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Valve materials
Technical delivery conditions

DIN 17 480

Ventilwerkstoffe; technische Lieferbedingungen

Supersedes September 1984 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.

See Explanatory notes for connection with draft of International Standard ISO/DIS 683-15 : 1991, published by the International Organization for Standardization.

1 Scope and field of application

1.1 This standard specifies technical delivery conditions for high-alloy materials for the manufacture of collets for inlet valves and exhaust valves intended to be used in reciprocating internal combustion engines ('valve materials', for short). Such materials are supplied in the form of bars, rod, wire or forgings, in the finishes specified in subclause 6.2.2.

1.2 This standard does not cover hard metal alloys which are for surface-layer welding of valve collets and valve seat rings.

1.3 Unless otherwise specified, the technical delivery conditions given in DIN EN 10 021 (at present at the stage of draft) for steel and steel products shall also be complied with.

2 Concept

For the purposes of this standard, valve materials comprise steel and non-ferrous alloys which are highly resistant to thermal stresses, fluctuations in temperature, corrosion, fatigue loading, impact and wear, even when exposed to exhaust gas.

3 Sizes and tolerances

The size and tolerances of semi-finished products shall be the subject of agreement at the time of ordering, reference being made where possible to the relevant dimensional standards listed in appendix A.

4 Steel grades

The materials covered in this standard are classified according to their chemical composition and the resulting microstructure (cf. table 1).

Martensitic steels are predominantly used for the manufacture of inlet valves, austenitic steels being used for exhaust valves.

5 Designation

5.1 The material designations given in table 1 have been taken from subclause 2.1.2.2 of the Explanatory notes to *DIN-Normenheft* (Standardization booklet) 3, the material numbers from DIN 17 007 Part 2, and those for the non-ferrous alloys NiCr 20 TiAl and NiFe 25 Cr 20 NbTi from DIN 17 007 Part 4.

5.2 The standard designation shall give the name of the product (steel), the DIN number (DIN 17 480), the material designation or number, and the symbol denoting heat treatment condition.

Example:

Designation of steel complying with this standard, made of a material identified by material designation X 45 CrSi 9 3 (material number 1.4718), supplied in the softened condition (G):

Steel DIN 17 480 – X 45 CrSi 9 3 – G

or

Steel DIN 17 480 – 1.4718 – G

5.3 The designation to be used when ordering shall include the standard designation, the number of items, the manufacturing process to be used (e.g. warm extrusion, upsetting with electric resistance heating), and any other relevant information.

6 Requirements

6.1 Manufacturing process

6.1.1 Where a particular manufacturing process is not specified at the time of ordering, it shall be at the manufacturer's discretion.

6.1.2 The non-ferrous alloys identified by material designation NiCr 20 TiAl (2.4952) and NiFe 25 Cr 20 NbTi (2.4955) are normally manufactured by remelting.

Continued on pages 2 to 13

6.1.3 Where a particular forming process is not specified at the time of ordering, it shall be at the manufacturer's discretion.

6.2 Heat treatment condition and finish

6.2.1 The heat treatment condition shall be the subject of agreement, bearing in mind that the raw materials as covered here will subsequently be formed. Martensitic steel is usually supplied in the softened or the quenched and tempered condition, and austenitic steel, either in the quenched condition or in a condition as obtained by controlled cooling (except for grades NiCr 20 TiAl (2.4952) and NiFe 25 Cr 20 NbTi (2.4955)) (cf. table 3).

Note. Valves which are ready to use are supplied in the quenched and tempered, aged, or quenched condition, as a function of their chemical composition.

Heat treatment conditions are specified in tables 3, B.1 and B.5.

6.2.2 For the purposes of this standard, valve materials are primarily supplied in the form of bars, with one of the following finishes:

a) peeled and ground;

b) ground;

c) peeled or ground, and polished;

d) as rolled (only for special applications).

6.3 Chemical composition

6.3.1 The chemical composition, as determined by ladle analysis, shall be in compliance with table 1.

6.3.2 With the consent of the purchaser, minor deviations of the chemical composition from the limiting values specified are permitted, provided they do not adversely affect the performance of the valve.

