



Cold-rolled steel strip



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Cold-rolled carbon steels

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Cold-rolled carbon steels

Carbon steels as cold-rolled strip for direct processing or repeated cold rolling are typically intended for heat treatment in order to achieve the desired processing and component properties. They are used in applications in which it is important to strike an optimum balance between hardness and toughness.

- **Case-hardening steels**

For components with high toughness and hard wearing surfaces
Delivery pursuant to EN 10132-2 and the voestalpine standard

- **Heat-treatable steels**

Unalloyed or alloyed for hardness and toughness as required
Delivery pursuant to EN 10132-3 and the voestalpine standard

- **Spring steels**

Springs, components with high abrasion resistance and rigidity
Delivery pursuant to EN 10132-4 and the voestalpine standard

EN 10132 differentiates between case-hardening steels, heat-treatable steels and spring steels as well as steels for special applications.

Case-hardening steels

The C content for optimized machining and forming lies between 0.07% and 0.20%. In order to achieve the desired properties, a high degree of hardness in the case and usually a tough core, the surface area must be enriched with carbon, hardened and perhaps tempered or stress-relieved. Carbon enrichment is accomplished in the course of component manufacturing by means of carburization. Carbonitriding is carried out when nitrogen enrichment is required.

Heat-treatable steels

The carbon content of heat-treatable steels lies between 0.17% and 0.65%. Additional alloying elements such as chromium, molybdenum and nickel make it possible to finely tune component properties. Heat treatment is required in order to adjust the desired component properties, mostly an optimized combination of strength and toughness:

- Normalizing
- Quenching and tempering

Spring steels

EN 10132 describes spring steels as materials that are especially suited in quenched and tempered condition for the manufacturing of spring components and other special applications. The resiliency of components made of such steels is based on their modulus of elasticity, which can only be influenced by alloying and heat treatment, and on their high yield strength. The desired properties are achieved through higher mass percentages of carbon and alloying constituents such as silicon, manganese, chromium, molybdenum or vanadium as well as by heat treatment in the form of hardening and tempering.

Chemical composition

Heat analysis in mass %

Case-hardening steel according to EN 10132-2

Steel grade	C	Si max.	Mn	P max.	S max.	Cr	Mo	Ni
C10E	0.07 - 0.13	0.40	0.30 - 0.60	0.035	0.035	max. 0.40	–	–
C15E	0.12 - 0.18	0.40	0.30 - 0.60	0.035	0.035	max. 0.40	–	–
16MnCr5	0.14 - 0.19	0.40	1.00 - 1.30	0.035	0.035	0.80 - 1.10	–	–

Unalloyed heat-treatable steels according to EN 10132-3

Steel grade	C	Si max.	Mn	P max.	S max.	Cr max.	Mo max.	Ni max.
C22E	0.17 - 0.24	0.40	0.40 - 0.80	0.035	0.035	0.40	0.10	0.40
C35E	0.32 - 0.39	0.40	0.50 - 0.80	0.035	0.035	0.40	0.10	0.40
C40E	0.37 - 0.44	0.40	0.50 - 0.80	0.035	0.035	0.40	0.10	0.40
C45E	0.42 - 0.50	0.40	0.50 - 0.80	0.035	0.035	0.40	0.10	0.40
C50E	0.47 - 0.55	0.40	0.60 - 0.90	0.035	0.035	0.40	0.10	0.40
C55E	0.52 - 0.60	0.40	0.60 - 0.90	0.035	0.035	0.40	0.10	0.40
C60E	0.57 - 0.65	0.40	0.60 - 0.90	0.035	0.035	0.40	0.10	0.40

Spring steels according to EN 10132-4

Steel grade	C	Si	Mn	P max.	S max.	Cr max.	Mo max.	Ni max.
C55S	0.52 - 0.60	0.15 - 0.35	0.60 - 0.90	0.025	0.025	0.40	0.10	0.40
C60S	0.57 - 0.65	0.15 - 0.35	0.60 - 0.90	0.025	0.025	0.40	0.10	0.40

Special steels according to voestalpine standard

Steel grade	C	Si max.	Mn	P max.	S max.	Cr max.	Mo	Ni	Sonstige
22MnB5	0.19 - 0.25	0.40	1.10 - 1.40	0.025	0.015	0.40	–	–	Ti max. 0.06 B max. 0.005
27MnB5	0.25 - 0.30	0.40	1.10 - 1.40	0.025	0.025	0.50	–	–	Ti max. 0.05 B max. 0.005
34MnB5	0.31 - 0.39	0.40	1.10 - 1.50	0.025	0.035	0.40	–	–	Ti max. 0.05 B max. 0.005
33Mn6	0.30 - 0.35	0.60	1.30 - 1.50	0.040	0.040	0.30	–	–	–
38MnSi4	0.34 - 0.42	0.95	0.90 - 1.20	0.035	0.035	–	–	–	–

The listed steel grades are an excerpt from our production range. Further steel grades defined by national and international standards and special analyses according to customer specifications are also available upon request.

