Offshore grades and special products






STAHLWERK THÜRINGEN

CSN Steel Sections

CSN
Companhia Siderúrgica Nacional

STAHLWERK THÜRINGEN GmbH

The German steel mill Stahlwerk Thüringen GmbH (SWT) belongs to the Brazilian group Companhia Siderúrgica Nacional. SWT is a sections producer being specialized in the size range between 100 mm and up to 550 mm.

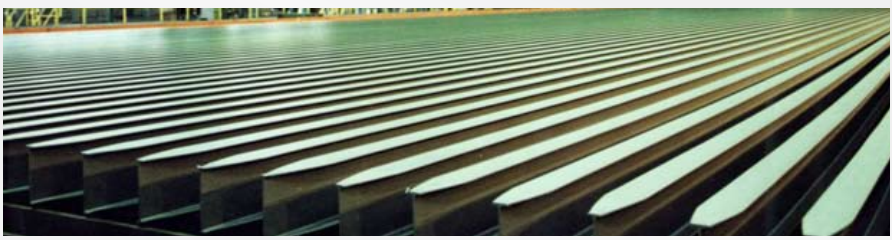
All SWT products are marketed by the sales organization CSN Steel Sections GmbH (further information on www.csn-sections.com).

SWT customers appreciate the very good product quality and the high delivery performance.

Since a couple of years SWT has been working on the extension of both the range of products as well as the variety regarding steel grades in order to provide extra services to its customers.

This brochure shall provide brief information about the products and services of SWT concerning special section shapes and higher steel grades. It includes details which are not published in the general sales programme.

SWT is a strong partner when it comes to realising particular projects, off-shore applications, applications with higher requirements as well as section and grade adaptations for special needs. This includes limitations regarding tolerances, length structure, weldability, weather resistance and high-temperature applications as well as beams on demand.



STAHLWERK THÜRINGEN steel grades

In addition to non-alloy structural steels according to EN 10025-2, SWT produces grades for applications in the offshore area, special grades with requirements for weather resistance and heat-resistant steel grades.

All SWT grades are characterised by a good weldability due to a lower carbon equivalent (CEV).

As a part of the integrated management system, SWT disposes of a quality management system according to DIN EN ISO 9001: 2008. As a result the quality level of SWT products is high, customers are satisfied, deliveries are in time and the number of complaints is low.

SWT products are accredited by numerous national and international inspection associations such as

- Germanischer Lloyd
- Lloyd`s Register EMEA
- Bureau Veritas
- Det Norske Veritas
- Deutsche Bahn AG

Grades for weldable fine grain structural steels according to EN 10025-4

Weldable fine grain structural steels are steel grades with higher strength up to 460 MPa and ideal for all applications with low temperature.
The products are supplied with a fine grain structure containing sufficient amounts of nitrogen binding elements in controlled rolled condition.

Tables 1 and 2 show the available grades as well as the mechanical and chemical compositions.

Table 1 Mechanical properties

Standard	Grades	Minimum yield strength R_{eH} MPa			Tensile strength R_m MPa	Minimum elongation $L_0 = 5{,}65\sqrt{S_0}$ %	Notch impact test	
		Nominal thickness (mm)					Temperature °C	Min. absorbed energy J
		≤ 16	> 16 ≤ 40					
EN 10025-4: 2004	**S 355 M****	355	345		470-630	22	-20	40
	S 355 ML*						-50	27
	S 460 M*	460	440		540-720	17	-20	40

Table 2 Chemical composition

Standard	Grades	Ladle analysis															
		C	Mn	Si[3]	P	S	Al total[1]	Nb	V	Ti	Cr	Mo	Ni	Cu	N	CEV[2] max. % Nominal thickness (mm)	
		max. %	max. %	max. %	max. %	max. %	min. %	max. %	max. %	max. %	max. %	max. %	max. %	max. %	max. %	≤16	>16 ≤40
EN 10025-4: 2004	**S 355 M****	0,16	1,60	0,50	0,035	0,030	0,02	0,05	0,10	0,05	0,30	0,10	0,50	0,55	0,015	0,39	0,39
	S 355 ML*	0,16	1,60	0,50	0,030	0,025	0,02	0,05	0,10	0,05	0,30	0,10	0,50	0,55	0,015	0,39	0,39
	S 460 M*	0,18	1,70	0,60	0,035	0,030	0,02	0,05	0,12	0,05	0,30	0,20	0,80	0,55	0,025	0,45	0,46

[1] If sufficient nitrogen binding elements are present, the minimum aluminium requirement does not apply.
[2] CEV = C+Mn/6+(Cr+Mo+V)/5+(Cu+Ni)/15 ; see § 7.2.5 of EN 10025-2 :2004 concerning special requirements for S275 and S3.
[3] Upon agreement: Si =0,14-0,25% and P ≤ 0,035% max. for capability of forming a zinc layer during hot-dip galvanisation (class 3).
* Available upon agreement.
** Request for quantities > 200 t.

