BS EN 10293:2015

BSI Standards Publication

Steel castings — Steel castings for general engineering uses

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National foreword

This British Standard is the UK implementation of EN 10293:2015. It supersedes BS EN 10293:2005 which is withdrawn.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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Compliance with a British Standard cannot confer immunity from legal obligations.

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Steel castings - Steel castings for general engineering uses

Aciers moulés - Aciers moulés d'usage général

Stahlguss - Stahlguss für allgemeine Anwendungen

This European Standard was approved by CEN on 5 December 2014.

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.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 10293:2015) has been prepared by Technical Committee ECISS/TC 111 “Steel castings and forgings”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by July 2015 and conflicting national standards shall be withdrawn at the latest by July 2015.

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 10293:2005.

In comparison with EN 10293:2005, the following significant technical changes were made:

— Alignment with the structure of EN 1559-1:2011, "*Founding - Technical conditions of delivery - Part 1: General*" and EN 1559-2:2014 "*Founding - Technical conditions of delivery - Part 2: Additional requirements for steel castings*";

— New grades (GE270, GE320 and GE360) added.

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, Former Yugoslav Republic of Macedonia, 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 document retains the same format for clauses as EN 1559-1:2011 and EN 1559-2:2014. It should be used in conjunction with these standards. Where no text is given under a paragraph heading, the corresponding paragraph of EN 1559-1:2011 and EN 1559-2:2014 applies.

The structure of this document is as follows:

— clauses and subclauses preceded by ■ indicates no additional conditions to EN 1559-1[1)] and EN 1559-2[1)] ;

— clauses and subclauses marked with a single dot • indicate that the conditions shall be agreed at the time of enquiry and order;

— subclauses marked with two dots •• indicate that conditions may be agreed at the time of enquiry and order (optional);

— subclauses without dot marking are mandatory.

1) When a complementary information is given in a clause or subclause of this document (versus the same clause or subclause of EN 1559-1:2011 or EN 1559-2:2014) it is preceded by “in addition to EN 1559-2:2014”.

1 Scope

This European Standard applies to steel castings:

— for general engineering uses. Its uses include machinery (mechanical, electrical...), automotive industries, railroad, armament, agricultural equipment, mining, etc.

In cases where castings are joined by welding by the founder, this document applies.

In cases where castings are welded:

— to wrought products (plates, tubes, forgings...), or

— by non-founders,

this document does not apply.

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 1559-2:2014, *Founding — Technical conditions of delivery — Part 2: Additional requirements for steel castings*

■ 3 Terms and definitions

• 4 Information to be supplied by the purchaser

In cases of grades with different mechanical properties relating to heat treatment conditions the purchaser shall specify the heat treatment symbol (see Clause 5).

5 Designation

In addition to EN 1559-2:2014:

— for a steel grade which can be delivered to different strength levels, according to the heat treatment, a suffix shall be added in accordance with Table 3. For example: G26CrMo4 +QT1.

6 Manufacture

6.1 Manufacturing process

■ 6.1.1 Melting

6.1.2 Heat treatment

Unless otherwise agreed, the type of heat treatment shall comply with Table 3.

6.2 Welding operations

■ 6.2.1 General

6.2.2 Production welding

In addition to EN 1559-2:2014:

— information on preheat and interpass temperatures as well as on postweld heat-treatment and the corresponding welding groups as defined in EN ISO 11970 is given in Annex A.

■ 6.3 Further processing

7 Requirements

■ 7.1 General

7.2 Material

7.2.1 Chemical composition

In addition to EN 1559-2:2014:

— the chemical composition determined by a cast analysis shall conform to the values given in Table 1;

— elements unspecified in Table 1 of this document shall not be intentionally added without agreement of the purchaser other than for the purpose of finishing the heat. If not otherwise agreed the maximum values in % (by mass) given in Table 2 shall be applicable;

— permissible deviations between the specified cast analysis and the product analysis are indicated in Table 1 of EN 1559-2:2014.

