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Stainless steel castings
Technical delivery conditions

DIN 17 445

Nichtrostender Stahlguss; technische Lieferbedingungen

Supersedes
February 1969 edition

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

The subclauses marked with a single dot • give specifications which are to be agreed upon at the time of ordering. The subclauses marked with two dots •• give specifications which are optional and may be agreed upon at the time of ordering.

1 Field of application

1.1 This standard applies to castings in current production, made from the stainless steel grades [1]) listed in table 1.

1.2 For further stainless steel grades for castings, used mainly for special purposes, see *Stahl–Eisen–Werkstoffblatt* (Iron and steel material sheet) 410 *Nichtrostender Stahlguss* (Stainless steel castings).

1.3 This standard does not apply to heat resisting ferritic steel castings (see DIN 17 245), heat resisting steel castings (see DIN 17 465) and steel castings with low temperature toughness (see *Stahl–Eisen–Werkstoffblatt* 685).

1.4 In addition to the specifications given in the present standard, the general technical delivery conditions for steel castings (see DIN 1690 Part 2, at present at the stage of draft) apply, except where different specifications are given in the present standard.

Note. The revised edition of DIN 1690 Part 2 will only specify the classification of steel castings by quality classes on the basis of non-destructive tests. All other specifications in the draft version of DIN 1690 Part 2 are being included in a new edition of DIN 1690 Part 1, to be published together with the revised edition of DIN 1690 Part 2. This means that after publication of the revised editions of DIN 1690 Part 1 and Part 2, the reference to DIN 1690 Part 2 will be replaced by the following references:

- in subclause 1.4, a reference to DIN 1690 Part 1 and DIN 1690 Part 2;
- in clauses 3 and 4 and subclauses 7.8.1 and 8.3, a reference to DIN 1690 Part 1;
- in subclauses 7.7.1, 7.7.2 and 8.4.7, a reference to DIN 1690 Part 2.

2 Concept

Stainless steel is a term which applies to grades of steel casting distinguished by an exceptional resistance to chemically aggressive substances. They have a chromium content of at least 12 % by mass.

Low alloy, so-called weathering resistant grades of steel casting that merely have an increased resistance to natural atmospheres are not regarded as stainless as defined in this standard.

3 Form, dimensions and permissible dimensional deviations

The specifications given in DIN 1690 Part 2 (see the note in subclause 1.4) shall apply.

4 Masses and permissible deviations in mass

The specifications given in DIN 1690 Part 2 (see the note in subclause 1.4) shall apply. The values of density specified in table 4 shall be used as a basis for calculating the mass.

5 Designation

5.1 The symbols identifying the individual grades of steel casting are to be formed on the basis of the relevant explanatory notes as given in *DIN-Normenheft* (DIN Standardization booklet) 3, and the material numbers as in DIN 17 007 Part 2.

Example:

A stainless steel casting identified by symbol G-X 20 Cr 14 or material number 1.4027 shall be designated as follows:

Steel casting DIN 17 445 – G-X 20 Cr 14
or Steel casting DIN 17 445 – 1.4027

5.2 If required, the code letter identifying the treatment condition shall be appended to the material designation.

Example:

Steel casting G-X 20 Cr 14 in the quenched and tempered condition:

G-X 20 Cr 14 V

[1]) In the case of products used for pressure vessel construction, see also the documents prepared by the *Arbeitsgemeinschaft Druckbehälter* (Study group on pressure vessels), *AD-Merkblätter* (AD Data sheets) W 2 *Austenitische Stähle* (Austenitic steels) and W 5 *Stahlguss* (steel castings).

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6 Classification into grades

The grades of steel casting given in table 1 are classified essentially on the basis of the type of alloy, their resistance to chemical exposure and their mechanical properties at room temperature.

7 Requirements

7.1 Manufacturing process

Stainless steel castings complying with this standard shall be melted in an electric furnace.

7.2 Condition on delivery

The ferritic (martensitic) grades of steel casting as listed in table 1 shall be supplied in the quenched and tempered condition and the austenitic grades in table 1 shall be supplied in the quenched condition (see table 6).