6.3.3 It may be agreed at the time of ordering to provide proof that the limiting values specified for the ladle analysis (cf. table 1) comply with the amounts by which the chemical composition as determined by product analysis may deviate (cf. table 2).

6.4 Mechanical properties

As a function of the steel grade and the heat treatment condition, the hardness and tensile strength shall be as specified in table 3 (see also tables B.1 to B.4).

6.5 Surface condition

6.5.1 Use of materials that are required to have a particularly low non-metallic inclusions content shall be the subject of agreement at the time of ordering.

Note. In this regard, it should be borne in mind that the materials covered here have a high alloy content when cast from an open furnace, and have a high content of non-metallic inclusions which are not uniformly distributed.

6.5.2 When tested as described in DIN 50 601, NiCr 20 TiAl shall have a grain size index of 4 or higher, it being permitted for individual grains to be coarser.

6.5.3 In the case of peeled and ground rounds, minor voids, pits or grooves in the steel shall be permitted, provided they do not affect the mechanical properties of the steel. The depth of surface imperfections shall lie within ISO tolerance h11.

Surface conditions other than those covered here shall be subject to agreement.

7 Testing

7.1 Inspection documents

7.1.1 The purchaser my specify that materials be supplied with a DIN 50 049 Inspection document, such normally being in the form of a test report which includes the results of the product analysis.

7.1.2 Where it has been agreed to issue an inspection certificate, this shall include the particulars covered in subclauses 7.2 to 7.6.

7.2 Test unit

A test unit consists of products from the same cast, heat treatment batch, and of the same size.

7.3 Scope of testing

7.3.1 Where it has been agreed to determine the chemical composition by product analysis, at least one test piece per cast shall be tested.

7.3.2 Unless otherwise agreed, the mechanical properties (cf. table 3) shall be determined for one test piece taken from a test unit (cf. subclause 7.2) having a mass of 10 t. It is preferable to determine hardness, but where such is not possible, a tensile test shall be carried out.

7.3.3 Where it has been agreed to determine the austenitic grain size, one test piece per cast shall be tested.

7.4 Sampling and sample preparation

7.4.1 The method of sampling specified in EURONORM 18 shall be used.

7.4.2 In the case of coils, the zone from which samples are taken shall be located not less than 300 mm from the beginning or end of the coil. In cases of dispute, the distance shall be not less than 1000 mm.

7.4.3 The product analysis shall be carried out using chips taken uniformly from the cross section of the product.

Where analysis is carried out by spectrometry, the surface of the product may be tested, in which case several analyses shall be made in different areas, and the mean from the results calculated.

7.4.4 Tensile test pieces shall be taken along the fibre, at the location illustrated in figure 1, which shall also be complied with for test pieces used for hardness testing. In addition, the specifications given in DIN EN 10 002 Part 1, DIN EN 10 004 Part 1 (at present at the stage of draft) and DIN 50 351 shall be complied with.

7.4.5 DIN 50 601 shall apply for sampling and sample preparation in the determination of austenitic grain size. Unless otherwise specified, the method of test shall be at the manufacturer's discretion.

7.4.6 Microscopic examination of the surface condition shall be carried out on microsections (cf. subclause 7.5.5).

7.5 Test procedure

7.5.1 The chemical composition shall be determined using a method specified in the *Handbuch für das Eisenhüttenlaboratorium* (Handbook for the ferrous metallurgy laboratory)

and developed by the Chemist's Commitee of the *Verein Deutscher Eisenhüttenleute* (Society of German Ferrous Metallurgy Engineers).

7.5.2 Tensile testing shall be carried out at ambient temperature as described in DIN EN 10 002 Part 1, and at elevated temperature, in DIN EN 10 002 Part 5.

7.5.3 Rockwell C hardness testing shall be carried out as described in DIN EN 10 004 Part 1, and Brinell hardness testing, in DIN 50 351.

7.5.4 The austenitic grain size shall be determined in accordance with DIN 50 601.

7.5.5 The depth of surface imperfections shall be determined on a microsection, using a metallographic method. Where such is not possible, the material shall be filed until the depth of imperfection can be determined with sufficient accuracy.

