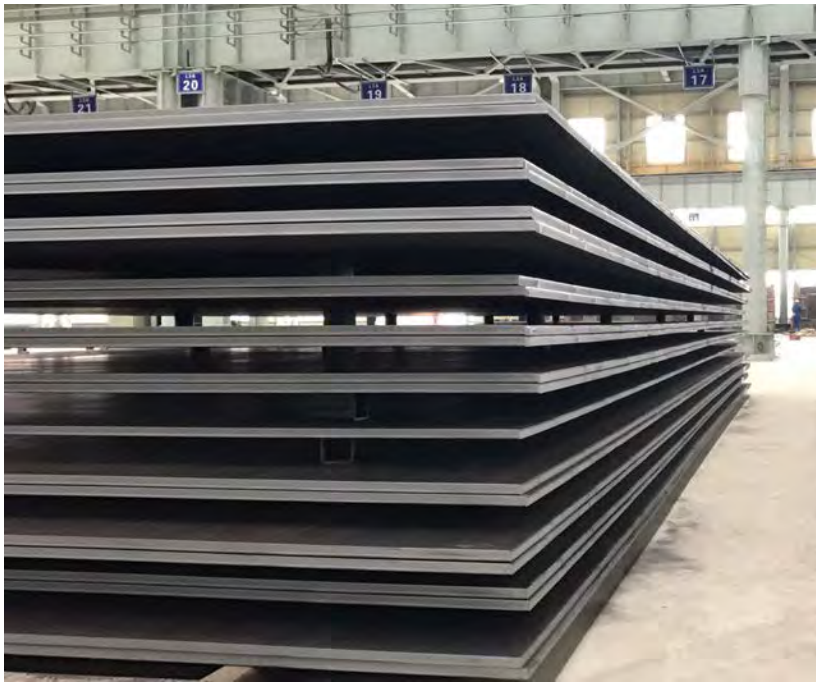

SG STEEL
STEEL
PLATES

MATERIAL CERTIFICATE DOCUMENTS COMPLIANT WITH EN 10204 & ASME SA-20SA-480, SA-530, SA788, SA-961

The required Inspection documents are issued by the Quality Control companies stating
the chemical composition of heat and the material testing results (e.g. ultrasound, mechanical testing) in accordance with the customer's order:
Declaration of Compliance with order "2.1" Test Report "2.2"
Inspection Certificate "3.1"
Inspection Certificate "3.2"

INSPECTION COMPANIES

ABS
BV
DNV GL
LR
TÜV NORD
TÜV SÜD
SGS
ASME
NACE
RINA



SG STEEL

INFORMATIVE SUMMARY OF BASIC PROPERTIES FOR THE OFFERED PLATES

Length Width	max: 24000 mm
Thickness	min: 500 mm max: 4200 mm
Weight	min: 2 mm max: 600 mm
	max: 26000 kgs

DELIVERY CONDITIONS OF PLATES (HEAT TREATMENT):

AR – as rolled
N – normalized
NT – normalized and tempered
A – annealed
M (TMCP) – thermomechanical rolled

Structural Steels

STEEL PLATES ACCORDING TO EN 10025-2 WITH „CE“ MARK

The most commonly used structural steels have
a minimum yield strength of 235 MPa and a guaran-teed weldability that can be used for less demanding steel structures structures including bridges, halls, railway sections, and motor vehicles, etc.

Designation/Steel number	Min. Yield Strength R_{eH} [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [°C/J]	CEV max. [1]	Thickness [5] [mm]	Thickness for option (C) [mm]
S235JR(C)/1.0038(1.0122)[4]	235	360–510	24	+20/27	0.35	5–100	5–30[3]
S235J0(C)/1.0114(1.0115)	235	360–510	24	0/27	0.35	5–100	5–30[3]
S235J2(C)/1.0117(1.0119)[4]	235	360–510	24	-20/27	0.35	5–100	5–30[3]
S275JR(C)/1.0044(1.0128)[4]	275	410–560	21	+20/27	0.40	5–100	5–30[3]
S275J0(C)/1.0143(1.0140)	275	410–560	21	0/27	0.40	5–100	5–30[3]
S275J2(C)/1.0145(1.0142)[4]	275	410–560	21	-20/27	0.40	5–100	5–30[3]
S355JR(C)/1.0045(1.0551)	355	470–630	20	+20/27	0.45	5–100	5–30[3]
S355J0(C)/1.0553(1.0554)	355	470–630	20	0/27	0.45	5–100	5–30[3]
S355J2(C)/1.0577(1.0579)[4]	355	470–630	20	-20/27	0.45	5–100	5–30[3]
S355K2(C)/1.0596(1.0594)[4]	355	470–630	20	-20/40	0.45	5–100	5–30[3]

