Nicorros® Al – alloy K-500

Material Data Sheet No. 4026
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Corrosion-resistant alloy

A company of
ThyssenKrupp
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Nicorros® Al – alloy K-500

Nicorros Al is a nickel-copper alloy with age-hardening properties imparted by alloying additions of aluminium and titanium. Its basic composition is similar to that of Nicorros but the alloying additions make it age hardenable under controlled conditions of temperature and time.

The alloy is available in the annealed, stress equalized, hot-finished or age-hardened conditions.

Nicorros Al is characterized by:

- excellent corrosion resistance in an extensive range of natural and chemical environments
- excellent resistance to chloride-ion stress-corrosion cracking
- very high strength and hardness

After age-hardening, Nicorros Al has:

- approximately 2 to 3 times higher mechanical properties than the nickel-copper alloy Nicorros (alloy 400)
- high tensile properties up to about 650 °C (1200 °F)
- good fatigue and corrosion fatigue resistance
- low permeability; non-magnetic down to -135 °C (-210 °F)

Designations and standards

Country National standards	Material designation	Specification							
		Chemical composition	Tube and pipe seamless	Tube and pipe welded	Sheet and plate	Rod and bar	Strip	Wire	Forgings
D DIN Luftfahrt-WL	**W.-Nr. 2.4375** NiCu30Al W.-Nr. 2.4374*	17743 Blatt 1, 2				17752 Blatt 1		Blatt 2	17754
F AFNOR	NU30AT								
UK BS	NA 18		3074		3072	3076	3073	3075	
USA AMS QQ-N-286	UNS N05500	4676 Table 1			Form 3, 6	4676 Form 1, 2	Form 4	Form 5	Form1, 2
ISO	NiCu30Al3Ti								
*Aerospace applications only									

Table 1 – Designations and standards

Chemical composition

	Ni	Fe	C	Mn	Si	Cu	Al	Ti	S	P	Zn	Pb	Sn
min	63.0	0.5				27.0	2.30	0.35					
max		2.0	0.20	1.5	0.50	33.0	3.15	0.85	0.010	0.020	0.020	0.006	0.006

Table 2 – Chemical composition (wt.-%)

Physical properties

Density Melting range	8.5 g/cm³ 1310 – 1350 °C	0.307 lb/in.³ 2400 – 2460 °F
Curie point: annealed age-hardened	-135 °C -100 °C	-210 °F -150 °F
Permeability at 20 °C/68 °F (RT)	1.0015	

Temperature (T)		Specific heat		Thermal conductivity		Electrical resistivity		Modulus of elasticity		Coefficient of thermal expansion between room temperature and T	
°C	°F	J/(kg K)	Btu/(lb °F)	W/(m K)	Btu in./(ft² h °F)	µ Ω cm	Ω circ mil/ft	kN/mm²	10³ ksi	10⁻⁶/K	10⁻⁶/°F
-130	**-200**	323	0.077	13.3	92					12.3	6.8
20	**68**	420	0.100	17.4	121	61	370	179	26.0		
93	**200**		0.107		136		372		25.8		7.6
100	212	454		19.4		62		178		13.7	
200	392	480		20.9		63		176		14.6	
204	**400**		0.114		156		378		25.5		8.1
300	572	491		25.1		64		173		14.9	
316	**600**		0.117		178		385		24.9		8.3
400	752	500		27.8		65		168		15.2	
427	**800**		0.120		198		390		23.9		8.5
500	932	517		30.5		65		164		15.5	
538	**1000**		0.125		220		393		23.4		8.7
600	1112	538		33.1		66		162		16.0	
649	**1200**		0.132		240		396		23.0		9.1
700	1292	567		35.7		66		158		16.6	
760	**1400**		0.141		262		400				9.3
800	1472	613		37.4		67				17.0	
871	**1600**		0.157		282		408				9.6
900	1652	685		41.2		68				17.5	

Table 3 – Typical physical properties at room and elevated temperatures.

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Mechanical properties

The following properties are applicable to Nicorros Al products in the stated conditions and indicated size ranges (according to QQ-N-286).

Specified properties of material outside these ranges are subject to special enquiry.