●● Some other heat treatment condition, for example annealed in the case of ferritic (martensitic) grades of steel casting, may be agreed at the time of ordering.

Table 6 gives information on the structure of grades of steel casting after heat treatment.

7.3 Chemical composition

The chemical composition of the different grades of steel casting shall be as specified in table 1. In the case of a subsequent test on the casting, slight deviations may be found compared with these values, which apply for the cast analysis, but these shall not be such as to impair the characteristics in use including weldability and the properties in relation to corrosion resistance.

7.4 Mechanical properties

7.4.1 The mechanical properties given in table 2 shall apply to the grades of steel casting covered by this standard, for specimens taken as described in subclause 8.3 from test pieces with thicknesses of up to 150 mm.

● If test pieces are taken from the finished product for determining the 0,2 % proof stress, the requirements with regard to the other properties shown in table 2 shall be agreed.

7.4.1.1 The impact value shall be determined as the average obtained from three impact tests.

7.4.1.2 Minimum values for the 0,2 % proof stress and 0,1 % proof stress of stainless steel castings at elevated temperatures are listed in table 3.

7.5 Physical properties

Guideline values for the physical properties of the different grades of stainless steel casting are given in table 4.

7.6 Intercrystalline corrosion

Guideline values for resistance to intercrystalline corrosion are given in table 5.

Note. Although the steels have been proved their value over a considerable period, it is difficult to specify values for their resistance to chemical attack. Such values determined in the laboratory are not always representative of the behaviour of the steels in use, because the conditions of chemical attack which, in a laboratory test, can be accurately observed and controlled, rarely exist under service conditions; additions and impurities in the corrosive media can considerably accelerate or slow down the corrosion process. In cases where the purchaser has no relevant experience, he is recommended to draw on the experience of the material supplier by requesting him for advice, indicating precisely the intended application, and the composition, temperature and pressure of the corrosive medium. Guidance can be found in the DECHEMA material tables.

7.7 General condition of the casting

7.7.1 The general specifications given in DIN 1690 Part 2 (see the note in subclause 1.4) shall apply.

7.7.2 ●● In cases where no agreement has been made at the time of ordering with regard to permissible external or internal imperfections, the specifications for quality class 4 given in DIN 1690 Part 2 (see the note in subclause 1.4) shall apply.

7.7.3 Impermissible defects are to be removed as described in subclause 7.8.

7.8 Welding requirements and condition of castings after welding

7.8.1 The general specifications given in DIN 1690 Part 2 (see the note in subclause 1.4) shall apply.

7.8.2 The welding filler metals used shall be of such quality that the deposited weld metal has chemical and mechanical properties that are satisfactory with regard to the parent metal.

●● This condition shall be deemed to be complied with if the filler metals specified in table 7 are used. Any departures from these shall be agreed.

7.8.3 Tables 6 and 7 shall apply for postweld heat treatment.

7.8.4 All large weld points shall be marked on an agreed basis unless the castings have been subjected to a complete heat treatment (quenching and tempering or quenching) as specified in table 7.

8 Testing

8.1 Documents on materials testing

8.1.1 ● Agreement shall be made at the time of ordering as to whether a document on materials testing complying with DIN 50 049 is to be issued, and if so, which.

8.1.2 ●● In cases where acceptance inspection is agreed, the details shall be in accordance with subclause 8.2 to 8.5. The tests shall generally be carried out by experts of the manufacturer's works, but if particularly agreed they may also be carried out by a third party commissioned by the purchaser.

8.1.3 For documenting the results of an agreed non-destructive test, only an inspection test complying with DIN 50 049, July 1982 edition, subclause 3.1 shall be used.

● Agreements shall be made at the time of ordering on the type of documents to be issued for certifying the test results.

8.2 Scope of test programme

8.2.1 • The number of test pieces depends on the size of the acceptance unit, i.e. on whether the steel castings are tested individually, by casts or by batches subjected to the same heat treatment; which of these three possibilities is chosen shall be agreed at the time of ordering.