EQUIVALENT DESIGNATION

EN 10025-2	EN 10025+A1	DIN 17100	BS 4360	NFA 35-501
S235JR(C)	S235JRG2(C)	RSt 37 - 2	40 B	E 24 - 2
S235J0(C)	S235J0(C)	St 37 - 3U	40 C	E 24 - 3
S235J2(C)	S235J2G4(C)	St 37 - 3N	40 D	E 24 - 4
S275JR(C)	S275JR(C)	St 44 - 2	43 B	E 28 - 2
S275J0(C)	S275J0(C)	St 44 - 3U	43 C	E 28 - 3
S275J2(C)	S275J2G4(C)	St 44 - 3N	43 D	E 28 - 4
S355JR(C)	S355JR(C)	–	50 B	E 36 - 2
S355J0(C)	S355J0(C)	St 52 - 3U	50 C	E 36 - 3
S355J2(C)	S355J2G4(C)	St 52 - 3N	50 D	–
S355K2(C)	S355K2G4(C)	–	50 DD	E 36 - 4

1) $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{N+Cu}{15}$

2) Valid for thicknesses up to 16 mm, for higher thicknesses refer to the standard.
3) According to the standard.
4) Upon agreement in accordance with AD2000 W1/W10 Technical Standard.
5) Higher thicknesses up to 300 mm upon agreement.

Structural Steels

PLATES OF FINE-GRAIN STEELS ACCORDING TO EN 10025-3 WITH „CE“ MARK

Structural steels with a guaranteed fine-grain structure and a low carbon equivalent. Thanks to the minimum yield strength of up to 460 MPa and an impact energy guaranteed at -50 °C, these steels are suitable for more demanding steel structures and their supporting elements. They are suitable for the construction of railway and motor vehicles as well.

Designation/Steel number	Min. Yield Strength R_{eH} [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [°C/J]	CEV max. [1]	Thickness [mm]
S275N/1.0490	275	370–510	24	-20/40	0.40	5–100[3]
S275NL/1.0491	275	370–510	24	-50/27	0.40	5–100[3]
S355N/1.0545	355	470–630	22	-20/40	0.43	5–100[3]
S355NL/1.0546	355	470–630	22	-50/27	0.43	5–100[3]
S420N/1.8902	420	520–680	19	-20/40	0.48	5–80
S420NL/1.8912	420	520–680	19	-50/27	0.48	5–80
S460N/1.8901	460	550–720	17	-20/40	0.53	6–80
S460NL/1.8903	460	550–720	17	-50/27	0.53	6–80

EQUIVALENT DESIGNATION

EN 10025-3	EN 10113-2	DIN 17102
S275N	S275N	StE 285
S275NL	S275NL	TStE 285
S355N	S355N	StE 355
S355NL	S355NL	TStE 355
S420N	S420N	StE 420
S420NL	S420NL	TStE 420
S460N	S460N	StE 460
S460NL	S460NL	TStE 460

1) $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{N+Cu}{15}$

2) Valid for thicknesses up to 16 mm, for higher thicknesses refer to the standard.

3) Higher thicknesses up to 300 mm upon agreement.

THERMOMECHANICALLY ROLLED PLATES OF FINE-GRAIN STEELS ACCORDING TO EN 10025-4 WITH „CE“ MARK

Thermomechanically rolled plates of structural steels have a low carbon equivalent, and thus excellent weldability. They are used for more demanding steel structures and their supporting elements. The impact energy is guaranteed at temperatures as low as -50 °C, facilitating a wide range of usage.

Designation/Steel number	Min. Yield Strength R_{eH} [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [°C/J]	CEV max. [1]	Thickness [mm]
S275M/1.8818	275	370–530	24	-20/40	0,34	8–40
S275ML/1.8819	275	370–530	24	-50/27	0,34	8–40
S355M/1.8823	355	470–630	22	-20/40	0,39	8–40
S355ML/1.8834	355	470–630	22	-50/27	0,39	8–40
S420M/1.8825	420	520–680	19	-20/40	0,43	8–40
S420ML/1.8836	420	520–680	19	-50/27	0,43	8–40
S460M/1.8827	460	540–720	17	-20/40	0,45	8–30[3]
S460ML/1.8838	460	540–720	17	-50/27	0,45	8–30[3]

EQUIVALENT DESIGNATION

EN 10025-4	EN 10113-3	SEW 092
S275M	S275M	-
S275ML	S275ML	-
S355M	S355M	QStE 380 TM
S355ML	S355ML	-
S420M	S420M	QStE 420 TM
S420ML	S420ML	-
S460M	S460M	QStE 460 TM
S460ML	S460ML	-

1) $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{N+Cu}{15}$

2) Valid for thicknesses up to 16 mm, for higher thicknesses refer to the standard.

