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1 Mechanical properties of rolled products

1.1.1 Hot rolled products of structural steel, non alloy, untreated (+U) (EN 10025-2)

Minimum yield strength R_{eH} in N/mm² ^a

Material-number (EN)	Designation	Nominal thickness in mm								
		≤ 16	> 16 ≤ 40	> 40 ≤ 63	> 63 ≤ 80	> 80 ≤ 100	> 100 ≤ 150	> 150 ≤ 200	> 200 ≤ 250	> 250 ≤ 400 ²
1.0038	S235JR	235	225	215	215	215	195	185	175	-
1.0114	S235J0	235	225	215	215	215	195	185	175	-
1.0117	S235J2	235	225	215	215	215	195	185	175	165
1.0044	S275JR	275	265	255	245	235	225	215	205	-
1.0143	S275J0	275	265	255	245	235	225	215	205	-
1.0145	S275J2	275	265	255	245	235	225	215	205	195
1.0045	S355JR	355	345	335	325	315	295	285	275	-
1.0553	S355J0	355	345	335	325	315	295	285	275	-
1.0577	S355J2	355	345	335	325	315	295	285	275	265
1.0596	S355K2	355	345	335	325	315	295	285	275	265
1.0590	S450J0 ³	450	430	410	390	380	380	-	-	-

^a For plates, band and bar with widths ≥ 600 mm is the direction transverse (t) to the rolling direction. For all other products, the values in the direction parallel (l) to the rolling direction.

² The values apply to flat products
³ Only applicable for long products

Tensile strength R_m ^a

Material-number (EN)	Designation	Nominal thickness in mm				
		≤ 3	> 3 ≤ 100	> 100 ≤ 150	> 150 ≤ 250	> 250 ≤ 400 ²
1.0038	S235JR	360 t/m 510	360 t/m 510	350 t/m 500	340 t/m 490	-
1.0114	S235J0	360 t/m 510	360 t/m 510	350 t/m 500	340 t/m 490	-
1.0117	S235J2	360 t/m 510	360 t/m 510	350 t/m 500	340 t/m 490	330 t/m 480
1.0044	S275JR	430 t/m 580	410 t/m 560	400 t/m 540	380 t/m 540	-
1.0143	S275J0	430 t/m 580	410 t/m 560	400 t/m 540	380 t/m 540	-
1.0145	S275J2	430 t/m 580	410 t/m 560	400 t/m 540	380 t/m 540	380 t/m 540
1.0045	S355JR	510 t/m 680	470 t/m 630	450 t/m 600	450 t/m 600	-
1.0553	S355J0	510 t/m 680	470 t/m 630	450 t/m 600	450 t/m 600	-
1.0577	S355J2	510 t/m 680	470 t/m 630	450 t/m 600	450 t/m 600	450 t/m 600
1.0596	S355K2	510 t/m 680	470 t/m 630	450 t/m 600	450 t/m 600	450 t/m 600
1.0590	S450J0 ³	-	550 t/m 720	530 t/m 700	-	-

^a For plates, band and bar with widths ≥ 600 mm is the direction transverse (t) to the rolling direction. For all other products, the values in the direction parallel (l) to the rolling direction.

² The values apply to flat products
³ Only applicable for long products



Minimum elongation % after fracture ^a

Material-number (EN)	Designation	Test piece position	L ₀ = 80 mm Nominal thickness in mm						L ₀ = 5,65 √S ₀ Nominal thickness in mm					
			≤ 1	> 1 ≤ 1,5	> 1,5 ≤ 2	> 2 ≤ 2,5	> 2,5 ≤ 3	> 3 ≤ 40	> 40 ≤ 63	> 63 ≤ 100	> 100 ≤ 150	> 150 ≤ 250	> 250 ≤ 400 ²	
			1.0038	S235JR	l	17	18	19	20	21	26	25	24	22
1.0114	S235J0												-	
1.0117	S235J2	t	15	16	17	18	19	24	23	22	22	21	21 (l and t)	
1.0044	S275JR	l	15	16	17	18	19	23	22	21	19	18	-	
1.0143	S275J0												-	
1.0145	S275J2	t	13	14	15	16	17	21	20	19	19	18	18 (l and t)	
1.0045	S355JR	l	14	15	16	17	18	22	21	20	18	17	-	
1.0553	S355J0												-	
1.0577	S355J2												17 (l and t)	
1.0596	S355K2	t	12	13	14	15	16	20	19	18	18	17	17 (l and t)	
1.0590	S450J0 ³	l	-	-	-	-	-	17	17	17	17	-	-	

^a For plates, band and bar with widths ≥ 600 mm is the direction transverse (t) to the rolling direction. For all other products, the values in the direction parallel (l) to the rolling direction.