7.6 Retests

The specifications given in DIN EN 10 021 (at present at the stage of draft) shall apply with regard to retests.

8 Marking

Each wire coil or bundle of steel bars shall bear a label which is durably attached and which includes the manufacturer's mark, the material designation, the cast number and the size. Where products are stored outdoors, particular care shall be taken when marking to ensure that the label is still legible after prolonged periods. Marking which indicates the surface condition shall be the subject of agreement.

In the case of bars with a diameter of 30 mm or more, or of those of equal cross section, the end face of one bar per bundle shall also be painted white and then engraved, stamped or labelled with the manufacturer's mark, the material designation and the cast number. Other sizes of bars shall bear a label marked with this information.

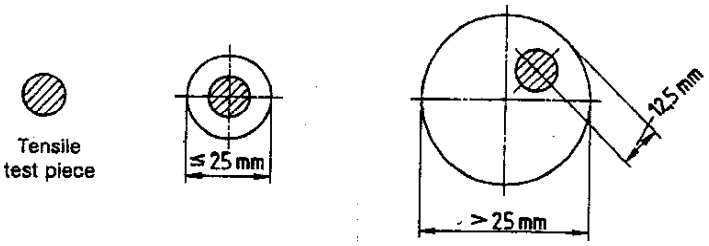

Figure 1. Location and orientation of tensile test pieces taken from bars

Table 1. **Steel grades and their chemical composition as determined by ladle analysis**

Material designation	number	Percentage by mass C	Si	Mn	P max.	S max.	Cr	Mo	Ni	Others
Martensitic steel										
X 45 CrSi 9 3	1.4718	0,40 to 0,50	2,7 to 3,3	max. 0,80	0,040	0,030	8,0 to 10,0			
X 85 CrMoV 18 2	1.4748	0,80 to 0,90	max. 1,0	max. 1,5	0,040	0,030	16,5 to 18,5	2,0 to 2,5	max. 0,60	0,30 to 0,60 V
Austenitic steel										
X 45 CrNiW 18 9	1.4873	0,40 to 0,50	2,0 to 3,0	0,80 to 1,5	0,045	0,030	17,0 to 19,0		8,0 to 10,0	0,80 to 1,20 W
X 55 CrMnNiN 20 8	1.4875	0,50 to 0,60	max. 0,25	7,0 to 10,0	0,050	0,030	19,5 to 21,5		1,5 to 2,75	0,20 to 0,40 N
X 53 CrMnNiN 21 9	1.4871	0,48 to 0,58	max. 0,25	8,0 to 10,0	0,050	0,030	20,0 to 22,0		3,25 to 4,5	0,35 to 0,50 N
X 50 CrMnNiNbN 21 9	1.4882	0,45 to 0,55	max. 0,45	8,0 to 10,0	0,050	0,030	20,0 to 22,0		3,5 to 5,5	0,80 to 1,50 W 1,80 to 2,50 Nb + Ta
X 60 CrMnMoVNbN 21 10	1.4785	0,57 to 0,65	max. 0,25	9,5 to 11,5	0,050	0,0250	20,0 to 22,0	0,75 to 1,25	max. 1,50	0,40 to 0,60 N 0,75 to 1,00 V 1,00 to 1,20 Nb
NiFe 25 Cr 20 NbTi	2.4955	max. 0,10	max. 1,0	max. 1,0	0,030	0,015	18,0 to 21,0		Remainder	0,40 to 0,60 N 0,30 to 1,00 Al 23,0 to 28,0 Fe 1,0 to 2,0 Nb + Ta 1,0 to 2,0 Ti
NiCr 20 TiAl	2.4952	0,04 to 0,10	max. 1,0	max. 1,0	0,020	0,015	18,0 to 21,0		min. 65	max. 0,008 B max. 1,5 Fe [1] max. 0,2 Cu max. 2,0 Co max. 0,008 B 1,0 to 1,8 Al 1,8 to 2,7 Ti

[1] A maximum iron content of 3,0 % by mass may be agreed at the time of ordering.