3) Higher thicknesses up to 300 mm upon agreement.

PLATES OF STEELS ACCORDING TO ASTM

Designation	Grade	Min. Yield Strength R_{eH} [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [°C/J]	Thickness [mm]
A 36		250	400–550	20/23	[2]	5–100[4]
A 283	C	205	380–515	22/25	[2]	5–100[4]
A 283	D	230	415–550	20/23	[2]	5–100[4]
A 529	50 (345)	345	485–690	18/21	[2]	5–25[3]
A 529	55 (380)	380	485–690	17/20	[2]	5–25[3]

PLATES OF FINE-GRAIN STEELS ACCORDING TO ASTM

Designation	Grade	Min. Yield Strength R_{eH} [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [°C/J]	Thickness [mm]
A 572	42 (290)	290	415 min.	20/24	[2]	5–100[4]
A 572	50 (345)	345	450 min.	18/21	[2]	5–100[3]
A 572	55 (380)	380	485 min.	17/20	[2]	5–50[3]
A 572	58 (400)	220	400–490	21/24	[2]	5–40[3]
A 573	65 (450)	240	450–530	20/23	[2]	5–40[3]
A 573	70 (485)	290	485–620	18/21	[2]	5–40[3]

Maximum value of the carbon equivalent as per the formula

$$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$ upon agreement.

1) Testing upon agreement
2) Testing temperature and minimum impact energy upon agreement
3) According to the standard
4) Higher thicknesses upon agreement

Structural Steels with Improved Atmospheric Corrosion Resistance

Plates of structural steels with improved atmospheric corrosion resistance do not require – unlike common steels – expensive surface treatments (painting). They feature increased resistance even against the impacts of impacts of higher levels of sulphur in the atmosphere. Their key use is in the area of in the area of bridge construction, but they can be used for chimney/stacks and flue-gas ducting structures, as well.

PLATES OF STEELS ACCORDING TO EN 10025-5 WITH „CE“ MARK

Designation/Steel number	Min. Yield Strength R_{eH} [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [°C/J]	CEV max. [1]	Thickness [mm]
S355J0W/1.8959	355[2]	470–630	20	0/27	0.52	6–80
S355J2W/1.8965	355[2]	470–630	20	-20/27	0.52	6–80
S355K2W/1.8967	355[2]	470–630	20	-20/40	0.52	6–80

1) $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$

2) Valid for thicknesses of up to 16 mm, for higher thicknesses refer to the standard

EQUIVALENT DESIGNATION

EN 10025-5	EN 10155	SEW 087	CAN/CSA – G40.21-M
S355J0W	S355J0W	–	–
S355J2W	S355J2G2W	WTSt 52 - 3	350AT
S355K2W	S355K2G2W	–	–

Hot-rolled Plates for Cold Forming

THERMOMECHANICALLY ROLLED PLATES OF STEELS ACCORDING TO EN 10149-2

Standard methods used used in the production of these plates are bending, flanging, cold roll forming, etc. Upon agreement, these plates can be delivered in in a condition suitable for hot-dip zinc-coating. These plates have excellent weldability thanks to their low carbon equivalent.

Designation/Steel number	Min. Yield Strength R_{eH} [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [1] [°C/J] – longitudinal	Transverse Bend Test [2]	Thickness [mm]
S315MC/1.0972	315	390–510	24	-20/40	0 t	8–20[3]
S355MC/1.0976	355	430–550	23	-20/40	0.5 t	8–20[3]
S420MC/1.0980	420	480–620	19	-20/40	0.5 t	8–20[3]
S460MC/1.0982	460	520–670	17	-20/40	1 t	8–20[3]

EQUIVALENT DESIGNATION

EN 10149-2	SEW 092
S315MC	(QStE 340 TM)
S355MC	(QStE 380 TM)
S420MC	QStE 420 TM
S460MC	QStE 460 TM

Maximum value of the carbon equivalent as per the formula

$$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$ upon agreement.

