UDC 669.14.018.29 : 620.1 November 1990

Bright steel made from structural steel

Technical delivery conditions

DIN 1652 Part 2

Blankstahl; technische Lieferbedingungen; allgemeine Baustähle

This standard, together with DIN 1652 Parts 1, 3 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.

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

Note. The requirements specified here are based on DIN 17 100, which has been superseded by DIN EN 10 025, January 1991 edition (also available in English). It can therefore be expected that a revised edition of the present standard will be published in the foreseeable future.

1 Field of application

This standard specifies requirements for bright steel made from general purpose structural steel covered in the January 1980 edition of DIN 17 100 *). 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 and 2 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 code letter denoting heat treatment condition.

Examples:

Steel DIN 1652 – ZSt 37-2 K

Steel DIN 1652 – 1.0159 K

Table 2 specifies steel grades designated with the code letter Z, which are suitable for drawing, and other steels which are worked by peeling. The material designation or number shall be used for ordering purposes, it being permissible to omit the letter Z from the order in the case of drawn steel (cf. footnote 5 to table 2).

*) Superseded by DIN EN 10 025.

6 Steel grades

The steel grades covered in this standard are given in table 2.

7 Requirements

7.1 Manufacturing process

The method of deoxidation to be used shall be taken from table 1 of DIN 17 100 *).

●● It shall be the manufacturer's responsibility to select the method of deoxidation for ZSt 37-2 and St 37-2 steels and, unless otherwise agreed, he need not inform the purchaser of the method selected.

Cf. DIN 1652 Part 1 for further requirements.

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

Steels belonging to quality group 3 shall be supplied separately by cast.

●● It may be agreed that steels belonging to quality group 2 be supplied separately by cast.

7.4 Chemical composition

Chemical composition, as determined by product and ladle analysis, shall be in compliance with table 1 of DIN 17 100 *). The maximum percentage by mass of any elements not specified in that standard shall be taken from table 1 of the August 1989 edition of DIN EN 10 020 (except for ZSt 50-2, St 50-2, ZSt 60-2, St 60-2, ZSt 70-2 and St 70-2 steels).

Continued on pages 2 to 7

7.5 Mechanical properties

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. The actual values for tensile strength and other properties are specified in table 2, those for impact energy being specified in table 2 of DIN 17 100*).

No particular requirements need be met regarding hardenability.

7.6 Other properties

7.6.1 Weldability

Where steel supplied in the cold drawn condition is to be welded, particular care shall be taken so that the material does not weaken or become brittle.

7.6.1.1 The steels specified here may not be suitable for all welding operations, as the behaviour of steel during and after welding changes as a function of the material, form and size of the component, and of the manufacturing and service conditions.1).

7.6.1.2 Steel belonging to quality group 2 or 3, and steels up to grade St 52-3 (i.e. those with a maximum carbon content of 0,22 % as determined by ladle analysis), are generally suitable for manual arc welding and gas welding. Where the elongation at fracture is the same, steels belonging to group 3 are preferable to those of group 2, and within group 2, those which have been killed are preferable to those which have not, particularly where segregated zones could be affected by welding.

ZSt 50-2, St 50-2, ZSt 60-2, St 60-2, ZSt 70-2 and St 70-2 steels are not suitable for manual arc welding or gas welding.

7.6.1.3 All steels covered in this standard are generally suitable for flash welding and gas pressure welding. In the case of steels with a high carbon content (e.g. ZSt 50-2, St 50-2, ZSt 60-2, St 60-2, ZSt 70-2 and St 70-2 steels), partial reheating or subsequent heat treatment may be necessary after welding.

7.6.1.4 Only steels in compliance with the specifications of table 1 of DIN 17 100*), and having a maximum carbon content of 0,22 % in the ladle analysis, may be deemed suitable for pressure welding other than gas pressure welding. The silicon content of the steel also affects its suitability for this welding process.

Depending on the carbon content, partial reheating or subsequent heat treatment may be necessary after welding.

7.7 Surface condition

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

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.

1) Cf. DIN 8528 Parts 1 and 2, *DASt-Richtlinie* (DASt Code of practice) 099, and the *Katalog zur Wahl der Stahlgütegruppen für geschweißte Stahlbauten* (Catalogue for selecting steel quality groups for welded steel structures).

For *), see page 1.