8.2.1.1 Testing of single castings will only be carried out by agreement.

8.2.1.2 In the case of testing by casts, the castings shall be grouped together by casts to give acceptance units of up to 2500 kg each. Remainders up to 1250 kg shall in all cases be added to the preceding acceptance unit; remainders of more than 1250 kg shall be treated as a separate acceptance unit.

8.2.1.3 In the case of testing by batches, the castings may originate from different casts of the same steel grade but they shall be heat treated together. They shall be grouped together by batches of 1500 kg each. Remainders of up to 750 kg shall be added to the preceding batch or distributed evenly over all the other batches; remainders of more than 750 kg shall be treated as a separate batch.

8.2.2 •• In cases where subsequent testing of the chemical composition on the casting has been agreed at the time of ordering, the scope of the test programme shall be agreed at the same time.

8.2.3 •• Testing for hardness may be agreed at the time of ordering.

8.2.4 For the tensile test, in the case of testing each casting separately, or where testing is to be carried out by casts or by batches, one specimen (see subclause 8.3) shall be taken from each acceptance unit or each batch. In the case of testing by casts however, no more than four specimens shall be taken per cast.

•• If, when testing single castings of particular importance or value, the scope of the test programme is to be larger than described above, this shall be agreed at the time of ordering.

8.2.5 The scope of test programme for the impact test shall be the same as that for the tensile test described in subclause 8.2.4, except that for tensile testing one specimen is required and for tensile testing three.

8.2.6 •• If the elevated temperature 0,2 % proof stress is to be determined the scope of test programme shall be agreed at the time of ordering, the test temperature being specified.

8.2.7 •• If verification of resistance to intercrystalline corrosion has been agreed at the time of ordering, the method of sampling and the scope of the test programme shall also be agreed.

8.2.8 •• If proof is required as to whether the requirements regarding the general condition of the castings as specified in subclause 7.7 have been complied with, this shall be stated at the time of ordering. At the same time, agreements shall be made as to the type of non-destructive testing and the locations on the casting where the test is to be carried out.

8.2.9 •• If a hydrostatic pressure test or other tests has been agreed at the time of ordering, the scope of the test programme shall be agreed.

8.3 Sampling and preparation of test pieces

The specifications given in DIN 1690 Part 2 (see the note in subclause 1.4) shall apply. The thickness of the cast-on specimen shall not exceed 150 mm.

8.4 Test methods to be used

8.4.1 The chemical composition shall be determined using the methods specified by the Chemists' Committee of the *Verein Deutscher Eisenhüttenleute*[2]) (Society of German Ferrous Metallurgy Engineers).

8.4.2 The tensile test shall be carried out as described in DIN 50 145, using if possible the proportional test bar specified in DIN 50 125; other specimens shall be agreed at the time of ordering.

8.4.3 The elevated temperature 0,2 % proof stress and 1 % proof stress shall be determined as described in DIN 50 145.

8.4.4 The Brinell hardness shall be determined as described in DIN 50 351.

8.4.5 The impact test shall be carried out as described in DIN 50 115 at room temperature on ISO V-notch specimens (ISO-V). The average from three specimens shall be regarded as the test result.

•• The use of DVM specimens instead of ISO V-notch specimens may be agreed at the time of ordering.

8.4.6 • If a hydraulic pressure test for testing the leak tightness has been agreed, this shall be carried out as specified in DIN 50 104. The pressure medium, pressure level and duration of application of the pressure shall be agreed at the time of ordering[1]). Appropriate specifications shall be agreed in cases where other tests for leak tightness are to be carried out.

8.4.7 • The non-destructive test methods to be used and the test conditions shall be agreed at the time of ordering (see DIN 1690 Part 2 and the note in subclause 1.4).

If testing for surface cracks has been agreed, this shall be carried out after the last heat treatment. If non-destructive testing of the internal condition has been agreed, this, unless otherwise agreed, shall be carried out before the last heat treatment.

8.4.8 The resistance to intercrystalline corrosion shall be tested as described in DIN 50 914.

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[1]) See page 1.