Table 2. **Amounts by which the chemical composition as determined by product analysis may deviate from the limiting values specified for ladle analysis**

Element	Limiting values as determined by ladle analysis, as in table 1, as a percentage by mass	Limit deviation for product analysis [1] [2], as a percentage by mass
C	< 0,60	± 0,02
	≥ 0,60 ≤ 0,90	± 0,03
Si	≤ 1,0	+ 0,05
	> 1,0 ≤ 3,3	± 0,10
Mn	< 1,0	+ 0,03
	≥ 1,0 ≤ 2,0	± 0,04
	> 2,0 ≤ 10,0	± 0,06
	> 10,0 ≤ 11,5	± 0,10
P	≤ 0,040	+ 0,005
	> 0,040 ≤ 0,050	+ 0,010
S	≤ 0,030	+ 0,005
N	≥ 0,20 ≤ 0,60	± 0,02
Cr	≥ 8,0 ≤ 10,0	± 0,10
	> 10,0 ≤ 15,0	± 0,15
	> 15,0 ≤ 20,0	± 0,20
	> 20,0 ≤ 22,0	± 0,25
Mo	≥ 0,75 < 1,75	± 0,05
	≥ 1,75 ≤ 2,5	± 0,10
Ni	< 5,0	± 0,07
	≥ 5,0 ≤ 10,0	± 0,10
Nb (+ Ta)	≥ 1,0 ≤ 2,5	± 0,05
V	≥ 0,30 ≤ 1,0	± 0,03
W	≥ 0,80 ≤ 1,50	± 0,05

[1] In the case of NiCr 20 TiAl (material number 2.4952) and NiFe 25 Cr 20 NbTi (material number 2.4955), the limit deviations may, if necessary, be agreed at the time of ordering.

[2] If a number of product analyses are to be carried out, the deviations shown by an element within one cast shall lie either only above the upper limit or below the lower limit of the range specified for the ladle analysis, but not both at the same time.

Table 3. **Mechanical properties as a function of heat treatment condition**

Material designation	Material number	Heat treatment condition	Hardness, in HB[1]	Tensile strength[1] in N/mm²
Martensitic steel				
X 45 CrSi 9 3	1.4718	Softened (G)	Max. 300	–
		Quenched and tempered (V)	Cf. table B.1.	
X 85 CrMoV 18 2	1.4748	Softened (G)	Max. 300	–
Austenitic steel				
X 45 CrNiW 18 9	1.4873	Cooled [2]	About 385	About 1300
		Quenched at 1000 to 1050 °C [3]	Max. 385	Max. 1300
X 55 CrMnNiN 20 8	1.4875	Cooled [2]	About 385	About 1300
		Quenched at 1000 to 1100 °C [3]	Max. 385	Max. 1300
X 53 CrMnNiN 21 9	1.4871	Cooled [2]	About 385	About 1300
		Quenched at 1000 to 1100 °C [3]	Max. 385	Max. 1300
X 50 CrMnNiNbN 21 9	1.4882	Cooled [2]	About 385	About 1300
		Quenched at 1000 to 1100 °C [3]	Max. 385	Max. 1300
X 60 CrMnMoVNbN 21 10	1.4785	Cooled [2]	About 385	About 1300
		Quenched at 1000 to 1100 °C [3]	Max. 385	Max. 1300
NiFe 25 Cr 20 NbTi	2.4955	Quenched at 930 to 1030 °C [3]	Max. 295	Max. 1000
NiCr 20 TiAl	2.4952	Quenched at 930 to 1030 °C [3]	Max. 325	Max. 1100

[1] In cases of doubt regarding austenitic steel, the tensile strength shall be deemed the relevant parameter.
[2] This heat treatment condition is suitable for processing by hot extrusion.
[3] This heat treatment condition is suitable for processing by upsetting with electric resistance heating.

Appendix A

Relevant dimensional standards

DIN	175	Polished steel rounds; dimensions and tolerances in accordance with ISO tolerance h9
DIN	688	Bright steel rounds; dimensions and tolerances in accordance with ISO tolerance h11
DIN	671	Bright steel rounds; dimensions and tolerances in accordance with ISO tolerance h9
DIN	1013 Part 1	Hot rolled round steel for general applications; dimensions and tolerances
DIN	1013 Part 2	Hot rolled round steel for special applications; dimensions and tolerances
DIN	59 115	Steel rod for bolts, nuts and rivets; dimensions and tolerances
DIN	59 130	Hot rolled round steel for bolts and rivets; dimensions and tolerances

Appendix B

Additional information

B.1 Mechanical properties

Guideline values for the reference heat treatment condition are given in table B.1, those for the 0,2 % proof stress and tensile strength at elevated temperature, in table B.2 and B.3, and those for the rupture strength after 1000 h, in table B.4.