Table 1 — Chemical composition (cast analysis), (% by mass)

Designation		C		Si	Mn		P	S	Cr		Mo		Ni		V		W
Name	Number	min.	max.	max.	min.	max.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max
GE200	1.0420	-	-	-	-	-	0,035	0,030	-	-	-	-	-	-	-	-	-
GS200	1.0449	-	0,18	0,60	-	1,20	0,030	0,025	-	-	-	-	-	-	-	-	-
GE240	1.0446	-	-	-	-	-	0,035	0,030	-	-	-	-	-	-	-	-	-
GS240	1.0455	-	0,23	0,60	-	1,20	0,030	0,025	-	-	-	-	-	-	-	-	-
GE270	1.0454	-	-	-	-	-	0,035	0,030	-	-	-	-	-	-	-	-	-
GE300	1.0558	-	-	-	-	-	0,035	0,030	-	-	-	-	-	-	-	-	-
GE320	1.0591	-	-	-	-	-	0,035	0,030	-	-	-	-	-	-	-	-	-
GE360	1.0597	-	-	-	-	-	0,035	0,030	-	-	-	-	-	-	-	-	-
G17Mn5	1.1131	0,15	0,20	0,60	1,00	1,60	0,020 [a]	0,020 [b]	--	-	-	-	-	-	-	-	-
G20Mn5	1.6220	0,17	0,23	0,60	1,00	1,60	0,020 [a]	0,020 [b]	-	-	-	-	-	0,80	-	-	-
G24Mn6	1.1118	0,20	0,25	0,60	1,50	1,80	0,020 [a]	0,015	-	-	-	-	-	-	-	-	-
G28Mn6	1.1165	0,25	0,32	0,60	1,20	1,80	0,035	0,030	-	-	-	-	-	-	-	-	-
G20Mo5	1.5419	0,15	0,23	0,60	0,50	1,00	0,025	0,020 [b]	-	-	0,40	0,60	-	-	-	-	-
G10MnMoV6-3	1.5410	-	0,12	0,60	1,20	1,80	0,025	0,020	-	-	0,20	0,40	-	-	0,05	0,10	-
G15CrMoV6-9	1.7710	0,12	0,18	0,60	0,60	1,00	0,025	0,020 [b]	1,30	1,80	0,80	1,00	-	-	0,15	0,25	-
G17CrMo5-5	1.7357	0,15	0,20	0,60	0,50	1,00	0,025	0,020 [b]	1,00	1,50	0,45	0,65	-	-	-	-	-
G17CrMo9-10	1.7379	0,13	0,20	0,60	0,50	0,90	0,025	0,020 [b]	2,00	2,50	0,90	1,20	-	-	-	-	-
G26CrMo4	1.7221	0,22	0,29	0,60	0,50	0,80	0,025	0,020 [b]	0,80	1,20	0,15	0,30	-	-	-	-	-
G34CrMo4	1.7230	0,30	0,37	0,60	0,50	0,80	0,025	0,020 [b]	0,80	1,20	0,15	0,30	-	-	-	-	-
G42CrMo4	1.7231	0,38	0,45	0,60	0,60	1,00	0,025	0,020 [b]	0,80	1,20	0,15	0,30	-	-	-	-	-
G30CrMoV6-4	1.7725	0,27	0,34	0,60	0,60	1,00	0,025	0,020 [b]	1,30	1,70	0,30	0,50	-	-	0,05	0,15	-
G35CrNiMo6-6	1.6579	0,32	0,38	0,60	0,60	1,00	0,025	0,020 [b]	1,40	1,70	0,15	0,35	1,40	1,70	-	-	-

