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Hot rolled steel strip of rectangular cross section, with rounded edges, for the manufacture of springs
Dimensions, material and form of supply

DIN 59 146

Federstahl, warmgewalzt, mit rechteckigem Querschnitt und gerundeten Kanten
für Blattfedern; Maße, Grenzabmaße, Gewichte, statische Werte

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.

Dimensions in mm

1 Scope and field of application

This standard specifies dimensions, material and form of supply for hot rolled steel strip of rectangular cross section, with rounded edges and with the cross-sectional shape shown in figure 1, used for the manufacture of springs, and provides information on the second moment of area and the mass of such material per unit length.

2 Designation

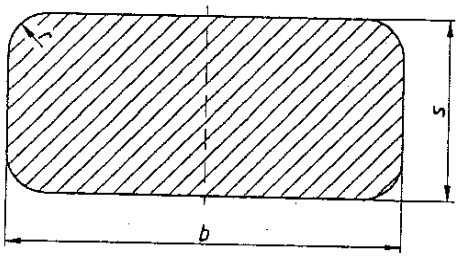

Figure 1

2.1 Standard designation

The standard designation shall give, in the following order:

a) name of product (spring steel);
b) DIN number (DIN 59 146);
c) material designation or number;
d) nominal diameter × nominal thickness.

EXAMPLE:

Hot rolled steel strip made of a material identified by material designation 51CrMoV4 (material number 1.7701) as specified in DIN 17 221, with a nominal width, *b*, of 80 mm and a nominal thickness, *s*, of 36 mm, shall be designated:

Spring steel DIN 59 146 – 51CrMoV4 – 80 × 36

or

Spring steel DIN 59 146 – 1.7701 – 80 × 36

2.2 Designation to be used when ordering

The designation to be used when ordering shall include the standard designation, preceded by the desired number of items, and succeeded by the desired length.

Example of an order:

Using the example given in subclause 2.1, 10 t of steel strip to be supplied in lengths of 6000 mm shall be ordered as:

10 t spring steel DIN 59 146 – 51CrMoV4 – 80 × 36 × 6000

or

10 t spring steel DIN 59 146 – 1.7701 – 80 × 36 × 6000

3 Dimensions and tolerances

3.1 Cross-sectional shape

3.1.1 Steel strip shall have the nominal widths and thicknesses specified in table 1. Only those combinations of sizes for which a second moment of area and a mass have been specified are covered by this standard.

3.1.2 The edge radius, *r*, shall be in compliance with table 2.

Continued on pages 2 to 6

Table 1: Nominal width, nominal thickness, and second moment of area of hot rolled steel strip

Nominal thickness, s [1]	Nominal width, b [1]					
	60	70	80	90	100	120
	Second moment of area, I, in mm^4 [2]					
22	48543					
23	55528					
24	63266					
25	71696	84717	97738	110759	123779	
26	80849	95496	110142	124789	139436	
27	90754	107157	123559	139962	156364	
28	101442	119735	138029	156322	174615	211202
29	112942	133266	153591	173915	194239	234887
30	125285	147785	170285	192785	215285	260285
31	138500	163326	188152	212978	237804	287455
32	152618	179925	207232	234538	261845	316458
33	167669	197616	227564	257511	287459	347354
34	183682	216435	249188	281942	314695	380202
35	200687	236416	272145	307875	343604	415062
36	218715	257595	296475	335355	374235	451995
37	237796	280007	322217	364428	406639	491061
38	257959	303685	349412	395139	440865	532319
39	279234	328667	378099	427532	476964	575829
40	301653	354986	408319	461653	514986	621653
41		362162	419596	477031	534465	649333
42		390070	451810	513550	575290	689770
43		419385	485641	551897	618152	750664
44		450144	521130	592117	663104	805077
45		482380	558318	634255	710193	862068
46		516130	597244	678357	759470	921697
47		551429	637948	724467	810986	984025
48		588310	680470	772630	864790	1049110
49		626810	724851	822891	920932	1117014
50		666962	771129	875296	979462	1187796
51			819346	929888	1040431	1261516
52			869541	986714	1103888	1338234
53			921754	1045818	1169883	1418011
54			976026	1107246	1238466	1500906
55			1032395	1171041	1309687	1586979
56			1090903	1237250	1383596	1676290
57			1151589	1305917	1460244	1768899
58			1214493	1377087	1539680	1864867
59			1279656	1450805	1621954	1964252
60			1347116	1527116	1707116	2067116

For [1], see subclause 3.1.1.
For [2], see subclause 3.1.3.