[2]) *Handbuch für das Eisenhüttenlaboratorium* (Handbook for the ferrous metallurgy laboratory), vol. 2: *Die Untersuchung der metallischen Stoffe* (Investigation of metallic materials), Düsseldorf, *Verlag Stahleisen mbH*, 1966;
vol. 5 (supplementary volume):
A 4.4 – *Aufstellung empfohlener Schiedsverfahren* (List of recommended arbitration procedures);
B – *Probenahmeverfahren* (Sampling procedures);
C – *Analysenverfahren* (Methods of analysis);
most recent edition in each case, Düsseldorf, *Verlag Stahleisen mbH.*

8.5 Retests

8.5.1 If the result of a mechanical test, in the case of testing by casts or batches, fails to comply with the requirements, two additional specimens (or in the case of the impact test, two additional sets of three specimens each) from another casting in the same acceptance unit shall be tested for each specimen that fails to comply with the requirements; both the substitute specimens shall meet the requirements. The casting from which the unsatisfactory specimen was taken, shall be rejected (see however subclause 8.5.3 and 8.5.4).

8.5.2 If the result of a mechanical test on a single casting fails to comply with the requirements, two additional specimens (or in the case of the impact test, two additional sets of three specimens each) from the same casting shall be tested for each unsatisfactory specimen; both the substitute specimens shall meet the requirements.

8.5.3 If, in the first mechanical test or a retest on substitute specimens, the specimen fails to meet the requirements, the supplier shall have the right to submit the castings to further heat treatment and to present them again.

8.5.4 If unsatisfactory test results can evidently be traced back to factors inherent to the test system or to a limited defect in one specimen, the test shall be repeated on a new specimen.

Table 1. **Chemical composition of grades of stainless steel casting as determined by the cast analysis**

Grade of steel casting		% by mass								
Symbol	Material number	C	Si max.	Mn max.	P max.	S max.	Cr	Mo	Ni	Other
Ferritic (martensitic) grades of steel casting										
G-X 8 CrNi 13	**1.4008**	0,06 to 0,12	1,0	1,0	0,045	0,030	12,0 to 13,5	≦ 0,50	1,0 to 2,0	–
G-X 20 Cr 14	**1.4027**	0,16 to 0,23	1,0	1,0	0,045	0,030	12,5 to 14,5	–	≦ 1,0	–
G-X 22 CrNi 17	**1.4059**	0,20 to 0,27	1,0	1,0	0,045	0,030	16,0 to 18,0	–	1,0 to 2,0	–
G-X 5 CrNi 13 4	**1.4313**	≦ 0,07	1,0	1,5	0,035	0,025	12,0 to 13,5	≦ 0,70	3,5 to 5,0	–
Austenitic grades of steel casting										
G-X 6 CrNi 18 9	**1.4308**	≦ 0,07	2,0	1,5	0,045	0,030	18,0 to 20,0	[2]	9,0 to 11,0	–
G-X 5 CrNiNb 18 9	**1.4552**	≦ 0,06	1,5	1,5	0,045	0,030	18,0 to 20,0	[2]	9,0 to 11,0	% Nb ≧ 8 x % C
G-X 6 CrNiMo 18 10	**1.4408**	≦ 0,07	1,5	1,5	0,045	0,030	18,0 to 20,0	2,0 to 3,0	10,0 to 12,0	–
G-X 5 CrNiMoNb 18 10	**1.4581**	≦ 0,06	1,5	1,5	0,045	0,030	18,0 to 20,0	2,0 to 2,5	10,5 to 12,5	% Nb ≧ 8 x % C
G-X 3 CrNiMoN 17 13 5	**1.4439**	≦ 0,04	1,0	1,5	0,045	0,030	16,5 to 18,5	4,0 to 4,5	12,5 to 14,5	0,12 to 0,22 %

[1] Part of the niobium may be replaced by twice the quantity of tantalum.

[2] In borderline cases, e.g. for use in nitric acid, grades of steel casting with the maximum permitted molybdenum content shall be agreed.