Product	Condition*		Dimensions mm	Dimensions in.	Tensile strength R_m N/mm²	Tensile strength R_m ksi	Yield strength $R_{p0.2}$ N/mm²	Yield strength $R_{p0.2}$ ksi	Elongation A_5 1) %	Brinell hardness max. HB
Rod, bar, forgings	0	hf								245
Hexagon	4	cd								260
Rod	4	cd	6 – 25	1/4 – 1						280
			> 25 – 75	> 1 – 3						265
			> 75 – 100	> 3 – 4						240
Rod, bar, forgings	1/5	an	30 – 160		620**		270**		25**	185
Rod, bar, forgings	3	hf-ag	all sizes		965	140	690	100	20	< 265 >
Rod	7	cd-ag	6 – 25	1/4 – 1	1000	145	760	110	15	< 300 >
			> 25 – 75	> 1 – 3	965	140	690	100	17	< 280 >
			> 75 – 100	> 3 – 4	930	135	655	95	20	< 255 >
Hexagon	7	cd-ag	6 – 50	1/4 – 2	965	140	690	100	15	< 265 >
Rod, bar, forgings	2/6	an-ag	≤ 25 > 25	≤ 1 > 1	895	130	620 585	90 85	20	< 250 >
Plate	15	hr-an	≤ 100	≤ 4						185
	16	hr-an-ag	≤ 100	≤ 4	895	130	550	80	20	< 130 >
Sheet	11	cr-an								165
	12	cr-an-ag			895	130	620	90	15	< 250 >
Strip 1)	21	cr-an								165
	22	cr-an-ag	≥ 0.5	≥ 0.020	895	130	620	90	15	< 250 >
	24	hh								< 230 >
	27	hh-ag	≥ 0.5	≥ 0.020	1000	145	760	110	8	< 300 >
	28	fh								< 255 >
	29	fh-ag	≥ 0.5	≥ 0.020	1170	170	895	130	2	< 310 >
Wire	30	cd	all sizes		760	110				
	31	cd-an			620	90				
	32	cd-an-ag			895	130				
	33	cd-ag			1070	155				
	34	sp	from 1.0 up to 14	from 0.04 up to 0.56	1070 to 830	155 to 120				
	37	sp-ag	from 1.0 up to 14	from 0.04 up to 0.56	1240 to 1100	180 to 160				

hf = hot formed, hr = hot rolled, cd = cold drawn, cr = cold rolled, an = annealed, ag = aged, hh = half hard, fh = full hard, sp = spring temper
<> informative only
* see Table 6; classification
** DIN 17752
1) Elongation values for strip products are normally determined based on an initial gauge length of 50 mm (2 in.). These values are lower, dependent on the alloy, than the corresponding A_5 values by an order of approx. 10 %.

Table 4 – Minimum mechanical properties at room temperature.

Thickness		Bending diameter	Bending angle		
mm	in.	relative to the thickness	annealed sheet and strip	half hard strip	annealed and aged sheet and strip and full hard cr strip
0.25 – 0.8 > 0.8 – 1.6 > 1.6 – 3.2	0.01 – 0.031 > 0.031 – 0.062 > 0.062 – 0.125	1	180°	120°	90°
> 3.2 – 6.35	> 0.125 – 0.250	2			

Table 5 – Bending properties of cold rolled sheet and strip, parallel to the direction of rolling, without cracking.

Condition	Rod, bar, forgings		Sheet and plate		Strip			Wire	
	hot finished	cold drawn	cold rolled	hot rolled	cold rolled	half hard	full hard	cold drawn	spring temper
not aged	0	4	–	–	–	24	28	30	34
annealed	1	5	11	15	21	–	–	31	–
annealed and aged	2	6	12	16	22	–	–	32	–
aged	3	7	–	–	–	27	29	33	37

Table 6 – Classification relative to form and condition (see Table 4 above).