Designation		C		Si	Mn		P	S	Cr		Mo		Ni		V		W
Name	Number	min.	max.	max.	min.	max.	max.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max
G9Ni14	1.5638	0,06	0,12	0,60	0,50	0,80	0,020	0,015	-	-	-	-	3,00	4,00	-	-	-
GX9Ni5	1.5681	0,06	0,12	0,60	0,50	0,80	0,020	0,020	-	-	-	-	4,50	5,50	-	-	-
G20NiMoCr4	1.6750	0,17	0,23	0,60	0,80	1,20	0,025	0,015 [b]	0,30	0,50	0,40	0,80	0,80	1,20	-	-	-
G32NiCrMo8-5-4	1.6570	0,28	0,35	0,60	0,60	1,00	0,020	0,015	1,00	1,40	0,30	0,50	1,60	2,10	-	-	-
G17NiCrMo13-6	1.6781	0,15	0,19	0,50	0,55	0,80	0,015	0,015	1,30	1,80	0,45	0,60	3,00	3,50	-	-	-
G30NiCrMo14	1.6771	0,27	0,33	0,60	0,60	1,00	0,030	0,020	0,80	1,20	0,30	0,60	3,00	4,00	-	-	-
GX3CrNi13-4	1.6982	-	0,05	1,00	-	1,00	0,035	0,015	12,00	13,50	-	0,70	3,50	5,00	-	-	-
GX4CrNi13-4	1.4317	-	0,06	1,00	-	1,00	0,035	0,025	12,00	13,50	-	0,70	3,50	5,00	-	-	-
GX4CrNi16-4	1.4421	-	0,06	0,80	-	1,00	0,035	0,020	15,50	17,50	-	0,70	4,00	5,50			-
GX4CrNiMo16-5-1	1.4405	-	0,06	0,80	-	1,00	0,035	0,025	15,00	17,00	0,70	1,50	4,00	6,00	-	-	-
GX23CrMoV12-1	1.4931	0,20	0,26	0,40	0,50	0,80	0,030	0,020	11,30	12,20	1,00	1,20	-	1,00	0,25	0,35	0,50

[a] P ≤ 0,025 % is permitted if agreed between purchaser and manufacturer.

[b] For castings of ruling thickness < 28 mm, S ≤ 0,030 % is permitted.

Table 2 — Maximum contents of unspecified elements (% by mass)

Steel types	Cr	Mo	Ni	V	Cu	Cr + Mo + Ni + V + Cu
Non alloy steels	0,30	0,12	0,40	0,03	0,30	1,00
Alloy steels	0,30	0,15	0,40	0,05 [a]	0,30	–
[a] 0,08 % V for steels with Cr ≥ 10 % by mass.						

7.2.2 Mechanical properties

In addition to EN 1559-2:2014:

7.2.2.1 The mechanical properties shall conform to the values given in Table 3.

These values apply up to the maximum wall thickness given in Table 3. They are verified on test blocks of relevant thickness (see 8.4.1 of EN 1559-2:2014). In all cases, the maximum wall thickness of test blocks shall be limited to 150 mm.

• In cases where the ruling thickness defined by the purchaser is above the maximum thickness given in Table 3, the foreseeable lowering of the mechanical properties shall be agreed.

7.2.2.2 The yield strength values at room temperature correspond to 0,2 % proof strength (*Rp*0,2).

•• 7.2.2.3 In cases where two impact values are given, at test temperature specified in Table 3 the purchaser shall state which impact value is required. If there is no such statement in the enquiry and order the impact test shall be conducted at room temperature.

Table 3 — Mechanical properties

Designation		Heat treatment [a]			Thickness	Mechanical properties				
						Tensile test at room temperature			Impact test [b]	
Name	Number	Symbol [c]	Normalizing or austenitizing °C	Tempering °C	*t* mm	$R_{p0,2}$ MPa [d] min.	R_m MPa [d]	A % min.	KV J min.	Temperature °C
GE200	1.0420	+N	900 to 980 [e]	-	$t \leq 300$	200	380 to 530	25	27	RT [f]
GS200	1.0449	+N	900 to 980 [e]	-	$t \leq 100$	200	380 to 530	25	35	RT [f]
GE240	1.0446	+N	900 to 980 [e]	-	$t \leq 300$	240	450 to 600	22	27	RT [f]
GS240	1.0455	+N	880 to 980 [e]	-	$t \leq 100$	240	450 to 600	22	31	RT [f]
GE270	1.0454	+NT	880 to 960	560 to 620	$t < 300$	270	480	22	29	RT
GE300	1.0558	+N	880 to 960 [e]	-	$t \leq 30$	300	600 to 750	15	27	RT [f]
					$30 < t \leq 100$	300	520 to 670	18	31	RT [f]
GE320	1.0591	+NT	880 to 960	560 to 620	$t < 300$	320	540	17	25	RT
GE360	1.0597	+NT	880 to 960	560 to 620	$t < 300$	360	590	16	20	RT
G17Mn5	1.1131	+QT	920 to 980 [e,g]	600 to 700	$t \leq 50$	240	450 to 600	24	27 70	-40 RT [f]
G20Mn5	1.6220	+N	900 to 980 [e]	-	$t \leq 30$	300	480 to 620	20	27 50	-30 RT [f]
		+QT	900 to 980 [e,g]	610 to 660	$t \leq 100$	300	500 to 650	22	27 60	-40 RT [f]
G24Mn6	1.1118	+QT1	880 to 950 [g]	520 to 570	$t \leq 50$	550	700 to 800	12	27	- 20
		+QT2		600 to 650	$t \leq 100$	500	650 to 800	15	27	- 30
		+QT3		650 to 680	$t \leq 150$	400	600 to 800	18	27	- 30

