



CryElso™ 203

SA-203 gr. D, E*

CryElso™ 203: Special low alloy (Ni) steel for low service temperature

CryElso™ 203 is a low-alloyed Ni steel, designed for low temperature applications and requiring a high level of toughness. Its high Charpy impact values at low temperature (-101 °C) are combined with good tensile properties and mainly with an ultra low Nil-ductility temperature (Drop weight tests). The crack propagation resistance of the material is therefore excellent.

CryElso™ 203 is manufactured via the electric furnace with dephosphoration, ladle refining and vacuum degassing to provide reproducible, clean and homogeneous steel.

The chemistry of **CryElso™ 203** has been carefully adapted to combine high mechanical properties and excellent weldability.

PROPERTIES

STANDARDS

- > EN 10028-3 12Ni 14
- > ASTM A 203 gr D,E*
- > ASME II Part A SA 203 gr D,E*

* A/SA 203 grade F can be available on special request, please enquire.

CHEMICAL ANALYSIS - WEIGHT %

C	Mn	Si	P	S	Ni	V
≤0.15	<0.80	<0.35	≤0.015	≤0.002	3.25-3.75	<0.05

MECHANICAL PROPERTIES

Typical transverse tensile values at room temperature after PWHT

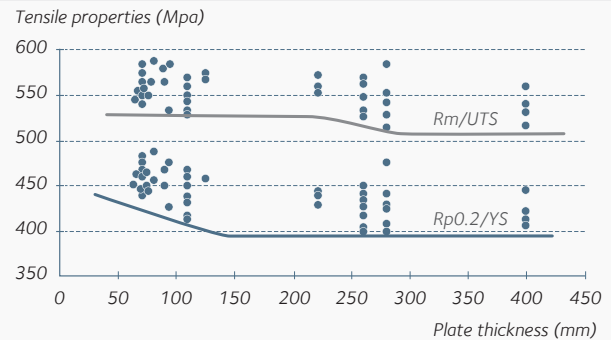
Guaranteed values as per applicable National Standard

	YS (MPa/ksi)		TS (MPa /ksi)		Elongation%
	Min	Max	Min	Max	Min
12 Ni 14 according to EN 10028-4	e > 30	345 / 50	490 / 66	640 / 88	22
	e < 30	355 / 51			
According to A/SA 203 gr E	275 / 40		485 / 70	620 / 90	21

Plate soundness guaranteed to ultrasonic levels determined by ASTM A 578 level B or EN 10160-S1E2.

PROPERTIES

The tensile requirements can be met even for extra-thick plates (< 450 mm).



IMPACT PROPERTIES

Specially designed for very low temperature impact values, CryElso™ 203 gives impact energies above 100 J at -101 °C. This toughness level is achieved also for the thickest plates (up to 450 mm)

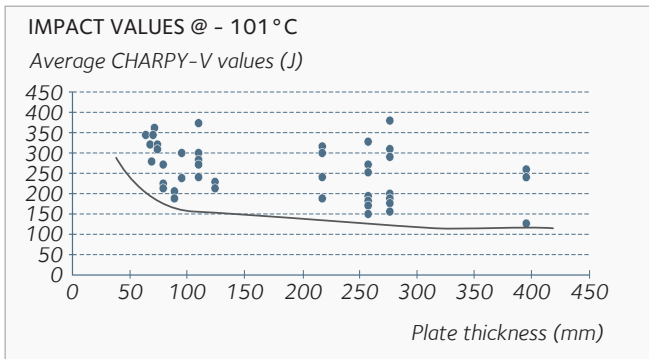


PLATE PROCESSING

NDT T DROP WEIGHT TESTS

The Nil Ductility Transition Temperature has been determined using Drop weight test procedure in accordance with ASTM E208.

Testing coupon has been stress relieved at 590 °C during 5h45 mn + air cooling. **NDT T = - 80 °C**

HEAT TREATMENT

The material is most generally quenched and tempered or normalized, accelerated cooled and tempered. However, as a function of the grade, the level of properties required and the thickness range, the material may also be normalized or normalized and tempered: please enquire.

Tempering temperature is performed above 595 °C (1100 °F) and adjusted as a function of the parameters noted above.

PWHT is in the range 580-600 °C (1220-1270 °F) at 1 hour + 1 hour per 50 mm (1 hour per 2").

FORMING

CryElso™ 203 is produced with a low level of Carbon to significantly improve weldability. To avoid any occurrence of cold cracking, it is recommended to preheat at 100°C all plates above 25 mm thickness. To achieve high level of toughness in the weld metal, an interpass temperature control is mandatory.

