

UR™ 600

An austenitic nickel-based alloy for high temperature and corrosion-resistant applications

UR™ 600 is an austenitic nickel based alloy designed for demanding corrosive environments, combining high resistance to stress corrosion cracking, caustic corrosion, and oxidation at elevated temperatures.

Its nickel and chromium contents ensure excellent corrosion resistance in both reducing and oxidizing conditions.

Properties

Standards

- EURONORM EN 2.4816 NiCr15Fe
- ASTM UNS N06600
- ASME SB-168
- AMS 5540

Chemical analysis (Wt %)

Typical values

	Ni	Cr	Fe	C	Mn	Si	Cu	S
Min	72.0	14.0	6.0	0.05	-	-	-	-
Max		17.0	10.0	0.15	1.0	0.5	0.5	0.015

Physical properties

Typical values - Room temperature:

Density: 8.45 kg/dm³ - 0.30 lb/in³

Mean coefficient of thermal expansion x 10⁻⁶ m/m/°C

100°C (212°F)	200°C (392°F)	300°C (572°F)	400°C (752°F)	500°C (932°F)	600°C (1112°F)	700°C (1292°F)
13.7	14.1	14.4	14.8	15.1	15.4	15.8

Physical properties

Coefficient of thermal conductivity, W/m.K

20°C (68°F)	100°C (212°F)	200°C (392°F)	300°C (572°F)	400°C (752°F)	500°C (932°F)	600°C (1112°F)	700°C (1292°F)
14.8	15.8	17	18.4	20.0	22.0	24.0	25.7

Curie temperature -124°C (255°F)

Properties at Room Temperature RT (approximately 20°C/68°F)

Coefficient of electrical resistivity, $\mu\Omega \times \text{cm}$	103
Modulus of elasticity, GPa	214
Poisson's ratio	0.29
Coefficient of specific heat, J/g/°C	0.455
Permeability	1.05

Mechanical properties

Tensile properties at elevated temperature (typical values)

Condition	YS 0.2 MPa (ksi)	UTS MPa (ksi)	Elongation (%)
Annealed	240 (35)	550 (80)	30

Tensile properties at elevated temperature (typical values)

Solution heat treated (1000°C to 1100°C – 1832°F to 2012 F°)

Temperature		YS 0.2%		UTS		E	Z
°C	°F	MPa	ksi	MPa	ksi	%	%
RT	RT	245	35	580	84	55	65
200	392	240	35	570	83	58	63
400	752	230	33	565	82	60	62
600	1112	200	29	515	75	63	59
800	1472	155	22	185	27	75	71
1000	1832	52	7	55	8	77	51

ISO V - notch impact toughness. Average values at RT: longitudinal $\geq 150 \text{ J/cm}^2$ - transverse $\geq 100 \text{ J/cm}^2$

Creep properties

Temperature	500°C	600°C	700°C	800°C	850°C	900°C	1000°C
Industeel - Creep rupture strength (at 10^4 h) MPa	310	145	70	40	30	20	9

In service conditions

Aqueous corrosion resistance

With a high nickel content of approximately 72%, UR™ 600 provides excellent resistance to chloride-induced stress corrosion cracking.

The alloy shows good corrosion resistance in inorganic, organic, and caustic media, but is not recommended in strong oxidizing environments, such as boiling nitric acid.



	Sulfuric acid	Hydrochloric acid	Hydrofluoric acid	Phosphoric acid	Nitric acid	Organic acid	Bases and salts	Seawater
UR™ 600	**	*	**	**	*	***	***	**

Legend:

Good to excellent: ***

Acceptable: **

Not recommended: *

High temperature corrosion resistance

UR™ 600 offers good oxidation resistance in air or carbon dioxide atmospheres up to approximately 1150°C (2102°F), but is sensitive to attack at elevated temperatures in sulfur containing media.

