Industeel

Amstrong® Ultra 960QL

ArcelorMittal

Amstrong® Ultra 960QL : a high yield strength steel for welded and weight saving structures

Amstrong® Ultra 960QL is a quenched and tempered steel for structure with higher strength.
Thanks to a minimum yield strength of 960 MPa (140 ksi), **Amstrong® Ultra 960QL** 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), **Amstrong® Ultra 960QL** is easy to machine, to bend and to weld which simplify production and maintenance.

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

Amstrong® Ultra 960QL can be delivered with XCarb® Recycled and Renewably Produced certificate.

Properties

Standards

Amstrong® Ultra 960QL fulfills the requirements of S9600QL according to EN 10025-6 standard, last edition.

Chemical Analysis (weight %-Max. values).

C	Mn	Si	Cr	Mo	P	S	V	Ni	Cu	Al
0.20	1.50	0.50	0.70	0.70	0.02	0.01	0.10	1.60	0.30	0.018 to 0.060

Carbon equivalent

	Thickness range (mm)	CET	CEV
$CET = C + \frac{Mn+Mo}{10} + \frac{Cr+Cu}{20} + \frac{Ni}{40}$ $CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$	8 - 50	≤ 0.41	≤ 0.59
	50.1 - 125	≤ 0.44	≤ 0.70

Mechanical properties (Min. values)

Thickness range (mm)	Yield Strength ReH (MPa)	Tensile Strength Rm (MPa)	Min Elongation Lo = 5.65√So (%)
8 - 50	960	980 - 1150	10
50.01 - 100	900	940 - 1100	10

Impact tests

Minimum value (average from 3 tests) according to EN10025-6.

Temperature	Longitudinal direction	Transversal direction
- 40°C (-104°F)	30 J (22 ft.lbs)	27 J (20 ft.lbs)

For 8 mm (.24") ≤ th ≤ 10 (.39"), subsize specimen will be used and requirement adapted accordingly.

Delivery conditions

Sizes and tolerances

Thickness		Quarto		Flatness*	
mm	inches	Width (mm)	Width feet	Tol./th (mm) *	mm per 1 m
8 - 10	.31 - .39	1200 - 2500	3.93' – 8.20'	± 0.6	11
11 - 14	.43 - .55	1200 - 3100	3.93' - 10.17'	± 0.7	10
15 - 24	.59 – .94	1200 - 3500	3.93' – 11.48'	± 0.7	10
25 - 39	.98 - 1.53	1200 - 3800	3.93' - 12.47'	± 1.0	9
40 - 59	1.57 - 2.32	1200 - 3800	3.93' - 12.47'	± 1.3	8
60 - 125	2.36 - 4.92	1200 - 3800	3.93' - 12.47'	± 1.4	8

Maximum length 13 m (42.65'), Minimum Length 4 m (13.12'), Max weight per plate 20 tons.
* Tighter flatness can be achieved upon request.

Plate processing

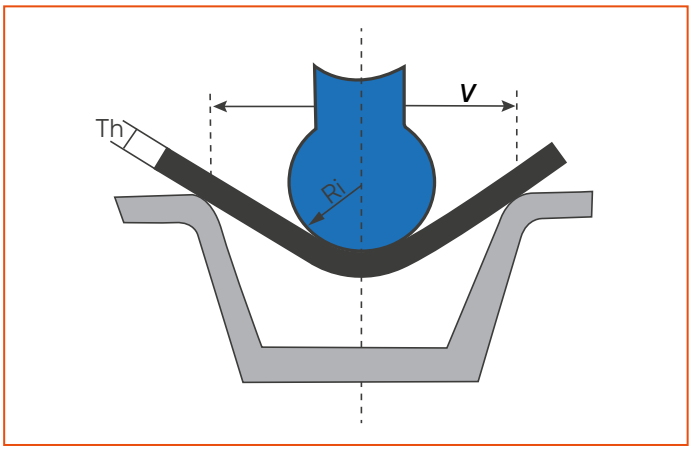
Forming

Thanks to the quality of steel making process, **Amstrong® Ultra 960QL** is easy to bend providing the following conditions are respected:

- Remove heat affected zones (cut edges) by grinding,
- Sufficiently powerful equipment,
- Respect of minimum forming radius

	Perpendicular to the rolling direction	Parallel to the rolling direction
Bending internal radius Ri (mini)	2.5 x th	3.5 x th
Die opening V (mini)	10 x th	12 x th

th = plate thickness



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

Machining

Amstrong® Ultra 960QL 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 **Amstrong® Ultra 960QL** 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 Amstrong® Ultra 960QL. Manual welding with basic coated electrodes, semi automatic or automatic, with shielded or submerged arc welding, or laser can be chosen according to the criteria of workshop know-how and economics.

