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June 1985

Hot rolled steel strip with semicircular edges for leaf springs

Dimensions, masses, permissible deviations, moment of inertia

DIN 59 145

Federstahl, warmgewalzt mit halbkreisförmigen Schmalseiten für Blattfedern; Maße, Gewichte, zulässige Abweichungen, 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 Field of application

This standard applies to steel strip with semicircular edges (see figure 1) of the dimensions specified in table 1, hot rolled from the steels specified in clause 4 and intended for the manufacture of leaf springs.

2 Designation

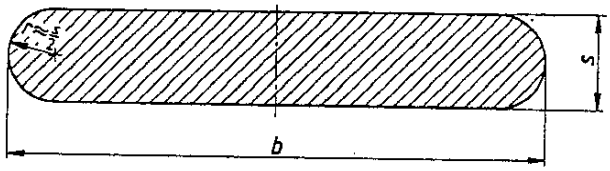

Figure 1.

2.1 Standard designation

The standard designation shall state in the following order:

- the term "spring steel";
- DIN number of the dimensional standard;
- symbol or material number identifying the steel grade;
- nominal width × nominal thickness.

Example:

Spring steel strip hot rolled from a steel identified by symbol 50 CrV 4, or material number 1.8159 as specified in DIN 17 221, of nominal width $b = 60$ mm and nominal thickness $s = 10$ mm shall be designated:

Spring steel strip DIN 59 145 – 50 CrV 4 – 60 × 10
or Spring steel strip DIN 59 145 – 1.8159 – 60 × 10

2.2 Designation to be used on ordering

The following information shall be added to the standard designation to ensure proper processing of an order:

a) quantity or number of units ordered (preceding the standard designation),

b) length (following the standard designation).

Example:

10 tonnes of spring steel strip with the standard designation as shown in subclause 2.1, in 6000 mm lengths shall be designated:

10 t spring steel strip DIN 59 145 – 50 CrV 4 – 60 × 10 × 6000
or **10 t spring steel strip DIN 59 145 – 1.8159 – 60 × 10 × 6000**

Continued on pages 2 to 5

3 Dimensions, geometrical tolerances

3.1 Cross section

3.1.1 Hot rolled spring steel strip complying with this standard shall be supplied in the nominal widths and nominal thicknesses given in table 1.

Table 1. **Nominal thickness, nominal width and moment of inertia for hot rolled spring steel strip**

Nominal thickness s	Nominal width b							
	40	50	60	70	80	90	100	120
	Moment of inertia [1], I, in mm^4							
5	395,26	499,43	603,60	707,76	811,93	–	–	–
6	675,62	855,62	1035,6	1215,6	1395,6	1575,6	–	–
7	1061,1	1346,9	1632,8	1918,6	2204,4	2490,3	2776,1	–
8	1566,4	1993,1	2416,7	2846,4	3273,1	3699,7	4126,4	4979,7
9	2205,3	2812,8	3420,3	4027,8	4635,3	5242,8	5850,3	7065,3
10	2990,9	3824,2	4657,5	5490,9	6324,2	7157,5	7990,9	9657,5
11	3935,3	5044,4	6153,6	7262,8	8371,9	9481,1	10590	12809
12	5049,9	6489,9	7929,9	9369,9	10810	12250	13690	16570
13		8176,1	10007	11838	13669	15499	17330	20992
14		10118	12404	14691	16978	19264	21551	26124
15		12329	15141	17954	20766	23579	26391	32016
16		14822	18236	21649	25062	28476	31889	38716
17		17611	21705	25799	29893	33897	38081	46270
18		20706	25565	30425	35285	40145	45005	54725
19			29833	35548	41264	46980	52695	64127
20			34524	41187	47854	54521	61187	74521
21			39646	47362	55080	62797	70515	85950
22			45222	54095	62964	71838	80711	98458
23				61393	71530	81669	91808	112087
24				69286	80797	92318	103838	126878
25				77775	90792	103810	116831	142873
26					101531	116170	130817	160110
27					113020	129421	145825	178630
28					125300	143599	161884	198471
29					138372	158699	179020	219668
30					152261	174778	197261	242261
31					166980	191806	216630	266283
32					182544	209851	237158	291771

[1]) See subclause 3.1.3.