Table 2. **Minimum values for the mechanical properties at room temperature [1]**

Grade of steel casting		Heat treatment condition [2]	Hardness	0,2 % proof stress	1 % proof stress	Tensile strength	Elongation after fracture ($l_0 = 5 \cdot d_0$)	Impact value (average)	
Symbol	Material number		HB	N/mm²	N/mm²	N/mm²	%	ISO-V J	DVM J
				min.	min.		min.	min.	
Ferritic (martensitic) grades of steel casting									
G-X 8 CrNi 13	1.4008	Annealed Quenched and tempered	170 to 240 170 to 240	– 440	– –	 590 to 790	– 15	– 27	 (27)
G-X 20 Cr 14	1.4027	Annealed Quenched and tempered	170 to 240 170 to 240	– 440	– –	 590 to 790	– 12	– 	 (13)
G-X 22 CrNi 17	1.4059	Annealed Quenched and tempered	200 to 270 230 to 300	– 590	– –	 780 to 980	– 4	– –	
G-X 5 CrNi 13 4	1.4313	Quenched and tempered, stage 1 Quenched and tempered, stage 2	240 to 300 280 to 350	550 830	– –	760 to 960 900 to 1100	15 12	50 35	(55) (40)
Austenitic grades of steel casting									
G-X 6 CrNi 18 9	1.4308	Quenched	130 to 200	175	200	440 to 640	20	60	(70)
G-X 5 CrNiNb 18 9	1.4552		130 to 200	175	200	440 to 640	20	35	(41)
G-X 6 CrNiMo 18 10	1.4408		130 to 200	185	210	440 to 640	20	60	(70)
G-X 5 CrNiMoNb 18 10	1.4581		130 to 200	185	210	440 to 640	20	35	(41)
G-X 3 CrNiMoN 17 13 5	1.4439		130 to 200	210	230	490 to 690	20	50	(60)

[1] The values shall apply for specimens as specified in subclause 8.3.
[2] See table 6.

Table 3. **Minimum values for elevated temperature 0,2 % proof stress and 1 % proof stress**

Grade of steel casting		Heat treatment condition [1]	0,2 % proof stress at a temperature, in °C, of										1 % proof stress at a temperature, in °C, of									
Symbol	Material number		100	150	200	250	300	350	400	450	500	550	100	150	200	250	300	350	400	450	500	550
			N/mm² min.										N/mm² min.									
Ferritic (martensitic) grades of steel casting																						
G-X 8 CrNi 13	**1.4008**	Quenched and tempered	365	355	345	335	325	315	305	–	–	–	–	–	–	–	–	–	–	–	–	–
G-X 20 Cr 14	**1.4027**		365	355	345	335	325	315	305	–	–	–	–	–	–	–	–	–	–	–	–	–
G-X 22 CrNi 17	**1.4059**		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
G-X 5 CrNi 13 4	**1.4313**	Quenched and tempered, stage 1	515	500	485	470	455	440	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Quenched and tempered, stage 2	810	770	750	725	700	680	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Austenitic grades of steel castings																						
G-X 6 CrNi 18 9	**1.4308**	Quenched	145	125	115	105	100	–	–	–	–	–	170	150	140	130	125	–	–	–	–	–
G-X 5 CrNiNb 18 9	**1.4552**		150	135	130	125	120	115	110	105	100	90	175	160	155	150	145	140	130	120	110	100
G-X 6 CrNiMo 18 10	**1.4408**		150	130	120	110	100	–	–	–	–	–	175	155	145	135	125	–	–	–	–	–
G-X 5 CrNiMoNb 18 10	**1.4581**		165	150	140	135	130	125	120	115	110	105	190	175	165	160	155	150	140	130	120	110
G-X 3 CrNiMoN 17 13 5	**1.4439**		165	150	140	130	120	115	110	–	–	–	192	177	162	151	143	138	125	–	–	–

[1]) See table 6.

