



## Amstrong® Ultra 690QL1

### Amstrong® Ultra 690QL1: A High Yield Strength steel for welded and weight - saving structures

Amstrong® Ultra 690QL1 is a high strength quenched and tempered steel dedicated for structure and enables to make weight savings thanks to a minimum yield strength of 690 N/mm<sup>2</sup>.

Thanks to its exceptional purity rate (very low sulphur and phosphorous contents), and its adapted chemical analysis, the Amstrong Ultra® 690QL1 steel is easy to shape and to weld.

#### PROPERTIES

#### STANDARDS

Amstrong® Ultra 690QL1 fulfills the requirements of S690QL according to EN 10025-6 standard, last edition.

#### CHEMICAL ANALYSIS - WEIGHT% max

C	Mn	Si	Cr	Mo	P	S	V	Ni	Cu	Al
.20	1.60	.50	1.50	.60	.02	.01	.080	2	.50	.018 to .05

#### CARBON EQUIVALENT

$C_{eq} = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$ $CET = C + \frac{Mn+Mo}{10} + \frac{Cr+Cu}{20} + \frac{Ni}{40}$	Thickness range - mm (")	C.Eq	CET
		4 - 20 (.15"-.78")	≤ .45
	20.01 - 60 (79" - 2.36")	≤ .55	≤ .36
	60.01 - 120 (2.37" - 4.73")	≤ .58	≤ .37
	120.01 - 150 (4.74" - 5.9")	≤ .61	≤ .38

#### MECHANICAL PROPERTIES

Thickness range - mm (")	Yield Strength R <sub>eH</sub> (MPa)	Tensile Strength R <sub>m</sub> (MPa)	Min Elongation A <sub>l0</sub> = 5.65√So (%)
4 - 50 mm (0.15" - 1.96")	690 (100)	770 - 940 (112 - 136)	14
50.01 - 100 mm (1.97" - 3.93")	650 (94)	760 - 930 (112 - 134)	14
100.00 - 150 (3.94" - 5.9")	630 (91)	710 - 900 (103 - 130)	14

Minimum values

## PHYSICAL PROPERTIES

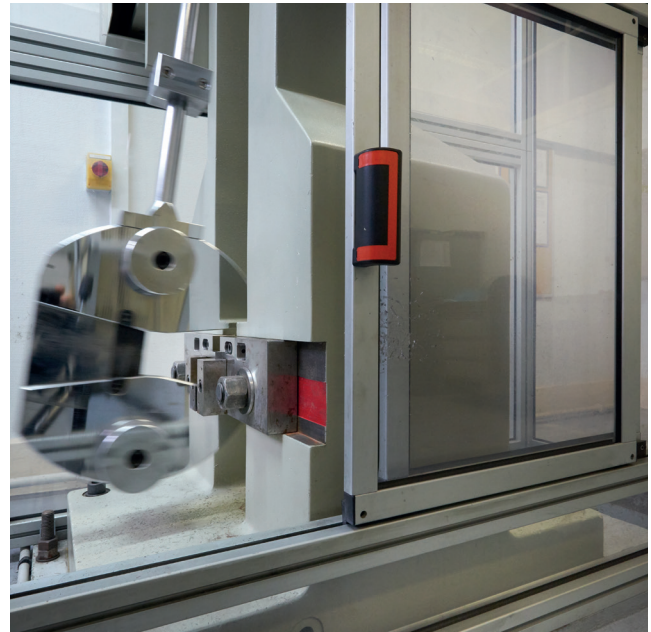
### Impact tests

Minimum value (guaranteed on 3 tests) according to EN10025-6

Temperature	Longitudinal direction impact toughness	Transversal direction impact toughness
- 60°C (- 76°F)	30 J (22 ft.lbs)	27 J (20 ft.lbs)

For 6 mm (.24") ≤ th ≤ 10 (.4"), subsize specimen will be used and requirement adapted accordingly.

**Industeel can produce plates from standard grades up to the most severe specifications. Our experts are available to help you in designing a grade matching your most demanding specification. Do not hesitate to contact us.**



### Weight saving and/or more resistant structures

Due to its high yield strength compared to classical steel (750 MPa in average), you can:

- > reduce thickness of structure and make weight saving,
- > support higher stresses and realize more resistant and innovative structures and design,
- > improve payload and reduce fuel consumption.