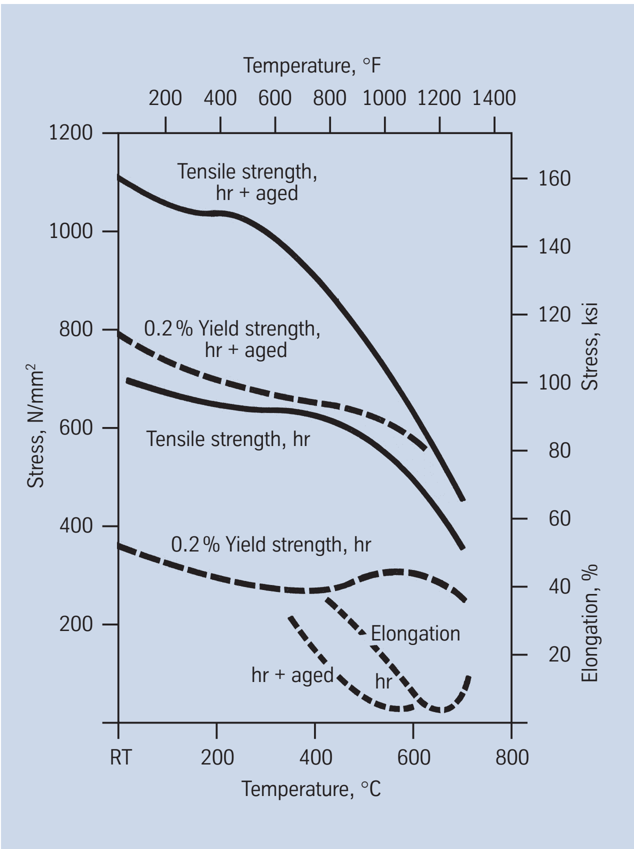

Fig. 1 – Typical short-time properties of hot rolled (hr) and hot rolled and aged Nicorros Al rod at elevated temperatures.

Metallurgical structure
Nicorros Al has a face-centered cubic structure. In the age-hardened condition a Ni_3Al phase is formed with similar structure.

Corrosion resistance
In general, the corrosion resistance of Nicorros Al is similar to that of Nicorros. Excellent resistance is shown to a wide range of media from pure water to mineral acids, salts and alkalis.

Nicorros Al is virtually immune to chloride-ion stress-corrosion cracking. In the aged condition, the alloy may be susceptible to stress-corrosion cracking in moist, aerated hydrofluoric acid vapour at stresses near the yield strength.

In high-velocity seawater and in marine atmospheres, good corrosion resistance is shown but, in slow-moving or stagnant seawater, pitting may occur. Nicorros Al also shows good resistance in sour-gas environments.

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Temperature °C	°F	Tensile strength R_m N/mm²	ksi	Yield strength $R_{p0.2}$ N/mm²	ksi
RT	RT	1100		690	
93	**200**		151		97
100	212	1040		670	
200	392	1020		640	
204	**400**		148		93
300	572	980		620	
316	**600**		139		90
400	752	890		600	
427	**800**		125		87
500	932	750		570	
538	**1000**		102		80
600	1112	620		490	
649	**1200**		80		64

Table 7 – Typical short-time properties of hot rolled and aged Nicorros Al rod at elevated temperatures.

Applications
Nicorros Al finds wide application in the marine, chemical, petrochemical and shipbuilding industries.

Typical applications include:
- valve seals, pump sleeves and wear rings in marine environments – high strength and resistance to seawater
- pump shafts for fire-fighting pumps – high strength (resulting in smaller diameter shafts) and resistance to flowing seawater
- propeller shafts – high strength (resulting in smaller diameter shafts and thus smaller bearings) and resistance to seawater
- fasteners, e.g. bolts, used in marine atmospheres and tidal waters – resistance to chloride-containing environments
- doctor blades and scrapers
- towing cable armouring – high strength, non-magnetic properties and resistance to seawater
- springs – resistance to a variety of corrosive media
- oil well drilling equipment such as non-magnetic drill collars, valves and instrumentation sleeves – resistance to chloride-containing media and sour-gas environments
- aviation instrument components – non-magnetic properties

Fabrication and heat treatment
Nicorros Al can readily be hot- and cold-worked and machined.

Heating
Workpieces must be clean and free from all kinds of contaminants before and during any heat treatment.

Nicorros Al may become impaired if heated in the presence of contaminants such as sulphur, phosphorus, lead and other low-melting-point metals. Sources of such contaminants include marking and temperature-indicating paints and crayons, lubricating grease and fluids, and fuels. Fuels must be as low in sulphur as possible. Natural gas should contain less than 0.1 wt.-% sulphur. Fuel oils containing no more than 0.5 wt.-% are suitable.

