

## Amstrong® Ultra 690

### Amstrong® Ultra 690: a high yield strength steel for welded and weight - saving structures

Amstrong® Ultra 690 is a high strength quenched and tempered steel dedicated for structural applications that enable weight savings thanks to a minimum yield strength of 690 MPa\*.

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

\* 1 MPa : 1N/mm<sup>2</sup>

#### PROPERTIES

#### STANDARDS

Amstrong® Ultra 690 fulfills the requirements of S690QL according to EN 10025-6. On request, Amstrong® Ultra 690 can also be delivered to EN 10025-6 S690QL1 or S690Q.

#### CHEMICAL ANALYSIS - WEIGHT% max

C	Mn	Si	Cr	Mo	P	S	V	Ni	Cu	Al
.20	1.60	.50	1.50	.60	.02	.010	.080	2	.50	.18 to .05

#### CARBON EQUIVALENT

$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$ $CET = C + \frac{Mn+Mo}{10} + \frac{Cr+Cu}{20} + \frac{Ni}{40}$	Thickness range - mm	CEV	CET
	4 - 20	≤ .45	≤ .30
	20.01 - 120	≤ .55	≤ .36
	120.01 - 150	≤ .58	≤ .37

#### MECHANICAL PROPERTIES

##### Tensile properties

Thickness range - mm	Minimum Yield Strength ReH (MPa)	Tensile Strength Rm (MPa)	Minimum Elongation (%)
4 - 50 mm	690	770 - 940	14
50.01 - 100 mm	650	760 - 930	14
100.01 - 150 mm	630	710 - 900	14

## PROPERTIES

### PHYSICAL PROPERTIES

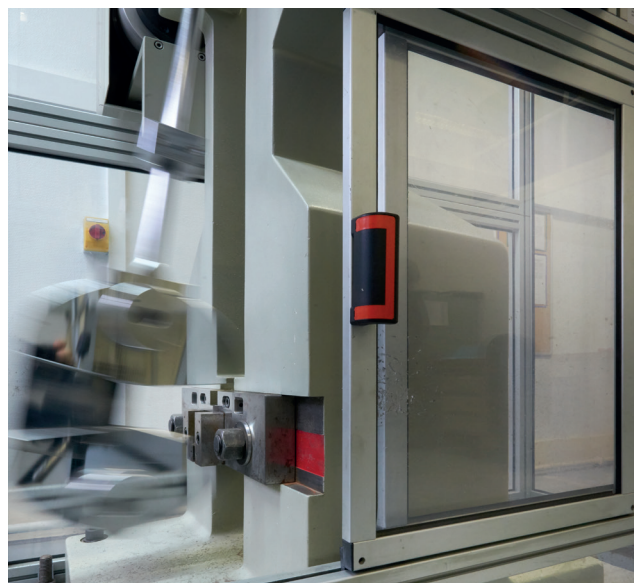
#### Impact tests

Minimum value properties according to EN10025-6

Temperature	Longitudinal direction	Transversal direction
- 40°C	40 J	30 J

Subsize specimens will be used and requirement adapted accordingly for thicknesses below 10mm.

**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

Thanks to its high yield strength compared to classical steel, it is possible to:

- > reduce thickness and achieve weight saving,
- > withstand higher stresses and with more resistant and innovative structures and design,
- > improve payload and reduce fuel consumption.

## DELIVERY CONDITIONS

### SIZES AND TOLERANCES

Thicknesses mm	Coil made plates		Quarto plates		Flatness* mm per 2 m
	Width (mm)	Thickness tolerance (mm)	Width (mm)	Thickness tolerance (mm)	
4 - 7	2000	± 0.25	1200 - 2500	± 0.5	14
8 - 10			1200 - 3100	± 0.5	8
11 - 14			1200 - 3800	± 0.5	8
15 - 24			1200 - 3800	± 0.7	8
25 - 39			1200 - 3800	± 0.8	8
40 - 59			1200 - 3500	± 1.2	8
60 - 65			1200 - 3500	± 1.4	8
66 - 120			1200 - 3500	± 1.4	8
121 - 150			1200 - 3500	± 1.6	8

Maximum length = 13 m. (42.65')

\*Tighter flatness can be provided upon request.