Table 2: Dimensions of and tolerances on edge radius

Nominal thickness, s	Edge radius, r
Up to 40	8 ± 2
Over 40	12 ± 2

The transition between the longitudinal and narrow faces of strip shall be as smooth as possible, it being permitted for the transition to be an obvious edge. The narrow edges shall not be concave, but may be slightly convex.

3.1.3 The values of the second moment of area, I, are specified in table 1. They have been calculated using the following formula and taking r as being equal to 8 mm where s is not greater than 40 mm, and 12 mm where s exceeds 40 mm:

$$I = \frac{b \cdot s^3}{12} - r^2 \cdot \left(r^2 \cdot \frac{16 - 5\pi}{4} - rs \cdot \frac{10 - 3\pi}{3} + s^2 \cdot \frac{4 - \pi}{4} \right)$$

3.1.4 Width and thickness shall be subject to the tolerances specified in table 3 (cf. subclauses 7.1 and 7.2).

Table 3: Tolerances on width and thickness

Nominal width, b	Tolerance on width	Tolerance on thickness, for a nominal thickness, s				Permissible difference in thickness [1]
		from 22 to 32	over 32 up to 40	over 40 up to 50	over 50 up to 60	
From 60 to 80	± 0,5	± 0,30	± 0,45	± 0,60	± 0,70	0,10
Over 80 up to 100	± 0,6	± 0,30	± 0,45	± 0,60	± 0,70	0,10
Over 100 up to 120	± 0,7	± 0,30	± 0,45	± 0,60	± 0,70	0,15
For [1], see subclause 3.1.6.						

3.1.5 The out-of-squareness of the cross section, u_{max}, shall be as specified in table 4 (cf. subclause 7.3).

Table 4: Out-of-squareness

Thickness, s	Out-of-squareness, u_{max} [1]
From 22 to 40	1,0
Over 40 up to 60	1,5
For [1], see subclause 7.3.	

The values specified in table 3 for the maximum permissible difference in thickness are based on the difference between the width measured at points M1 and M2 (cf. figure 2), these being located a maximum of 12 mm from each edge where r is equal to 8 mm, or 16 mm, where r is equal to 12 mm.

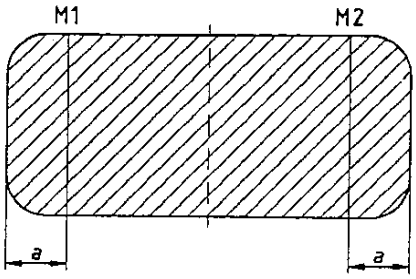

Figure 2

The shape of the product surface between points M1 and M2 (cf. figure 2) shall not be convex, any concavity being within the tolerances on thickness specified in table 3.

3.2 Straightness

The tolerance on straightness shall be $0{,}002 \cdot l_1$ for q_1, and 2 mm for q_2 (cf. figure 3 and subclause 7.4).

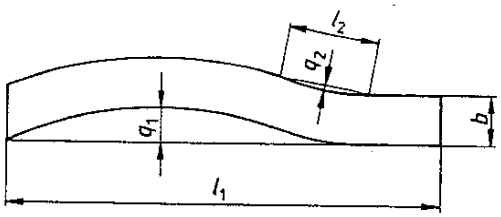

Figure 3

4 Materials

The steel used shall preferably be in compliance with DIN 17 221 or the subject of agreement.
The desired steel grade shall be given in the designation.

5 Mass

The values of mass specified in table 5 have been calculated, taking the density as 7,85 kg/dm^3, and the cross-sectional area, A, from the following equation:

$$A = b \cdot s - r^2 \cdot (4 - \pi) \qquad (2)$$

Table 3: Mass of hot rolled steel strip

Nominal thickness, s [1]	Nominal width, b [1]					
	60	70	80	90	100	120
	Mass[2], in kg/m					
22	9,931					
23	10,402					
24	10,873					
25	11,344	13,306	15,269	17,231	19,194	
26	11,815	13,856	15,897	17,938	19,979	
27	12,286	14,405	16,525	18,644	20,764	
28	12,757	14,955	17,153	19,351	21,549	25,945
29	13,228	15,504	17,781	20,057	22,334	26,887
30	13,699	16,054	18,409	20,764	23,119	27,829
31	14,170	16,603	19,037	21,470	23,904	28,771
32	14,641	17,153	19,665	22,177	24,689	29,713
33	15,112	17,702	20,293	22,883	25,474	30,655
34	15,583	18,252	20,921	23,590	26,259	31,597
35	16,054	18,801	21,549	24,296	27,044	32,539
36	16,525	19,351	22,177	25,003	27,829	33,481
37	16,996	19,900	22,805	25,709	28,614	34,423
38	17,467	20,450	23,433	26,416	29,399	35,365
39	17,938	20,999	24,061	27,122	30,184	36,307
40	18,409	21,549	24,689	27,829	30,969	37,249
41		21,559	24,778	27,996	31,215	37,652
42		22,109	25,406	28,703	32,000	38,594
43		22,658	26,034	29,409	32,785	39,536
44		23,208	26,662	30,116	33,570	40,478
45		23,757	27,290	30,822	34,355	41,420
46		24,307	27,918	31,529	35,140	42,362
47		24,856	28,546	32,235	35,925	43,304
48		25,406	29,174	32,942	34,710	44,246
49		25,955	29,802	33,648	37,495	45,188
50		26,505	30,430	34,355	38,280	46,130
51			31,058	35,061	39,065	47,072
52			31,686	35,768	39,850	48,014
53			32,314	34,474	40,635	48,956
54			32,942	37,181	41,420	49,898
55			35,570	37,887	42,205	50,840
56			34,198	38,594	42,990	51,782
57			34,826	39,300	43,775	52,724
58			35,454	40,007	44,560	53,666
59			36,082	40,713	45,345	54,608
60			36,710	41,420	46,130	55,550

For [1], see subclause 3.1.1.
For [2], see subclause 5.

6 Form of supply and marking

6.1 Steel strip shall be supplied in the form of bars, their length and the tolerance on length being the subject of agreement.

6.2 Strip shall be supplied in batches, separated according to cast (cf. DIN 17 221). Marking of the bars (which shall indicate nominal size, steel grade and cast number) shall be in accordance with DIN 1599 and the subject of agreement.

7 Check of dimensional accuracy

7.1 The point at which the thickness is measured shall not fall in either edge zone (cf. subclause 3.1.6).

7.2 Dimension be shall b_e measured as illustrated in figure 4.

7.3 The out-of-squareness (dimension u) shall be established on the basis of dimensions b' and b, measured as illustrated in figure 5.

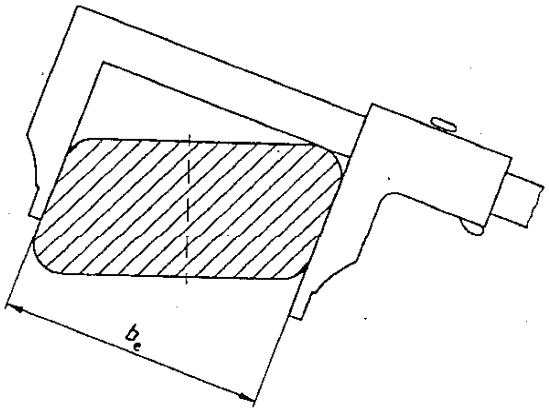

Figure 4

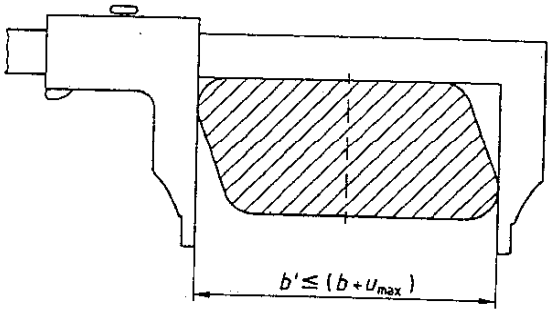

Figure 5

7.4 When checking straightness for compliance with subclause 3.2, dimension q_1 shall be measured along the entire length of the bar, l_1, whereas q_2 may be determined along any section of the bar, along a reference length, l_2, of 1000 mm.

Standards referred to

DIN 1599 Identification marking of steel

DIN 17 221 Hot rolled steel for the manufacture of hardenable springs; technical delivery conditions

Other relevant standards

DIN 4620 Hot rolled steel strip with rounded edges for the manufacture of springs; dimensions, material and form of supply

DIN 59 145 Hot rolled steel strip with semi-circular edges for the manufacture of springs; dimensions, material and form of supply

Explanatory notes

This standard covers 186 sizes of steel strip, having thicknesses between 22 and 60 mm and widths from 60 to 120 mm, for the manufacture of springs. Along with DIN 4620, which covers 288 sizes (with rounded edges), and DIN 59 145, which covers 167 sizes (with semi-circular edges), a total of 641 standardized sizes are now available.

It should be noted that efforts at the European level to harmonize the requirements, types and number of available sizes of steel strip used in spring manufacturing have been unsuccessful. The responsible CEN committee discontinued its work in this regard several years ago, and has not yet resumed such work.

International Patent Classification

C 22 C 38/00

F 16 F 1/18

G 01 B 21/02