Due to their close control of temperature and freedom from contamination, thermal treatments in electric furnaces under vacuum or an inert gas atmosphere are to be preferred. Treatments in an air atmosphere and alternatively in gas-fired furnaces are acceptable though, if contaminants are at low levels so that a neutral or slightly oxidizing furnace atmosphere is attained. A furnace atmosphere fluctuating between oxidizing and reducing must be avoided as well as direct flame impingement on the metal.

Hot working
Nicorros Al may be hot-worked in the temperature range 1150 to 900 °C (2100 to 1650 °F). Cooling after hot working must be by water quenching from above 800 °C (1470 °F). Air cooling allows precipitation of Ni (TiAl), which hardens the alloy and may lead to cracking if the material is reheated.

After hot working, a stress-relieving anneal at 850 – 900 °C (1560 – 1650 °F) with subsequent water quench is recommended to remove thermal stresses and any mixed crystal structure.

For hot working, the material may be charged into the furnace at the maximum hot working temperature of 1150 °C (2100 °F). Prolonged soaking is harmful and the temperature should be dropped to 1040 °C (1900 °F) if the hot working operation is delayed. Reheating to 1150 °C before working is necessary.

During the final hot working operation with a minimum of 25 % reduction, the temperature should not exceed 1050 °C (1920 °F).

Cold working
Cold working should be carried out on annealed material. The work-hardening rate of Nicorros Al is similar to that of austenitic stainless steels. This should be taken into account when selecting the forming equipment.

When cold working is performed, interstage annealing may become necessary with high degrees of cold deformation.

Heat treatment
Annealing is carried out within the temperature range 850 to 1000 °C (1560 to 1830 °F), preferably though at 980 °C (1800 °F) and soaking for 3 to 5 minutes per mm (0.04 in.) of thickness. Annealing above 1000 °C (1830 °F) is not

recommended as excessive grain growth may occur. For thicknesses above 3 mm (0.125 in.) or diameter above 12.5 mm (0.5 in.), water quenching or rapid air cooling is recommended and is essential to prevent preciptation.

Stress equalizing by soaking for 1 to 2 hours at 300 to 350 °C (570 to 660 °F), followed by air cooling, is necessary with machined material to remove stress concentrations prior to age hardening. It may also be applied to aged material which has been cold worked, e.g. by straightening or machining, after the final ageing treatment.

Age hardening
To obtain the maximum mechanical properties of Nicorros Al, an age-hardening treatment is carried out. This may follow either the hot or cold finished condition, or the hot or cold worked and annealed condition.

The basic ageing treatment is carried out at 580 to 610 °C (1080 to 1130 °F). Holding time is

3 to 5 hours for flat products,
4 to 16 hours for rod, bar and forgings,

followed by furnace cooling (FC) with a cooling rate of approximately 12 °C (20 °F) per hour, down to 480 °C (900 °F) and then air cooling.

An abridged ageing treatment can be effected by holding at 640 °C (1180 °F) for 2 hours, then furnace cooling over 10 hours down to 480 °C (900 °F).

In order to establish the best age-hardening procedure, pilot testing is recommended.