Grades for offshore applications according to EN 10225: 2009

Weldable structural steels for fixed offshore structures according to EN 10225 are grades with a low alloy content, combining high strength, good toughness and superior weldability for applications in the offshore sector. These grades are also applicable in other areas provided that due consideration is given to local condition e.g. low temperature.

SWT also offers offshore grades according to Norsok standard M-120.

All offshore steel grades are available in treatment condition "+N" (normalized rolling) upon agreement!

Tables 3 and 4 show the available steel grades as well as the mechanical characteristics and chemical compositions.

Table 3 Mechanical properties

Standard	Grades	Minimum yield strength ReH MPa			Tensile strength R_m MPa	Minimum elongation $L_0 = 5{,}65\sqrt{S_0}$ %	Notch impact test	
		Nominal thickness (mm)					Temperature °C	Min. absorbed energy J
		≤16	>16 ≤40	R_e/R_m max.				
EN 10225: 2009	*S 355 G1*[2]*	355	345[2]	0,87	470-630	22	-20	50
	S 355 G4**	355	345[2]	0,87	450-610	22	-20	50
	S 355 G11**	355	345	0,87	460-620	22	-40[1]	50
	S 355 G12[3]	355	345	0,87	460-620	22	-40[1]	50

[1] For up to and including 25 mm thickness, test at -20°C.
[2] Available up to 25 mm thick only.
[3] Transvers Charpy V-notch impact test shall be carried out in lieu of longitudinal test to meet 50J minimum average at -40°C.
* Available upon agreement.
** Request for quantities > 200 t.

Table 4 Chemical composition

Standard	Grades	Ladle analysis																	
		C max. %	Si[5] max. %	Mn %	P max. %	S max. %	Cr max. %	Mo max. %	Ni max. %	Al (total)[2] %	Cu max. %	N max. %	Nb max. %	Ti max. %	V max. %	Cr+ Mo+ Ni+Cu max. %	Nb+ V max. %	Nb+ V+ Ti max. %
EN 10225: 2009	*S 355 G1[4]**	0,20	0,50	0,90-1,65	0,035	0,030	0,30	0,10	0,50	0,020 min.	0,35	0,015	0,050	0,030	0,120	.	.	.
	S 355 G4	0,16	0,50	1,60 max.	0,035	0,030	.	0,20	0,30	0,020 min.	0,35	0,015	0,050	0,050	0,100	.	.	.
	S 355 G11[3]	0,14	0,55	1,65 max.	0,025	0,015	0,25	0,08	0,50	0,015-0,055	0,30	0,012	0,040	0,025	0,060	0,80	0,06	0,08
	S 355 G12[3]	0,14	0,55	1,65 max.	0,020	0,007	0,25	0,08	0,50	0,015-0,055	0,30	0,012	0,040	0,025	0,06	0,80	0,06	0,08

1) For product chemical composition see of EN 10225:2001.

2) 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 A_{total}:N ratio does not apply.

3) The levels of the residual elements: arsenic, antimony, boron, tin, lead, bismuth and calcium shall not exceed 0,030% As, 0,010% Sb, 0,020% Sn, 0,010% Pb, 0,010% Bi and 0,005% Ca. Boron (B) shall not exceed 0,0005%. These elements shall be checked at least once every 5000 tonnes at each manufacturing location and shall be reported as a ladle analysis.

4) As rolled condition limited to a maximum thickness of 25 mm.

5) Upon agreement: Si = 0,14-0,25% and P≤ 0,035% for capability of forming a zinc layer during a hot-dip galvanisation.

Weather resistant steel grades according to EN 10025-5

Weathering steels are grades with a certain number of alloying elements such as phosphorus, copper, chromium, nickel, molybdenum and others. Those elements are added to increase the resistance to atmospheric corrosion by itself under the influence the weather protective oxide scales formed on the base material.

Grades according to this standard are summarized in tables 5 and 6.