1) Testing upon agreement
2) Minimum former diameter for 180° bend angle; t – plate thickness
3) According to the standard

NORMALIZED PLATES OF STEELS ACCORDING TO EN 10149-3

These plates guarantee suitability for cold forming because of their technological processing. Standard methods used in the production of these plates include bending, flanging, cold roll forming, etc. Based on agreement these plates can be delivered in a condition suitable for hot-dip zinc-coating.

Designation/Steel number	Min. Yield Strength R_{eH} [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [1] [°C/J] – longitudinal	Transverse Bend Test [2]	Thickness [mm]
S260NC/1.0971	260	370-490	30	-24/40	0 t	5–20[3]
S315NC/1.0973	315	430–550	27	-20/40	0.5 t	5–20[3]
S355NC/1.0977	355	470–610	25	-20/40	0.5 t	5–20[3]
S420NC/1.0981	420	530–670	23	-20/40	0.5 t	5–20[3]

EQUIVALENT DESIGNATION

EN 10149-3	SEW 092
S260NC	QStE 260N
S315NC	(QStE 340N)
S355NC	(QStE 380N)
S420NC	QStE 420N

Maximum value of the carbon equivalent as per the formula

$$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$ upon agreement.

1) Testing upon agreement
2) Minimum former diameter for 180° bend angle; t – plate thickness
3) According to the standard

Ship Building Plates

PLATES ACCORDING TO INDIVIDUAL SHIPPING COMPANIES

Plates of structural steel grades according to the requirements of the inspection companies ABS, BV, DNV GL, LR, and others, with a minimum yield strength 235 to 355 MPa are used for ship and wa-tercraft construction. The quality of this assortment is guaranteed by product certification awarded by the individual shipping companies.

Steel Group	Min. Yield Strength R_{eH} [MPa]	Min. Impact Energy KV [1] [°C/J] – longitudinal	ABS – American Bureau of Shipping	BV – Bureau Veritas	DNV GL	LR – Lloyd's Register of Shipping
Normal Strength Steel Grades	235	–	A	A	A	A
	235	0/27	B	B	B	B
	235	-20/27	D	D	D	D
	235	-40/27	E	E	E	E
High Strength Steel Grades	315	0/31	AH 32	AH 32	A 32	AH 32
	315	-20/31	DH 32	DH 32	D 32	DH 32
	315	-40/31	EH 32	EH 32	E 32	EH 32
	355	0/34	AH 36	AH 36	A 36	AH 36
	355	-20/34	DH 36	DH 36	D 36	DH 36
	355	-40/34	EH 36	EH 36	E 36	EH 36

Maximum value of the carbon equivalent as per the formula

$$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$ upon agreement

Thermomechanically Rolled Plates for Welded Pipes

Thermomechanically rolled plates made of non-alloyed and micro-alloyed steels with an excellent weldability are designed exclusively for welded pipelines for combustible and non-combustible fluids. These can be supplied only upon agreement on the basis of the Technical Conditions negotiated between the manufacturer and the customer for supplies of these plates. The Technical Conditions must specify all customer requirements for the ordered plates.

PLATES FOR PIPES ACCORDING TO API 5L [1] / EN ISO 3183[1] - PSL1[4]

Grade	Min. Yield Strength $R_{t0,5}$ ($R_{t0,2}$)[2] [MPa]	Min. Tensile Strength R_m [2] [MPa]	Thickness [3] [mm]
B / L245	245	415	8-30
X42 / L290	290	415	8-30
X46 / L320	320	435	8-30
X52 / L360	360	460	8-30
X56 / L390	390	490	8-30
X60 / L415	415	520	8-22
X65 / L450	450	535	8-22
X70 / L485	485	570	8-22

PLATES FOR PIPES ACCORDING TO API 5L [1] / EN ISO 3183[1] - PSL2[4]

Grade	Yield Strength $R_{t0,5}$ ($R_{t0,2}$)[2] [MPa]	Tensile Strength R_m [2] [MPa]	CEV max. [2]	Thickness [3] [mm]
B M(S) / L245 M(S)	245-450	415-655	0,43	8-30
X42 M(S) / L290 M(S)	290-495	415-655	0,43	8-30
X46 M(S) / L320 M(S)	320-525	435-655	0,43	8-30
X52 M(S) / L360 M(S)	360-530	460-760	0,43	8-30
X56 M(S) / L390 M(S)	390-545	490-760	0,43	8-30
X60 M(S) / L415 M(S)	415-565	520-760	0,43	8-22
X65 M / L450 M	450-600	535-760	0,43	8-22
X70 M / L485 M	485-635	570-760	0,43	8-22

1) API 5L and EN ISO 3183 are technical requirements for welded pipes, not for plates
2) Informative value
3) Higher thicknesses upon agreement
4) PSL = Product Specification Level

Normalized Plates for Welded Pipes

Normalized rolled plates made of non-alloyed and mi-cro-alloyed steels are designed exclusively for welded pipelines for combustible and non-combustible fluids. These can be supplied only upon agreement on the basis of the Technical Conditions negotiated between the manufacturer and the customer for supplies of these plates. The Technical Conditions must specify all customer requirements for the ordered plates.