² The values apply to flat products
³ Only applicable for long products



1.1.2 Hot rolled products of structural steel, non alloy, normalized or normalized rolled (+N) (EN 10025-3)

Minimum yield strength R_{eH} in N/mm² ^a

Material-number (EN)	Designation	Nominal thickness in mm								
		≤ 16	> 16 ≤ 40	> 40 ≤ 63	> 63 ≤ 80	> 80 ≤ 100	≤ 150	> 100 ≤ 150	> 150 ≤ 200	> 200 ≤ 250
1.0490	S275N	275	265	255	245	235	225	215	205	-
1.0491	S275NL									
1.0545	S355N	355	345	335	325	315	295	285	275	-
1.0546	S355NL									
1.8902	S420N	420	400	390	370	360	340	330	320	-
1.8912	S420NL									
1.8901	S460N	460	440	430	410	400	380	370	-	-
1.8903	S460NL									

^a For plates, band and bar with widths ≥ 600 mm is the direction transverse (t) to the rolling direction. For all other products, the values in the direction parallel (l) to the rolling direction.

² The values apply to flat products
³ Only applicable for long products

Tensile strength R_m ^a

Material-number (EN)	Designation	Nominal thickness in mm		
		≤ 100	> 100 ≤ 200	> 200 ≤ 250
1.0490	S275N	370 t/m 510	350 t/m 480	350 t/m 480
1.0491	S275NL			
1.0545	S355N	470 t/m 630	450 t/m 600	450 t/m 600
1.0546	S355NL			
1.8902	S420N	520 t/m 680	500 t/m 650	500 t/m 650
1.8912	S420NL			
1.8901	S460N	540 t/m 720	530 t/m 710	-
1.8903	S460NL			

^a For plates, band and bar with widths ≥ 600 mm is the direction transverse (t) to the rolling direction. For all other products, the values in the direction parallel (l) to the rolling direction.



Minimum elongation % after fracture ^a

Material-number (EN)	Designation	L ₀ = 5,65 √S ₀ Nominal thickness in mm					
		≤ 16	> 16 ≤ 40	> 40 ≤ 63	> 63 ≤ 80	> 80 ≤ 200	> 200 ≤ 250
1.0490	S275N	24	24	24	23	23	23
1.0491	S275NL						
1.0545	S355N	22	22	22	21	21	21
1.0546	S355NL						
1.8902	S420N	19	19	19	18	18	18
1.8912	S420NL						
1.8901	S460N	17	17	17	17	17	-
1.8903	S460NL						

^a For plates, band and bar with widths ≥ 600 mm is the direction transverse (t) to the rolling direction. For all other products, the values in the direction parallel (l) to the rolling direction.



1.2.1 Steels for quenching and tempering, non alloy, normalized or normalized rolled (+N) (EN 10083-2)

Material number (EN)	Designation	Nominal thickness in mm for diameter (d) or for flat products, thickness (t)								
		d ≤ 16 mm			16 mm < d ≤ 100 mm			100 mm < d ≤ 250 mm		
		t ≤ 16 mm			16 mm < t ≤ 100 mm			100 mm < t ≤ 250 mm		
		R _e N/mm ² min ^a	R _m N/mm ² min	R _p % min L ₀ = 5,65 √S ₀	R _e N/mm ² min ^a	R _m N/mm ² Min	R _p % min L ₀ = 5,65 √S ₀	R _e N/mm ² min ^a	R _m N/mm ² min	R _p % min L ₀ = 5,65 √S ₀
1.0501	C35	300	550	18	270	520	19	245	500	19
1.0511	C40	320	560	16	290	560	17	260	530	17
1.0503	C45	340	620	14	305	580	16	275	560	16
1.0535	C55	370	680	11	330	640	12	300	620	12
1.0601	C60	380	710	10	340	670	11	310	650	11
1.1151	C22E	240	430	24	210	410	25	-	-	-
1.1149	C22R									
1.1181	C35E	300	550	18	270	520	19	245	500	19
1.1180	C35R									
1.1186	C40E	320	580	16	290	550	17	260	530	17
1.1189	C40R									
1.1191	C45E	340	620	14	305	580	16	275	560	16
1.1201	C45R									
1.1206	C50E	355	650	13	320	610	14	290	590	14
1.1241	C50R									
1.1203	C55E	370	680	11	330	640	12	300	620	12
1.1209	C55R									
1.1221	C60E	380	710	10	340	670	11	310	650	11
1.1223	C60R									
1.1170	28Mn6	345	630	17	310	600	18	290	590	18

