	MPa	%	MPa	HBW
Symbol	Number			min.	min.	min.	max.
EN-GJMW-**350-4**	5.4200	$t \leq 3$	6	270	10	— [a]	230
		$3 < t \leq 5$	9	310	5	—	
		$5 < t \leq 7$	**12**	**350**	**4**	—	
		$t > 7$	15	360	3	—	
EN-GJMW-**360-12** [b]	5.4201	$t \leq 3$	6	280	16	— [a]	200
		$3 < t \leq 5$	9	320	15	170	
		$5 < t \leq 7$	**12**	**360**	**12**	**190**	
		$t > 7$	15	370	7	200	
EN-GJMW-**400-5**	5.4202	$t \leq 3$	6	300	12	— [a]	220
		$3 < t \leq 5$	9	360	8	200	
		$5 < t \leq 7$	**12**	**400**	**5**	**220**	
		$t > 7$	15	420	4	230	
EN-GJMW-**450-7**	5.4203	$t \leq 3$	6	330	12	— [a]	220
		$3 < t \leq 5$	9	400	10	230	
		$5 < t \leq 7$	**12**	**450**	**7**	**260**	
		$t > 7$	15	480	4	280	
EN-GJMW-**550-4**	5.4204	$t \leq 3$	6	—	—	— [a]	250
		$3 < t \leq 5$	9	490	5	310	
		$5 < t \leq 7$	**12**	**550**	**4**	**340**	
		$t > 7$	15	570	3	350	

NOTE The figures given in bold indicate the minimum tensile strength, proof strength and minimum elongation $A_{3,4}$ to which the material designation of the grade is related and the preferred nominal diameter of the test piece.

[a] Because of the difficulty in determining the proof strength of small test pieces the values and the method of measurement shall be agreed between the manufacturer and the purchaser by the time of acceptance of the order.

[b] Material most suitable for welding.

Table 2 — Mechanical properties of blackheart malleable cast irons grades without specified minimum impact energy

Material designation		Nominal diameter of test piece [a]	Tensile strength	Elongation	0,2 % proof strength	Brinell hardness (for information only)
		d	R_m	$A_{3,4}$	$R_{p0,2}$	
		mm	MPa	%	MPa	HBW
Symbol	Number		min.	min.	min.	
EN-GJMB-300-6[b]	5.4100	12 or 15	300	6	—	max. 150
EN-GJMB-500-5	5.4206	12 or 15	500	5	300	165 to 215
EN-GJMB-550-4	5.4207	12 or 15	550	4	340	180 to 230
EN-GJMB-600-3	5.4208	12 or 15	600	3	390	195 to 245
EN-GJMB-700-2 [c, d]	5.4301	12 or 15	700	2	530	240 to 290
EN-GJMB-800-1 [c]	5.4302	12 or 15	800	1	600	270 to 320

[a] Where a 6 mm or 9 mm diameter test piece is representative of the relevant wall thickness of a casting, this size of the test piece may be used by agreement between the manufacturer and the purchaser by the time of acceptance of the order. The minimum properties given in this table shall apply.

[b] Grade EN-GJMB-300-6 (5.4100) malleable cast iron shall not be used for any pressure application, e. g. also pressure applications not covered by the Pressure Equipment Directive 97/23/EC.

[c] Oil quenched and subsequently tempered.

[d] If this grade is air quenched, the 0,2 % proof strength shall be at least 430 MPa.

Table 3 — Mechanical properties of blackheart malleable cast irons grades with specified minimum impact energy

Material designation		Nominal diameter of test piece [a]	Tensile strength	Elongation	0,2 % proof strength	Impact energy at (23 ± 5) °C	Brinell hardness (for information only)
		d	R_m	$A_{3,4}$	$R_{p0,2}$		
		mm	MPa	%	MPa	J	HBW
Symbol	Number		min.	min.	min.	min.	
EN-GJMB-350-10	5.4101	12 or 15	350	10	200	14	max. 150
EN-GJMB-450-6	5.4205	12 or 15	450	6	270	10	150 to 200
EN-GJMB-650-2	5.4300	12 or 15	650	2	430	5	210 to 260

[a] Where a 6 mm or 9 mm diameter test piece is representative of the relevant wall thickness of a casting, this size of the test piece may be used by agreement between the manufacturer and the purchaser by the time of acceptance of the order. The minimum properties given in this table shall apply.