Table 4. Guideline values for the physical properties

Grade of steel casting		Density	Thermal expansion between 20 °C and					Thermal conductivity at 20 °C	Specific heat at 20 °C	Shrinkage
Symbol	Material number		100 °C	200 °C	300 °C	400 °C	500 °C			
		g/cm³	10^{-6} K^{-1}					W/m K	J/g K	%
Ferritic (martensitic) grades of steel casting										
G-X 8 CrNi 13	**1.4008**	7,7	10,5	11,0	11,5	12,0	12,3	29	0,46	2,0
G-X 20 Cr 14	**1.4027**	7,7	10,5	11,0	11,5	11,5	12,0	29	0,46	
G-X 22 CrNi 17	**1.4059**	7,7	10,0	10,5	11,0	11,0	11,0	25	0,46	
G-X 5 CrNi 13 4	**1.4313**	7,7	10,5	11,0	12,0	12,5	13,0	25	0,46	
Austenitic grades of steel casting										
G-X 6 CrNi 18 9	**1.4308**	7,9	16,0	17,0	17,0	18,0	18,0	15	0,50	2,5
G-X 5 CrNiNb 18 9	**1.4552**	7,9	16,0	17,0	17,0	18,0	18,0	15	0,50	
G-X 6 CrNiMo 18 10	**1.4408**	7,9	16,5	17,5	17,5	18,5	18,5	15	0,50	
G-X 5 CrNiMoNb 18 10	**1.4581**	7,9	16,5	17,5	18,0	18,5	19,0	15	0,50	
G-X 3 CrNiMoN 17 13 5	**1.4439**	8,0	16,5	17,5	17,5	18,5	18,5	17	0,50	

Table 5. Guideline values for resistance of austenitic grades of steel casting to intercrystalline corrosion

Grade of steel casting		Resistance to intercrystalline corrosion [1]		
Symbol	Material number	in as delivered condition (quenched)	in welded condition, not subjected to postweld heat treatment	in welded condition, subjected to postweld heat treatment [2]
G-X 6 CrNi 18 9	**1.4308**	Yes	Given to a limited extent [3]	Yes
G-X 5 CrNiNb 18 9	**1.4552**	Yes	Yes	Yes
G-X 6 CrNiMo 18 10	**1.4408**	Yes	Given to a limited extent [3]	Yes
G-X 5 CrNiMoNb 18 10	**1.4581**	Yes	Yes	Yes
G-X 3 CrNiMoN 17 13 5	**1.4439**	Yes	Yes	Yes

[1] When testing as described in DIN 50 914.
[2] See also table 6.
[3] Dependent on the heat applied during welding.

Table 6. **Guideline values for heat treatment and structure**

Grade of steel casting		Annealing		Quenching		Tempering	Structure after heat treatment for as delivered condition
Symbol	Material number	Temperature °C	Method of cooling	Temperature °C	Quenching medium	Temperature °C	
Ferritic (martensitic) grades of steel casting							
G-X 8 CrNi 13	1.4008	700 to 750 –	Furnace –	– 1000 to 1050[1]	– Air	– 650 to 720	Ferrite, pearlite, carbide, heat treatable structure[2]
G-X 20 Cr 14	1.4027	750 to 800 –	Furnace –	– 1000 to 1050	– Air	– 650 to 750	Ferrite, pearlite, carbide, heat treatable structure[2]
G-X 22 CrNi 17	1.4059	700 to 750	Furnace –	– 1000 to 1050	– Air	– 600 to 700	Ferrite, pearlite, carbide, heat treatable structure[2]
G-X 5 CrNi 13 4	1.4313	–	–	1000 to 1050	Air	580 to 620[3] 500 to 540[4]	Heat treatable structure
Austenitic grades of steel casting							
G-X 6 CrNi 18 9	1.4308	–	–	1050 to 1100	Water, air[5]	–	Austenite[2]
G-X 5 CrNiNb 18 9	1.4552			1050 to 1100	Water, air[5]	–	Austenite[2]
G-X 6 CrNiMo 18 10	1.4408			1050 to 1100	Water, air[5]	–	Austenite[2]
G-X 5 CrNiMoNb 18 10	1.4581			1050 to 1100	Water, air[5]	–	Austenite[2]
G-X 3 CrNiMoN 17 13 5	1.4439			1130 to 1180	Water	–	Austenite[6]

[1] After quenching, intermediate annealing at 820 to 870 °C/air is advisable.
[2] Ferrite content generally small.
[3] Quenching and tempering, stage 1, as in table 2.
[4] Quenching and tempering, stage 2, as in table 2.
[5] Cooling in air, as quickly as possible.
[6] Intermetallic precipitations possible.