Table 5 Mechanical properties

Standard	Grades	Minimum yield strength R_{eH} MPa		Tensile strength R_m MPa	Minimum elongation $L_0 = 5{,}65\sqrt{S_0}$ %	Notch impact test	
		Nominal thickness (mm)		Nominal thickness (mm)	Nominal thickness (mm)	Temperature °C	Min. absorbed energy J
		≤16	> 16 ≤ 40	≥ 3 ≤ 100	≥ 3 ≤ 40		
EN 10025-5: 2004	*S 355 J0W**	355	345	470-630	22	0	27
	*S 355 J2W**					-20	

Table 6 Chemical composition

Standard	Grades	Ladle analysis									
		C max. %	Si max. %	Mn %	P max. %	S max. %	N max. %	Addition of n.b.e.[1]	Cr %	Cu %	Others
EN 10025-5: 2004	*S 355 J0W**	0,16	0,50	0,50-1,50	0,040	0,040	0,009[2)5)]	-	0,40-0,80	0,25-0,55	3)4)
	*S 355 J2W**				0,035	0,035	-	yes			

1) Addition of nitrogen binding elements: the steels shall contain at least one of the following elements: Al total ≥ 0,020%, Nb: 0,015 – 0,060%,
V: 0,02 – 0,12%, Ti: 0,02 – 0,10%.
If these elements are used in combination, at least one of them shall be present with the minimum content indicated.

2) It is permissible to exceed the specified values provided that for each increase of 0,001% N, the P_{max} content will be reduced by 0,005%; the N content of the ladle analysis, however, shall not be more than 0,012%.

3) The steels may show a Ni content of max. 0,65%.

4) The steels may contain max. 0,30% Mo and max. 0,15% Zr.

5) The max. value for nitrogen does not apply if the chemical composition shows a minimum total Al content of 0,020% or if sufficient other N binding elements are present. The N binding elements shall be mentioned in the inspection document.

* Available upon agreement.

High-temperature structural steel grades according to EN 10273: 2007

Steel grades according to particular specifications (chemical composition and mechanical properties) with specified elevated temperature properties (16Mo3) are summarized in tables 7 and 8.

Table 7 Mechanical properties

Standard	Grade	Minimum yield strength R_{eH} MPa		Tensile strength R_m MPa	Minimum elongation $L_0 = 5{,}65\sqrt{S_0}$ %	Notch impact test	
		Nominal thickness (mm)				Temperature °C	Min. absorbed energy J
		≤16	> 16 ≤ 40				
EN 10273: 2007	16Mo3*	275	270	440-590	24	+20	40

Table 8 Chemical composition

Standard	Grade	Ladle analysis														
		C max. %	Si max. %	Mn max. %	P max. %	S max. %	Cr max. %	Mo max. %	Ni max. %	Al total %	Cu max. %	N max. %	Nb max. %	Ti max. %	V max. %	Cr+ Mo+ Ni+Cu max. %
EN 10273: 2007	16Mo3*	0,12-0,20	0,35	0,40-0,90	0,025	0,010	0,30	0,25-0,35	0,30	1)	0,30	0,012	-	-	-	-

1) The value of aluminum is to identify and shall be mentioned in the inspection document.
* Available upon agreement.

Additional characteristics of SWT steel grades

Grades being produced at SWT are characterised by a good weldability due to a lower carbon equivalent (e.g. S 355 = 0,39% in average). Considering the common welding standards they can be welded and flame straightened without difficulties.

Under the condition that welding additives with low hydrogen content are being applied, a pre-heating of the entire thickness area is not necessary (valid for all SWT grades according to EN 10225:2009).

However, pre-heating is indispensable when the steel is being processed at temperatures lower than 5°C: due to the low temperatures cold cracks might occur and at temperatures lower than the dew-point (humidity) hydrogen-induced cracks are probable.

SWT sections are typically delivered with a Si content ranging between 0,14% and 0,25%, and are as such capable of forming a zinc layer during hot-dip galvanization. As the range of phosphorus content enables as well.

The standard program of SWT includes sections in grades for non-alloy structural steels according to EN 10025-2.

Following steel grades are available: **S235 JR, J0, J2**
S275 JR, J0, J2
S355 JR, J0, J2, K2

In addition, structural steels according to American standard ASTM and other international standards are available. Special shipbuilding grades **(AH 36, DH 36)** are subject to prior approval and minimum tonnages to be agreed on.