8 Samples

8.1 General

Samples shall be made from the same material and the same malleablising treatment as that used to produce the casting(s) during the time period as the castings that they represent.

All test pieces shall be prepared from separately cast or side-by-side samples and shall be tested un-machined.

NOTE It may be necessary to machine the holding shanks of the test piece and/or fettle the joint lines in some circumstances.

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

Test pieces shall be provided to represent the castings produced and shall be heat-treated by the same process as the castings that they represent in accordance with the quality assurance procedures of the manufacturer.

8.2 Cast samples

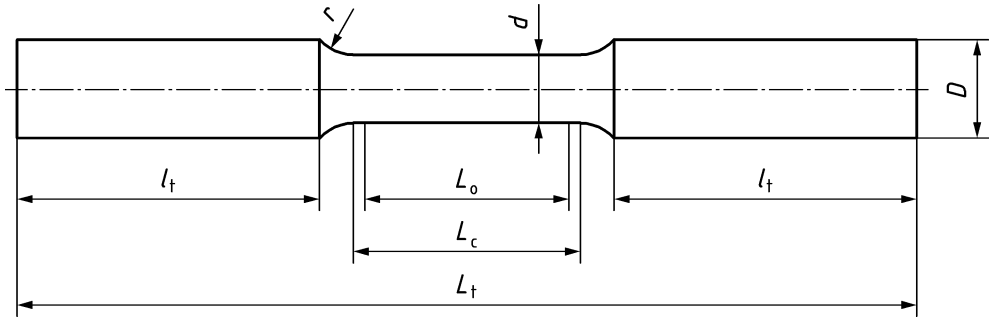
8.2.1 Size of test pieces

For the purpose of determining the diameter of the test piece to be used, the purchaser shall by the time of acceptance of the order indicate to the manufacturer the important sections of the casting(s). In the absence of any direction by the purchaser, the manufacturer may choose the diameter of the test piece to be used.

In the case of whiteheart malleable cast iron, the diameter d of the test piece, in millimetres, shall be representative of the relevant wall thickness of the casting as shown in Table 1.

The test pieces shall be in accordance with the shape and dimensions given in Figure 1 and Table 4 and shall be un-machined. Only the holding shanks of the sample may need to be machined and/or the joint line fettled. The diameter d is obtained from the average of two measurements taken in the same plane at right angles to each other. The two values shall not differ by more than 0,7 mm.

The diameter d of the test piece shall not vary along the parallel length by more than 0,35 mm.



Key

L_o is the original gauge length, i.e. $L_o = 3 \times d$;

d is the diameter of the test piece along the gauge length;

L_c is the parallel length; $L_c > L_o$;

L_t is the total length of the test piece, which depends on L_c;

r is the transition radius.

The method of gripping the ends of the test piece, together with their length l_t, may be agreed between the manufacturer and the purchaser.

Figure 1 — Tensile test piece

Table 4 — Dimensions of tensile test pieces (see Figure 1)

Diameter	**Limit deviations on diameter**	**Original cross-sectional area**	**Original gauge length**	**Parallel length**	**Transition radius**	**Preferred shank dimensions** (for information only)	
						diameter	length
d		S_o	$L_o = 3{,}4\sqrt{S_o}$	L_c	r	D	l_t
mm	mm	mm^2	mm	mm	mm min.	mm	mm
6	± 0,5	28,3	18	25	4	10	30
9	± 0,5	63,6	27	30	6	13	40
12	± 0,7	113,1	36	40	8	16	50
15	± 0,7	176,7	45	50	8	19	60
NOTE Elongation $A_{3,4}$ is measured on L_o.							