Table 7. **Data on suitable welding filler metals and on heat treatment before and after welding**

Grade of steel casting		Suitable filler metal			Preheating temperature	Postweld heat treatment[5] (see also table 6 for temperatures)
		Covered electrode	Wire and rod			
Symbol	Material number	Symbol	Symbol	Material number	°C	
Ferritic (martensitic) grades of steel casting						
G-X 8 CrNi 13	**1.4008**	13[1]	X 8 Cr 14[2]	1.4009	150 to 250	1. Either cooling from welding heat to less than 100 °C with subsequent tempering or 2. renewed quenching and tempering.
G-X 20 Cr 14	**1.4027**	13[1]	X 8 Cr 14[2]	1.4009	200 to 400	
G-X 22 CrNi 17	**1.4059**	18[3] 17 13[3]	X 8 Cr 18 X 20 CrMo 17 1	1.4015 1.4115	300 to 400	
G-X 5 CrNi 13 4	**1.4313**	13 4[1], [4]	X 3 CrNi 13 4[2], [4]	1.4351	100 to 200[6]	
Austenitic grades of steel casting						
G-X 6 CrNi 18 9	**1.4308**	19 9[1] 19 9 nC[1] 19 9 Nb[1]	X 5 CrNi 19 9[2] X 2 CrNi 19 9[2] X 5 CrNiNb 19 9[2]	1.4302 1.4316 1.4551	[7]	[8]
G-X 5 CrNiNb 18 9	**1.4552**	19 9 Nb[1]	X 5 CrNiNb 19 9[2]	1.4551	[7]	Quenching not necessary.
G-X 6 CrNiMo 18 10	**1.4408**	19 12 3[1] 19 12 3 nC[1] 19 12 3 Nb[1]	X 5 CrNiMo 19 11[2] X 2 CrNiMo 19 12[2] X 5 CrNiMoNb 19 12[2]	1.4403 1.4430 1.4576	[7]	[8]
G-X 5 CrNiMoNb 18 10	**1.4581**	19 12 3 Nb[1]	X 5 CrNiMoNb 19 12[2]	1.4576	[7]	Quenching not necessary.
G-X 3 CrNiMoN 17 13 5	**1.4439**	18 17 5 nC[3]	X 2 CrNiMo 18 16 5	1.4440	[7]	[8]

[1] DIN 8556 Part 1, March 1976 edition, table 1.

[2] DIN 8556 Part 1, March 1976 edition, table 2.

[3] Symbol based on DIN 8556 Part 1, March 1976 edition, subclause 3.3.

[4] The chemical composition and ferrite content shall be matched to that of 1.4313 material.

[5] Structural welding and production welding.

[6] In the case of small production welds on thin-walled components, both preheating and tempering or stress-relief annealing may be omitted.

[7] Low heat input recommended.

[8] After welding has been carried out with considerable heat input, renewed quenching is necessary if there is a danger of intercrystalline corrosion.

Standards and other documents referred to

DIN 1690 Part 1	Technical delivery conditions for castings made from metallic materials; general conditions
DIN 1690 Part 2	(at present at the stage of draft) Technical delivery conditions for castings made from metallic materials; general conditions for steel castings (For the revised edition, the following title has been proposed: "Technical delivery conditions for castings made from metallic materials; steel castings; classification into quality classes on the basis of non-destructive tests". See also the note in subclause 1.4.)
DIN 8556 Part 1	Filler metals for welding stainless and heat resisting steels; designation; technical delivery conditions
DIN 17 007 Part 2	Material numbers; system of principal group 1: steel
DIN 17 245	Ferritic steel castings creep resistant at elevated temperatures; technical delivery conditions
DIN 17 465	Heat resisting steel castings; technical delivery conditions
DIN 50 049	Documents on materials testing
DIN 50 104	Hydraulic pressure test on hollow bodies; leak tightness test up to a defined internal pressure; general specifications
DIN 50 115	Testing of metallic materials; impact test
DIN 50 125	Testing of metallic materials; tensile test pieces; rules for their preparation
DIN 50 145	Testing of metallic materials; tensile test
DIN 50 351	Testing of metallic materials; Brinell hardness test
DIN 50 914	Testing the resistance of stainless steels to intercrystalline corrosion; copper sulfate-sulfuric acid method; Strauss test
DIN-Normenheft 3	*Kurznamen und Werkstoffnummern der Eisenwerkstoffe in DIN-Normen und Stahl-Eisen-Werkstoffblättern* (Symbols and material numbers for ferrous materials used in DIN Standards and Iron and steel material sheets); (*Verlag Stahleisen mbH*, Düsseldorf and *Beuth Verlag GmbH*, Berlin)

