

CARBON STEEL (C ≤ 0,35 % AND C > 0,35 %)

We can also produce according to DIN 17222, NFA 37-505, ASTM A108

ACCORDING TO EN 10132 – Tolerances according to EN 10140

STEEL GRADE		CHEMICAL COMPOSITION %								MECHANICAL PROPERTIES (0,3 MM ≤ THICKNESS < 3 MM)			
										TO ANNEALED CONDITION (+ A) OR SKIN-PASSED (+LC)			HARDENED* CR
Symbolic	Numerical	C	Si	Mn	P	S	Cr	Mo	Ni	Rm	Rp 0,2	A80	Rm
			<i>maxi</i>		<i>maxi</i>	<i>maxi</i>	<i>maxi</i>	<i>maxi</i>	<i>maxi</i>	(Mpa) <i>maxi</i>	(Mpa) <i>maxi</i>	(%) <i>mini</i>	(Mpa) <i>maxi</i>
C10E	1.1121	0,07 to 0,13	0,40	0,30 to 0,60	0,035	0,035	0,40	-	-	430	345	26	830
C15E	1.1141	0,12 to 0,18	0,40	0,30 to 0,60	0,035	0,035	0,40	-	-	450	360	25	870
C22E	1.1151	0,17 to 0,24	0,40	0,40 to 0,70	0,035	0,035	0,40	0,10	0,40	500	400	22	900
C30E	1.1178	0,27 to 0,34	0,40	0,50 to 0,80	0,035	0,035	0,40	0,10	0,40	520	420	20	920

* Hardened condition : Minimum 150 Mpa range

STEEL GRADE		CHEMICAL COMPOSITION %								MECHANICAL PROPERTIES (0,3 MM ≤ THICKNESS < 3 MM)			
										TO ANNEALED CONDITION (+ A) OR SKIN-PASSED (+LC)			HARDENED* CR
Symbolic	Numerical	C	Si*	Mn	P*	S*	Cr	Mo	Ni	Rm	Rp 0,2	A80	Rm
					<i>maxi</i>	<i>maxi</i>	<i>maxi</i>	<i>maxi</i>	<i>maxi</i>	(Mpa) <i>maxi</i>	(Mpa) <i>maxi</i>	(%) <i>mini</i>	(Mpa) <i>maxi</i>
C35E	1.1181	0,32 to 0,39	≤0,40	0,50 to 0,80	0,035	0,035	0,40	0,10	0,40	540	430	19	930
C40E	1.1186	0,37 to 0,44	≤0,40	0,50 to 0,80	0,035	0,035	0,40	0,10	0,40	550	440	18	970
C45E	1.1191	0,42 to 0,50	≤0,40	0,50 to 0,80	0,035	0,035	0,40	0,10	0,40	570	455	18	1020
C50E	1.1206	0,47 to 0,55	≤0,40	0,60 to 0,90	0,035	0,035	0,40	0,10	0,40	580	465	17	1050
C55E	1.1203	0,52 to 0,60	≤0,40	0,60 to 0,90	0,035	0,035	0,40	0,10	0,40	600	480	17	1070
C60E	1.1221	0,57 to 0,65	≤0,40	0,60 to 0,90	0,035	0,035	0,40	0,10	0,40	620	495	17	1100
C67S	1.1231	0,65 to 0,73	0,15 to 0,35	0,60 to 0,90	0,025	0,025	0,40	0,10	0,40	640	510	16	1140
C75S	1.1248	0,70 to 0,80	0,15 to 0,35	0,60 to 0,90	0,025	0,025	0,40	0,10	0,40	640	510	15	1170
C85S	1.1269	0,80 to 0,90	0,15 to 0,35	0,40 to 0,70	0,025	0,025	0,40	0,10	0,40	670	535	15	1190
C90S	1.1217	0,85 to 0,95	0,15 to 0,35	0,40 to 0,70	0,025	0,025	0,40	0,10	0,40	680	545	14	1200
C100S	1.1274	0,95 to 1,05	0,15 to 0,35	0,30 to 0,60	0,025	0,025	0,40	0,10	0,40	690	550	13	1200

* Composition for springs and special applications from C55S to C125S: Reduced content of : Si = 0,15 % to 0,35 % - P ≤ 0,025 % - S ≤ 0,025 %