8.2 Items to be included in inspection documents

Subject to agreement, where products are to be supplied separately by cast (cf. subclause 7.3), the manufacturer shall issue a test report stating the chemical composition as determined by ladle analysis. As a departure from this requirement, in the case of ZSt 37-2 and St 37-2 steels (where the method of deoxidation is up to the manufacturer), the test report shall state only the proportion by mass of carbon, phosphorus, sulfur and nitrogen.

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

8.3.1 Where it has been agreed to issue a test report covering a consignment, a tensile test (cf. subclause 8.3.4) shall be carried out.

●● It may be agreed to perform the following:

a) notched bar impact test (not applicable to ZSt 50-2, St 50-2, ZSt 60-2, St 60-2, ZSt 70-2 and St 70-2 steels);

b) product analysis (not applicable to ZSt 37-2 and St 37-2 steels), where the products are to be supplied separately by cast (cf. subclause 7.3).

8.3.1.1 For the purposes of product analysis, the cast shall be regarded as the test unit.

●● One test piece per cast shall be taken for the product analysis, unless otherwise agreed.

8.3.1.2 For tensile and impact testing, the number of test pieces (cf. subclause 8.3.1.2.2) is a function of whether the material is supplied in batches or by cast. Steel belonging to quality group 2 shall be supplied either in batches or by cast, those belonging to quality group 3, by cast only.

● It shall be agreed at the time of ordering whether steel belonging to quality group 2 is to be supplied in batches or by cast. Where it is ordered by batch, testing by cast shall nonetheless be permitted, provided the material is submitted for testing by cast.

8.3.1.2.1 The mass of a test unit shall be at most 40 t where steel is tested by cast and at most 20 t where it is tested by batch.

8.3.1.2.2 From each test unit and thickness range (cf. table 2), one test piece for the tensile test and, where impact testing has been agreed, one sample large enough to produce six test pieces, shall be taken.

●● Unless otherwise agreed, the test pieces shall be taken from a product of average thickness.

8.3.1.2.3 For impact testing, three test pieces shall be taken from the sample (cf. subclause 8.3.1.2.2). Where the results obtained comply with the specifications given in table 2 of DIN 17 100*), further testing need not be performed.

8.3.1.2.4 For tensile testing of products up to 25 mm in thickness, the test piece shall be taken in such a way that it will not require extensive machining for testing pruposes. For products from 25 mm up to 40 mm in thickness, the test pieces shall be taken from any zone of the cross section. For products over 40 mm in thickness, test pieces in the form of bars shall be taken so that their longitudinal axis is located at a point corresponding to one-third of either the radius (rounds) or half the material width (bars, etc.) (see the figures in the table in appendix A of DIN EN 10 025).

8.3.1.2.5 The zones from which impact test pieces are to be taken shall be those specified in subclause 8.3.1.2.4. One side of the test pieces shall be as close as possible to the surface that was rolled during production, with the notch at right angles to this surface.

01-12-11;10:50AM;

8.3.2 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 Chemists Committee of the *Verein Deutscher Eisenhüttenleute* (Society of German Ferrous Metallurgy Engineers).

8.3.3 Testing of mechanical properties shall be carried out at ambient temperature (about 20 °C), except where a lower temperature has been specified for impact testing.

8.3.4 DIN 50 125 test pieces, which have been produced from the same semi-finished product and undergone the same heat treatment, shall normally be used for tensile testing in accordance with DIN 50 145. Where the diameter of test pieces is less than or equal to 6 mm, testing shall be carried out in accordance with DIN 51 210 Part 1. In cases of dispute or arbitration, such test pieces must be used.

The results of Brinell hardness testing as specified in DIN 50 351, on test pieces in the finally annealed condition, approximate those of tensile testing (cf. DIN 50 150 for conversion tables), but the latter shall apply for acceptance inspection purposes.

8.3.5 DIN 50 115 test pieces shall be used for notched bar impact testing.

8.4 Retests

DIN 17 010 shall apply for retests.

9 Marking

9.1 ●● Subject to agreement at the time of ordering, products may be marked in accordance with DIN 1599.

9.2 Where acceptance inspection has been agreed, marking shall include the test piece number and the inspector's mark.

9.3 ●● Any additional marking shall be the subject of agreement at the time of ordering.

10 ●● Heat treatment

Heat treatment as specified in table 1 may be agreed.