Welding energy

The Heat input to avoid toughness loss shall not exceed 15kJ/cm.

Preheating

Amstrong® Ultra 960QL can be welded without crack risk according to recommended conditions (forecast for highly clamped weld) in following these preheating conditions: For control of the preheating, 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.

Post welding heat treatment- PWHT

We do not recommend PWHT for **Amstrong® Ultra 960QL.**

Welding consumable

Electrodes and fluxes should be re-dried at 350°C (660°F) for minimum 2 hours (specified on label) and stored at 120-150°C (250-300°F) in holding oven or heated quiver before welding to maintain the lowest possible hydrogen content.

Combined thickness	Hydrogen content	Pre - heating température	Post - heating
< 15 mm (5/8")	H_2 < 5 ml/100 g (FCAW, GMAW)	No pre - heating	Not required
	H_2 > 5 ml/100 g (SMAW, SAW)	No pre - heating	Not required
15 to 50 mm (5/8" to 2")	H_2 < 5 ml/100 g (FCAW, GMAW)	130°C (265°F)	Not required
	H_2 > 5 ml/100 g (SMAW, SAW)	130°C (265°F)	100°C/2H (210°F/2h)
50 to 125 mm (2" to 4.92")	H_2 < 5 ml/100 g (FCAW, GMAW)	150°C (300°F)	Not required
	H_2 > 5 ml/100 g (SMAW, SAW)	150°C (300°F)	150°C/2H (300°F/2h)

Process	SMAW	GMAW	FCAW	SAW
Standard	AWS 5.5 EN ISO 18275	AWS 5.28 EN ISO 16834	AWS 5.36 EN ISO 18276	AWS 5.23 EN ISO 26304
VABW	BÖHLER FOX EV 85 E11018-GH4R E 69 6 Mn2NiCrMo B 4 2 H5	BÖHLER NiCrMo 2.5-IG ER110S-G G 69 6 M21 Mn3Ni2.5CrMo	BÖHLER Kb 85 T-FD E110T5-M21A8-K4-H4 T 69 6 Mn2NiCrMo B M 3 H5	BÖHLER 3 NiCrMo 2,5-UP+BB 24 S 69 6 FB S3Ni2,5CrMo F11A8-EM4 (mod.)-M4H4
ESAB	OK 75.75 E11018-G E 69 5 Mn 2 NiCrMo B 42 H5	OK AristoRod 69 ER 110S-G G 69 4 M Mn3Ni1CrMo	Dual shield 69 E111T1-M21A6-G-H4 T 69 6 Z P M 2 H5	OK Autrod 15.27S+ Flux 10.62 F11A8-EG-G S 69 6 FB S3Ni2,5CrMo
FSH	SELECTARC B77 E11018-M E 69 4 Mn2NiCrMo B 4 2 H5	SELECTARC F77 ER100S-1 G 69 Z Mn3Ni1.5Mo	SELECTARC FCW 77-B E110T5-M21A8-K4-H4 T 69 6 Mn2NiCrMo B M 3 H5	
OERLIKON	TENACITO 80CL E11018-G H4 E 69 6 Mn2NiMo B 4 2 H5	CARBOFIL NiMoCr ER 110 S-G G 69 4 M21 Mn3Ni1CrMo	FLUXOFIL 42 E110T5-M21A4-K4H4 T 69 6 Mn2NiCrMo B M 2 H5	FLUXOCORD 42 / OP121TTW F11A8-EC-F5 S 69 6 FB (T3Ni2,5CrMo) H5

Above list has been determined according to suppliers data.
For your application, please confirm choice with your supplier.

Applications

Mobile crane

Mobile crane

Crawler crane

For more information

Industeel France
Châteauneuf plant
118 route des Etaings
F - 42803 RIVE-DE-GIER Cedex
FRANCE

Industeel France
Le Creusot plant
56, rue Clemenceau - BP 19
F - 71201 LE CREUSOT Cedex
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