SWT is Q1 supplier of the German railway association and delivers steel sections according to DB-standards DBS 918002-01 (vehicles on rails) and DBS 918002-02 (bridge construction and noise barriers).

Separate **ultrasonic testings** may be agreed at an extra charge.

Delivery conditions of Stahlwerk Thüringen

Length structure

- 5,50m … 28,1m
- 24,1m max. packable length
- Lengths 20,2-28,1m exclusively upon request
- Admissible variations of length: -0/+100mm
- Differing length tolerances exclusively upon request

Rolling tolerances

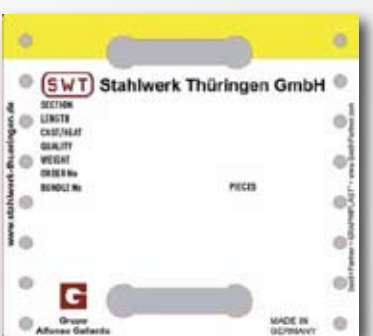
Common rolling tolerances concerning dimension, theoretical weight, form and length are stated in the Technical Data and correspond to the relevant standards

Restricted tolerance

In individual cases, certain measures can be produced upon request with ½ or ¼ of the corresponding standard available.

Bundles + Labels

- The standard bundle weight amounts to 5,5t
- The in-house stacking catalogue specifies particular package dimensions and bundle weights (variation exclusively upon agreement)
- Package labeling of 1-2 labels per package
- Non-packable material is always marked with a single beam label
- Special customer wishes concerning labeling to be agreed on, e.g. single beam labels in packages
- Die stamping upon agreement
- Standard content extendable upon customer request, e.g. cast number
- Single beam labels can be applied exclusively on one side for technical reasons



Example package label

Example single beam label


Example die stamping

Product range of Stahlwerk Thüringen

IPE sections according to DIN 1025 / SWT standard, tolerances DIN EN 10034

IPE 120	to	IPE 550
IPE AL 140	to	IPE AL 550
IPE A 140	to	IPE A 550
IPE O 140	to	IPE O 550
IPE V 400	to	IPE V 500

HE sections according to DIN 1025 / SWT standard, tolerances DIN EN 10034

HE 100 AA	to	HE 260 AA
HE 100 A	to	HE 260 A
HE 100 B	to	HE 260 B
HE 100 C	to	HE 220 C
HE 100 M	to	HE 220 M
HS 80 A		
HS 80 B		
HS 80 C		
HS 80 M		

U sections according to DIN 1026 / SWT Standard, tolerances EN 10279

U 100	to	U 400
UPE 120	to	UPE 400
UPE V 300	to	UPE V 400

British sections according to BS 4

UB 152 x 89 x 16	to	UB 533 x 210 x 122
UC 152 x 152 x 23	to	UC 203 x 203 x 86
BP 203 x 203 x 45		
BP 203 x 203 x 54		
HP 220 x 220 x 57		
PFC 180 x 75 x 20		
PFC 300 x 100 x 46		

American sections according to ASTM A6 / A6M

W 4 x 4	x 13		
W 5 x 5	x 16	to	W 5 x 5 x 19
W 6 x 4	x 8,5	to	W 6 x 4 x 16
W 6 x 6	x 15	to	W 6 x 6 x 25
W 8 x 4	x 10	to	W 8 x 4 x 15
W 8 x 5,25	x 14	to	W 8 x 5,25 x 21
W 8 x 6,5	x 24	to	W 8 x 6,5 x 28
W 8 x 8	x 31	to	W 8 x 8 x 67
W 10 x 4	x 12	to	W 10 x 4 x 19
W 10 x 5,25	x 16	to	W 10 x 5,25 x 30
W 12 x 4	x 14	to	W 12 x 4 x 22
W 12 x 6,5	x 21	to	W 12 x 6,5 x 35
W 14 x 5	x 22	to	W 14 x 5 x 26
W 14 x 6,75	x 30	to	W 14 x 6,75 x 38
W 16 x 5,5	x 26	to	W 16 x 5,5 x 31
W 16 x 7	x 36	to	W 16 x 7 x 57
W 18 x 6	x 35	to	W 18 x 6 x 46
W 18 x 7,5	x 41	to	W 18 x 7,5 x 71
W 21 x 8,25	x 48	to	W 21 x 8,25 x 83

C 8	to	C 15
HP 8 x 29		
HP 8 x 36		
S 5 x 3		