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	Chemical composition, as specified in	Tensile strength, as specified in table	Impact energy, as specified in
1	Cold drawn [1]	and untreated.	K	table 1 of DIN 17 100*).	2	–
2	Peeled [2]		SH		2	table 2 of DIN 17 100*).
3	Cold drawn [1]	and stress relieved.	K + S		● Mechanical properties shall be agreed at the time of ordering.	
4	Peeled [2]		SH + S			
5	Cold drawn [1]	and softened.	K + G		2	–
6	Peeled [2]		SH + G		2	–
7	Cold drawn [1]	and normalized.	K + N		2	table 2 of DIN 17 100*).
8	Peeld [2]		SH + N		2	

[1] Normally, rounds with a diameter exceeding 50 mm are only suitable for peeling.

[2] 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.

For *), see page 1.

Table 2. **Mechanical properties of bright steel made from general purpose structural steel, in the as delivered condition, tested at ambient temperature**

DIN 17100 steel Material		Thickness [1], in mm		Heat treatment condition										
				Cold drawn and untreated (K) [2]			Peeled and untreated (SH)			Cold drawn and softened (K + G) [2],[4] Peeled and softened (SH + G) [4]		Cold drawn and normalized (K + N) Peeled and normalized (SH + N)		
designation	number	From	To below	Tensile strength, in N/mm²	Min. upper yield strength, in N/mm²	Min. elongation at fracture ($L_0=5d_0$), as a percentage	Tensile strength [3], in N/mm²	Min. upper yield strength, in N/mm²	Min. elongation at fracture ($L_0=5d_0$), as a percentage	Maximum tensile strength, in N/mm²	Min. elongation at fracture ($L_0=5d_0$), as a percentage	Tensile strength, in N/mm²	Min. upper yield strength, in N/mm²	Min. elongation at fracture ($L_0=5d_0$), as a percentage
ZSt 37-2 [5]	1.0159		5	520 to 820	390	7	–	–	–	440	26	340 to 470	235	26
St 37-2	1.0037	5	10	470 to 770	355	8								
UZSt 37-2 [5]	1.0161	10	16	440 to 690	300	9								
USt 37-2	1.0036	16	25	440 to 690	285	10	340 to 470	225	24				225	
RZSt 37-2 [5]	1.0165	25	40	420 to 690	260	11				470	25			
RSt 37-2	1.0038	40	63	380 to 630	235	12		215	23				215	25
ZSt 37-3 [5]	1.0168	63	80	350 to 600	215	12			22					24
St 37-3	1.0116	80		Subject to agreement [6].										
ZSt 44-2 [5] St 44-2	1.0129 1.0044		5	590 to 890	470	6	–	–	–	500	22	410 to 560	275	
		5	10	580 to 840	420	7								
		10	16	530 to 820	380	8								
		16	25	510 to 790	330	9	410 to 540	265	20				265	
ZSt 44-3 [5] St 44-3	1.0153 1.0144	25	40	490 to 740	300	10				520	21			
		40	63	440 to 690	265	11		255	19				255	21
		63	80	420 to 670	245	11		245	18		20		245	20
		80		Subject to agreement [6].										

01-12-11;10:50AM; # 22/ 37

ZSt 52-3 [5] St 52-3	1.0597 1.0570		5	700 to 1000	600	5	–	–	–	600	21	490 to 630	355	22
		5	10	650 to 950	520	6								
		10	16	600 to 850	450	7								
		16	25	550 to 800	400	8	490 to 630	345	20					
		25	40	530 to 780	350	9				620	22		345	
		40	63	520 to 770	345	10		335	19		21		335	21
		63	80	500 to 750	325	10		325	18		20		325	20
		80		Subject to agreement [6].										
ZSt 50-2 [5] St 50-2	1.0533 1.0050		5	660 to 960	590	5	–	–	–	580	20	470 to 610	295	20
		5	10	620 to 920	510	6								
		10	16	580 to 830	420	7								
		16	25	550 to 800	390	8	470 to 610	285	18				285	
		25	40	540 to 790	335	9				600	19			
		40	63	500 to 760	300	10		275	17				275	19
		63	80	490 to 740	265	10		265	16		18		265	18
		80		Subject to agreement.										
ZSt 60-2 [5] St 60-2	1.0543 1.0060		5	780 to 1080	665	5	–	–	–	680	16	570 to 710	335	16
		5	10	740 to 1040	590	5								
		10	16	680 to 990	490	6								
		16	25	670 to 920	440	7	570 to 710	325	14				325	
		25	40	640 to 890	380	8				710	15			
		40	63	620 to 870	340	9		315	13				315	15
		63	80	590 to 810	305	9		305	12		14		305	14
		80		Subject to agreement.										