3.1.2 The radius of curvature of the edges shall be $r \approx s/2$ (see figure 1). An attempt shall be made to achieve a smooth transition between the wide and the narrow sides; a visual edge is permitted.

3.1.3 The values of moment of inertia, I, of the cross sections covered by this standard are stated in table 1. They were calculated from the nominal dimensions using the following formula:

$$I = \frac{b \cdot s^3}{12} \cdot \left[1 - \frac{s}{b} \cdot \left(1 - \frac{3\pi}{16}\right)\right]$$

3.1.4 The permissible deviations from nominal width and nominal thickness are stated in table 2.

Table 2. **Permissible deviations in width and thickness**

Nominal width b	Permissible deviations in width	Permissible deviations in thickness for a nominal width, s,			Permissible difference in thickness [1]
		up to 12	over 12 up to 18	over 18	
From 40 up to 50	± 0,3	± 0,15	± 0,20	–	0,10
Over 50 up to 80	± 0,5	± 0,15	± 0,20	± 0,25	0,10
Over 80 up to 100	± 0,6	± 0,20	± 0,25	± 0,30	0,10
Over 100 up to 120	± 0,7	± 0,20	± 0,30	± 0,30	0,15

[1]) See subclause 3.1.5.

3.1.5 The specifications given in table 2 for the permissible difference in thickness relate to measuring points M 1 and M 2 in the same plane of cross section. The distance of each point from the edge of the product shall be as shown in figure 2.

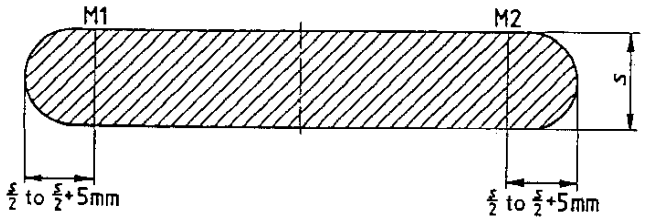

Figure 2.

3.1.6 The surfaces shall not have convex curvature between measuring points M 1 and M 2 (see figure 2). Any concave curvature on the surfaces is only permitted within the range of values of permissible deviation in thickness specified in table 2.

3.2 Straightness (camber)

The tolerance on straightness (camber) is 0,002 × l_1 for q_1 and 2 mm for q_2 (see figure 3 and subclause 7.2).

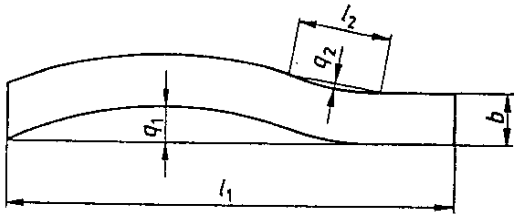

Figure 3.

4 Material

Steel strip specified in this standard shall preferably be manufactured from steels conforming to DIN 17 221.
The steel grade required shall be stated in the designation.

5 Mass

The values of mass stated in table 3 were calculated from the cross-sectional area, A, taking the density as 7,85 kg/dm^3, A being calculated from the following formula:

$$A = b \cdot s \left[1 - \frac{s}{b} \cdot \left(1 - \frac{\pi}{4}\right)\right]$$

6 Form of supply and marking

6.1 Hot rolled spring steel strip shall be supplied in straight bars. The length and the permissible deviations in length shall be agreed.

6.2 Each supply shall come from the same cast (see DIN 17 221). The type of marking, which shall indicate the nominal dimensions, the steel grade and the cast number, shall be agreed in accordance with the requirements of DIN 1599.

7 Inspection for accuracy to size

7.1 The thickness s shall be measured outside the area of the curvature of the narrow sides (see also subclause 3.1.5).

7.2 Dimension q_1 shall be measured over the complete length, l_1, of the bar when testing for straightness in accordance with subclause 3.2. Dimension q_2 over a gauge length, l_2, of 1000 mm may be determined at any point on the bar.