PLATES FOR PIPES ACCORDING TO EN 10208-1[1)]

Designation/Steel number	Min. Yield Strength $R_{t0,5}$ [2)] [MPa]	Tensile Strength R_m [2)] [MPa]	Min. Elongation[2)] [1)](L0 = 5,65√S0) [%]	CEV max. [2)]	Thickness [3)] [mm]
L210GA/1.0319	210	335–475	25	0,40	5–40
L235GA/1.0458	235	370–510	23	0,40	5–40
L245GA/1.0459	245	415–555	22	0,42	5–40
L290GA/1.0483	290	415–555	21	0,42	5–40
L360GA/1.0499	360	460–620	20	0,43	5–40

1) EN 10208-1 and EN ISO 10208-2 are technical requirements for welded pipes, not for plates
2) Informative value
3) Higher thicknesses upon agreement

PLATES FOR PIPES ACCORDING TO EN 10208-2[1)]

Designation/Steel number	Min. Yield Strength $R_{t0,5}$ [2)] [MPa]	Tensile Strength R_m [2)] [MPa]	Min. Elongation[2)] [)](L0 = 5,65√S0) [%]	CEV max. [2)]	Thickness [3)] [mm]
L245NB/1.0457	245–440	415	22	0,42	5–40
L290NB/1.0484	290–440	415	21	0,42	5–40
L360NB/1.0582	360–510	460	20	0,43	5–40
L415NB/1.8972	415–565	520	18	on agreement	5–40

1) EN 10208-1 and EN ISO 10208-2 are technical requirements for welded pipes, not for plates
2) Informative value
3) Higher thicknesses upon agreement

Steel Plates for Offshore Structures

NORMALIZED PLATES OF STEELS ACCORDING TO EN 10225

Designation/Steel number	Group	Min. Yield Strength R_{eH} [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy Min. KV [°C/J] – longitudinal	CEV max. [3]	P_{cm} max. [4]	Thickness [mm]
S355G2+N/1.8801	1	355 [1]	470–630	22	-20/50 [6]	0.43	…	5–20 [5]
S355G3+N/1.8802	1	355 [1]	470–630	22	-40/50 [6]	0.43	…	5–40 [5]
S355G7+N/1.8808+N	2	355 [2]	470–630	22	-40/50 [7]	0.43	0.24	5–62 [8]
S355G8+N/1.8810+N	3	355 [2]	470–630	22	-40/50 [7]	0.43	0.24	5–62 [8]
S355G9+N/1.8811+N	2	355 [2]	470–630	22	-40/50 [7]	0.43	0.22	5–62 [8]
S355G10+N/1.8813+N	3	355 [2]	470–630	22	-40/50 [7]	0.43	0.22	5–62 [8]

1) Valid for thicknesses of up to 16 mm, for higher thicknesses refer to the standard

2) Valid for thicknesses of up to 25 mm, for higher thicknesses refer to the standard

3) $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$

4) $P_{cm} = C + \frac{Si}{30} + \frac{Mn+Cu+Cr}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B$

5) According to the standard

6) Longitudinal

7) Transverse

8) Higher thicknesses up to 80 mm upon request

THERMOMECHANICALLY ROLLED PLATES OF STEELS ACCORDING TO EN 10225

Designation/Steel number	Group	Min. Yield Strength R_{eH} [MPa]	Tensile Strength	Min. Elongation	Min. Impact Energy KV [°C/J] – longitudinal	CEV max. [3]	P_{cm} max. [4]	Thickness
S355G5+M/1.8804	1	355 [1]	470–610	22	-20/50 [6]	0.43	…	8–20 [5]
S355G6+M/1.8805	1	355 [1]	470–610	22	-40/50 [6]	0.43	…	8–40 [5]
S355G7+M/1.8808+M	2	355 [2]	470–630	22	-40/50 [7]	0.43	0.24	8–40
S355G8+M/1.8810+M	3	355 [2]	470–630	22	-40/50 [7]	0.43	0.24	8–40
S355G9+M/1.8811+M	2	355 [2]	470–630	22	-40/50 [7]	0.41	0.21	8–40
S355G10+M/1.8813+M	3	355 [2]	470–630	22	-40/50 [7]	0.41	0.21	8–40
S420G1+M/1.8830+M	2	420 [1]	500–660	19	-40/60 [7]	0.42	0.22	8–40
S420G2+M/1.8857+M	3	420 [1]	500–660	19	-40/60 [7]	0.42	0.22	8–40
S460G1+M/1.8878+M	2	460 [1]	540–700 [1]	17	-40/60 [7]	0.43	0.22	8–30
S460G2+M/1.8887+M	3	460 [1]	540–700 [1]	17	-40/60 [7]	0.43	0.22	8–30