Where determination of mechanical properties (cf. table B.1) has been agreed, the heat treatment specified in table B.5 shall be carried out before testing begins. The specifications given in subclauses 7.2, 7.3.2, 7.4.1, 7.4.2, 7.4.4, 7.5.2 and 7.5.3 shall also be complied with.

B.2 Physical properties

Guideline values for the physical properties of the materials covered here are given in table B.6.

B.3 Processing and subsequent heat treatment

B.3.1 Forming and heat treatment

All materials covered here are suitable for hot forming. It becomes more difficult to hot-form materials as their alloy content increases (due to lower flowability), and particular care must be taken so that the cross-sectional area does not become smaller. During warming, due consideration shall be given to the low thermal conductivity of the material, which can lead to stresses in or cracking of the material if done too fast.

Guideline temperatures for hot forming and heat treatment are given in table B.5.

B.3.2 Machining

It is possible but difficult to machine austenitic steel, owing to its high strength and thoughness and to its being cold strain hardened. Grinding shall be carried out so as to preclude the formation of cracks.

Table B.1. **Guideline values for mechanical properties, at ambient temperature, of products up to 40 mm in diameter, supplied in the reference heat treatment conditions as defined in table B.5**

Material designation	Material number	Heat treatment condition	Hardness HB	Hardness HRC [1]	0,2 % proof stress [1], in N/mm²	Tensile strength, in N/mm²	Min. elongation at fracture, ($L_0 = 5d_0$), as a percentage [1]	Reduction in area after fracture [1], as a percentage
Martensitic steel								
X 45 CrSi 9 3	**1.4718**	Quenched and tempered [2]	266 to 325	–	700	900 to 1100	14	40
X 85 CrMoV 18 2	**1.4748**	Quenched and tempered	296 to 355	–	800	1000 to 1200	7	12
Austenitic steel								
X 45 CrNiW 18 9	**1.4873**	Solution heat treated	–	–	380	800 to 1000	25	35
X 55 CrMnNiN 20 8	**1.4875**	Aged	–	28 [3]	550	900 to 1150	8	10
X 53 CrMnNiN 21 9	**1.4871**	Aged	–	30 [3]	580	950 to 1200	8	10
X 50 CrMnNiNbN 21 9	**1.4882**	Aged	–	30 [3]	580	950 to 1150	12	15
X 60 CrMnMoVNbN 21 10	**1.4785**	Aged	–	35 [3]	800	1000 to 1250	8	10
NiFe 25 Cr 20 NbTi	**2.4955**	Aged	–	28	500	900 to 1100	25	30
NiCr 20 TiAl	**2.4952**	Aged	–	32	725 [4]	1100 to 1400 [4]	15	25

[1] The values specified approach the lower limit of the scatterband.

[2] May also be an as delivered condition, in which case compliance with the values specified is mandatory.

[3] When grades X 55 CrMnNiN 20 8 to X 60 CrMnMoVNbN 21 10 are tested for hardness, the values obtained may not be suitable, using common conversion tables, for conversion to tensile strength values. For this reason, the tensile strength shall be deemed the relevant parameter.

[4] These values are higher than those specified in DIN 17 240 for the same material, since lower solution heat treatment temperatures and shorter holding times are necessary for the manufacture of valves, as compared to screws.

