High-carbon steel: Annealed (+LC)

Chemical Composition

Classification of symbols	Numerical classification	European Standard (EN)	Chemical Composition %								
			C	Si	Mn	Max. P	Max. S	Cr	Mo	V	Ni
C10E	1.1121	EN 10132-2	0.07 - 0.13	max. 0.40	0.30 - 0.60	0.035	0.035	max. 0.40			
C15E	1.1141	EN 10132-2	0.12 - 018	max. 0.40	0.30 - 0.60	0.035	0.035	max. 0.40			
16MnCr5	1.7131	EN 10132-2	0.14 - 0.19	max. 0.40	1.00 - 1.30	0.035	0.035	0.80 - 1.10			
C22E	1.1151	EN 10132-3	0.17 - 0.24	max. 0.40	0.40 - 0.70	0.035	0.035	max. 0.40	max. 0.10		max. 0.40
C35E	1.1181	EN 10132-3	0.32 - 0.39	max. 0.40	0.50-0.80	0.035	0.035	max. 0.40	max. 0.10		max. 0.40
C45E	1.1191	EN 10132-3	0.42 - 0.50	max. 0.40	0.50-0.80	0.035	0.035	max. 0.40	max. 0.10		max. 0.40
25CrMo4	1.7218	EN 10132-3	0.22 - 0.29	max. 0.40	0.60-0.90	0.035	0.035	0.90-1.20	0.15-0.30		-
42CrMo4	1.7225	EN 10132-3	0.38 - 0.45	max. 0.40	0.60-0.90	0.035	0.035	0.90-1.20	0.15-0.30		-
C55S	1.1204	EN 10132-4	0.52 - 0.60	0.15 - 0.35	0.60 - 0.90	0.025	0.025	max. 0.40	max. 0.10	-	max. 0.40
C60S	1.1211	EN 10132-4	0.57 - 0.65	0.15 - 0.35	0.60 - 0.90	0.025	0.025	max. 0.40	max. 0.10	-	max. 0.40
C67S	1.1231	EN 10132-4	0.65 - 0.73	0.15 - 0.35	0.60 - 0.90	0.025	0.025	max. 0.40	max. 0.10	-	max. 0.40
C75S	1.1248	EN 10132-4	0.70 - 0.80	0.15 - 0.35	0.60 - 0.90	0.025	0.025	max. 0.40	max. 0.10	-	max. 0.40
C90S	1.1217	EN 10132-4	0.85 - 0.95	0.15 - 0.35	0.40 - 0.70	0.025	0.025	max. 0.40	max. 0.10	-	max. 0.40
C100S	1.1274	EN 10132-4	0.95 - 1.05	0.15 - 0.35	0.30 - 0.60	0.025	0.025	max. 0.40	max. 0.10	-	max. 0.40
51CrV4	1.8159	EN 10132-4	0.47 - 0.55	max. 0.40	0.70 - 1.10	0.025	0.025	0.90 - 1.20	max. 0.10	0.10 - 0.25	max. 0.40
80CrV2	1.2235	EN 10132-4	0.75 - 0.85	0.15 - 0.35	0.30 - 0.50	0.025	0.025	0.40 - 0.60	max. 0.10	0.15 - 0.25	max. 0.40

Equivalents

Classification of symbols	Numerical	European Standard (EN)	Approximate international equivalents					
			US		Japan (JIS)		China (GB)	
C10E	1.1121	EN 10132-2						
C15E	1.1141	EN 10132-2	SAE 1015	1015	S15C	G4051	15	GB 3522
16MnCr5	1.7131	EN 10132-2	AISI 5115	5115	-	-	16MnCr	-
C22E	1.1151	EN 10132-3						
C35E	1.1181	EN 10132-3						
C45E	1.1191	EN 10132-3	1045	A682/684	S45C	G4051	45	GB 3522
25CrMo4	1.7218	EN 10132-3	SAE 4130	4130	SCM 420	G 4105	30CrMo	-
42CrMo4	1.7225	EN 10132-3	SAE 4140	4140	SCM 440	G 4105	42CrMo	-
C55S	1.1204	EN 10132-4						
C60S	1.1211	EN 10132-4						
C67S	1.1231	EN 10132-4	1065	A682/684	S65C-CSP	G4802	70	GB/T 1222
C75S	1.1248	EN 10132-4	1074	A682/684	-	-	-	-
C90S	1.1217	EN 10132-4	-	-	-	-	-	-
C100S	1.1274	EN 10132-4	1095	A682/684	SK4-CSP	G4802	-	-
51CrV4	1.8159	EN 10132-4	6150	A505/506	SUP 10	G4802	50CrVA	GB/T 1222
80CrV2	1.2235	EN 10132-4						