^a R_e: Upper yield point or when no flow occurs, the 0.2% yield strength Rp0,2



1.2.1 Steels for quenching and tempering, non alloy, quenched and tempered (+QT) (EN 10083-2)

Nominal thickness in mm for diameter (d) or for flat products, thickness (t)										
Material number (EN)	Designation	d ≤ 16 mm			16 mm < d ≤ 100 mm			100 mm < d ≤ 250 mm		
		t ≤ 8 mm			8 mm < t ≤ 20 mm			20 mm < t ≤ 60 mm		
		R _e N/mm ² min ^a	R _m N/mm ² min	R _p % min L ₀ = 5,65 √S ₀	R _e N/mm ² min ^a	R _m N/mm ² Min	R _p % min L ₀ = 5,65 √S ₀	R _e N/mm ² min ^a	R _m N/mm ² min	R _p % min L ₀ = 5,65 √S ₀
1.0501	C35	430	630-780	17	380	600-750	19	320	550-700	20
1.0511	C40	460	650-800	16	400	630-780	18	360	600-750	19
1.0503	C45	490	700-850	14	430	650-800	16	370	630-780	17
1.0536	C55	530	800-950	12	490	790-900	14	420	700-850	15
1.0601	C60	580	850-1000	11	520	800-950	13	450	750-900	14
1.1151	C22E	340	500-650	20	290	470-620	22	-	-	-
1.1149	C22R									
1.1181	C35E	430	630-780	17	380	600-790	19	320	550-700	20
1.1180	C35R									
1.1186	C40E	460	650-800	16	400	630-780	18	350	600-750	19
1.1189	C40R									
1.1191	C45E	490	700-850	14	430	650-800	16	370	630-780	17
1.1201	C45R									
1.1206	C50E	520	750-900	13	460	700-850	15	400	650-800	16
1.1241	C50R									
1.1203	C55E	550	800-950	12	490	750-900	14	420	700-850	15
1.1209	C55R									
1.1221	C60E	580	850-1000	11	520	800-950	13	450	750-900	14
1.1223	C60R									
1.1170	28Mn6	590	800-950	12	490	700-850	15	440	650-800	16