Designation		Heat treatment [a]			Thickness	Mechanical properties				
						Tensile test at room temperature			Impact test [b]	
Name	Number	Symbol [c]	Normalizing or austenitizing °C	Tempering °C	t mm	$R_{p0,2}$ MPa [d] min.	R_m MPa [d]	A % min.	KV J min.	Temperature °C
G28Mn6	1.1165	+N	880 to 950 [e]		$t \leq 250$	260	520 to 670	18	27	RT [f]
		+QT1	880 to 950 [g]	630 to 680	$t \leq 100$	450	600 to 750	14	35	RT [f]
		+QT2	880 to 950 [g]	580 to 630	$t \leq 50$	550	700 to 850	10	31	RT [f]
G20Mo5	1.5419	+QT	920 to 980 [g]	650 to 730	$t \leq 100$	245	440 to 590	22	27	RT [f]
G10MnMoV6-3	1.5410	+QT1	950 to 980 [e]	640 to 660	$t \leq 50$	380	500 to 650	22	27 60	-20 RT [f]
					$50 < t \leq 100$	350	480 to 630	22	60	RT [f]
					$100 < t \leq 150$	330	480 to 630	20	60	RT [f]
					$150 < t \leq 250$	330	450 to 600	18	60	RT [f]
		+QT2	950 to 980 [g]	640 to 660	$t \leq 50$	500	600 to 750	18	27 60	-20 RT [f]
					$50 < t \leq 100$	400	550 to 700	18	60	RT [f]
					$100 < t \leq 150$	380	500 to 650	18	60	RT [f]
					$150 < t \leq 250$	350	460 to 610	18	60	RT [f]
		+QT3	950 to 980 [g]	740 to 760 and 600 to 650	$t \leq 100$	400	520 to 650	22	27 60	-20 RT [f]
G15CrMoV6-9 [h]	1.7710	+QT1	950 to 980 [g]	650 to 670	$t \leq 50$	700	850 to 1 000	10	27	RT [f]
		+QT2	950 to 980 [g]	610 to 640	$t \leq 50$	930	980 to 1 150	6	27	RT [f]
G17CrMo5-5	1.7357	+QT	920 to 960 [e,g]	680 to 730	$t \leq 100$	315	490 to 690	20	27	RT [f]