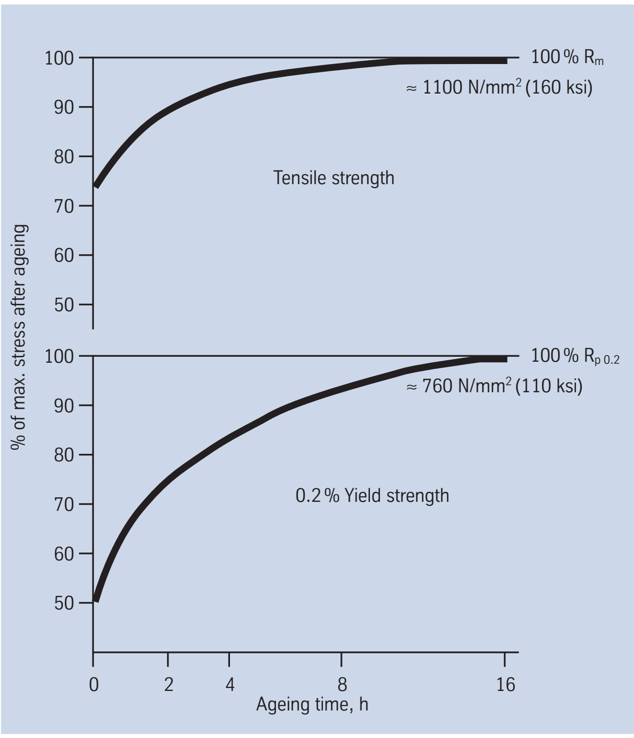

Fig. 2 – Effect of ageing time at 600 °C (1000 °F), followed by 10 h FC to 480 °C (900 °F), on the mechanical properties of hot-formed Nicorros Al rod.

For any thermal treatment the material should be charged into the furnace at temperature observing the precautions concerning cleanliness mentioned earlier under **'Heating'**.

Descaling and pickling
Oxides of Nicorros Al and discoloration adjacent to welds, are more adherent than on stainless steels. Grinding with very fine abrasive belts or discs is recommended.

Before pickling which may be performed in a nitric/hydrofluoric acid mixture with proper control of pickling time and temperature, the surface oxide layer must be broken up by abrasive blasting, by carefully performed grinding or by pretreatment in a fused salt bath.

Machining
Nicorros Al should be rough machined in the annealed or hot-worked and quenched condition. Rough machined and age-hardened material can be machined to close tolerances and finished only with a subsequent stress-equalizing treatment.

The alloy's high work-hardening rate should be considered. Thus only low cutting speeds should be used and the tool should be engaged at all times. Heavy feeds are important in getting below the work-hardened surface layer.

Welding
When welding nickel-base alloys, the following instructions should be adhered to:

Workplace
The workplace should be in a separate location, well away from areas where carbon steel fabrication takes place. Maximum cleanliness and avoidance of draughts are paramount.

Auxiliaries, clothing
Clean fine leather gloves and clean working clothes should be used.

Tools and machines
Tools used for nickel-base alloys and stainless steels must not be used for other materials. Brushes should be made of stainless materials.

Fabricating and working machinery such as shears, presses or rollers should be fitted with means (felt, cardboard, plastic sheeting) of avoiding contamination of the metal with ferrous particles, which can be pressed into the surface and thus lead to corrosion.

Cleaning
Cleaning of the base metal in the weld area (both sides) and of the filler metal (e.g. welding rod) should be carried out with ACETONE.

Trichlorethylene (TRI), perchlorethylene (PER) and carbon tetrachloride (TETRA) must not be used.

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Edge preparation
This should preferably be done by mechanical means by turning, milling or planing; plasma cutting is also possible. However, in the latter case the cut edge (the face to be welded) must be finished off cleanly. Careful grinding without overheating is permitted. Also a zone approximately 25 mm (1 in.) wide on each side of the joint should be ground to bright metal.

Included angle
The different physical characteristics of nickel-base alloys and special stainless steels compared with carbon steel generally manifest themselves in a lower thermal conductivity and a higher rate of thermal expansion.

This should be allowed for by means of, among other things, wider root gaps or openings (1 – 3 mm), while larger included angles (60 – 70 °), as shown in Fig. 3, should be used for individual butt joints owing to the viscous nature of the molten weld metal and to counteract the pronounced shrinkage tendency.

Striking of the arc
The arc should only be struck in the weld area, e.g. on the faces to be welded or on a run-out piece. Striking marks lead to corrosion.

Welding processes
Nicorros Al in the annealed condition can be joined to itself and to many other metals by conventional welding processes. These include GTAW (TIG), plasma arc, GMAW (MIG/MAG) and SMAW (MMA). Pulsed arc welding is the preferred technique. For MAG welding the use of a multi-component shielding gas (Ar + He + H_2 + CO_2) is recommended.

For welding, Nicorros Al should be in the annealed condition and be free from scale, grease and markings. After welding and prior to ageing the assembly should be stress-relieved as suggested under **'Postweld treatment'**. Welding in the age-hardened condition is difficult and thus not recommended. It should be avoided, if at all possible. When welding the root, care should be taken to achieve best-quality root backing (argon 99.99), so that the weld is free from oxides after welding the root. Any heat tint should be removed preferably by brushing with a stainless steel wire brush while the weld metal is still hot.