1) Valid for thicknesses of up to 16 mm, for higher thicknesses refer to the standard

2) Valid for thicknesses of up to 25 mm, for higher thicknesses refer to the standard

3) $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$

4) $P_{cm} = C + \frac{Si}{30} + \frac{Mn+Cu+Cr}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B$

5) According to the standard

6) Longitudinal

7) Transverse

PLATES OF STEELS ACCORDING TO API 2H [2]

Tensile Strength R_m [MPa]	Min. Elongation 200/50 [%]	Min. Impact Energy KV [1] [°C/J] – longitudinal	CEV max. [1]	Thickness [mm]
427-565	18/22	-40/34	0.432)	5–80
427-565	18/22	-40/34	0.453)	5–80
483-620	16/21	-40/41	0.434)	5–80
483-620	16/21	-40/41	0.455)	5–80

1) $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$

2) Without the API monogram

Non-alloy or Alloy Steels for Quenching and Tempering

PLATES OF STEELS ACCORDING TO EN 10083-2

These plates are used for machinery parts in all machinery production areas. In most cases they are difficult to weld. They are supplied either without heat treatment or in soft annealed (+A) or normalized (+N) condition, according to the following table. Products from these plates are further processed with heat treatment – quenching and tempering. After such treatment, they obtain their typical properties, i.e. high toughness, hardness and strength.

Designation/Steel number	Min. Yield Strength R_{eH} [1] [MPa]	Min. Tensile Strength R_m [1] [MPa]	Min. Elongation [1] [1]($L_0 = 5.65\sqrt{S_0}$)[%]	HB max. (+A)	Thickness [mm]
C45/1.0503 [2]	340	620	14	207	6–80 [3]
C45E/1.1191 [2]	340	620	14	207	6–80 [3]

1) Valid for plates in normalized contition and for thicknesses of up to 16 mm, for higher thicknesses refer to the standard
2) EN 10083-2
3) Higher thicknesses upon request

EQUIVALENT DESIGNATION

EN 10083 -2	Germany	Great Britain
C45/C45E	C45/CK45	080M46

PLATES OF STEELS ACCORDING TO EN 10343 WITH „CE“ MARK FOR CONSTRUCTION PURPOSES

These plates are used in the building industry for the production of quenched and tempered components. They can also be used in normalized condition. In most cases these plates are difficult to weld. They are supplied in normalized condition. Products of these plates are further processed with heat treat-ment – quenching and tempering. After such treat-ment, they obtain their typical properties, i.e. high hardness, toughness and strength.

Designation/Steel number	Min. Yield Strength R_{eH} [1) 2)] [MPa]	Min. Tensile Strength R_m [1) 2)] [MPa]	Min. Elongation [1) 2)] [2)] ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [1) 3)] [°C/J] – longitudinal	Thickness [mm]
C45 /1.0503	340	620	14	+20/12	6–80 [4)]
C45E /1.1191	340	620	14	+20/12	6–80 [4)]

1) Valid for normalized condition
2) Valid for thicknesses of up to 16 mm, for higher thicknesses refer to the standard
3) Valid for thicknesses of over 16 mm, for thicknesses of up to 16 mm without KV testing
4) Higher thicknesses upon request

Case Hardening Steels

PLATES OF STEELS ACCORDING TO EN 10084

These plates are supplied only in soft annealed (+A) condition.

Designation/Steel number	HB max. (+A)	Thickness [mm]
16MnCr5/1.7131	207	6–80
20MnCr5/1.7147	217	6–80

Tool Steels

PLATES OF STEELS ACCORDING TO EN ISO 4957

These plates are supplied only in soft annealed (+A) condition.

Designation/Steel number	HB max. (+A)	Thickness [mm]
C45U/1.1730	207	10–80

1) Other thicknesses upon agreement

PLATES OF STEELS ACCORDING TO EN 10028-2

Plates of unalloyed as well as alloyed steels for pressure-loaded vessels and facilities, operating un-der normal as well as elevated temperatures. These plates are usually delivered in normalized condition or in normalized and tempered condition.

