UDC 669.14.018.298 : 620.1 November 1990

Bright steel made from case hardening steel

Technical delivery conditions

DIN 1652 Part 3

Blankstahl; technische Lieferbedingungen;
Blankstahl aus Einsatzstählen

This standard, together with DIN 1652 Parts 1, 2 and 4, November 1990 editions, supersedes DIN 1652, May 1963 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 International Standard ISO 683-18 : 1976, published by the International Organization for Standardization.

The symbol ● denotes items which shall, the symbol ●● denoting items which may, be agreed upon at the time of ordering.

1 Field of application

This standard specifies requirements for bright steel made from case hardening steel covered in DIN 17 210. Other requirements with which bright steel is expected to comply are specified in DIN 1652 Part 1.

2 Concepts

See DIN 1652 Part 1 for concepts.

3 Product forms, dimensions and tolerances

Product forms, dimensions and tolerances shall be as specified in DIN 1652 Part 1.

4 Mass

Cf. DIN 1652 Part 1.

5 Designation

See tables 1 to 3 for material designations and numbers, and heat treatment conditions.

The standard designation of steel covered in this standard shall include the following items:

a) the term 'steel';
b) the DIN number;
c) the material designation or number;
d) the symbol denoting degree of hardenability (hardenability band), where applicable;
e) the code letter denoting heat treatment condition.

Examples:

Steel DIN 1652 – 16 MnCr 5 HH K + BG
Steel DIN 1652 – 1.7131 HH K + BG

6 Steel grades

The steel grades covered in this standard are given in subclause 6.1 of the September 1986 edition of DIN 17 210.

7 Requirements

7.1 Manufacturing process

The steelmaking process, the casting process and the process of shaping the product shall be at the manufacturer's discretion.

●● In special cases, these processes may be the subject of agreement at the time of ordering.

7.2 Heat treatment condition

The steel shall be supplied in one of the heat treatment conditions specified in table 1, further requirements being specified in DIN 1652 Part 1.

7.3 Separation by cast

Products belonging to one consignment shall be separated by cast.

7.4 Chemical composition

7.4.1 Chemical composition, as determined by ladle analysis, shall be in compliance with table 2 of DIN 17 210.

7.4.2 The amounts by which the chemical composition in the product analysis may deviate from the limiting values specified for the ladle analysis (cf. table 2 of DIN 17 210) shall be as specified in table 3 of DIN 17 210.

7.5. Mechanical properties

7.5.1 ●● Table 1 gives a summary of the requirements regarding chemical composition and mechanical properties, as a function of the heat treatment condition, with which the steel is expected to comply.

Actual values and guideline values for mechanical properties and hardness are specified in table 2, those for hardenability of stainless steel being specified in table 4 of DIN 17 210.

Continued on pages 2 to 6

7.5.2 ●● Narrower hardenability bands corresponding to figures 1a and 1c to 1i and footnote 1 to table 4 of DIN 17 210 may be agreed at the time of ordering, except for steel grades 20 Cr 4 and 20 CrS 4. Where a narrower hardenability band with respect to the upper or lower limiting curve is required, the letters HH or HL shall be appended to the material designation or number when ordering.

7.6 Other properties

7.6.1 Weldability

Cf. subclause 7.4.1 of DIN 17 210.

7.6.2 Shearability

Under suitable conditions, all steel grades and product sizes specified in this standard are shearable, with the exception of 17 CrNiMo 6 steel products up to 16 mm thick, in the cold drawn condition (K).

7.6.3 Machinability

Where improved machinablity is required, consideration should be given to those steels for which a minimum sulfur content is specified.

A well-developed ferrite/pearlite structure is required for heat treatment conditions K + BG, SH + BG and BG + K. Small amounts of bainite may be present in nickel alloy steels.

7.7 Surface condition

The surface condition shall be as specified in subclause 7.7 of DIN 1652 Part 1.

7.8 ●● Grain size

The grain size shall be as specified in subclause 7.5 of DIN 17 210.

7.9 ●● Non-metallic inclusions

See subclause 7.6 and table 6 of DIN 17 210 for requirements regarding non-metallic inclusions.

7.10 ●● Soundness

See subclause 7.7 of DIN 17 210 for requirements regarding soundness.

8 Testing

Testing shall be as specified in DIN 1652 Part 1.

8.1 ●● Tests and inspection documents

The tests to be carried out and the inspection documents to be issued shall be as specified in DIN 1652 Part 1.

8.2 Items to be included in inspection documents

8.2.1 ●● Inspection documents issued by the manufacturer's works

The inspection documents to be issued by the manufacturer's works shall be as specified in subclause 8.2 of DIN 17 210.

8.2.2 ●● Inspection documents issued by third-party inspectors

The inspection documents to be issued by independent inspectors shall be as specified in subclause 8.3 of DIN 17 210.