Filler metal
For the gas-shielded welding processes, filler metal with the same composition as the base metal is recommended:

Bare electrodes:	Nicorros S 6530 – FM 60 Werkstoff-Nr. 2.4377 SG-NiCu 30 MnTi AWS A 5.14: ERNiCu-7
Covered electrodes:	Werkstoff-Nr. 2.4366 EL-NiCu30Mn AWS A 5.11: ENiCu-7

Welding parameters and influences
(heat input/linear energy input per unit length of weld)

Care should be taken that the work is performed with a deliberately chosen, low heat input as indicated in Table 9 by way of example. Use of the stringer bead technique should be aimed at. Interpass temperature should be kept below 120 °C (250 °F).

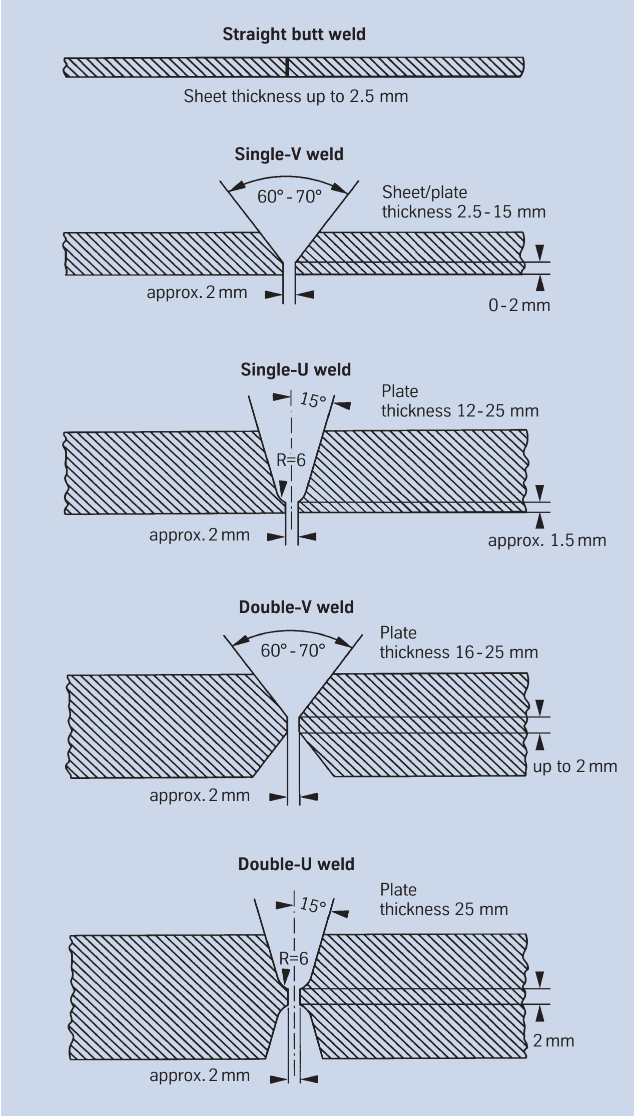

Fig. 3 – Edge preparation for welding of nickel-base alloys and special stainless steels.

The welding parameters should be monitored as a matter of principle.

The heat input Q may be calculated as follows:

$$Q = \frac{U \times I \times 60}{v \times 1000} \text{ (kJ/cm)}$$

U = arc voltage, volts
I = welding current, amps
v = welding speed, cm/min.

Consultation with ThyssenKrupp VDM's Welding Laboratory is recommended and essential if welding in the age-hardened condition cannot be avoided.