Designation/Steel number	Min. Yield Strength R_{eH} [1] [MPa]	Min. Yield Strength $R_{P0.2}$ [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [°C/J]	Thickness [mm]
P235GH/1.0345 [4] [6]	235	153	360–480	24	-20/27	5–80 [5]
P265GH/1.0425 [4] [6]	265	173	410–530	22	-20/27	5–80 [5]
P295GH/1.0481 [4] [6]	295	192	460–580	21	-20/27	5–80 [5]
P355GH/1.0473 [4] [6]	355	232	510–650	20	-20/27	5–80 [5]
16Mo3/1.5415 [6]	275	194	440–590	22	+20/31	6–80
13CrMo4-5/ .7335 [6]	300	216	450–600	19	+20/31	6–80

EQUIVALENT DESIGNATION

EN 10028-2	DIN 17155
P235 GH	H I
P265 GH	H II
P295 GH	17Mn4
P355 GH	19Mn6
16Mo3	15Mo3
13CrMo4-5	13CrMo44

1) Valid for thicknesses of up to 16 mm, for higher thicknesses refer to the standard
2) Testing upon agreement; valid for a temperature of 300 °C and thicknesses of up to 16 mm; for other temperatures or higher thicknesses refer to the standard
3) For other temperatures according to the standard refer to the standard or upon agreement
4) Maximum value of the carbon equivalent based on the formula

$$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$ upon agreement

5) Higher thicknesses of up to 100 mm upon agreement
6) Upon agreement in accordance with the EU PED 97/23/EC Directive and AD 2000 / Merkblatt W1/W10 Technical Standard

PLATES OF FINE-GRAIN STEELS ACCORDING TO EN 10028-3

These plates have a guaranteed fine-grain structure and a low carbon equivalent. The mechanical proper-ties of these plates are guaranteed at high tempera-tures (up to 400 °C) – yield strength of Rp0,2, even at low temperatures (-50 °C) – impact energy KV. They can be used for the construction of more demanding pressure vessels working under high as well as low temperatures.

EQUIVALENT DESIGNATION

EN 10028-3	DIN 17102
P275NH	WStE 285
P275NL1	TStE 285
P275NL2	EStE 285
P355N	StE 355
P355NH	WStE 355
P355NL1	TStE 355
P355NL2	EStE 355
P460NH	WStE 460
P460NL1	TStE 460
P460NL2	EStE 460

Designation/Steel number	Min. Yield Strength R_{eH} [1] [MPa]	Min. Yield Strength $R_{P0.2}$ [2] [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [3] [°C/J] – longitudinal	CEV max. [4]	Thickness [mm]
P275NH/1.0487 [6]	275	179	390–510	24	-20/30	0.40	5–80 [5]
P275NL1/1.0488 [6]	275	179	390–510	24	-40/27	0.40	5–80 [5]
P275NL2/1.1104 [6]	275	179	390–510	24	-50/27	0.40	5–80 [5]
P355N/1.0562 [6]	355	–	490–630	22	-20/30	0.43	5–80 [5]
P355NH/1.0565 [6]	355	232	490–630	22	-20/30	0.43	5–80 [5]
P355NL1/1.0566 [6]	355	232	490–630	22	-40/27	0.43	5–80 [5]
P355NL2/1.1106 [6]	355	232	490–630	22	-50/27	0.43	5–80 [5]
P460NH/1.8935 [6]	460	300	570–720	17	-20/30	0.53	6–80
P460NL1/1.8915 [6]	460	300	570–720	17	-40/27	0.53	6–80
P460NL2/1.8918 [6]	460	300	570–720	17	-50/27	0.53	6–80

1) Valid for thicknesses of up to 16 mm, for higher thicknesses refer to the standard
2) Testing upon agreement; valid for temperature of 300 °C and thicknesses of up to 16 mm; for other temperatures under the standard or higher thicknesses refer to the standard
3) For other temperatures according to the standard refer to the standard or upon agreement
4) Upon agreeement; $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$; valid for thicknesses of up to 60 mm, for higher thicknesses refer to the standard
5) Higher thicknesses of up to 100 mm upon agreement
6) Upon agreement in accordance with the EU PED 97/23/EC Directive and AD 2000 / Merkblatt W1/W10 Technical Standard

THERMOMECHANICALLY ROLLED PLATES OF FINE-GRAIN STEELS ACCORDING TO EN 10028-5

Thermomechanically rolled plates have a higher minimum yield strength of up to 460 MPa and are designed for pressure vessels and facilities working under normal or low temperatures. These plates have excellent weldability because of their low carbon equivalent. Impact energy is guaranteed at tempera-tures as low as -50 °C .

