UDC 621.87:625.143.1-034.14-423 September 1991

Crane rails

Hot rolled flat bottom crane rails (type A)
Dimensions, section parameters and steel grades

DIN 536 Part 1

Kranschienen; Maße, statische Werte,
Stahlsorten für Kranschienen mit Fußflansch Form A

Supersedes December 1974 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.

Dimensions in mm

1 Scope and field of application

This standard specifies requirements for hot rolled crane rails with a flat bottom (type A), with the dimensions specified in table 1 and made from steel with the properties specified in clause 4.

2 Dimensions and designation

2.1 Designation

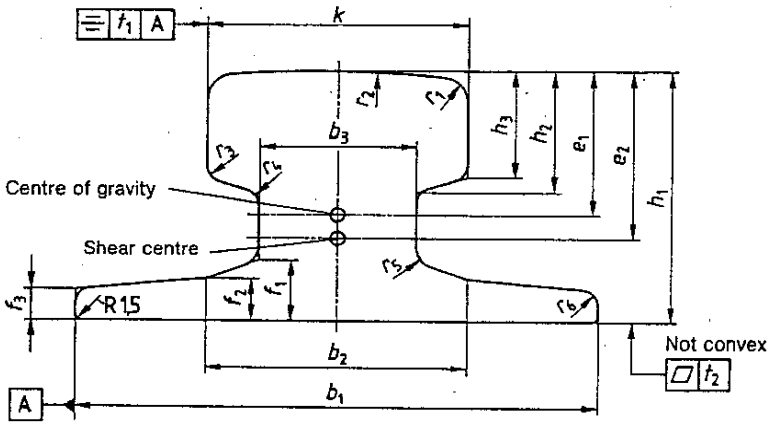

Figure 1: Type A crane rail

Designation of a flat bottom crane rail (type A) complying with this standard, with a head width, k, of 100 mm (A 100) and made from steel with a minimum tensile strength of 690 N/mm²:

Crane rail DIN 536 – A 100 – 690

Continued on pages 2 to 5.

2.2 Dimensions and tolerances

2.2.1 Crane rails shall be of the sizes and be subject to the limit deviations and geometrical tolerances specified in table 1. Any values for which no tolerance is specified shall be regarded as approximate values.

Table 1: Dimensions, limit deviations and geometrical tolerances (cf. subclause 2.2.1)

Crane rail symbol	k	Limit-deviations	b_1	Limit-deviations	b_2	b_3	f_1	f_2	f_3	h_1	Limit-deviations	h_2	h_3	r_1	r_2 [3]	r_3	r_4	r_5	r_6	t_1 [1]	t_2 [2]
A 45	45	±0,6	125	$^{+1,5}_{-3}$	54	24	14,5	11	8	55	±1	24	20	4	400	3	4	5	4	2	$^{+0,6}_{0}$
A 55	55	±0,6	150	$^{+1,5}_{-3}$	66	31	17,5	12,5	9	65	±1	28,5	25	5	400	5	5	6	5	2	$^{+0,6}_{0}$
A 65	65	±0,8	175	$^{+1,5}_{-4}$	78	38	20	14	10	75	±1	34	30	6	400	5	5	6	5	2	$^{+0,6}_{0}$
A 75	75	±0,8	200	$^{+2}_{-5}$	90	45	22	15,4	11	85	±1	39,5	35	8	500	6	6	8	6	2	$^{+0,8}_{0}$
A 100	100	±1	200	$^{+2}_{-5}$	100	60	23	16,5	12	95	±1,5	45,5	40	10	500	6	6	8	6	3	$^{+0,8}_{0}$
A 120	120	±1	220	$^{+2}_{-5}$	120	72	30	20	14	105	±1,5	55,5	47,5	10	600	6	10	10	6	3	$^{+1,0}_{0}$
A 150	150	±1	220	$^{+2}_{-5}$	–	80	31,5	–	14	150	±1,5	64,5	50	10	800	10	30	30	6	3	$^{+1,0}_{0}$

[1]) Cf. subclauses 2.2.2 and 2.2.4. [2]) Cf. subclauses 2.2.3 and 2.2.4. [3]) Cf. Explanatory notes

2.2.2 The tolerance on the symmetry of the head, t_1, shall be established for two parallel surfaces at a distance of t_1 from each other, the reference plane being that at the centre of the head, which is equal to $b_1/2$.

2.2.3 The rail seat shall not be convex, the baseplate being subject to the tolerance on flatness, t_2, specified in table 1 (cf. figure 2).