## DELIVERY CONDITIONS

### SIZES AND TOLERANCES

Thicknesses		Coils			Quarto			Flatness mm per 2 m
mm	inches	Width mm	Width feet	Tol./Th mm	Width mm	Width feet	Tol./th mm	
4 - 7	.15 - .24	2000	4.92'	± 0.25	1500 - 2500	4.92' - 8.20'	± 0.5	14
8 - 10	.27 - .39				1500 - 3100	4.92' - 10.17'	± 0.5	8
11 - 14	.43 - .55				1500 - 3800	4.92' - 12.47'	± 0.5	8
15 - 24	.59 - .94				1500 - 3800	4.92' - 12.47'	± 0.7	8
25 - 39	.98 - 1.53				1500 - 3800	4.92' - 12.47'	± 0.8	8
40 - 59	1.57 - 2.32				1500 - 3500	4.92' - 12.47'	± 1.2	8
60 - 65	2.36 - 2.56				1500 - 3500	4.92' - 12.47'	± 1.4	8
66 - 120	2.60 - 4.72				1500 - 3500	4.92' - 11.48'	± 1.4	8
121 - 150	4.76 - 5.90				1500 - 3500	4.92' - 11.48'	± 1.6	8

Maximum length = 13 m. (42.65')

Surface condition: according to EN 10163-2 Standard (unless other conditions agreed).

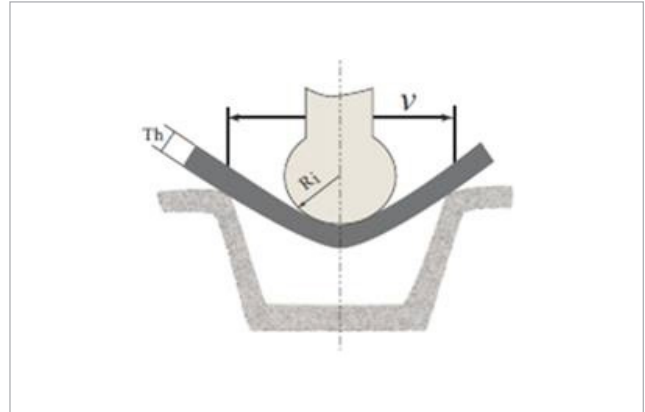
**FORMING**

Thanks to the quality of steel making process, Armstrong® Ultra 690QL1 is easy to shape providing the following conditions are respected:

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

	Perpendicular to the rolling direction	Parallel to the rolling direction
Bending internal radius $R_i$ (mini)	2 x th	3 x th
Die opening V (mini)	8 x th	10 x th

th = thickness



In hot condition, Armstrong® Ultra 690QL1 is unsuitable for hot forming at a temperature higher than 600°C (1110°F).

**MACHINING**

Armstrong® Ultra 690QL1 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 Armstrong® Ultra 690QL1 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:

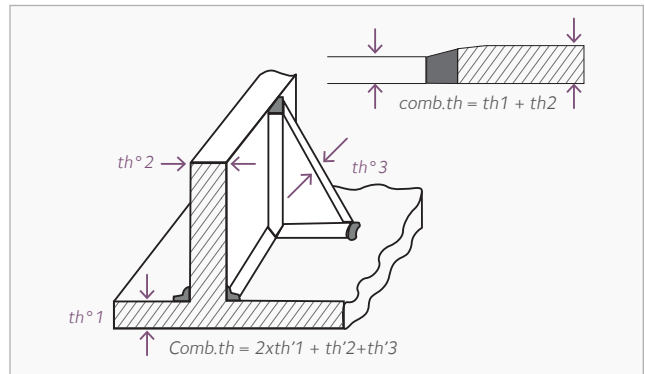
- > Removing all traces of grease and water
- > Grinding of cuts to remove any oxides, slag of grooves from cutting with excessive oxygen pressure
- > Grinding of any sheared edges, tears, final drips

**Welding process**

Any conventional fusion welding method can be used, such as submerged arc welding (SAW), manual metal arc welding (SMAW), flux core wire arc welding (FCAW), MIG, MAG (GMAW) and TIG (GTAW) Interpass temperature should be limited to a maximum of 200°C (390°F).

**Preheating**

Armstrong® Ultra 690QL1 can be welded without any crack risk according to recommended conditions (forecast for highly clamped weld).



Welding processes SMAW - GMAW - SAW	Energy (kJ/cm)	10 mm .4"	20 mm 0.8"	30 mm 1.18"	40 mm 1.57"	50 mm 1.96"
	15					
30						

Welding processes SMAW - GMAW - SAW	Energy (kJ/cm)	60 mm 2.4"	70 mm 2.75"	80 mm 3.15"	90 mm 3.54"	100 mm 3.93"	>100 mm >3.93"
	15						
30							

- Without preheating
- With slight preheating at 75°C (165°F)
- With pre-post-heating ≥ 100°C (210°F)
- With pre-post-heating ≥ 150°C (300°F)

**Welding consumables**

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.

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



Jaw crushers



Lift heavy loads



Dumpers, Chassis

YOUR CONTACTS

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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 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. Further information may be obtained from the address opposite.