Table B.2. **Guideline values for tensile strength at elevated temperature** [1])

Material designation	number	Heat treatment condition	Tensile strength, in N/mm², at a temperature, in °C, of 500	550	600	650	700	750	800
Martensitic steel									
X 45 CrSi 9 3	**1.4718**	Quenched and tempered	500	360	250	170	110	–	–
X 85 CrMoV 18 2	**1.4748**	Quenched and tempered	550	400	300	230	180	140	–
Austenitic steel									
X 45 CrNiW 18 9	**1.4873**	Solution heat treated	600	550	500	410	350	270	180
X 55 CrMnNiN 20 8	**1.4875**	Aged	640	590	540	490	440	360	290
X 53 CrMnNiN 21 9	**1.4871**	Aged	650	600	550	500	450	370	300
X 50 CrMnNiNbN 21 9	**1.4882**	Aged	680	650	610	550	480	410	340
X 60 CrMnMoVNbN 21 10	**1.4785**	Aged	800	780	750	680	600	500	400
NiFe 25 Cr 20 NbTi	**2.4955**	Aged	800	800	790	740	640	500	340
NiCr 20 TiAl	**2.4952**	Aged	1050	1030	1000	930	820	680	500

[1]) The values specified approach the lower limit of the scatterband.

Table B.3. **Guideline values for 0,2% proof stress at elevated temperature** [1])

Material designation	number	Heat treatment condition	0,2 % proof stress, in N/mm², at a temperature, in °C, of 500	550	600	650	700	750	800
Martensitic steel									
X 45 CrSi 9 3	**1.4718**	Quenched and tempered	400	300	240	120	80	–	–
X 85 CrMoV 18 2	**1.4748**	Quenched and tempered	500	370	280	170	120	80	–
Austenitic steel									
X 45 CrNiW 18 9	**1.4873**	Solution heat treated	250	230	210	190	170	140	100
X 55 CrMnNiN 20 8	**1.4875**	Aged	300	280	250	230	220	200	170
X 53 CrMnNiN 21 9	**1.4871**	Aged	350	330	300	270	250	230	200
X 50 CrMnNiNbN 21 9	**1.4882**	Aged	350	330	310	285	260	240	220
X 60 CrMnMoVNbN 21 10	**1.4785**	Aged	500	480	450	430	400	380	350
NiFe 25 Cr 20 NbTi	**2.4955**	Aged	450	450	450	450	430	380	250
NiCr 20 TiAl[2])	**2.4952**[2])	Aged	700	650	650	600	600	500	450

[1]) The values specified approach the lower limit of the scatterband.

[2]) These values are higher than those specified in DIN 17 240 for the same material, since lower solution heat treatment temperatures and shorter holding times are necessary for the manufacture of valves, as compared to screws.

Table B.4. **Guideline values for rupture strength after 1000 h** (mean values from scatterbands established to date)

Material		Rupture strength after 1000 h, in N/mm², at a temperature, in °C, of			
designation	number	500	650	725	800
Martensitic steel					
X 45 CrSi 9 3	1.4718	190	40	–	–
X 85 CrMoV 18 2	1.4748	260	52	18	–
Austenitic steel					
X 45 CrNiW 18 9	1.4873	–	110	55	22
X 55 CrMnNiN 20 8	1.4875	–	160	85	45
X 53 CrMnNiN 21 9	1.4871	–	200	110	50
X 50 CrMnNiNbN 21 9	1.4882	–	220	120	55
X 60 CrMnMoVNbN 21 10	1.4785	–	240	120	55
NiFe 25 Cr 20 NbTi	2.4955	–	400	180	60
NiCr 20 TiAl	2.4952	–	500	290	150

Table B.5. **Guideline temperatures (given in °C) for hot forming and heat treatment**

Material designation	number	Hot forming	Softening	Quenching or solution heat treatment	Cooling media	Tempering or quench ageing
Martensitic steel						
X 45 CrSi 9 3	1.4718	1100 to 900	780 to 820/air or water	1000 to 1050	Oil	720 to 820/air or water
X 85 CrMoV 18 2	1.4748	1100 to 900	820 to 860/retarded cooling	1050 to 1080	Oil	700 to 800/air
Austenitic steel						
X 45 CrNiW 18 9	1.4873	1100 to 900	–	1000 to 1050	Water	–
X 55 CrMnNiN 20 8	1.4875	1100 to 950	–	1140 to 1180	Water	760 to 815/4 to 8 h in air
X 53 CrMnNiN 21 9	1.4871	1150 to 950	–	1140 to 1180	Water	760 to 815/4 to 8 h in air
X 50 CrMnNiNbN 21 9	1.4882	1150 to 950	–	1160 to 1200	Water	760 to 815/4 to 8 h in air
X 60 CrMnMoVNbN 21 10	1.4785	1150 to 950	–	1180 to 1200	Air	650 to 700/2 h in air
NiFe 25 Cr 20 NbTi	2.4955	1150 to 1050	–	1000 to 1080	Air	690 to 710/16 h in air
NiCr 20 TiAl	2.4952	1150 to 1050	–	1000 to 1080	Air and water	690 to 710/16 h in air