8.3 Scope of testing, sampling, sample preparation and test methods

8.3.1 Chemical composition, hardness and hardenability

Where the chemical composition, hardness and hardenability are to be tested, the test conditions specified in table 4 shall apply.

8.3.2 ●● Grain size

Grain size shall be tested in accordance with subclause 8.4.2 of DIN 17 210.

8.3.3 Non-metallic inclusions

Testing for non-metallic inclusions shall be performed in accordance with DIN 50 602.

8.3.4 ●● Soundness

Subclause 8.4.4 of DIN 17 210 shall apply for testing the soundness.

8.3.5 ●● Surface defects

Subclause 8.4.5 of DIN 17 210 shall apply for the check for surface defects.

8.3.6 ●● Visual examination and dimensional check

Subclause 8.4.6 of DIN 17 210 shall apply for the visual examination and dimensional check.

8.4 Retests

DIN 17 010 shall apply for retests.

9 Marking

Subclauses 9.1 to 9.3 of DIN 17 210 shall apply for the marking of steel in compliance with this standard.

10 Heat treatment

The temperatures for hardening in the end quench test shall be as specified in table 4 of DIN 17 210.

See table A.1 and figure A.1 of DIN 17 210 for guideline values for hardening temperatures and examples of common heat treatment sequences for case hardening.

11 Dispatch

The condition of the steel for dispatching purposes shall be as specified in DIN 1652 Part 1.

12 Complaints

DIN 1652 Part 1 shall apply for complaints.

Table 1. **Summary of requirements for chemical composition and mechanical properties, as a function of heat treatment condition**

	1		2	3		4		
No.	Heat treatment condition 1)		Symbol	Requirements Steel not subject to a requirement class 3.1	3.2	Steel subject to requirement class H*) 4.1	4.2	4.3
1	Cold drawn 2)		K	Chemical composition as in tables 2 and 3 of DIN 17 210.	Mechanical properties of unalloyed steel as in table 2, column 4; maximum tensile strength of alloy steel as in table 3, column 4.	As specified in columns 3.1 and 3.2.		Hardenability as in table 4 4) of DIN 17 210.
2	Untreated and peeled 3)		SH					
3	Cold drawn 2)	and stress relieved.	K + S		●● If necessary, the values (or guideline values) shall be agreed upon, based on the specifications given in tables 2 and 3.			
4	Peeled 3)		SH + S					
5	Cold drawn 2)	and softened.	K + G		Hardness as in table 2, column 5, or table 3, column 5.			
6	Peeled 3)		SH + G					
7	Cold drawn 2)	and treated to have a ferrite/pearlite structure.	K + BG		Hardness as in table 3, column 6.			
8	Peeled 3)		SH + BG					
9	Treated to have a ferrite/pearlite structure	and cold drawn 2).	BG + K		Hardness as in table 3, column 7.			

1) ●● Where a heat treatment condition other than one given above is required, this shall be stated at the time of ordering, the product form and all other requirements being subject to agreement.

2) Normally, rounds with a diameter exceeding 50 mm are only suitable for peeling.

3) Peeling is usually suitable where the diameter of the material is more than 16 mm, the supplier being permitted to rough turn the material instead.

4) With the exception of those values which are to be regarded as provisional.

*) H = steel subject to particular hardenability requirements.

Table 2. **Mechanical properties of bright unalloyed case hardening steel**

1	2	3		4			5
Steel grade		Thickness [1], in mm		Heat treatment condition			
				Cold drawn (K) [2]			Cold drawn and softened (K + G) [3]
				Minimum tensile strength, in N/mm²	Minimum upper yield strength, in N/mm²	Minimum elongation at fracture ($L_0 = 5d_0$), as a percentage	Peeled and softened (SH + G) [3] Maximum hardness, in HB
Material designation	Material number	From	To				
C 10 Ck 10	1.0301 1.1121		5	500	400	7	131
		5	10	480	365	8	
		10	16	450	300	9	
		16	25	420	270	10	
		25	40	380	240	11	
		40	100	340	180	12	
		100	160	Subject to agreement.			
C 15 Ck 15 Cm 15	1.0401 1.1141 1.1140		5	540	440	6	143
		5	10	500	385	7	
		10	16	480	340	8	
		16	25	450	300	9	
		25	40	420	250	10	
		40	100	370	200	12	
		100	160	Subject to agreement.			

1) Cf. subclause 2.3 of DIN 1652 Part 1.
2) In the case of flats and of steel drawn more than once, the values specified are guideline values, deviations of ±10 % being likely. No specifications can be made for products having a cross section other than those covered here.
3) The heat treatment condition 'annealed for spheroidal carbides' (GKZ) is dealt with in DIN 1654 Part 3.