^a R_e: Upper yield point or when no flow occurs, the 0.2% yield strength Rp0,2



1.3 Steels for quenching and tempering, alloy, quenched and tempered (+QT) (EN 10083-3)

Material number (EN)	Designation	Nominal thickness in mm for diameter (d) or for flat products, thickness (t)														
		d ≤ 16 mm			16 mm < d ≤ 40 mm			40 mm < d ≤ 100 mm			100 mm < d ≤ 160 mm			180 mm < d ≤ 250 mm		
		t ≤ 8 mm			8 mm < t ≤ 20 mm			20 mm < t ≤ 60 mm			60 mm < t ≤ 100 mm			100 mm < t ≤ 180 mm		
		R _e min ^a	R _m min	R _p ^b %	R _e min ^a	R _m min	R _p ^b %	R _e min ^a	R _m min	R _p ^b %	R _e min ^a	R _m min	R _p ^b %	R _e min ^a	R _m min	R _p ^b %
1.7003	38Cr2	550	800-950	14	450	700-850	15	350	600-750	17	-	-	-	-	-	-
1.7006	42Cr2	650	900-1100	12	550	800-950	14	400	650-800	15	-	-	-	-	-	-
1.7033	34Cr4	700	900-1100	12	590	800-950	14	480	700-850	15	-	-	-	-	-	-
1.7037	34CrS4															
1.7034	37Cr4	750	950-1150	11	630	850-1000	13	510	750-900	14	-	-	-	-	-	-
1.7038	37CrS4															
1.7035	41CR4	800	1000-1200	11	660	900-1100	12	560	800-950	14	-	-	-	-	-	-
1.7039	41CrS4															
1.7218	25CrMo4	700	900-1100	12	600	800-950	14	450	700-850	15	400	650-800	16	-	-	-
1.7213	25CrMoS4															
1.7220	34CrMo4	800	1000-1200	11	650	900-1100	12	550	800-950	14	500	750-900	15	450	700-850	15
1.7226	34CrMoS4															
1.7225	42CrMo4	900	1100-1300	10	750	1000-1200	11	650	900-1100	12	550	800-950	13	500	750-900	14
1.7227	42CrMoS4															
1.7228	50CrMo4	900	1100-1300	9	780	1000-1200	10	700	900-1100	12	650	850-1000	13	550	800-950	13
1.6582	34CrNiMo6	1000	12000-1400	9	900	1100-1300	10	800	1000-1200	11	700	900-1100	12	600	800-950	13
1.6580	30CrNiMo8	1050	1250-1450	9	1050	1250-1450	9	900	1000-1300	10	800	1000-1200	11	700	900-1100	12
1.5815	30CrNiMo8	740	880-1080	12	740	880-1080	14	640	780-980	15	-	-	-	-	-	-
1.6773	36NiCrMo16	1050	1250-1450	9	1050	1250-1450	9	900	1100-1300	10	800	1000-1200	11	800	100-1200	11
1.6510	39NiCrMo4	785	980-1180	11	735	930-1130	11	685	880-1080	12	635	830-980	12	540	740-880	13
1.6747	30NiCrMo 16-6	880	1080-1230	10	860	1080-1230	10	830	1030-1230	10	790	900-1050	11	880	900-1050	11
1.8159	51CrV4	900	1100-1300	9	800	100-1200	10	700	900-1100	12	650	850-1000	13	600	800-950	13
1.5530	20MnB5	700	900-1050	14	600	750-900	15	-	-	-	-	-	-	-	-	-
1.5531	30MnB5	800	950-1150	13	650	800-950	13	-	-	-	-	-	-	-	-	-
1.5532	38MnB5	900	1050-1250	12	700	850-1050	12	-	-	-	-	-	-	-	-	-
1.7182	27MnCrB 5-2	800	1000-1250	14	750	900-1150	14	700	800-1000 ^c	15	-	-	-	-	-	-
1.7185	33MnCrB5-2	850	1050-1300	13	800	950-1200	13	750	900-1100 ^c	13	-	-	-	-	-	-
1.7189	39MnCrB6-2	900	1100-1350	12	850	1050-1250	12	800	1000-1200 ^c	12	-	-	-	-	-	-

^a R_e: R_e: Upper yield point or when no flow occurs, the 0.2% yield strength Rp0, 2.

^b Elongation after fracture L₀ = 5,65 √S₀

^c For 40 mm < d ≤ 60 mm and 20 mm < t ≤ 40 mm



1 Mechanical properties of steel plates

2.1.1 Cold rolled low carbon steel sheet for cold forming (EN 10130)

Material number (EN)	Designation	R_e N/mm ² min ^a	Tensile strength R_m N/mm ²	Elongation A_{80} % min ^b
1.0330	DC01	- / 280	270 / 410	28
1.0347	DC03	- / 240	370 / 370	34
1.0338	DC04	- / 210	270 / 350	38
1.0312	DC05	- / 180	270 / 330	40
1.0873	DC06	- / 180	270 / 350	38

^a The values of yield strength are those of the 0.2% yield strength at products that do not clearly show flow and the lower yield strength R_{el} to other products. At a thickness ≤ 0.7 mm and > 0.5 mm is the minimum value of the yield strength of 20 N/mm² increased. At a thickness ≤ 0.5 mm is the maximum value of the yield strength increased by 40 N/mm². For design purposes, the lower yield strength of DC01, DC03, DC04 and DC05 is 140 N/mm². For DC06 120 N/mm².

^b At a thickness ≤ 0.7 mm and > 0.5 mm is the minimum value for the elongation at break reduced with 2 units. At a thickness ≤ 0.5 mm is the minimum value for the elongation at break reduced by 4 units.

2.1.2 Cold rolled steel sheet with high yield strength for cold forming (EN 10268)

Material number (EN)	Designation	0,2% yield strength $R_{p0,2}$ N/mm ² ^{a, b}	Tensile strength R_m N/mm ²	Elongation A_{80} % min ^b
1.0480	H240LA	340-310	340-420	27
1.0489	H280LA	280-360	370-470	24
1.0548	H320LA	320-410	400-500	22
1.0550	H360LA	380-460	430-550	20
1.0556	H400LA	400-500	460-580	18

^a The data applies to test specimens from the transverse direction.

^b If there is flow occurring, the values apply for the lower yield strength R_{el} .

^c At a thickness ≤ 0.7 mm (including zinc layer) is the minimum value for the elongation at break reduced with 2 units.