Designation/Steel number	Min. Yield Strength R_{eH} [MPa]	Tensile Strength R_m [MPa]	Min. Elongation ($L_0 = 5.65\sqrt{S_0}$)[%]	Min. Impact Energy KV [3] [°C/J] – longitudinal	CEV max. [4]	Thickness [mm]
P355 M/1.8821 [6]	355 [1]	450–610	22	-20/27	0.39	8–40
P355ML 1/1.8832 [6]	355 [1]	450–610	22	-40/27	0.39	8–40
P355ML2/1.8833 [6]	355 [1]	450–610	22	-50/27	0.39	8–40
P420M/1.8824 [6]	420 [2]	500–660	19	-20/27	0.43	8–40
P420ML1/1.8835 [6]	420 [2]	500–660	19	-40/27	0.43	8–40
P420ML 2/1.8828 [6]	420 [2]	500–660	19	-50/27	0.43	8–40
P460M/1.8826 [6]	460 [2]	530–720	17	-20/27	0.45	8–30 [5]
P460ML1/1.8837 [6]	460 [2]	530–720	17	-40/27	0.45	8–30 [5]
P460ML2/1.8831 [6]	460 [2]	530–720	17	-50/27	0.45	8–30 [5]

1) Valid for thicknesses of up to 40 mm, for higher thicknesses refer to the standard
2) Valid for thicknesses of up to 16 mm, for higher thicknesses refer to the standard
3) For other temperatures according to the standard refer to the standard

4) Upon agreement; $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$ hesses of up to 16 mm, for higher thicknesses refer to the standard

5) Higher thicknesses upon agreement
6) Upon agreement in accordance with EU/PED 97/23/EC, directive and AD2000/Merkblatt W1/W10 Technical standard.

STEEL PLATES ACCORDING TO ASTM/ASME

Designation	Grade	Min. Yield Strength [MPa]	Tensile Strength R_m [MPa]	Min. Elongation 200/50 [%]	Min. Impact Energy KV [1] [°C/J] – longitudinal	Thickness [mm]
A/SA 285	A	165	310–450	27/30	4/14	5–50 [3]
A/SA 285	B	185	345–485	25/28	10/14	5–50 [3]
A/SA 285	C	205	380–515	23/27	16/14	5–50 [3]
A/SA 515	60 (415)	220	415–550	21/25	[2]	5–80 [4]
A/SA 515	65 (450)	240	450–585	19/23	[2]	5–80 [4]
A/SA 515	70 (485)	260	485–620	17/21	[2]	5–80 [4]

PLATES OF FINE-GRAIN STEELS ACCORDING TO ASTM/ASME

Designation	Grade	Min. Yield Strength [MPa]	Tensile Strength R_m [MPa]	Min. Elongation 200/50 [%]	Min. Impact Energy KV [1] [°C/J] – longitudinal	Thickness [mm]
	55 (380)	205	380–515	23/27	-51/18	5–80 [4]
A/SA 516	60 (415)	220	415–550	21/25	-51/18	5–80 [4]
	65 (450)	240	450–585	19/23	-51/18	5–80 [4]
	70 (485)	260	485–620	17/21	-46/20	5–80 [4]
A/SA 537 class 1		345	485–620	18/22	-62/20	5–80 [4]

Maximum value of the carbon equivalent as per the formula

$$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$ upon agreement.

1) Testing upon agreement
2) Testing temperature and minimum impact energy upon agreement
3) According to the standard
4) Higher thicknesses up to 100 mm upon agreement

Delivery Conditions

APPLICABLE STANDARDS

Dimension, flatness	EN 10029, A(SA)20/A(SA)20M, A(SA)6/A(SA)6M
Surface	EN 10163, A(SA)20/A(SA)20M, A(SA)6/A(SA)6M
Z – testing (through thickness)	EN 10164, A(SA)770/A(SA)770M
Ultrasound	EN 10160, SEL 072/77, A(SA)435, A(SA)578, other standards on agreement
Inspection Documents	EN 10204; EN 10168
Testing	In accordance with EN, ASTM, ASME, shipping company standards, other standards on agreement

INTERNAL SOUNDNESS HOMOGENEITY ULTRASONIC TESTING

An automatic TUV Nord certified ultrasonic line is used for testing the internal homogeneity of plates. Manual testing is available to meet stricter require-ments.

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