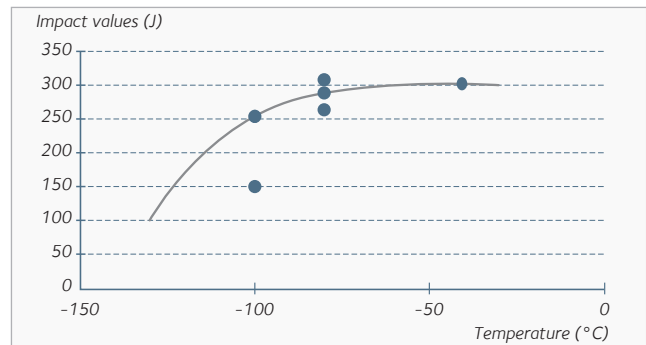
$T^{\circ} < 150^{\circ}\text{C}$

For the same reason, it is important to optimize the cooling cycle of the weld metal avoiding excessive heat input. We recommend welding below 2 kJ/mm.

HAZ PROPERTIES

The graph below shows the evolution of the Charpy-V values in the coarse grain Heat Affected Zone as a function of temperature.

Equivalent properties to base metal are easily achieved using a proper Post Weld Heat Treatment (in this case 590°C/6h).



FILLER MATERIALS

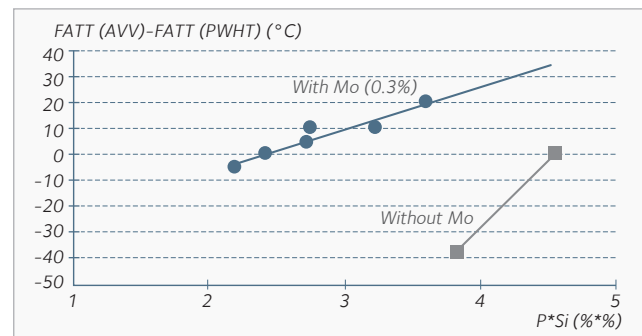
For this grade of steel it is difficult for a weld metal to respect Low temperature toughness (-100°C) as well as high tensile properties. As a consequence, there is a technical choice possible in this case between a homogeneous weld metal and a Nickel alloy.

Homogeneous solution:

Filler material should respect the following standards:

	SMAW	GMAW	FCAW	SAW Wire-Flux
AWS	A5-5 E 70XX- C2L	A5-28 ER80S-Ni3	A5-29 E80T5-Ni3	A5-23 F8P15 ENi3-Ni3
EN	EN 499 E42 6 3 Ni B 12			

A study performed by Industeel has demonstrated the favourable effects of Mo and the deleterious of Si & P in the weld metal chemical composition. The graph below illustrates these effects:



NB: negative values mean embrittlement during Post Weld Heat Treatment.

Hereafter, a non-exhaustive list of consumables for the assembly of CryElso™ 203 with a homogeneous weld metal.

	SMAW	SAW	
		Wire	Flux
ETC	PH 87		
KOBELCO	NB 3N	US 203 E	PF H203
LINCOLN	Kryo 4	LNS 175	
METRODE	3NiB		
OERLIKON	TENACITO E 8018 C	S2 3.5Ni	OP 121 TTW
SAF	FREEZAL E Ni3	FREEZAL S Ni3	FREEZAL F Ni3
SUDOMETAL	TENASOUDO Ni3S	SODOR ENI3	RECORD SB

PLATE PROCESSING

Ni-alloy solution:

Suitable for Extra High Charpy values at low temperature.

Standards:

	SAEE	GMAW	SAW Wire-Flux
AWS	A5-11 E Ni Cr Mo 6 E Ni Cr Mo 3 (625)	A5-14 ER Ni Cr Mo 3 (625) ER Ni Cr Mo 4 (276)	A5.14 ER Ni Cr Mo 3 (625)

List of consumables available:

	SMAW	SAW Wire + Flux
ESAB	OK 92.55	OK 19.82 + OK 10.16
OERLIKON		AS 625 + OP76
SAF	FREEZAL E Ni9 FREEZAL 625	AS 625 + AS 516
THYSSEN	Thermanit 13.65 TTW 150	Thermanit 625 + Marathon 444

APPLICATIONS

This material may be used in all applications requiring low temperature impact values such as:

- > Compressors housings
- > Nuclear waste containers
- > Liquid gas storage tankers...

CryElso™ 203 is available in plate form up to 450 mm thick. It can also be provided in flame-cut or formed pieces.

YOUR CONTACTS

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