2.2.1 Continuously hot-dip coated sheet of low carbon steels for cold forming (Sendzimir) (EN 10327)

Material number (EN)	Designation	0,2% yield strength $R_{p0,2}$ N/mm ² ^a	Tensile strength R_m N/mm ² ^a	Elongation A_{80} % min ^b
1.0226	DX51D+Z, +ZF, +ZA, +AZ, +AS	-	270 - 500	22
1.0350	DX52D+Z, +ZF, +ZA, +AZ, +AS	140 - 300 ^c	270 - 420	26
1.0355	DX53D+Z, +ZF, +ZA, +AZ, +AS	140 - 260	270 - 380	30
1.0306	DX54D+Z, +ZA	120 - 220	260 - 350	36
	DX54D+ZF			34
	DX54D+AS			34
1.0309	DX55D+AS	140 - 240	270 - 370	30
1.0322	DX56D+Z, +ZA	120 - 180	260 - 350	39
	DX56D+ZF			37
	DX56D+AS			39
1.0853	DX57D+Z, +ZA	120 - 170	260 - 350	41
	DX57D+ZF			39
	DX57D+AS			41

^a The data applies to test specimens from the transverse direction.

^b The values for the yield strength are valid for the 0,2% yield strength ($R_{p0,2}$) if there is no flow occurs, otherwise applies the lower yield strength

^c For products 0,50 < t ≤ 0,7 mm the minimum value for the elongation at break was reduced with 2 units, for t ≤ 0,50 with 4 units.

^d Value applies for cold finished products (surface qualities B and C).

2.2.2 Continuously hot-dip coated sheet of structural steels (EN 10326)

Materialnumber (EN)	Designation	0,2% yield strength $R_{p0,2}$ N/mm ² ^{a, b}	Tensile strength R_m N/mm ² ^a	Elongation A_{80} % min ^b
1.0241	S220GD+Z, +ZF, +ZA, +AZ	220	300	20
1.0242	S250GD+Z, +ZF, +ZA, +AZ, +AS	250	330	19
1.0244	S280GD+Z, +ZF, +ZA, +AZ, +AS	280	360	18
1.0250	S320GD+Z, +ZF, +ZA, +AZ, +AS	320	390	17
1.0529	S350GD+Z, +ZF, +ZA, +AZ, +AS	350	420	16
1.0531	S550GD+Z, +ZF, +ZA, +AZ,	550	560	-

^a The data applies to test specimens from the transverse direction.

^b With a noticeable yield strength, the values apply for the upper yield point ReH .

^c At all grades of steel - except S550GD - a margin of 140 N/mm² tensile strength can be expected.



2.3.1 Hot rolled plate made of high yield strength steel for cold forming (thermomechanically rolled) (EN 10149-2)

Material number (EN)	Designation	Yield strength R_{eH} N/mm ² min ¹	Tensile strength R_m N/mm ² min ¹	Rp % min, thickness nominal ¹	
				< 3 L _o = 80 mm	≥ 3 L _o = 5,65 √ S _o
1.0972	S315MC	315	309 t/m 510	20	24
1.0976	S355MC	355	430 t/m 550	19	23
1.0980	S420MC	420	480 t/m 620	16	19
1.0982	S460MC	460	520 t/m 670	14	17
1.0984	S500MC	500	550 t/m 700	12	14
1.0986	S550MC	550	600 t/m 760	12	14
1.8969	S600MC	600	650 t/m 820	11	13
1.8976	S650MC	650	700 t/m 880	10	12
1.8974	S700MC	700	750 t/m 950	10	12

¹ The values for the tensile test are applicable to test specimens of the longitudinal direction for the product widths less than 600 mm and for test specimens in transverse direction for widths equal to or greater than 600 mm.

2.3.2 Hot rolled plate made of high yield strength steel for cold forming (normalized or normalized rolled) (EN 10149-3)

Material number (EN)	Designation	Yield strength R_{eH} N/mm ² min ¹	Tensile strength R_m N/mm ² min ^a	Rp % min, thickness nominal ¹	
				< 3 L _o = 80 mm	≥ 3 L _o = 5,65 √ S _o
1.0971	S260NC	260	370 t/m 490	24	30
1.0973	S315NC	315	430 t/m 550	22	27
1.0977	S355NC	355	470 t/m 610	20	26
1.0981	S420NC	420	530 t/m 670	18	23

^a The values for the tensile test are applicable to test specimens of the longitudinal direction for the product widths less than 600 mm and for test specimens in transverse direction for widths equal to or greater than 600 mm.