Table B.6. **Guideline values for physical properties**

Material designation	number	Density, in kg/dm³, at 20 °C	Modulus of elasticity, in kN/mm², at 20 °C	Coefficient of linear thermal expansion, in $10^{-6} \cdot K^{-1}$, at a temperature between 20 °C and 100 °C	300 °C	500 °C	700 °C	Thermal conductance, W in $\frac{W}{K \cdot m}$, at 20 °C	Heat capacity, J in $\frac{J}{kg \cdot K}$, at 20 °C	Magnetizable
Martensitic steel										
X 45 CrSi 9 3	1.4718	7,7	210	10,9	11,2	11,5	11,8	21	500	Yes
X 85 CrMoV 18 2	1.4748	7,7	210	10,9	11,2	11,5	11,8	21	500	Yes
Austenitic steel										
X 45 CrNiW 18 9	1.4873	7,9	205	15,5	17,5	18,2	18,6	14,5	500	No[1])
X 55 CrMnNiN 20 8	1.4875	7,8	205	15,5	17,5	18,5	18,8	14,5	500	No[1])
X 53 CrMnNiN 21 9	1.4871	7,8	205	15,5	17,5	18,5	18,8	14,5	500	No[1])
X 50 CrMnNiNbN 21 9	1.4882	7,8	205	15,5	17,5	18,5	18,8	14,5	500	No[1])
X 60 CrMnMoVNbN 21 10	1.4785	7,8	210	16,1	17,2	18,0	19,0	14,5	500	No[1])
NiFe 25 Cr 20 NbTi	2.4955	8,1	215	14,1	15,5	15,9	16,8	13,0	460	No
NiCr 20 TiAl	2.4952	8,3	215	11,9	13,1	13,7	14,5	13,0	460	No

[1]) Austenitic steel supplied in the aged condition is only sligthly magnetizable, but this property can be improved as cold forming proceeds.

Standards and other documents referred to

DIN 17 007 Part 2	Material numbers; main group 1: steel
DIN 17 007 Part 4	Material numbers; main groups 2 and 3: non-ferrous metals
DIN 17 240	High-temperature bolt and nut materials; quality requirements
DIN 50 049	Inspection documents for the delivery of metallic materials
DIN 50 351	Brinell hardness testing of metallic materials
DIN 50 601	Determination of grain size of ferrite or austenite in ferrous materials by metallographic methods
DIN EN 10 002 Part 1	Tensile testing of metallic materials; method of test at ambient temperature
DIN EN 10 002 Part 5	Tensile testing of metallic materials; method of test at elevated temperature
DIN EN 10 004 Part 1	(at present at the stage of draft) Hardness testing of metallic materials; Rockwell scales A, B, C, D, E, F, G, H and K
DIN EN 10 021	(at present at the stage of draft) General technical delivery conditions for steel and steel products
ISO/DIS 683-15 : 1991	Heat-treatable steels, alloy steels and free-cutting steels; valve steels for internal combustion engines
EURONORM 18-79	Selection and preparation of samples and test pieces for steel and iron and steel products
EURONORM 90-71	Steels for exhaust valves for internal combustion engines

DIN-Normenheft 3 *Kurznamen und Werkstoffnummern der Eisenwerkstoffe in DIN-Normen und Stahl-Eisen-Werkstoffblättern* (Ferrous material designations and numbers as used in DIN Standards and Steel and iron materials sheets)

Handbuch für das Eisenhüttenlaboratorium [1])

Cf. Appendix A for other relevant standards.

Previous edition

DIN 17 480: 09.84.