Steel grade table of comparison

Case-hardening steels			
Steel grade	Material number	Euronorm	SAE
C10E	1.1121	EN 10132 Part 2	1010
C15E	1.1141	EN 10132 Part 2	1013, 1015
16MnCr5	1.7131	EN 10132 Part 2	–

Unalloyed heat-treatable steels			
Steel grade	Material number	Euronorm	SAE
C22E	1.1151	EN 10132 Part 3	1021
C35E	1.1181	EN 10132 Part 3	1035
C40E	1.1186	EN 10132 Part 3	1040
C45E	1.1191	EN 10132 Part 3	1045
C50E	1.1206	EN 10132 Part 3	1050
C55E	1.1203	EN 10132 Part 3	1055
C60E	1.1221	EN 10132 Part 3	1060

Spring steels			
Steel grade	Material number	Euronorm	SAE
C55S	1.1204	EN 10132 Part 4	1055
C60S	1.1211	EN 10132 Part 4	1060

Special steels according to voestalpine standard			
Steel grade	Material number	Euronorm	SAE
22MnB5	1.5528	–	–
27MnB5	1.5529	–	–
34MnB5	–	–	–
33Mn6	1.0525	–	–
38MnSi4	1.5120	–	–

Mechanical properties

Indicative values depending on as-delivered condition

Steel grade	Cold-rolled (+CR) = as-rolled condition		Annealed (+A), annealed and slightly rerolled (+LC)			
	Tensile strength R_m max. [MPa]	HV max.	Yield strength $R_{p0.2}$ max. [MPa]	Tensile strength R_m max. [MPa]	A_{90} min. [%]	HV max.
C10E	830	250	345	430	26	135
C15E	870	260	360	450	25	140
16MnCr5	830	250	345	430	26	135
C22E	900	265	400	500	22	155
C35E	930	275	430	540	19	170
C40E	970	280	440	550	18	170
C45E	1020	290	455	570	18	180
C50E	1050	295	465	580	17	180
C55E/C55S	1070	300	480	600	17	185
C60E/C60S	1100	305	495	620	17	195
22MnB5 ¹⁾	-		400	550	24	-
27MnB5 ¹⁾	-		400	550	24	-
34MnB5 ¹⁾	-		400	550	24	-
33Mn6	Upon request		Upon request			
38MnSi4	Upon request		Upon request			

¹⁾ voestalpine standard values

Dimensions and forms of delivery

Cold-rolled carbon steels can be supplied as coils or as preprocessed material (slit or cut to length).

The following dimensions are available:

- Coil width: 900 - 1750 mm
- Strip widths beginning at 30 mm
- Thickness: 0.6 - 3 mm
- Weight/width: 18 - 20 kg/mm

Available combinations of widths and thicknesses vary depending on the steel grade. Indicated values are standard; limitations possible depending on thickness. Further dimensions upon request.

Dimensional tolerances

Dimensional tolerances of the cold-rolled strip comply with EN10131. Narrower thickness tolerances are possible upon request. A very flat strip shape (crown) is decisive for a number of further processing steps. Dimensions and material properties are subject to agreement.

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GENERAL INFORMATION ABOUT MATERIAL PROPERTIES

Chemical composition

The basis for achievement of the desired hardness values after heat treatment is the chemical composition. The carbon content influences achievable hardness, and alloying elements such as manganese, chromium and molybdenum influence the through-hardening. The indicated analysis boundaries apply to the ladle analysis. A number of modifications to the chemical composition are available for several grades. Further steels not included in the list can be supplied upon request according to standards and individual customer specifications.

Mechanical properties

Further values pursuant to EN 10132 and this data sheet upon request.

As-delivered condition

Following terms of delivery upon request:

- Cold-rolled (+CR)
- Annealed (+A)
- Annealed and skin-passed (slightly rerolled/+LC)
- Batch annealing with guaranteed level of spheroidization according to grade upon request

Degree of purity

The carbon steels produced at voestalpine Stahl GmbH come with reduced sulfur and phosphorus content. This is in view of the microscopic degree of purity and formation of segregations. Customer-specific requirements with regard to degree of purity can be met upon request.

voestalpine Steel Division

voestalpine-Straße 3
4020 Linz, Austria
T. +43/50304/15-8018
produktmanagement@voestalpine.com
www.voestalpine.com/steel