** Cold-drawn state : with minimum range of 150 Mpa

ALLOY STEEL

ACCORDING TO EN 10132 – Tolerances according to EN 10140

STEEL GRADE		CHEMICAL COMPOSITION %									MECHANICAL PROPERTIES TO ANNEALED CONDITION (+A) OR SKIN-PASSED (+LC) FOR THICKNESS 0,3 TO < 3 MM		
											Rm	Rp 0,2	A80
Symbolic	Numerical	C	Si	Mn	P	S	Cr	Mo	V	Ni	(Mpa) <i>maxi</i>	(Mpa) <i>maxi</i>	(%) <i>mini</i>
					<i>maxi</i>	<i>maxi</i>				<i>maxi</i>			
16MnCr5	1.7131	0,14 to 0,19	≤0,40	1,00 to 1,30	0,035	0,035	0,80 to 1,10	-	-	-	550	420	21
25CrMo4	1.7218	0,22 to 0,29	≤0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	0,15 to 0,30	-	-	580	440	19
34CrMo4	1.7220	0,30 to 0,37	≤0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	0,15 to 0,30	-	-	600	460	16
42CrMo4	1.7225	0,38 to 0,45	≤0,40	0,60 to 0,90	0,035	0,035	0,90 to 1,20	0,15 to 0,30	-	-	620	480	15
51CrV4	1.8159	0,47 to 0,55	≤0,40	0,70 to 1,10	0,025	0,025	0,80 to 1,20	≤0,10	0,10 to 0,25	0,40	700	550	13
56Si17	1.5026	0,52 to 0,60	1,60 to 2,00	0,60 to 0,90	0,025	0,025	≤0,40	≤0,10	-	0,40	740	600	12

HARDENED CARBON AND ALLOY STEEL

We can also produce according to DIN 17222, NFA 37-505, ASTM A108

ACCORDING TO EN 10132 – Tolerances according to EN 10140

STEEL GRADE	HARDENING TEMPERATURES (ENVIRONMENT: OIL) C °	MINIMUM HARDNESS OF TEMPERED CONDITION WITHOUT QUENCHED		HARDNESS QUENCHED AND TEMPERED CONDITION (+ QT)(0,3 MM THICKNESS < 3 MM)						
		HRC	HV	HRC	HV (Thickness en mm)					
					0,30 ≤ 0,50	0,50 ≤ 0,75	0,75 ≤ 1,00	1,00 ≤ 1,50	1,50 ≤ 2,00	2,00 < 3,00
C60S	825 to 855	57	640	35 to 51,5	485 to 535	465 to 515	455 to 505	445 to 495	425 to 475	415 to 465
C67S	815 to 845	59	670	38,5 to 54	485 to 535	465 to 515	455 to 505	445 to 495	425 to 475	415 to 465
C75S	810 to 840	60	700	38,5 to 54	520 to 570	500 to 550	480 to 530	465 to 515	440 to 490	435 to 485
C85S	800 to 830	61	720	38,5 to 55	520 to 570	500 to 550	480 to 530	465 to 515	440 to 490	435 to 485
C90S	790 to 820	61	720	38,5 to 55	555 to 605	525 to 575	505 to 555	485 to 535	465 to 515	455 to 505
C100S	790 to 820	61	720	38,5 to 57	555 to 605	525 to 575	505 to 555	485 to 535	465 to 515	455 to 505
25CrMo4*	-	-	-	31,5 to 44	-	-	-	-	-	-
34CrMo4	840 to 870	48	480	32 to 46	-	-	-	-	-	-
42CrMo4	840 to 870	51	530	35 to 48,5	-	-	-	-	-	-
51CrMo4	840 to 870	57	640	38,5 to 52,5	520 to 570	500 to 550	480 to 530	465 to 515	440 to 490	435 to 485
56S17	840 to 870	55	600	38,5 to 50,5	485 to 535	465 to 515	455 to 505	445 to 495	425 to 475	415 to 465

- HARDNESS HRC 40 → Range of 5 HRC minimum
- HARDNESS HRC > 40 → Range of 4 HRC minimum.

* Water hardening : 840-870 = • 44 HRC • 430 HV

USUAL CORRESPONDANCE RANGES hardness mechanical strength according to ISO 18265

USED STEEL GRADE	THICKNESS 0,15 TO 3 MM					
	C60S to C85S				C90S to C100S	
Hardness ROCKWELL (HRC)	35 to 40	40 to 43	43 to 46	47 to 51	51 to 55	> 55
Hardness VICKERS (HV)	340 to 390	390 to 430	430 to 470	480 to 530	530 to 600	> 600
Indicative Rm (MPa)	1100 to 1270	1270 to 1390	1390 to 1500	1550 to 1700	1700 to 1850	> 1850

ADDITIONAL INFORMATION

RECOMMENDED MEASUREMENTS :

- HV (thickness in mm)
- HRC for thicknesses 1 mm

SURFACE FINISHES : grey blue (as quenched) ; blue polish (bright) ;
BRUSHED : scratch brushed (special finish).