Amendments

The following amendments have been made to the September 1984 edition.

a) Specifications are no longer made for steel identified by material designation X 40 CrSiMo 10 2 (1.4731) (cf. Explanatory notes).

b) Some of the values specified for the chemical composition of grades X 55 CrMnNiN 20 8 (1.4875), X 53 CrMnNiN 21 9 (1.4871), X 50 CrMnNiNbN 21 9 (1.4882), and NiCr 20 TiAl (2.4952) have been changed.

c) The values specified in Appendix B for the mechanical properties of grade NiCr 20 TiAl (2.4952) have been changed (cf. Explanatory notes).

d) Values for the properties covered in tables B.2 and B.3 are no longer specified for 850 °C.

e) Some of the values specified in table B.3 for grade X 50 CrMnNiNbN 21 9 (1.4882) have been changed.

f) Some of the guideline values specified in tables B.5 and B.6 have been changed.

g) Clause 3, subclause 5.2 and 6.3.3 and table 2 have been editorially revised.

Explanatory notes

Revision of the September 1984 edition of this standard was based on the discovery that the guideline values specified for the 0,2 % proof stress and tensile strength of NiCr 20 TiAl (2.4952) were too high.

The guideline values specified here for 0,2 % proof stress at ambient temperature are higher than the values specified in DIN 17 240, since lower solution heat treatment temperatures and shorter holding times are necessary for valve manufacture, as compared to bolt manufacture.

The steel grade X 40 CrSiMo 10 2 (1.4731) is rarely ordered because it can be used in only a few cases, and it has been deleted from this edition.

The material designations and numbers used here are largely in agreement with those specified in ISO/DIS 683-15 and in EURONORM 90. The table on the following page illustrates the comparison of the material designations and numbers used in these three standards.

Note that the values specified here for certain materials have been taken from ISO/DIS 683-15, insofar as those materials are covered in the latter.

[1]) Obtainable from *Verlag Stahleisen mbH*, Postfach 10 51 45, D-4000 Düsseldorf 1.

Comparison of similar valve materials as specified in this standard, ISO/DIS 683-15 : 1991 and EURONORM 90-71.

DIN 17 480		EURONORM 90-71		ISO/DIS 683-15 : 1991	
Material designation	Material number	Material designation	1)	Material designation	1)
–	–	–		X 50 CrSi 8 2	
X 45 CrSi 9 3	1.4718	X 45 CrSi 8	○	X 45 CrSi 9 3	×
–	–	X 40 CrSiMo 10		–	
X 85 CrMoV 18 2	1.4748	–		X 85 CrMoV 18 2	×
–	–	X 80 CrSiNi 20		–	
–	–	X 42 CrNiW 14 14		–	
X 45 CrNiW 18 9	1.4873	X 45 CrNiW 18 9	●	–	
X 55 CrMnNiN 20 8	1.4875	–		X 55 CrMnNiN 20 8	×
X 53 CrMnNiN 21 9	1.4871	X 53 CrMnNiN 21 9	○	X 53 CrMnNiN 21 9	×
–	–	X 53 CrMnNiNS 21 9		–	
X 50 CrMnNiNbN 21 9	1.4882	–		X 50 CrMnNiNbN 21 9	×
–	–	–		X 53 CrMnNiNbN 21 9	
X 60 CrMnMoVNbN 21 10	1.4785	–		–	
–	–	X 12 CrCoNiMoWNb 21 20 20		–	
–	–	–		X 33 CrNiMnN 23 8	
–	–	–		NiCr 15 Fe 7 TiAl	
NiFe 25 Cr 20 NbTi	2.4955	–		NiFe 25 Cr20NbTi	×
NiCr 20 TiAl	2.4952	–		NiCr 20 TiAl	×

1) The symbols indicate the degree of conformance of the chemical composition of the materials covered here, as compared with EURONORM 90-71 and ISO/DIS 683-15 : 1991, as follows: × = identical; ● = sligthly different; ○ = substantially different.

International Patent Classification

B 21 K 1/20
B 21 K 1/22
C 22 C 38/08
C 22 C 38/18
F 16 K 1/38
F 01 L 3/02
G 01 N 33/20