Mechanical properties

Classification of symbols	Numerical	European Standard (EN)	Mechanical properties and hardness requirements Delivery condition annealed and skin-passed (+LC)				Rockwell hardness values[1] of steel for springs Annealed and skin-passed (+LC)
			Rp0.2 N/mm² max	Rm N/mm² max.	A_{80} % min.	Max. HV	Max. HRB.
C10E	1.1121	EN 10132	345	430	26	135	
C15E	1.1141	EN 10132	360	450	25	140	
16MnCr5	1.7131	EN 10132	420	550	21	170	
C22E	1.1151	EN 10132	400	500	22	155	78
C35E	1.1181	EN 10132	430	540	19	170	86
C45E	1.1191	EN 10132	455	570	18	180	88
25CrMo4	1.7218	EN 10132	440	580	19	175	87
42CrMo4	1.7225	EN 10132	480	620	15	195	90
C55S	1.1204	EN 10132	480	600	17	185	90
C60S	1.1211	EN 10132	495	620	17	195	91
C67S	1.1231	EN 10132	510	640	16	200	92
C75S	1.1248	EN 10132	510	640	15	200	93
C90S	1.1217	EN 10132	545	680	14	215	94
C100S	1.1274	EN 10132	550	690	13	220	95
51CrV4	1.8159	EN 10132	550	700	13	220	94
80CrV2	1.2235	EN 10132	580	720	12	225	95

1)Approximate values.

Note: it is possible to specify the hardness values or the tensile strength values, but not both. If neither of the two values is specified, the tensile strength value is calculated. The hardness/tensile strength specification must fall within a range of 150 N/mm² or 50 HV, unless stated otherwise in the commercial agreement.

Finishes

EN 10132-2:2000

- The requirements regarding roughness can be agreed when requesting the quote or placing the order.
- Cold-rolled strips should have a bright surface finish, as obtained during rolling or annealing in a controlled atmosphere.

Tolerances

THICKNESS TOLERANCES

A) Specified thickness tolerances for cold rolled strip and strip obtained strapping wide precision rolling *w*.

According to the EN 10140:2006 Standard.

Nominal Thickness *t*		Thickness tolerances according to EN 10140 for nominal widths *w* of					
		<125			≥ 125 and <600		
>	≤	A normal	B fine	C precision	A normal	B fine	C precision
-	0.10	± 0.008	± 0.006	± 0.004	± 0.010	± 0.008	± 0.005
0.10	0.15	±0.010	± 0.008	± 0.005	± 0.015	± 0.012	± 0.010
0.15	0.25	±0.015	± 0.012	± 0.008	± 0.020	± 0.015	± 0.010
0.25	0.40	± 0.020	± 0.015	± 0.010	± 0.025	± 0.020	± 0.012
0.40	0.60	± 0.025	± 0.020	± 0.012	± 0.030	± 0.025	± 0.015
0.60	1.00	± 0.030	± 0.025	± 0.015	± 0.035	± 0.030	± 0.020
1.00	1.50	± 0.035	± 0.030	± 0.020	± 0.040	± 0.035	± 0.025
1.50	2.50	± 0.045	± 0.035	± 0.025	± 0.050	± 0.040	± 0.030
2.50	4.00	± 0.050	± 0.040	± 0.030	± 0.060	± 0.050	± 0.035
4.00	6.00	± 0.060	± 0.050	± 0.035	± 0.070	± 0.055	± 0.040

Sizes in mm.