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.

The number of test pieces shall be determined by the manufacturer in accordance with the tonnage and types of castings to be produced and the requirement of the purchaser, see Clause 5 d).

Additional test pieces shall be available in the event of retests being required (see Clause 10).

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 samples shall meet the requirements of Figure 1. The samples shall be removed from the mould at a temperature similar to that of the casting.

8.2.4 Side-by-side cast samples

Side-by-side cast samples are representative of the castings concurrently cast and also of all other castings of similar relevant wall thickness from the same test unit.

The samples shall meet the requirements of Figure 1.

9 Test methods

9.1 Tensile test

The tensile test shall be carried out in accordance with EN ISO 6892-1:2009, but using an un-machined test piece produced in accordance with 8.2.3, 8.2.4 and Table 4.

9.2 0,2 % proof strength

The 0,2 % proof strength shall be determined only if requested by the purchaser and agreed by the time of acceptance of the order.

For the determination of proof strength, the rate of increase of stress in the elastic range shall not exceed 20 N/mm^2 per second. When the strain rate can be controlled, a rate of 1 %/min. shall be set and maintained throughout the test so that 1 % strain is reached between 30 s and 60 s.

9.3 Brinell hardness

The Brinell hardness shall be determined only if requested by the purchaser and agreed by the time of acceptance of the order.

The Brinell hardness test shall be carried out using a test piece or a casting provided that the material has not been affected by any prior testing.

If the test is to be carried out on a test piece, then this shall be performed on one of the shanks, either on a prepared surface or on a cross section.

If the test is to be carried out on a casting, then this shall be performed on one or several points as defined and agreed between the manufacturer and the purchaser by the time of acceptance of the order.

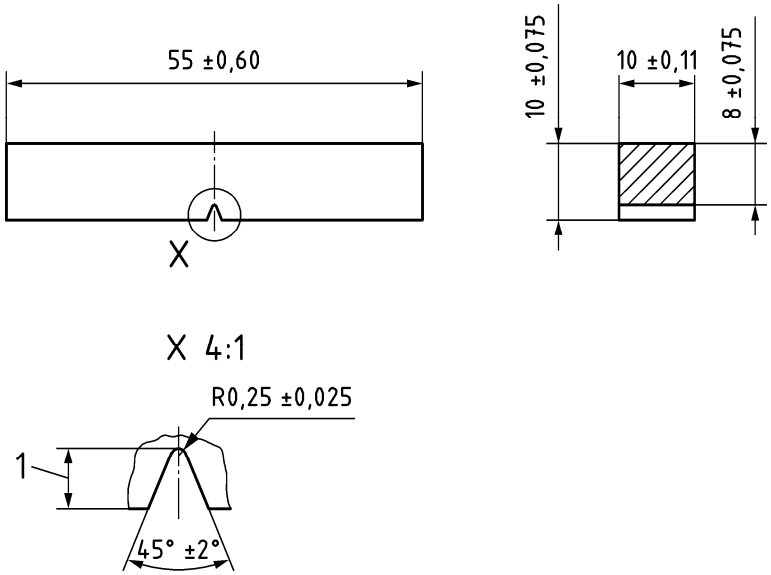
The test method given in EN ISO 6506-1 shall be used for the determination of Brinell hardness preferably with the largest compatible ball diameter specified.

The test shall be carried out on an appropriately prepared surface so as to ensure a reliable result representative of the material.

9.4 Impact test

The impact test shall be carried out on three Charpy V-notched impact test pieces (see Figure 2), obtained from separately cast samples or side-by-side cast samples, in accordance with EN ISO 148-1:2010 at (23 ± 5) °C using test equipment with an appropriate energy to determine the properties correctly.

Dimensions in millimetres



Key

1 notch depth.