Stahl-Eisen-Werkstoffblatt 410[3])
Nichtrostender Stahlguss; Gütevorschriften (Stainless steel castings; quality specifications)

Stahl-Eisen-Werkstoffblatt 685[3])
Kaltzäher Stahlguss (Steel castings with low temperature toughness)

Handbuch für das Eisenhüttenlaboratorium,
volume 2[3]): *Die Untersuchung der metallischen Stoffe*, Düsseldorf 1966.
volume 5 (supplementary volume)[3]):
A 4.4 – *Aufstellung empfohlener Schiedsverfahren;*
B – *Probenahmeverfahren;*
C – *Analysenverfahren;*
most recent edition in each case.

AD-Merkblatt W 2[4]) *Austenitische Stähle*

AD-Merkblatt W 5[4]) *Stahlguss*

DECHEMA material tables[5])

Previous editions

DIN 17 445: 02.69

Amendments

The following amendments have been made in comparison with the February 1969 edition:

a) Grades G-X 10 CrNi 18 8 (1.4312) and G-X 10 CrNiMo 18 9 (1.4410) have been deleted.

b) Grades G-X 5 CrNi 13 4 (1.4313) and G-X 3 CrNiMoN 17 13 5 (1.4439) have been included for the first time.
Grade G-X 5 CrNi 13 4 has found widespread application in recent years because of its good toughness properties and high strength and also because of its high corrosion resistance.
Grade G-X CrNiMoN 17 13 5 is being increasingly used, mainly because of its high resistance to pitting corrosion. Its molybdenum content, at 4,0 to 4,5 %, is significantly higher than for the grades previously specified in DIN 17 445.

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[3]) Obtainable from: *Verlag Stahleisen mbH*, Postfach 82 29, D-4000 Düsseldorf 1.

[4]) Obtainable from: *Beuth Verlag GmbH*, Burggrafenstrasse 4-10, D-1000 Berlin 30.

[5]) Obtainable from: *Deutsche Gesellschaft für chemisches Apparatewesen e. V.*, Theodor-Heuss-Allee 25, D-6000 Frankfurt 97.

c) For grade G-X 12 Cr 14 (1.4008) the chemical composition has been modified, with regard to the carbon, chromium and nickel contents, so that good toughness properties may be obtained more reliably. Because of the changes in the chemical composition, the symbol has been changed to G-X 8 CrNi 13, but the material number 1.4008 has been retained.

d) Because of the reduction in the maximum carbon content from 0,08 to 0,06 %, the symbols for grades G-X 7 CrNiNb 18 9 (1.4552) and G-X 7 CrNiMoNb 18 10 (1.4581) have been changed to G-X 5 CrNiNb 18 9 and G-X 5 CrNiMoNb 18 10 respectively, the material numbers being retained.

e) Since the general technical delivery conditions for steel castings specified in DIN 1690 Part 2 also apply, it was possible to replace the extensive specifications for form, sizes and permissible dimensional deviations, masses and permissible deviations in mass, general condition of the castings and procedure for welding work, and also sampling for carrying out the tests, by references to DIN 1690 Part 2. At the same time, more stringent requirements have been laid down in respect of the general condition of the castings by specifying quality class 4 in accordance with DIN 1690 Part 2 (see the note in subclause 1.4).

International Patent Classification

C 21 C 5-00
C 22 C 37-08