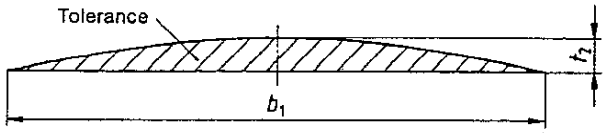

Figure 2: Tolerance on flatness of baseplate

2.2.4 The specifications given in ISO 1101 shall apply for tolerances t_1 and t_2.

3 Mass and section parameters

3.1 Figure 3 illustrates the relevant stress components of crane rails, in accordance with DIN 1080 Parts 1 and 2.

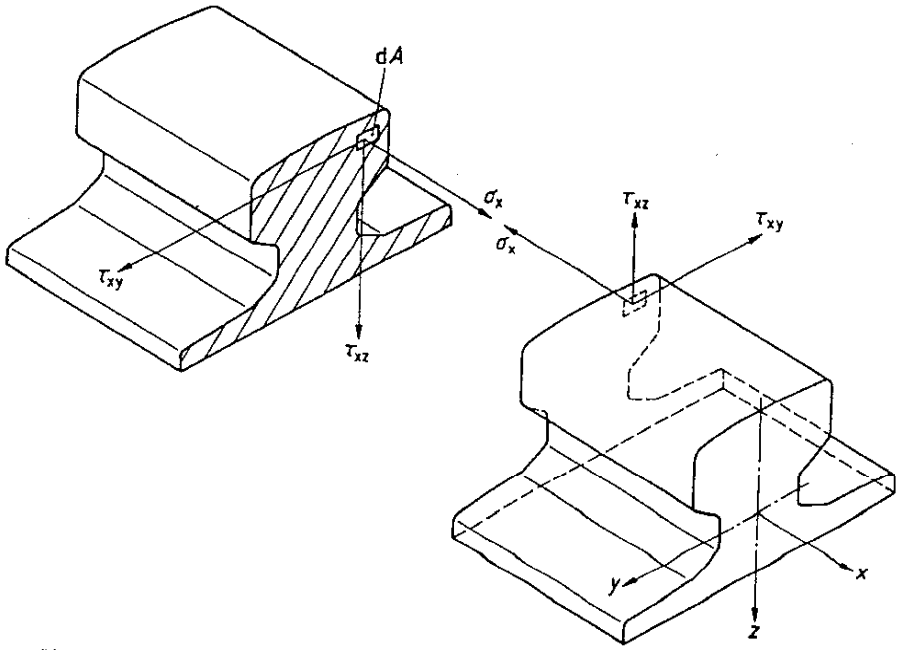

Figure 3: Stress components for crane rails on section planes parallel to the yz-plane

3.2 The mass of crane rails, as a function of the section parameters, shall be as specified in table 2.

Table 2: Mass and section parameters

Crane rail symbol	Mass, in kg/m	Section parameters[1]									
		e_1 cm	e_2 cm	A_x cm²	A_y cm²	A_z cm²	I_x cm⁴	I_y cm⁴	I_z cm⁴	$\overline{S}_y$ cm³	$\overline{S}_z$ cm³
A 45	22,1	3,33	4,24	28,2	17,0	9,6	39	90	170	22,88	26,12
A 55	31,8	3,90	4,91	40,5	24,8	14,6	88	178	337	38,45	48,64
A 65	43,1	4,47	5,61	54,9	33,7	20,2	173	319	606	60,18	69,22
A 75	56,2	5,04	6,29	71,6	44,1	26,9	311	531	1011	88,41	102,09
A 100	74,3	5,29	6,27	94,7	65,8	41,6	666	856	1345	128,78	141,58
A 120	100,0	5,79	6,53	127,4	97,1	58,5	1302	1361	2350	187,23	222,35
A 150	150,3	7,73	8,48	191,4	153,6	107,1	2928	4373	3605	412,00	342,60

[1] In accordance with DIN 1080 Parts 1 and 2, the symbols have the following meaning.
A_x cross-sectional area
A_y, A_z surfaces subjected to shear
I_x second moment of area (torsion)
I_y, I_z second moments of area (flexure)
$\overline{S}_y$, $\overline{S}_z$ static moments of parts of cross sections delineated by and related to the principal axes

4 Materials

4.1 Hot rolled crane rails shall be made from steel complying with the specifications given in table 3. In the case of rail types A 75, A 100, A 120 and A 150, the required minimum tensile strength (690 or 880 N/mm²) shall be specified at the time of ordering.

4.2 The actual tensile strength of the material may be 20 N/mm² less than the minimum values specified, unless otherwise agreed at the time of ordering.

4.3 Tensile strength shall be determined on longitudinal test pieces which have been taken from the zone of the crane rail illustrated in figure 4.

4.4 Crane rails may be supplied with a DIN 50 049 inspection document, the type of document being the subject of agreement at the time of ordering.

4.5 In the strength analysis, a guideline value of 60 % of the value specified for tensile strength in table 3 may be assumed for the proof strength [1].

Table 3: Tensile strength and chemical composition of steel

Crane rail symbol[1]	Minimum tensile strength[2], in N/mm²	Chemical composition (percentage by mass)[3]				
		C	Si max.	Mn	P max.	S max.
A 45, A 55 A 65, A 75 A 100, A 120 A 150	690	0,40 to 0,60	0,35	0,80 to 1,20	0,045	0,045
A 75, A 100	880[4]	0,60 to 0,80	0,50	0,80 to 1,30		
A 120, A 150		0,55 to 0,75	0,50	1,30 to 1,70		

[1] Cf. subclause 4.1.
[2] Cf. subclauses 4.2 and 4.3.
[3] Guideline values for cast analysis.
[4] The method used to determine chemical composition shall be up to the manufacturer.