Figure 2 — Charpy V-notched test piece

10 Retests

10.1 Need for retests

Retests shall be carried out if a test is not valid.

Retests are permitted to be carried out if a test result does not meet the mechanical property requirements for the specified grade.

10.2 Test validity

A test is not valid if there is:

a) a faulty mounting of the test piece or defective operation of the test machine;

b) a defective test piece because of incorrect pouring;

c) a fracture of the test piece beyond the gauge marks;

d) a casting defect in the test piece, revealed after fracture.

In the above cases, a new test piece shall be taken from the same sample or from a duplicate sample cast at the same time. The result of the retest shall be substituted for the result of the invalid test.

The result of the retest shall be used.

If the test piece shows primary graphite (eutectic flake graphite), no retests shall be permitted and the castings of which the test piece is representative shall be deemed to be non-conforming. The presence of primary graphite shall be confirmed by metallographic examination.

If one of the additional test pieces fails, the castings of which they are representative shall be deemed to be non-conforming.

NOTE In the absence of further separately cast test pieces for blackheart malleable cast irons, the manufacturer has the option of submitting test pieces cut from a casting (castings). In this case the manufacturer and the purchaser should agree on the location(s) on a casting where the sample(s) shall be taken and the minimum values to be obtained.

In the absence of further separately cast test pieces for whiteheart malleable cast irons details of testing and evaluation of the results should be agreed between the manufacturer and the purchaser.

10.3 Non-conforming test results

If any test gives results which do not conform to the specified requirements, for reasons other than those given in 10.2, the manufacturer shall have the option to conduct retests. If the manufacturer conducts retests, two retests shall be carried out for each failed test.

If both retests give results that meet the specified requirements, the material shall be deemed to conform to this European Standard.

If one or both retests give results that fail to meet the specified requirements, the material shall be deemed not to conform to this European standard.

10.4 Heat treatment of samples and castings

In the case of castings for which the test results are not valid or not satisfactory, the manufacturer shall be permitted to re-heat treat the castings and the representative samples. In this event, the samples shall receive the same number of heat treatments as the castings.

If the results of the tests carried out on the re-heat treated samples are satisfactory, then the re-heat treated castings shall be regarded as conforming to the specified requirements of this European Standard.

The number of re-heat treatment cycles shall not exceed two.

11 Inspection documentation

When requested by the purchaser and agreed with the manufacturer, the manufacturer shall issue for the products the appropriate inspection documentation according to EN 10204:2004.

When ordering material for pressure equipment applications, the equipment manufacturer shall request appropriate inspection documentation according to the applicable product or application standard(s), EN 764-5:2002 and EN 10204:2004.

The material manufacturer is responsible for affirming conformity with the specification for the material ordered.

Annex A
(informative)

Comparison of malleable cast iron material designations according EN 1560 and ISO/TR 15931 [1], [6]

This informative annex compares the material designation of the standardised grades of malleable cast iron based on the ISO and EN designation systems.

Table A.1 — Material designations of whiteheart malleable cast irons

EN 1562:2012		EN 1562:1997	ISO 5922
Symbol	Number	Number	Material designation
EN-GJMW-350-4	5.4200	EN-JM1010	ISO 5922/JMW/350-4
EN-GJMW-360-12	5.4201	EN-JM1020	ISO 5922/JMW/360-12
EN-GJMW-400-5	5.4202	EN-JM1030	ISO 5922/JMW/400-5
EN-GJMW-450-7	5.4203	EN-JM1040	ISO 5922/JMW/450-7
EN-GJMW-550-4	5.4204	EN-JM1050	ISO 5922/JMW/550-4