Table 3. **Mass of hot rolled spring steel**

Nominal thickness s [1]	Nominal width b							
	40	50	60	70	80	90	100	120
	Mass [1], in kg/m							
5	1,53	1,92	2,31	2,71	3,10	–	–	–
6	1,82	2,29	2,77	3,24	3,71	4,18	–	–
7	2,12	2,67	3,21	3,76	4,31	4,86	5,41	–
8	2,40	3,03	3,66	4,29	4,92	5,54	6,17	7,43
9	2,69	3,40	4,10	4,81	5,52	6,22	6,93	8,34
10	2,97	3,76	4,54	5,33	6,11	6,90	7,68	9,25
11	3,25	4,11	4,98	5,84	6,70	7,57	8,43	10,2
12	3,53	4,47	5,41	6,35	7,29	8,24	9,18	11,1
13		4,82	5,84	6,86	7,88	8,90	9,92	12,0
14		5,17	6,26	7,36	8,46	9,56	10,7	12,9
15		5,51	6,69	7,86	9,04	10,2	11,4	13,8
16		5,85	7,11	8,36	9,62	10,9	12,1	14,6
17		6,18	7,52	8,86	10,2	11,5	12,9	15,5
18		6,51	7,93	9,35	10,8	12,2	13,6	16,4
19			8,34	9,83	11,3	12,8	14,3	17,3
20			8,74	10,3	11,9	13,5	15,0	18,2
21			9,14	10,8	12,4	14,1	15,7	19,0
22			9,54	11,3	13,0	14,7	16,5	19,9
23				11,7	13,6	15,4	17,2	20,8
24				12,2	14,1	16,0	17,9	21,6
25				12,7	14,6	16,6	18,6	22,5
26					15,2	17,2	19,3	23,4
27					15,7	17,8	20,0	24,2
28					16,3	18,5	20,7	25,1
29					16,8	19,1	21,3	25,9
30					17,3	19,7	22,0	26,7
31					17,8	20,3	22,7	27,6
32					18,4	20,9	23,4	28,4

[1] See clause 5.

Standards referred to

DIN 1599 Marking of steel

DIN 17221 Hot rolled steels for heat treatable springs; quality specifications

Other relevant standards

DIN 4620 Hot rolled spring steel strip for laminated leaf springs

Explanatory notes

This is the first edition of DIN 59145 specifying the nominal dimensions and moments of inertia, and the requirements on the geometrical tolerances of hot rolled spring steel strip with semicircular edges. The discussions concerning this standard within a German working group made up of representatives of the steel producers, the spring manufacturers and the automobile industry were started ten years ago and they led to a first draft edition which was published in October 1976. However, further progress was suspended in order to await the results of the discussions on a corresponding EURONORM with which it was intended to harmonize, as far as possible, the delivery conditions for Germany. As yet, however, efforts to achieve international agreement on the requirements relating to the sections used predominantly for leaf springs in the automobile industry have remained unsuccessful. At the moment, the various countries use differing sectional forms for this purpose; it has not been possible to find agreement on a single specific form.

It appeared necessary to publish the national standard since the proportion of sections with semicircular edges in the overall production and application of steel strip used in the manufacture of leaf springs has continually increased in recent years, and the advantages of this sectional form over that of products complying with DIN 4620 (narrow sides with a radius $r \approx 20$ mm) already described in the Explanatory notes to the October 1976 draft of DIN 59145 are no longer in dispute. The main technical points are the same as those in the October 1976 draft.

It does not appear possible to confine the production and use of steel strip for leaf springs exclusively to the sectional form described in DIN 59145 for economic reasons. The representatives of the automobile industry consider it important that the products specified in DIN 4620 also remain available for an unlimited period for replacement and maintenance purposes, as well as certain types of spring (laminated trapezoidal springs) and types of vehicle. Thus, it is not possible, as was first planned, to withdraw DIN 4620, April 1954 edition, after a transitional period without replacement. Instead, a revised edition of the standard will be published.

Furthermore, an additional dimensional standard is in preparation for steel strip in nominal thicknesses of about 20 to 45 mm with a sectional form differing from that specified in DIN 59145 (narrow sides formed as an arc with radius $r = s$ and edge radii of $s/4$ or 6 to 8 mm).

International Patent Classification

F 16 F 1/18
C 21 D 9/02
C 22 C 38/00