DECARBURIZATION ≤ 1% thicknesses

- For thicknesses < 0,15 et > 3 mm production possibilities are related to the grade, hardness and appearance required.

DIMENSIONAL AND OTHER TOLERANCES (EXCLUDING STAINLESS STEEL)

EN 10140

We can also produce according to DIN 1544, NFA 47-501, ASTM

NOMINAL THICKNESS (e) (mm)		THICKNESS TOLERANCES (mm)					
		Width < 125 mm			≥ 125 mm and < 600 mm ^a		
>	≤	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
6,00	8,00	± 0,075	± 0,060	± 0,040	± 0,085	± 0,065	± 0,045
8,00	10,00	± 0,090	± 0,070	± 0,045	± 0,100	± 0,075	± 0,050

Note 1 : The thickness measurement is made at 10 mm from the edge (on th middle of the strip for the widths <= 20 mm)

Note 2 : Thickness >= 5 mm : on study

NOMINAL THICKNESS (e) (mm)	WIDTH TOLERANCES (mm)					
	Width < 125 mm		125 mm ≤ Width < 250 mm		250 mm ≤ Width < 600 mm	
	A Normal	B Precision	A Normal	B Precision	A Normal	B Precision
- e ≤ 0,60	± 0,15	± 0,10	± 0,20	± 0,13	± 0,25	± 0,18
0,60 < e ≤ 1,50	± 0,20	± 0,13	± 0,25	± 0,18	± 0,30	± 0,20
1,50 < e ≤ 2,50	± 0,25	± 0,18	± 0,30	± 0,20	± 0,35	± 0,25
2,50 < e ≤ 4,00	± 0,30	± 0,20	± 0,35	± 0,25	± 0,40	± 0,30
4,00 < e ≤ 6,00	± 0,35	± 0,25	± 0,40	± 0,30	± 0,45	± 0,35
6,00 < e ≤ 8,00	± 0,45	-	± 0,50	-	± 0,55	-
8,00 < e ≤ 10,00	± 0,50	-	± 0,55	-	± 0,60	-

Note 1 : For strip with mill edges see 7.2.3 of standard NF EN 10140.

Note 2 : Thickness >= 5 mm : on study

STRAIGHTNESS TOLERANCES (CAMBER, SABER, CAMBERING)		
Measurement length of 1000 mm		
Nominal width (L) (mm)	Division A Normal (mm/m)	Division B (FS) Precision (mm/m)
10 ≤ L < 25	≤ 5,00	≤ 2,00
25 ≤ L < 40	≤ 3,50	≤ 1,50
40 ≤ L < 125	≤ 2,50	≤ 1,25
125 ≤ L < 600	≤ 2,00	≤ 1,00

Note 1 : The above tolerances apply to strip whose width is at least 10 times the thickness.

Note 2 : For strips with width < 10 mm and for strips whose cross-section ratio is not standardised, special agreements are possible.

THICKNESS MEASUREMENT (mm)		
The thickness tolerances given only apply for measurements carried out according to the specifications below :		
Sheared edges	Nominal width (L) (mm)	Minimum distance of measuring points from edges
	L ≤ 20	Middle of strip
	20 ≤ L < 600	10 mm

LENGTH AND FLATNESS TOLERANCES FOR LENGTH SECTION STRIPS		
Nominal length (L) (mm)	More tolerances in relation to the nominal length (mm)	
	Division A Normal	Division B Precision
L ≤ 1000	+ 10	+ 6
1000 ≤ L < 2500	+ 0,01 L	+ 6
L > 2500	+ 0,01 L	+ 0,003 L

The tolerance can be divided ± in relation to the nominal length. Reduced tolerance by mutual agreement

Flatness tolerances	
ANNEALED STATE : flatness tolerance in rolling direction, 10 mm maximum on 1000 mm.	
Cold-drawn state tolerance by mutual agreement.	
CROSS FLATNESS	
T ≤ 0,15 % of width	W ≤ 0,25 % of width