Table A.2 — Material designations of blackheart malleable cast irons

EN 1562:2012		EN 1562:1997	ISO 5922
Symbol	Number	Number	Material designation
EN-GJMB-300-6	5.4100	EN-JM1110	ISO 5922/JMB/300-6
EN-GJMB-350-10	5.4101	EN-JM1130	ISO 5922/JMB/350-10
EN-GJMB-450-6	5.4205	EN-JM1140	ISO 5922/JMB/450-6
EN-GJMB-500-5	5.4206	EN-JM1150	ISO 5922/JMB/500-5
EN-GJMB-550-4	5.4207	EN-JM1160	ISO 5922/JMB/550-4
EN-GJMB-600-3	5.4208	EN-JM1170	ISO 5922/JMB/600-3
EN-GJMB-650-2	5.4300	EN-JM1180	ISO 5922/JMB/650-2
EN-GJMB-700-2	5.4301	EN-JM1190	ISO 5922/JMB/700-2
EN-GJMB-800-1	5.4302	EN-JM1200	ISO 5922/JMB/800-1

Annex B
(informative)

Un-notched impact test

B.1 General

The minimum impact energy values for the different material grades should be as specified in Table B.1 and Table B.2.

Table B.1 — Un-notched impact energy values for whiteheart malleable cast iron

Material grade	Impact energy (Joules) at (23 ± 5) °C	
	min.	max.
EN-GJMW-350-4	30	80
EN-GJMW-360-12	130	180
EN-GJMW-400-5	40	90
EN-GJMW-450-7	80	130
EN-GJMW-550-4	30	80

Table B.2 — Un-notched impact energy values for blackheart malleable cast iron

Material grade	Impact energy (Joules) at (23 ± 5) °C	
	min.	max.
EN-GJMB-350-10	90	130
EN-GJMB-450-6	80	120
EN-GJMB-550-4	70	110
EN-GJMB-650-2	60	100
EN-GJMB-700-2	50	90
EN-GJMB-800-1	30	70

B.2 Test piece

The impact test pieces should be prepared to dimensions according to Figure 2, but without the notch.

B.3 Test method

The impact test should be carried out on four un-notched test pieces in accordance with EN ISO 148-1 using test equipment with an appropriate energy to determine the properties correctly. The lowest impact energy value should be discarded, and the average of the three remaining values should be used.

B.4 Retests

Retests should be permitted and carried out under the same conditions as those specified in Clause 10.

Annex C
(Informative)

Significant technical changes between this European standard and the previous edition

Table C.1 — Significant technical changes between this European standard and the previous edition

Clause/Paragraph/Table/Figure	Change
3	Definitions added for: cast sample, separately cast sample, side-by-side cast sample and relevant wall thickness.
Tables 1, 2 and 3	Designation by numbers has been changed.
7.5, Table 3	Minimum impact energy values measured on V-notched test pieces machines from cast samples of blackheart malleable cast iron added.
Annex A	Informative Annex A added for the comparison of malleable cast iron material designations according to EN 1560 and ISO/TR 15931.
Annex B	Informative description of un-notched impact test and details for un-notched test pieces.
NOTE The technical changes referred include the significant technical changes from the EN revised but is not an exhaustive list of all modifications from the previous version.	

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC

This European Standard has been prepared under a Mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

For this harmonized supporting standard for materials, presumption of conformity to the Essential Requirements of the Directive is limited to technical data of the material in the standard and does not presume adequacy of the material to specific equipment. Consequently the technical data stated in the material standard should be assessed against the design requirements of the specific equipment to verify that the Essential Requirements of the Pressure Equipment Directive (PED) are satisfied.

Table ZA.1 — Correspondence between this European Standard and Directive 97/23/EC

Clause(s)/ sub-clause(s) of this EN	Subject	Qualifying remarks/Notes
Table 3	Material properties	Annex I, 4.1 a) of the Directive
11	Conformity of material and manufacturer's certified documentation	Annex I, 4.3 of the Directive

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 1560, *Founding — Designation system for cast iron — Material symbols and material numbers*

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

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

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

[5] ISO 5922, *Malleable cast iron*

[6] ISO/TR 15931, *Designation system for cast irons and pig irons*

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