Sheet/ plate thick-ness mm	Welding process	Filler metal Diameter mm	Speed m / min.	Welding parameters Root pass A	V	Intermediate and final passes A	V	Welding speed cm / min.	Flux/ shielding gas rate l / min.	Plasma-gas rate l / min.	Plasma-nozzle diameter mm
3.0	Manual GTAW	2.0		90	10	110 – 120	11	10 – 15	Ar W3[1] 8 – 10		
6.0	Manual GTAW	2.0 – 2.4		100 – 110	10	120 – 130	12	10 – 15	Ar W3[1] 8 – 10		
8.0	Manual GTAW	2.4		110 – 120	11	130 – 140	12	10 – 15	Ar W3[1] 8 – 10		
10.0	Manual GTAW	2.4		110 – 120	11	130 – 140	12	10 – 15	Ar W3[1] 8 – 10		
3.0	Autom. GTAW	1.2	0.5	manual		150	10	25	Ar W3[1] 15 – 20		
5.0	Autom. GTAW	1.2	0.5	manual		150	10	25	Ar W3[1] 15 – 20		
2.0	Hot wire GTAW	1.0	0.3			180	10	80	Ar W3[1] 15 – 20		
10.0	Hot wire GTAW	1.2	0.45	manual		250	12	40	Ar W3[1] 15 – 20		
4.0	Plasma arc	1.2	0.5	165	25			25	Ar W3[1] 30	Ar W3[1] 3.0	3.2
6.0	Plasma arc	1.2	0.5	190 – 200	25			25	Ar W3[1] 30	Ar W3[1] 3.5	3.2
8.0	MIG/MAG GMAW	1.0	approx. 8	GTAW		130 – 140	23 – 27	24 – 30	MAG[2] MIG: argon 18 – 20		
10.0	MIG/MAG GMAW	1.2	approx. 5	GTAW		130 – 150	23 – 27	20 – 26	MAG[2] MIG: argon 18 – 20		
6.0	SMAW	2.5		40 – 70	approx. 21	40 – 70	approx. 21				
8.0	SMAW	2.5 – 3.25		40 – 70	approx. 21	70 – 100	approx. 22				
16.0	SMAW	4.0				90 – 130	approx. 22				

[1] Argon or argon + max. 3 % hydrogen
[2] For MAG welding the use of the shielding gas Cronigon He30S or Argomag-Ni, for example, is recommended.
In all gas-shielded welding operations, ensure adequate back shielding.
These figures are only a guide and are intended to facilitate setting of the welding machines.

Table 8 – Welding parameters (guide values).

Welding process	Heat input per unit length kJ / cm	Welding process	Heat input per unit length kJ / cm
GTAW, manual, fully mechanised	max. 10	GMAW, MIG/MAG, manual, fully mechanised	max. 11
Hot wire GTAW	max. 6	SMAW, manual metal arc (MMA)	max. 7
Plasma arc	max. 10		

Table 9 – Heat input per unit length (guide values).

Postweld treatment
(brushing, pickling and thermal treatments)

Brushing with a stainless steel wire brush immediately after welding, i.e. while the metal is still hot generally results in removal of heat tint and produces the desired surface condition without additional pickling.

Pickling, if required or prescribed, however, would generally be the last operation performed on the weldment. Also refer to the information on **'Descaling and pickling'**.

Neither pre- nor postweld thermal treatments are required other then a stress-relieve treatment in the temperature range 790 – 820 °C (1450 – 1500 °F) after welding and prior to ageing. For this treatment the weldment must be taken through the age-hardening temperature range as quickly as possible. Thin welded sections should be charged into the furnace at temperature. After bringing the assembly up to temperature it should be held for a few minutes before discharging and cooling it as rapidly as possible. For heavier sections a furnace temperature of 940 °C (1725 °F) should be used.

Availability
Nicorros Al is available in the following standard product forms:

Sheet & plate
(for cut-to-length availability, refer to strip)

Conditions:
hot or cold rolled (hr, cr),
thermally treated and pickled

Thickness mm	hr / cr	Width[1] mm	Length[1] mm
1.10 – < 1.50	cr	2000	8000
1.50 – < 3.00	cr	2500	8000
3.00 – < 7.50	cr / hr	2500	8000
7.50 – ≤ 25.00	hr	2500	8000[2]
> 25.00[1]	hr	2500[2]	8000[2]

inches		inches	inches
0.043 – < 0.060	cr	80	320
0.060 – < 0.120	cr	100	320
0.120 – < 0.300	cr / hr	100	320
0.300 – ≤ 1.000	hr	100	320[2]
> 1.000[1]	hr	100[2]	320[2]

