

High yield structural Plates for offshore S355G10+M

S355G10+M high yield structural plates are intended for (but not limited to) use in fixed offshore structures, designed to operate in the offshore sector.

Applicable codes and standards

BS- EN 10225:2009

Weldable structural steels for fixed offshore structures - technical delivery conditions.

Grade

S 355 G 10 +M

Structural	Minimum Yield	Letter G	Delivery condition
Symbol indicating that the following figures specify the minimum yield strength in MPa. (MPa = N/mm ²)	In MPa for thicknesses t ≤ 16mm. t ≤ 16 mm 355 MPa 16 < t ≤ 25 mm 355 MPa 25 < t ≤ 40 mm 345 MPa 40 < t ≤ 63 mm 335 MPa 63 < t ≤ 100 mm 325 MPa	Followed by a maximum of two digits characterizing and indicating the steel grade within the groups 1, 2 or 3, as defined per table 4 of EN 10225.	+ M Thermo mechanical rolling + N Normalizing rolling + Q Quenched and tempered Thermo mechanical rolling is a rolling process in which the final deformation is carried out in a particular temperature range leading to a material condition equivalent with certain properties which cannot be achieved or repeated by a heat treatment alone.

Within EN 10225 this steel is designated as a group 3 steel which means that this grade is substantially modified from EN 10025-4. This steel offers enhanced through thickness ductility and impact values verified at -40 °C.

This grade is also known as 1.8813+M.

Chemical composition

Product analysis in % (All values are max. unless otherwise stated.)

C	0,12	Cu	0,30	Cr+Mo+Ni+Cu	-
Si	0,15-0,55	N	0,010	Nb+V	0,06
Mn	1,65	Nb	0,030	Nb+V+Ti	0,08
P	0,015	Ti	0,025	CEV (IIW) see formula below	T ≤ 75mm: 0,41 T > 75mm: 0,42
S	0,005	V	0,060	Pcm see formula below	T ≤ 75mm: 0,21 T > 75mm: 0,22
Cr	0,20	As ²	0,03		
Mo ³	0,08	Sb ²	0,010	Bi ²	0,010
Ni ⁴	0,70	Sn ²	0,020	Ca ²	0,005
Al ⁵	0,015/0,055	Pb ²	0,010	B ²	0,0005

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

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

¹ As per paragraph 8.2.3.2 of EN 10225 the Pcm-value shall apply (instead of the CEV-value, see option 9)

² Residual elements shall be checked once every 5.000 tons per manufacturing location and shall be reported as a ladle analysis

³ For T > 75 mm with supply condition +M the maximum Mo content shall be 0,20%

⁴ For T > 40 mm the minimum Ni content shall be 0,30%

⁵ The total aluminium to nitrogen ratio shall be a minimum of 2:1. When other nitrogen binding elements are used the minimum Al value and Al:N ratio does not apply

Mechanical properties

S355G10+M

Thickness t	Yield R_{eh}	Tensile R_m	R_{eh} / R_m	CVN	EI
mm	MPa (min.)	MPa	-	-40 °C	%
$t \leq 16$	355	470-630	max. 0,93	$\geq 50J$ transverse	22
$16 < t \leq 25$	355				
$25 < t \leq 40$	345				
$40 < t \leq 63$	335				
$63 < t \leq 100$	325				

Available options for stock plates as per section 13 of EN 10225

Option	Subject	Remarks
10	PWHT*	Mechanical tests include SPWHT condition for thicknesses greater than 40 mm
12	Strain ageing*	Strain ageing tests are carried out for thicknesses greater than or equal to 12,5 mm. Plastic strain 5%, aged for 1h at 250 °C. Transverse CVN-values in strain aged condition min. 36/26J at -40 °C
13	Through Thickness Testing	TTP testing for thicknesses ≥ 15 mm. To meet class Z35 according to EN 10164. Through thickness strengths min 80% of specified minimum tensile strength for specified thickness
-	Low Sulphur	$S \leq 0,005\%$ in combination with above option 13
-	Hardness	Hardness tested according to Vickers
18	Weldability*	Pre qualification for thicknesses ≥ 40 mm up to 75 mm

*Available upon request

Surface

All surfaces have been 100% visually inspected. The surface condition does comply with EN 10163-2, class A, sub-class 3.

NDT

All plates have been ultrasonically tested in accordance with EN 10160. Ultrasonic testing has been carried out either prior to, or after the final heat treatment and does meet the requirements of EN 10160, class S1/E2 for steels of group 3. According EN 10225 this steel designated a group 3 steel.

Certification and traceability

All dimensions will be supplied with a 3.2 certificate according to EN 10204, endorsed by recognized and independent inspection agency. Low stress die-stamping on head and tail of each plate.

Dimensional control

All dimensions will be supplied according to EN 10029, flatness class N, thickness class A.