Table 3. **Mechanical properties of bright alloy case hardening steel**

1	2	3		4	5	6	7
Steel grade		Thickness [1], in mm		Hardness, in HB, for heat treatment condition			
				Cold drawn (K) [2]	Cold drawn or peeled and softened (K + G or SH + G) [3], [4]	Cold drawn or peeled and treated to have a ferrite/pearlite structure (K + BG or SH + BG) [4], [5]	Treated to have a ferrite/pearlite structure and drawn (BG + K) [6]
Material designation	number	From	To	Maximum tensile strength, R_m, in N/mm²	Not exceeding		
17 Cr 3	**1.7016**	16 40	16 40 80 [7]	750 720 670	174	–	–
20 Cr 4 **20 CrS 4**	**1.7027** **1.7028**	16 40	16 40 80 [7]	820 800 750	197	145 to 192	145 to 292
16 MnCr 5 **16 MnCrS 5**	**1.7131** **1.7139**	16 40	16 40 80 [7]	820 780 720	207	140 to 187	140 to 287
20 MnCr 5 **20 MnCrS 5**	**1.7147** **1.7149**	16 40	16 40 80 [7]	850 830 780	217	152 to 201	152 to 301
20 MoCr 4 **20 MoCrS 4**	**1.7321** **1.7323**	16 40	16 40 80 [7]	800 780 720	207	140 to 187	140 to 287
22 CrMoS 3 5	**1.7333**	16 40	16 40 80 [7]	850 830 780	217	152 to 201	152 to 301
21 NiCrMo 2 **21 NiCrMoS 2**	**1.6523** **1.6526**	16 40	16 40 80 [7]	820 800 750	197	145 to 192	145 to 292
15 CrNi 6	**1.5919**	16 40	16 40 80 [7]	850 830 780	217	152 to 201	152 to 301
17 CrNiMo 6	**1.6587**	16 40	16 40 80 [7]	900 870 820	229	159 to 207	159 to 307

[1] Cf. subclause 2.3 of DIN 1652 Part 1.
[2] Heat treatment prior to cold drawing at manufacturer's discretion.
[3] The heat treatment condition 'annealed for spheroidal carbides' (GKZ) is dealt with in DIN 1654 Part 3.
[4] The values specified in DIN 17 210 shall apply.
[5] For diameters up to about 60 mm.
[6] For diameters up to about 60 mm and a maximum degree of forging of 10 %.
[7] ●● The supply of products exceeding 80 mm in thickness shall be the subject of agreement.

Table 4. **Test conditions for verifying compliance with requirements[1])**

No.	Property	See table(s)	Test -unit	Number of test pieces per test unit	Number of tests per test piece	Sampling and sample preparation	Test method to be used
1	Chemical composition	2 and 3 of DIN 17 210.	Cf. DIN 17 210.				
2	Hardenability	4 of DIN 17 210.	Cf. DIN 17 210.				
3	Mechanical properties	2 and 3.	All products from the same cast, heat treatment batch, and of the same size.	1	1		Tensile testing shall be in accordance with DIN 50 145 (or with DIN 51 210 Part 1 where so required), on DIN 50 125 test pieces produced from the same semi-finished product, having undergone the same heat treatment. Where the yield point is not pronounced, the 0,2 % proof stress shall be determined.
4	Hardness in conditions G, BG and BG + K	2 and 3.	Cf. DIN 17 210.				

1) Verification is only necessary if one of the requirements specified in table 1, column 3 or 4, is to be satisfied, and the relevant test has been agreed.

Standards referred to

DIN 1652 Part 1 Bright steel; general technical delivery conditions
DIN 1654 Part 3 Cold-heading and cold extruded steel; technical delivery conditions
DIN 17 010 General technical delivery conditions for steel and steel products
DIN 17 210 Case hardening steel; technical delivery conditions
DIN 50 125 Test pieces for the tensile testing of metallic materials
DIN 50 145 Tensile testing of metallic materials
DIN 50 602 Microscopic examination of high-grade steel to determine the non-metallic inclusions content
DIN 51 210 Part 1 Tensile testing of wire without using an extensometer

Previous editions

DIN 1652: 08.44x, 05.63.

Amendments

In comparison with the May 1963 edition of DIN 1652, the following amendments have been made.

a) The standard has been divided into four Parts.
b) Cm 15 unalloyed steel and DIN 17 210 alloy steels have been included.
c) Rather than repeating relevant requirements, DIN 17 210 is referred to where such are specified therein.
d) The requirements for mechanical properties have been revised.
e) The scope of testing has been amended.

Explanatory notes

Cf. DIN 1652 Part 1.

International Patent Classification

C 21 D 1/68 G 01 N 3/00