WIDTH TOLERANCES

Width tolerances for strips with sheared edges		Standard slitting tolerances for Metalle Schmidt GmbH [1)]				Width tolerances according to the EN 10140 Standard for nominal widths of:					
Nominal Thickness *t*		3-15	15-50	50-150	>150	<125		≥ 125 and <250		≥250 and <600	
>=	<					A	B	A	B	A	B
0.1	0.4	± 0.075 [2)]	± 0.075 [2)]	± 0.075 [2)]	± 0,10 [2)]	± 0.15	± 0.10	± 0.20	± 0.13	± 0.25	± 0.18

Width tolerances for strips with sheared edges		Standard slitting tolerances for Metalle Schmidt GmbH [1]				Width tolerances according to the EN 10140 Standard for nominal widths of:					
Nominal Thickness *t*		3-15	15-50	50-150	>150	<125		≥ 125 and <250		≥250 and <600	
>=	<					A	B	A	B	A	B
0.4	0.7	± 0,085	± 0,09	± 0,10	± 0,12	± 0.15	± 0.10	± 0.20	± 0.13	± 0.25	± 0.18
0.7	1.0	± 0.085 [3]	± 0.09 [3]	± 0.10 [3]	± 0.12 [3]	± 0.20	± 0.13	± 0.25	± 0.18	± 0.30	± 0.20
1.0	1.5	± 0.10 [4]	± 0.10 [4]	± 0.10 [4]	± 0.15 [4]	± 0.20	± 0.13	± 0.25	± 0.18	± 0.30	± 0.20
1.5	2.5	on request	± 0.13 [5]	± 0.15 [5]	± 0.16 [5]	± 0.25	± 0.18	± 0.30	± 0.20	± 0.35	± 0.20
2.5	2.6	on request	on request	± 0.16	± 0.175	± 0.25	± 0.18	± 0.30	± 0.20	± 0.35	± 0.25
2.6	4.1	on request	on request	± 0.16	± 0.175	± 0.30	± 0.20	± 0.35	± 0.25	± 0.40	± 0.30
4.1	6.1	on request	on request	± 0.16	± 0.175	± 0.35	± 0.25	± 0.40	± 0.30	± 0.45	± 0.35

1) Other, closer dimensional tolerances are possible under a commercial agreement

2) Including the value *t*= 0.4

3) Including the value *t*= 1

4) Including the value *t*= 1.5

5) Including the value *t*= 2.5

LENGTH TOLERANCES

Length tolerances	Closer tolerances are possible under a commercial agreement	Positive tolerance in relation to the nominal length, according to the EN 10140 Standard for the	
L ≤ 1000	+ 2	+ 10	+ 6
1000 < L ≤ 2500	+0,002L	+ 0.01 L	+ 6
L > 2500	+0,002L	+ 0.01 L	+ 0.003 L

Sizes in mm.

EDGE CAMBER TOLERANCES

Nominal width (w)	Closer edge curve tolerances possible under a commercial agreement		Edge curve tolerances according to the EN 10140 Standard	
	Maximum deviation 1000 mm			
	Thickness t		Class A (Normal) (maximum deviation)	Class B (FS) (Reduced) (maximum deviation)
	$t \leq 1.20$ mm	$t > 1.20$ mm		
3 ≤ W < 6	2.50	4.00	-	-
6 < W ≤ 10	2.00	3.00	-	-
10 < W ≤ 20	1.00	1.50	5.00	2.00
20 < W < 25	1.00	1.50	5.00	2.00
25 ≤ W < 40	1.00	1.50	3.50	1.50
40 ≤ W < 125	1.00	1.50	2.50	1.25
125 ≤ W ≤ 350	1.00	1.50	2.00	1.00
350 < W < 600	-	-	2.00	1.00

Sizes in mm.

The absolute value of the tolerance can be divided within that range.

RIPPLE - LONGITUDINAL FLATNESS

The flatness tolerance of the strips in cut lengths in the direction of rolling must be a maximum of 10 mm over 1000 mm. Any other flatness requirement must be agreed when placing the order.