[1] other sizes subject to special enquiry
[2] depending on piece weight

Discs and rings
Conditions:
hot rolled or forged,
thermally treated,
pickled or machined

Product	Weight kg	Thickness mm	O. D.[1] mm	I. D.[1] mm
Disc	≤ 10000	≤ 300	≤ 3000	
Ring	≤ 3000	≤ 200	≤ 2500	on request

	lbs	inches	inches	inches
Disc	≤ 22000	≤ 12	≤ 120	
Ring	≤ 6600	≤ 8	≤ 100	on request

[1] other sizes subject to special enquiry

Rod & bar
Conditions:
forged, rolled, drawn,
thermally treated,
pickled, machined, peeled or ground

Product	Forged[1] mm	Rolled[1] mm	Drawn[1] mm
Rod (o. d.)	≤ 600	8 – 100	12 – 65
Bar, square (a)	40 – 600	15 – 280	not standard
Bar, flat (a x b)	(40 – 80) x (200 – 600)	(5 – 20) x (120 – 600)	(10 – 20) x (30 – 80)
Bar, hexagonal (s)	40 – 80	13 – 41	≤ 50

	inches	inches	inches
Rod (o. d.)	≤ 24	$^5/_{16}$ – 4	$^1/_2$ – 2 $^1/_2$
Bar, square (a)	1$^5/_8$ – 24	$^{10}/_{16}$ – 11	not standard
Bar, flat (a x b)	(1$^5/_8$ – 3$^1/_8$) x (8 – 24)	($^3/_{16}$ – $^3/_4$) x (4$^3/_4$ – 24)	($^3/_8$ – $^3/_4$) x (1$^1/_4$ – 3$^1/_8$)
Bar, hexagonal (s)	1$^5/_8$ – 3$^1/_8$	$^1/_2$ – 1$^5/_8$	≤ 2

[1] other sizes and conditions subject to special enquiry

Forgings
Shapes other than discs, rings, rod and bar are subject to special enquiry. Flanges and hollow shafts may be available up to a piece weight of 10 t.

Strip[1)]
Conditions:
cold rolled,
thermally treated and pickled or bright annealed.[2)]

Thickness mm	Width[3)] mm	Coil I. D. mm			
0.04 – ≤ 0.10	4 – 200	300	400		
> 0.10 – ≤ 0.20	4 – 350	300	400	500	
> 0.20 – ≤ 0.25	4 – 750		400	500	600
> 0.25 – ≤ 0.60	6 – 750		400	500	600
> 0.60 – ≤ 1.0	8 – 750		400	500	600
> 1.0 – ≤ 2.0	15 – 750		400	500	600
> 2.0 – ≤ 3.0	25 – 750		400	500	600

inches	inches	inches			
0.0016 – ≤ 0.004	0.16 – 8	12	16		
> 0.004 – ≤ 0.008	0.16 – 14	12	16	20	
> 0.008 – ≤ 0.010	0.16 – 30		16	20	24
> 0.010 – ≤ 0.024	0.20 – 30		16	20	24
> 0.024 – ≤ 0.040	0.32 – 30		16	20	24
> 0.040 – ≤ 0.080	0.60 – 30		16	20	24
> 0.080 – ≤ 0.120	1.0 – 30		16	20	24

1) Cut-to-length available in lengths from 250 to 4000 mm (10 to 158 in.)
2) Maximum thickness 3 mm (0.125 in.)
3) Wider widths subject to special enquiry

Wire
Conditions:
bright drawn, 1/4 hard to hard,
bright annealed.

Dimensions:
0.01 – 12.0 mm (0.0004 – 0.47 in.) diameter,
in coils, pay-off packs, on spools and spiders

Welding filler metals
Suitable welding rods, wire, strip electrodes and electrode core wire are available in all standard sizes.

Seamless tube and pipe
Using ThyssenKrupp VDM cast materials seamless tubes and pipes are produced and available from DMV STAINLESS Int. Sales, Tour Neptune, F-92086 Paris, La Defence Cedex (Fax: +33-1-4796 8126; Tel.: +33-1-4796 8128).

Welded tube and pipe
Welded tubes and pipes are obtainable from qualified manufacturers using ThyssenKrupp VDM semi-fabricated products.

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