



SuperElso® 960

A High Yield Strength steel for welded and weight-saving structures

SuperElso® 960 is a quenched and tempered steel for structure with higher strength.

Thanks to a minimum yield strength of 960 N/mm² (140 KSI), SuperElso® 960 enables to make weight savings or support higher stresses and thus carry higher payload.

With a good quality of steel making process, an adapted chemical analysis (low alloying content) and an excellent precision in our fabrication process (thickness tolerance, uniform mechanical characteristics), SuperElso® 960 is easy to machine, to bend and to weld which simplify production and maintenance.

By using SuperElso® 960 and thus thinner plate in welded structures, you limit preheating conditions, you decrease quantity of consumables, welding time and so production costs.

Standards

SuperElso® 960 fulfills the requirements of S 960 QL according to EN 10025-6 standard, last edition

Chemical analysis - Weight %

C	Mn	Si	Cr	Mo	P	S	V	Ni	Cu	Al
.19	1.50	.50	.80	.70	.020	.010	.10	1.6	.30	.04 to .080

Maximum values

C. Equivalent

$$C_{eq} = C + \frac{Mn}{8} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

Thickness range - mm (")	C.Eq
6-50 (.24"-2")	≤ .59
50.1-125 (2"-4.92")	≤ .70

Mechanical properties

Y.S. 0.2 N/mm ² (KSI)	UTS N/mm ² (KSI)	Elongation A 5%
960 (140)	980-1150 (142-166)	10

Minimum values

Mechanical properties

Impact tests

Minimum value (guaranteed on 3 tests), according to EN 10025-6

Temperature	Transversal direction
-40°C (-40°F)	27 j (20 ft.lbs)

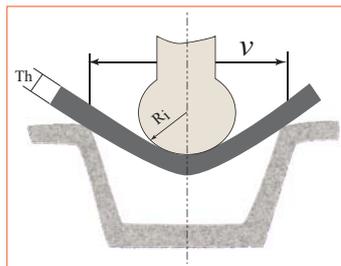
For 6mm (.24") ≤ th ≤ 10 (.39"), subsize specimen will be used and requirement adapted accordingly.

Processing

Forming

Thanks to the quality of steel making process, SuperElso® 960 is easy to shape providing the following conditions are respected:

- Dressing (or grinding) of the ridges caused by gas-cutting to limit the hardened zones,
- Sufficiently powerful equipment,
- Respect of minimum forming radius



Bending angle ≤ 90°

<i>th</i> = thickness	Perpendicular to the rolling direction	Parallel to the rolling direction
Bending internal radius R_i (mini)	2.5 x <i>th</i>	3.5 x <i>th</i>
Die opening <i>V</i> (mini)	10 x <i>th</i>	12 x <i>th</i>

In hot condition, SuperElso® 960 is unsuitable for hot forming at a temperature higher than 600°C (1110°F).

Machining

SuperElso® 960 can be machined without any difficulty using the same methods as those used for the classical steels.

Welding

The reduced carbon and alloying elements content of SuperElso® 960 allow welding in very good conditions with excellent characteristics.

Weld preparation

The preparation of joints and surfaces is obviously very important to work in safe conditions:

- Removing all traces of grease and water,
- Grinding of cuts to remove any oxides, slag of grooves from cutting with excessive oxygen pressure,
- Grinding of any sheared edges, tears, final drips.

Welding process

Any arc welding process may weld SuperElso® 960. Manual welding with basic coated electrodes, semi automatic or automatic, with shielded or submerged arc welding can be chosen according to the criteria of workshop know-how and economics.