Grades	Parabolic Oxidation rate $k_p \times 10^{-12} \text{ (g}^2\text{.cm}^{-4}\text{.s}^{-1}\text{)}$
UR™ 600	1.2
Sirius™ 800H	3.9
Sirius™ 314	4.0
Sirius™ 4828	2.0
Sirius™ 815	1.6

	Resistance and stability	Resistance to oxidation	Resistance to carburization	Resistance to sulfidation	Resistance to nitridation	Resistance to carbonitriding	Resistance to molten salts
UR™ 600	***	***	***	*	***	***	***

Legend:

Good to excellent: ***

Acceptable: **

Not recommended: *

Plate processing

Welding

UR™ 600 can be readily welded using conventional welding processes, such as SMAW, GMAW, FCAW, GTAW, and SAW. Welding rods and wires are commercially available for joining UR™ 600 to itself as well as to other materials.

Recommended filler materials for homogeneous welding:

Welding processes	UR™ 600				
	SMAW	GMAW	FCAW	SAW	
				Wire	Flux
BOHLER	Thermanit Nicro 82	Thermanit Nicro 82	Thermanit Nicro 82	UTP UP 6222 Mo	RECORD IN
	EN ISO 14172 : E Ni 6082	EN ISO 14172 : E Ni 6082	EN ISO 121533 : T Ni 6082 R M21 3	EN ISO 18274 : S Ni 6625	EN ISO 14174 : S A AB 2
	AWS A5.11 : ENiCrFe-3 (mod)	AWS A5.14 : ENiCrMo-3	AWS A5.34 : ENiCr3T0-4	AWS A5.14 : ER NiCrMo-3	
ESAB	OK NiCrMo-3	OK Autrod NiCrMo-3		OK Autrod NiCrMo-3	OK Flux 10.93
	EN ISO 14172 : E Ni 6625	EN ISO 18274 : S Ni 6625		EN ISO 18274 : S Ni 6625	EN ISO 14174 : S A AF 2 56 54 DC
	AWS A5.11 : ENiCrMo-3	AWS A5.14 : ENiCrMo-3		AWS A5.14 : ER NiCrMo-3	
WELDING ALLOYS			GAMMA 182		
			EN ISO 12153 : T Ni 6182 B M21 3		
			AWS A 5.34 : ENiCrFeT0-4		

Thermal welding recommendations:

- Interpass temperature must be limited to 150 °C (302 °F).
- The heat input must be controlled (below 10 kJ/cm).

Hot forming

UR™ 600 can be hot-formed within a temperature range of 1200°C to 900°C (2192°F to 1652°F), followed by rapid cooling in water or air. For heating, workpieces should be placed in a furnace that has already reached the target temperature. A heat treatment after hot forming is recommended to achieve optimal properties.

Cold forming

Workpieces should be in the solution-annealed condition before cold forming. **UR™ 600** exhibits a significantly higher work-hardening rate compared to austenitic stainless steels. This must be considered when designing and selecting forming tools and equipment, as well as during process planning. Intermediate annealing is required for major cold-forming operations. For cold forming exceeding 15%, a final solution annealing must be performed.

Solution Annealing Heat Treatment

Solution annealing heat treatment for use at service temperature above 700°C (1290°F) providing an improved creep resistance : preferably 1000°C to 1100°C (1832°F to 2012°F)

- Soaking time: 30 min minimum at annealing temperature
- Cooling : water quench

Delivery conditions

Size range

	Plates
Thickness	4.76 mm to 50 mm 3/16" to 2"
Width	Up to 3000 mm Up to 118"
Length	Up to 12300 mm Up to 40.3 ft

Please consult for specific request.

Applications

This grade is used in chemical and petrochemical processing, nuclear and automotive engineering, as well as thermal processing applications.

Typical applications include:

- Equipment for food and chemical industries (heaters, condensers, tank car)
- High temperature furnaces
- Heat exchangers
- Digesters (for alkaline media)

Industeel France
Le Creusot Plant
56, rue Clémenceau
F - 71202 Le Creusot Cedex
industeel.arcelormittal.com



Sukriye DEMIR

Tel. +33 6 07 01 28 63

sukriye.demir@arcelormittal.com

Technical data and information are to the best of our knowledge at the time of editing. 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.