Designation		Heat treatment [a]			Thickness	Mechanical properties				
						Tensile test at room temperature			Impact test [b]	
Name	Number	Symbol [c]	Normalizing or austenitizing °C	Tempering °C	t mm	$R_{p0,2}$ MPa [d] min.	R_m MPa [d]	A % min.	KV J min.	Temperature °C
G17CrMo9-10	1.7379	+QT	930 to 970 [e,g]	680 to 740	$t \leq 150$	400	590 to 740	18	40	RT [f]
G26CrMo4	1.7221	+QT1	880 to 950 [e,g]	600 to 650	$t \leq 100$	450	600 to 750	16	40	RT [f]
					$100 < t \leq 250$	300	550 to 700	14	27	RT [f]
		+QT2	880 to 950 [g]	550 to 600	$t \leq 100$	550	700 to 850	10	18	RT [f]
G34CrMo4	1.7230	+QT1	880 to 950 [g]	600 to 650	$t \leq 100$	540	700 to 850	12	35	RT [f]
					$100 < t \leq 150$	480	620 to 770	10	27	RT [f]
					$150 < t \leq 250$	330	620 to 770	10	16	RT [f]
		+QT2	880 to 950 [g]	550 to 600	$t \leq 100$	650	830 to 980	10	27	RT [f]
G42CrMo4	1.7231	+QT1	880 to 950 [g]	600 to 650	$t \leq 100$	600	800 to 950	12	31	RT [f]
					$100 < t \leq 150$	550	700 to 850	10	27	RT [f]
					$150 < t \leq 250$	350	650 to 800	10	16	RT [f]
		+QT2	880 to 950 [g]	550 to 600	$t \leq 100$	700	850 to 1 000	10	27	RT [f]
G30CrMoV6-4	1.7725	+QT1	880 to 950 [g]	600 to 650	$t \leq 100$	700	850 to 1 000	14	45	RT [f]
					$100 < t \leq 150$	550	750 to 900	12	27	RT [f]
					$150 < t \leq 250$	350	650 to 800	12	20	RT [f]
		+QT2	880 to 950 [g]	530 to 600	$t \leq 100$	750	900 to 1 100	12	31	RT [f]
G35CrNiMo6-6	1.6579	+N	860 to 920 [e]		$t \leq 150$	550	800 to 950	12	31	RT [f]
					$150 < t \leq 250$	500	750 to 900	12	31	RT [f]
		+QT1	860 to 920 [e,g]	600 to 650	$t \leq 100$	700	850 to 1 000	12	45	RT [f]
					$100 < t \leq 150$	650	800 to 950	12	35	RT [f]
					$150 < t \leq 250$	650	800 to 950	12	30	RT [f]
		+QT2	860 to 920 [g]	510 to 560	$t \leq 100$	800	900 to 1 050	10	35	RT [f]

Designation		Heat treatment [a]			Thickness	Mechanical properties				
						Tensile test at room temperature			Impact test [b]	
Name	Number	Symbol [c]	Normalizing or austenitizing °C	Tempering °C	*t* mm	$R_{p0,2}$ MPa [d] min.	R_m MPa [d]	A % min.	KV J min.	Temperature °C
G9Ni14	1.5638	+QT	820 to 900 [g]	590 to 640	$t \leq 35$	360	500 to 650	20	27	- 90
GX9Ni5	1.5681	+QT	800 to 850 [g]	570 to 620	$t \leq 30$	380	550 to 700	18	27 100	- 100 RT [f]
G20NiMoCr4	1.6750	+QT	880 to 930 [e,g]	650 to 700	$t \leq 150$	410	570 to 720	16	27 40	- 45 RT [f]
G32NiCrMo8-5-4	1.6570	+QT1	880 to 920 [e,g]	600 to 650	$t \leq 100$	700	850 to 1 000	16	50	RT [f]
					$100 < t \leq 250$	650	820 to 970	14	35	RT [f]
		+QT2	880 to 920 [e,g]	500 to 550	$t \leq 100$	950	1 050 to 1 200	10	35	RT [f]
G17NiCrMo13-6	1.6781	+QT	890 to 930 [e,g]	600 to 640	$t \leq 200$	600	750 to 900	15	27	- 80
G30NiCrMo14	1.6771	+QT1	820 to 880 [e,g]	600 to 680	$t \leq 100$	700	900 to 1 050	9	30	RT [f]
					$100 < t \leq 150$	650	850 to 1 000	7	30	RT [f]
					$150 < t \leq 250$	600	800 to 950	7	25	RT [f]
		+QT2	820 to 880 [e,g]	550 to 600	$t \leq 50$	1 000	1 100 to 1 250	7	20	RT [f]
					$50 < t \leq 100$	1 000	1 100 to 1 250	7	15	RT [f]
GX3CrNi13-4	1.6982	+QT	1 000 to 1 050 [e]	670 to 690 [e] and 590 to 620	$t \leq 300$	500	700 to 900	15	27	- 120
GX4CrNi13-4	1.4317	+QT	1 000 to 1 050 [e]	590 to 620	$t \leq 300$	550	760 to 960	15	50	RT [f]
GX4CrNi16-4	1.4421	+QT1	1 020 to 1 070 [e]	580 to 630	$t \leq 300$	540	780 to 980	15	60	RT [f]
		+QT2	1 020 to 1 070 [e]	450 to 500	$t \leq 300$	830	1 000 to 1 200	10	27	RT [f]
GX4CrNiMo16-5-1	1.4405	+QT	1 020 to 1 070 [e]	580 to 630	$t \leq 300$	540	760 to 960	15	60	RT [f]
GX23CrMoV12-1	1.4931	+QT	1 030 to 1 080 [e,g]	700 to 750	$t \leq 150$	540	740 to 880	15	27	RT [f]