Pre-heating

SuperElso® 960 can be welded without crack risk according to recommended conditions (forecast for highly clamped weld) in following these pre-heating conditions :

Thickness	Hydrogen content	Pre-heating temperature	Post-heating
< 15 mm (5/8")	H ₂ < 5 ml/100g (FCAW, GMAW)	No pre-heating	Not required
	H ₂ > 5 ml/100g (SMAW, SAW)	No pre-heating	Not required
15 to 50mm (5/8" to 2")	H ₂ < 5 ml/100g (FCAW, GMAW)	130°C (265°F)	Not required
	H ₂ > 5 ml/100g (SMAW, SAW)	130°C (265°F)	100°C/2H (210°F/2h)
50 to 125mm (2" to 4.92")	H ₂ < 5 ml/100g (FCAW, GMAW)	150°C (300°F)	Not required
	H ₂ > 5 ml/100g (SMAW, SAW)	150°C (300°F)	150°C/2H (300°F/2h)

For control of the pre-heating, the temperature must be checked on the opposite side of the plate and at 100 mm (3.93") from the axis of the weld. A contact thermometer or thermo sticks are recommended for this control.

Interpass Temperature must be lower than 200°C (390°F) max.

Filler materials

Electrodes and fluxes will have to be stored at 350°C (660°F) -2 hours before using. They must be stocked at 150°C (300°F) until using.

A filler materials list is given hereafter according to yield strength choosen :

700 MPa	SMAW	GMAW	FCAW	SAW Wire - (Flux)
ESAB	OK 75.75 OK 7892	OK 13.29	OK 15.27	OK 13.43 (OK Flux 10.62)
OERLIKON	TENACITO 75 & 80	CARBOFIL NiMoCr	FLUXOFIL 42	FLUXOCORD 42 (OP 121 TT)
SAF	SAFER ND 80	NIC 86	-	AS 589 (SAFCORE 6501)
THYSSEN	FOX EV 75 FOX EV 85	UNION X70	-	-

800 MPa	SMAW	GMAW	FCAW	SAW Wire - (flux)
ESAB	OK 75.76		FILARC PZ 6149	
OERLIKON	TENACITO 100			FLUXOCORD 45 (OP 121 TT)
SAF	SAFER ND 100	NIC 88		
THYSSEN		UNION X90		
THYSSEN	FOX EV 75 FOX EV 85	UNION X70		

These lists of filler materials have been determined according to suppliers datas, please confirm this choice for your application with your supplier.

Sizes and tolerances

Thicknesses		Quarto		Flatness*	
mm	inches	Width mm	Width feet	Tol./th mm	mm/meter
5-6	.20-.24	1500-2000	4.92-6.56	± 0.6	5
7-8	.27-.31	1500-2500	4.92-8.20	± 0.6	5
9-10	.35-.39	1500-3000	4.92-9.84	± 0.6	5
11-14	.43-.55	1500-3500	4.92-11.48	± 0.6	5
15-24	.59-.94	1500-3500	4.92-11.48	± 0.7	5
25-39	.98-1.53	1500-3500	4.92-11.48	± 0.8	5
40-59	1.57-2.32	1500-3500	4.92-11.48	± 1.2	5
60-125	2.36-4.92	1500-3500	4.92-11.48	± 1.4	5

Maximum length = 13 m.

* Tighter flatness can be achieved upon request.

Applications



①



②



③

- ① Cranes, Mobile cranes
- ② Tailers, bulldozers, loaders, industrial trucks, buckets
- ③ Pipes, bridge, steel buildings...

For any information

Industeel Belgium

266 rue de Chatelet
B-6030 Marchienne au Pont
Tel +32 71 44 17 51
Fax +32 71 44 19 50

Industeel France

Le Creusot Plant
56 rue Clemenceau
F-71202 Le Creusot Cedex
Tel +33 3 85 80 58 04
Fax +33 3 85 80 55 00

www.industeel.info
www.arcelormittal.com

**transforming
tomorrow**

Nota - Technical data and information are to the best of our knowledge at the time of printing. However, they may be subject to some slight variations due to our ongoing research programme on HYS Steels. Therefore, we suggest that information be verified at time of enquiry or order.

Furthermore, in service, real conditions are specific for each application. The data presented here are only for the purpose of description, and considered as guarantees when written formal approval has been delivered by our company.