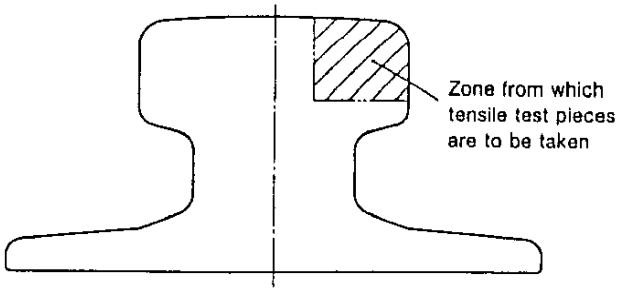

Figure 4: Orientation of sampling for tensile testing

5 Form of supply

5.1 Crane rails shall be supplied in specified lengths, which shall be the subject of agreement.

5.2 The upper limit deviation for the crane rail length shall be 100 mm, lower values being the subject of agreement. The lower limit deviation is zero.

6 Other requirements

6.1 Crane rails shall be free from internal and external defects that would likely impair their performance to a considerable degree.

6.2 Welded crane rails shall comply with the requirements specified in *Stahl-Eisen-Betriebsblatt* (Iron and steel instruction sheet) (SEB) 368 100.

6.3 The tolerances on crane travelling and crane trolley tracks and on welded rail joints shall be as specified in SEB 664 035.

Standards and other documents referred to

DIN 1080 Part 1 Quantities, symbols and units used in civil engineering; principles

DIN 1080 Part 2 Quantities, symbols and units used in civil engineering; statics

DIN 50 049 Inspection documents for the delivery of metallic products

ISO 1101 : 1983 Technical drawings; geometrical tolerancing; tolerancing of form, orientation, location and run-out; generalities, definitions, symbols and indications on drawings

Stahl-Eisen-Betriebsblatt 368 100[1]) *Geschweißte Kranschienenstöße; technische Anforderungen* (Welded crane rail joints; technical requirements)

Stahl-Eisen-Betriebsblatt 664 035[1]) *Krane und Kranbahnen einschließlich geschweißter Kranschienenstöße; Toleranzen für das Fahrsystem Laufrad-Schiene* (Cranes and rail crane tracks with welded crane rail joints; tolerances for running wheel tracks)

Other relevant standard and document

DIN 15 070 Cranes; design principles for track wheels

[1] Moissiadis, A. *Untersuchung der Beanspruchbarkeit von Kranschienen auf elastischer Bettung* (Analysis of the bearing capacity of crane rails installed on elastic bedding), Dissertation, Ruhr-Universität Bochum, 1986.

Previous editions

DIN 536: 05.41; DIN 536 Part 1: 04.59, 12.74.

Amendments

In comparison with the December 1974 edition, the following amendments have been made.

a) Rail type A 150 is included for the first time.

b) Additional dimensional and geometrical tolerances have been specified.

c) More information has been given with regard to section parameters.

d) The standard has been editorially revised.

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[1]) Issued by the *Verein Deutscher Eisenhüttenleute* (Society of German Ferrous Metallurgists), obtainable from *Verlag Stahleisen mbH*, Postfach 10 51 64, D-40042 Düsseldorf.

Explanatory notes

It was originally intended to prepare a new series of standards on crane rails, but after many justified objections were raised at the draft stage, the project was terminated, and the decision was made to update the specifications of the present standard. To ensure interchangeability with crane rails complying with the previous edition, no changes were made to the principal dimensions.

Over time, crane systems have been modified, and new designs developed, which involve an increase in the load the wheel exerts on the rail and an improvement in the properties of the wheel material. In practice, this has meant that type A 120 rails suffered frequent fractures, particularly in the welded joints. Laboratory tests and analyses have shown that at the load levels currently involved, the strength of the welded joint zone falls below the fatigue strength at a stated number of cycles, i. e. the possibility of fracture cannot be ruled out.

To ensure the future performance of crane rails at these higher load levels, type A 150 rails have been specified here. The connecting dimensions for their baseplates correspond to those for type A 120 rails, so that no changes need to be made to the rail fixings when this type is incorporated into existing rail-wheel systems. However, changes will have to be made to the crane design, since the head of type A 150 rails is 45 mm higher than type A 120, which will have a negative impact on other features (e.g. required power supply).

The shape of the head was previously required to be flat, but is now to be slightly curved. Laboratory tests and practical experience have shown that this causes the load to be applied more centrally and prevents an accumulation of stresses at the rail edges.

The dimensional and geometrical tolerances and section parameters have been specified in greater detail and brought into line with the design principles given in DIN 1080 Parts 1 and 2, which reflect the state of the art.

Other standards relating to crane rails are currently in preparation, these covering elastic bedding of crane rails, crane rail fixings, and sole plates.

International Patent Classification

B 66 C 7/00

E 01 B 25/00