Designation		Heat treatment [a]			Thickness	Mechanical properties				
						Tensile test at room temperature			Impact test [b]	
Name	Number	Symbol [c]	Normalizing or austenitizing	Tempering	t	$R_{p0,2}$	R_m	A	KV	Temperature
			°C	°C	mm	MPa [d] min.	MPa [d]	% min.	J min.	°C

[a] Temperature (for information only).

[b] If two impact values are given, see 7.2.2.3.

[c] +N means: Normalizing; +QT or +QT1 or +QT2 means: Quenching (air or liquid) and Tempering.

[d] 1 MPa = 1 N/mm^2.

[e] Cooling in air (for information only).

[f] RT means Room Temperature.

[g] Cooling in liquid (for information only).

[h] Grade G15CrMoV6-9 is applicable for short time uses at elevated temperature and the following yield strength values can be agreed:

$R_{p0,2}$ min.

MPa

	350 °C	450 °C	500 °C	550 °C
G15CrMoV6-9+QT1	610	550	510	420
+QT2	750	670	610	520

•• **7.2.3** Other properties (magnetic properties)

By agreement at the enquiry and order, values as indicated in Table 4 for the magnetic induction shall be required. In this case the measuring procedure to be used to determine magnetic induction shall be agreed.

Table 4 — Magnetic properties

Designation		Minimum magnetic induction in Tesla at a field intensity of		
		2,5 kA/m	5,0 kA/m	10,0 kA/m
Name	**Number**			
GE200	1.0420	1,45	1,60	1,75
GE240	1.0446	1,40	1,55	1,70
GE270	1.0454	1,35	1,5	1,65
GE300	1.0558	1,30	1,50	1,65
GE320	1.0591	1,2	1,45	1,65
GE360	1.0597	1	1,4	1,6

7.3 Casting

■ 7.3.1 Chemical composition

7.3.2 Mechanical properties

In addition to EN 1559-2:2014:

— the values of yield and tensile strength given in Table 3 also apply to the casting itself up to the maximum wall thickness stated.

■ 7.3.3 Non-destructive testing

■ 7.3.4 Conditions of the casting

• 7.3.4.1 Shape and size

■ 7.3.4.2 Fettling and finishing

■ 7.3.5 Mass of the casting

■ 7.3.6 Additional requirements regarding the condition of the casting

8 Inspection

■ 8.1 General

■ 8.2 Type of inspection document and type of inspection

■ 8.3 Test unit

■ 8.4 Samples

8.5 Test procedures

■ a) tensile test at room temperature;

b) tensile test at elevated temperature only for grade G15CrMoV6-9;

■ c) impact test;

d) ferrite content test not applicable for grades specified in this European Standard (except for martensitic stainless steels);

■ e) hardness test;

■ f) homogeneity of test units (hardness test);

■ g) pressure or leak testing;

h) intergranular corrosion test not applicable for the grades specified in this European Standard;

■ i) tests for magnetic properties only for grades GE200, GE240, GE270, GE300, GE320 and GE360;

■ j) other tests for any other properties shall be agreed.