For [1] to [6], see page 6.

01-12-11;10:50AM; # 23/ 37

Table 2 (concluded).

DIN 17100 steel Material		Thickness[1], in mm		Heat treatment condition									
				Cold drawn and untreated (K)[2]			Peeled and untreated (SH)			Cold drawn and softened (K + G)[2],[4] Peeled and softened (SH + G)[4]		Cold drawn and normalized (K + N) Peeled and normalized (SH + N)		
designation	number	From	To below	Tensile strength, in N/mm²	Min. upper yield strength, in N/mm²	Min. elongation at fracture ($L_0=5d_0$), as a percentage	Tensile strength[3], in N/mm²	Min. upper yield strength, in N/mm²	Min. elongation at fracture ($L_0=5d_0$), as a percentage	Maximum tensile strength, in N/mm²	Min. elongation at fracture ($L_0=5d_0$), as a percentage	Tensile strength, in N/mm²	Min. upper yield strength, in N/mm²	Min. elongation at fracture ($L_0=5d_0$), as a percentage
ZSt 70-2[5] St 70-2	1.0633 1.0070		5	880 to 1180	745	5	–	–	–	810	11	670 to 830	360	11
		5	10	830 to 1130	665	5								
		10	16	780 to 1080	560	6								
		16	25	750 to 1000	520	6	670 to 830	355	9				355	
		25	40	720 to 970	450	7				830	10			
		40	63	700 to 950	360	8		345	8				345	10
		63	80	680 to 930	355	8		335			9		335	9
		80		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) In the case of thicknesses up to 25 mm, the higher value specified may be exceeded by 10 N/mm².
4) Cf. subclause 7.2.2 of DIN 1652 Part 1.
5) Where drawn material is ordered, 'Z' may be omitted from the designation.
6) See *Stahl-Eisen-Werkstoffblatt* (Iron and steel materials sheet) 011 for the mechanical properties of products exceeding 100 mm in thickness.

01-12-11;10:50AM; ; # 25/ 37

Standards and other documents referred to

DIN 1599	Identification marking of steel
DIN 1652 Part 1	Bright steel; general technical delivery conditions
DIN 8528 Part 1	Weldability of metallic materials; concepts
DIN 8528 Part 2	Weldability; suitability of general structural steels for fusion welding
DIN 17 010	General technical delivery conditions for steel and steel products
DIN 50 115	Notched bar impact testing of metallic materials using test pieces other than ISO test pieces
DIN 50 125	Test pieces for the tensile testing of metallic materials
DIN 50 145	Tensile testing of metallic materials
DIN 50 150	Testing of steel and cast steel; conversion tables for Vickers hardness, Brinell hardness, Rockwell hardness and tensile strength
DIN 50 351	Brinell hardness testing of metallic materials
DIN 51 210 Part 1	Tensile testing of wire without using an extensometer
DIN EN 10 020	Definition and classification of steel grades
DIN EN 10 025	Hot rolled unalloyed structural steel products

Stahl-Eisen-Werkstoffblatt 011 *Mechanisch-technologische Eigenschaften von allgemeinen Baustählen nach DIN 17 100 im Abmessungsbereich* $> 100 \leqq 250$ *mm* (Mechanical properties of DIN 17 100 steel with thicknesses from 100 mm to 250 mm) [2]

Handbuch für das Eisenhüttenlaboratorium [2]

DASt-Richtlinie 009 *Empfehlungen zur Wahl der Stahlgütegruppen für geschweißte Stahlbauten (Recommendations for selecting the steel quality group for welded steel structures)* [3]

Katalog zur Wahl der Stahlgütegruppen für geschweißte Stahlbauten [4]

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) The steel grades and material numbers have been brought into line with DIN 17 100 *).

c) The requirements for mechanical properties have been revised.

d) Specifications regarding weldability have been included.

e) The scope of testing has been amended.

Explanatory notes

Cf. DIN 1652 Part 1.

International Patent Classification

C 21 D 5/06

E 21 D 19/04

G 01 N 3/00

---

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

[3] Obtainable from *Deutscher Ausschuß für Stahlbau*, Ebertplatz 1, D-5000 Köln 1.

[4] Issued by the *Technischer Ausschuß des Deutschen Verbandes für Schweißtechnik* (Technical committee of the German Welders Association), 1964.

For *), see page 1.