## PLATE PROCESSING

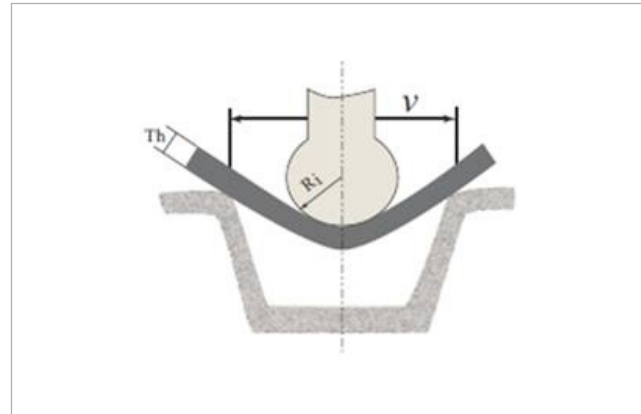
### FORMING

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

- > Dressing (or grinding) of the ridges caused by flame cutting 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



Armstrong® Ultra 690 is unsuitable for hot forming at a temperature higher than 500°C.

### MACHINING

Armstrong® Ultra 690 can be machined without any difficulty using the same methods as those used for classical steels.

### WELDING

The low carbon and alloying elements content of Armstrong® Ultra 690 allows welding in very good conditions with excellent characteristics.

#### Weld preparation

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

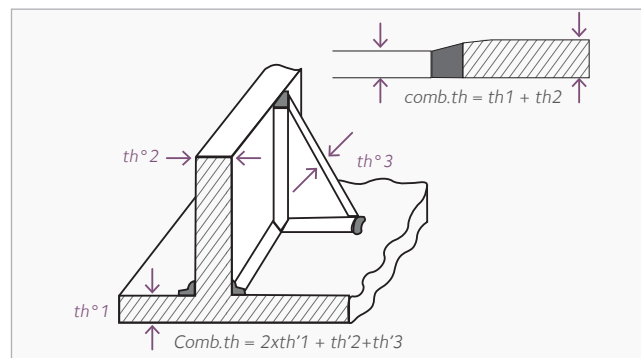
- > Removing all traces of grease and water
- > Grinding of cut faces to remove any oxides, slag
- > Grinding of any sheared edges, tears, final drips

#### 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.

#### Preheating

Armstrong® Ultra 690 can be welded without any risk of cracking when following to recommended conditions (forecast for highly clamped weld).



Welding processes SMAW - SAW GMAW - SAW	Energy (kJ/cm)	10 mm	20 mm	30 mm	40 mm	Combined thickness 50 mm
		15				
	30					

Welding processes SMAW - SAW GMAW - SAW	Energy (kJ/cm)	60 mm	70 mm	80 mm	90 mm	Combined thickness 100 mm
		15				
	30					

- Without preheating
- With slight preheating at 75°C
- With pre-post-heating ≥ 100°C
- With pre-post-heating ≥ 150°C

## PLATE PROCESSING

### Welding consumables

Electrodes and fluxes should be re-dried at 350°C for minimum 2 hours (specified on label) and stored at 120-150°C 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	BOHLER 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

## APPLICATIONS



Jaw crushers



Heavy lift arms



Dumpers, chassis

## YOUR CONTACTS

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*Note - This technical data and information represents our best knowledge at the time of printing. However, it may be subject to some slight variations due to our ongoing research program on offshore steel grades. We therefore 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 is only for the purpose of description, and may only be considered as guarantees when our company has given written formal approval. All information in this brochure is for the purpose of information only. Industeel reserves the right to change its product range at any time without prior notice. All Industeel facilities are ISO 9001, ISO 14001 and OHSAS 18001 certified.*