■ 8.6 Invalidation of test results

■ 8.7 Retests

■ 8.8 Sorting and reprocessing

■ 9 Marking

■ 10 Packaging and surface protection

■ 11 Complaints

Annex A
(informative)
Guidance data for welding

Table A.1 — Guidance data for welding

Designation		Preheat temperature [a]	Interpass temperature max.	Post weld heat treatment	Welding group [f]
Name	Number	°C	°C	°C	
GE200	1.0420	20 to 150	350	none	B1
GS200	1.0449	20 to 150	350	none	B1
GE240	1.0446	20 to 150	350	none	B1
GS240	1.0455	20 to 150	350	none	B1
GE270	1.0454	150 to 300	350	b	B1
GE300	1.0558	150 to 300	350	b	B1
GE320	1.0591	150 to 300	350	b	B1
GE360	1.0597	150 to 300	350	b	B2
G17Mn5	1.1131	20 to 150	350	none	C1
G20Mn5	1.6220	20 to 150	350	none	C1 (B1 for +N)
G24Mn6	1.1118	20 to 150	350	b	C2 (C1 for +QT3)
G28Mn6	1.1165	20 to 150	350	b	C1 for +QT1 C2 for +QT2 B1 for +N
G20Mo5	1.5419	20 to 200	350	≥ 650 [b]	C1
G10MnMoV6-3	1.5410	20 to 150	350	none or [b]	C1 C2 for +QT2 and $t \leq 50$ mm
G15CrMoV6-9	1.7710	200 to 300	350	b	C3
G17CrMo5-5	1.7357	150 to 250	350	≥ 650 [b]	C1
G17CrMo9-10	1.7379	150 to 250	350	≥ 680 [b]	C1
G26CrMo4	1.7221	150 to 300	350	b	C1 (C2 for +QT2)
G34CrMo4	1.7230	200 to 350	400	b	C2 for +QT1 and $t \leq 100$ mm and +QT2 C1 for +QT1 and $t > 100$ mm
G42CrMo4	1.7231	200 to 350	400	b	C2 (C1 for +QT1 and $t > 150$ mm)
G30CrMoV6-4	1.7725	200 to 350	400	b	C2 (C1 for +QT1 and $t > 150$ mm)
G35CrNiMo6-6	1.6579	200 to 350	400	b	C2 (C3 for +QT1 and $t \leq 100$ mm and +QT2) B2 for +N
G9Ni14	1.5638	20 to 200	300	≥ 560	C1
GX9Ni5	1.5681	20 to 200	350	b	C1
G20NiMoCr4	1.6750	150 to 300	350	b	C1

Designation		Preheat temperature [a]	Interpass temperature max.	Post weld heat treatment	Welding group [f]
Name	Number	°C	°C	°C	
G32NiCrMo8-5-4	1.6570	200 to 350	400	≥ 560	C3 C2 for +QT1 and *t* > 100 mm
G17NiCrMo13-6	1.6781	20 to 200	350	≥ 560	C2
G30NiCrMo14	1.6771	300 to 350	350	b	C3 C2 for +QT1 and *t* > 100 mm
GX3CrNi13-4	1.6982	20 to 200	c	c	E1
GX4CrNi13-4	1.4317	100 to 200	300	d	E1
GX4CrNi16-4	1.4421	no preheat	200	d	E1
GX4CrNiMo16-5-1	1.4405	no preheat	200	d	E1
GX23CrMoV12-1	1.4931	20 to 450	450	≥ 680 [e]	E1

[a] The preheating temperature is related to the geometry, the thickness of the casting and climate conditions.

[b] The post weld heat treatment temperature shall be at least 20 °C but not more than 50 °C below the tempering temperature, (e.g. for a tempering temperature of 650 °C the post weld heat treatment temperature shall be between 600 °C and 630 °C).

[c] At the discretion of the manufacturer unless otherwise agreed.

[d] Same as the tempering temperature used.

[e] After cooling to a temperature between 80 °C to 130 °C.

[f] See EN ISO 11970.

Bibliography

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

[2] EN ISO 11970, *Specification and approval of welding procedures for production welding of steel castings (ISO 11970)*

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