

# URANUS<sup>®</sup> B6 and B6N

A multipurpose Austenitic stainless steel with PREN ≥ 34

URANUS B6 (904L) is a multipurpose 20 Cr - 4.3 Mo high corrosion resistance austenitic stainless steel developed 40 years ago by CLI. The UR B6N is alloyed with nitrogen (≈ 0.13%) to increase its structure stability and corrosion resistance.

Due to combined additions of chromium (20%), molybdenum (4.3%), copper (1.5%) combined with its high nickel content, the grade is recommended for most applications dealing with medium to severe corrosive solutions. UR B6 has improved stress corrosion resistance properties.

UR B6 alloy is particularly used in sulphuric and phosphoric acids applications. The localized corrosion resistance of UR B6N grade is much higher than that of alloy 825. UR B6N is particularly well adapted to clad plates applications (separators).

## STANDARDS

EN 10088 - EN 10028.7 ..... X1 Ni Cr Mo Cu 25.20.5 - 1.4539  
AFNOR ..... Z2 NCDU 25.20 (AZ)  
DIN..... W. Nr 1.4539  
ASTM..... B 625 - UNS N 08904

## CHEMICAL ANALYSIS

### Typical values (Weight %)

| C  | Cr | Ni | Mo  | (N) for UR B6N | Others   |
|--|----|----|-----|----------------|----------|
| .020   | 20 | 25 | 4.3 | 0.13           | Cu = 1.5 |
| PREN = [Cr %] + 3.3 [Mo %] + 16 [N %] ≥ 34 (URB6) or 36 (UR B6N) |    |    |     |                |          |

Nitrogen additions (0.13%) improve the structure stability and corrosion resistance properties of UR B6N

## MECHANICAL PROPERTIES

### Tensile properties - Minimum values

| °C  | Rp 0.2 MPa | Rp 1.0 MPa | Rm MPa | °F  | YS 0.2% KSI | YS 1.0% KSI | UTS KSI | EI % |
|-----|------------|------------|--------|-----|-------------|-------------|---------|------|
| 20° | 245        | 275        | 550    | 68  | 36          | 39          | 80      | 40   |
| 100 | 205        | 230        | 520    | 212 | 30          | 33          | 75      | 40   |
| 300 | 145        | 170        | 490    | 572 | 21          | 26          | 71      | 40   |
| 500 | 125        | 150        | 410    | 932 | 18          | 22          | 35      | 40   |

Values for hot rolled 10 mm thick plates

Impact values KCV > 100 J/cm<sup>2</sup> (70 ft.lbs) at -196°C (-319°F)

Hardness values : HV<sub>10</sub> : [160 - 210]

# PHYSICAL PROPERTIES

## Typical values

**Density** = 8,050 kg/m<sup>3</sup> - 0.29 lb/in<sup>3</sup>

| Interval Temper<br>°C | Thermal expansion<br>a x 10 <sup>-6</sup> K <sup>-1</sup> | °C  | °F  | Resistivity<br>(μΩ cm) | Thermal conductivity<br>(W.m <sup>-1</sup> .K <sup>-1</sup> ) | Specific heat | Young modulus E<br>(GPa) | Shear modulus G<br>(GPa) |
|-----------------------|---|-----|-----|------------------------|---|---------------|--------------------------|--------------------------|
| 20-100                | 15  | 20  | 68  | 80                     | 17  | 500           | 200                      | 75                       |
| 20-300                | 16  | 300 | 572 | 100                    | 13  | 550           | 180                      | 70                       |
| 20-500                | 17  | 500 | 932 | 120                    | 14  | 650           | 165                      | 66                       |

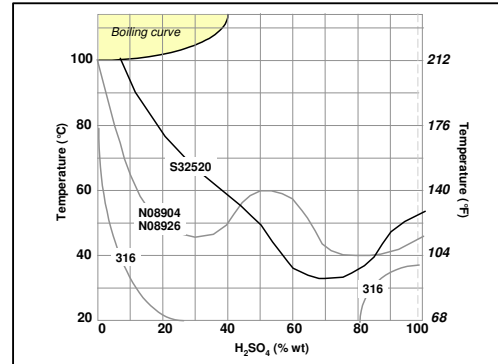
# CORROSION RESISTANCE

## General corrosion

### ♦ Sulphuric acid environments

In sulphuric acid environments, the range of concentrations and temperatures in which UR B6 can be used are much wider than those of most of the other high corrosion resistant grades *i.e.* 317L (CLC 17.12.3) or 22 Cr Duplex (S31803 - UR 45N).

This is partially explained by its high copper content.

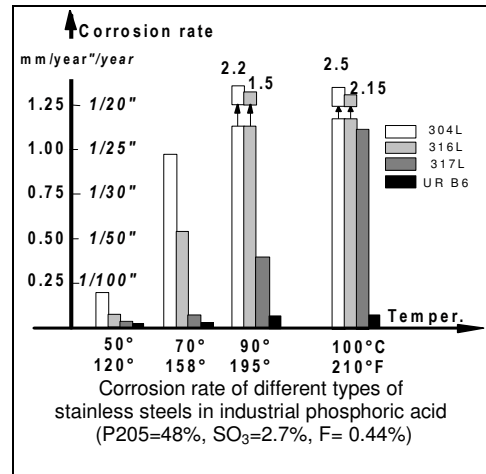


Uses for UR B6 in sulfuric solution (corrosion ≤ 0.1 mm/year)

### ♦ Phosphoric acid environments

General corrosion resistance properties of alloy UR B6 (904L) in industrial phosphoric acid solutions are excellent and much better than those of 316L or 317L grades. At higher temperatures, the alloy behaves also better than 22.05 duplex stainless steels.

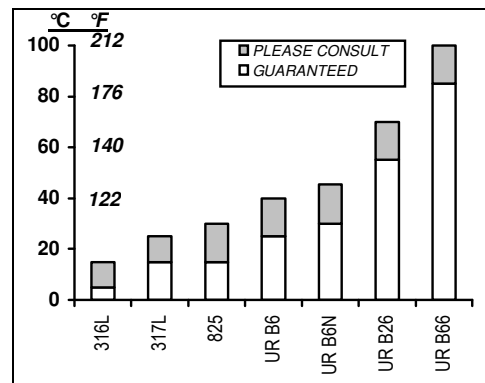
The UR B6(N) grade is commonly used in phosphoric acid applications. The resistance in these environments is strongly influenced by impurities (chlorides, fluorides, etc).



## Localised corrosion

Pitting and crevice corrosion : UR B6 has been extensively tested in laboratory and actual service in many halogene containing elements give to UR B6 medium to good resistance to pitting and crevice corrosion. In all cases, UR B6 performs better than 317L type steels. URB6N has improved localised corrosion resistance compared to UR B6 grade.

In the most severe conditions such as stagnant sea water, it is preferable to use super duplex (UR 52N<sup>+</sup>) or super austenitic (URB26, URB66) stainless steels.



ASTM G48A - PITTING in Fe Cl<sub>3</sub> solution

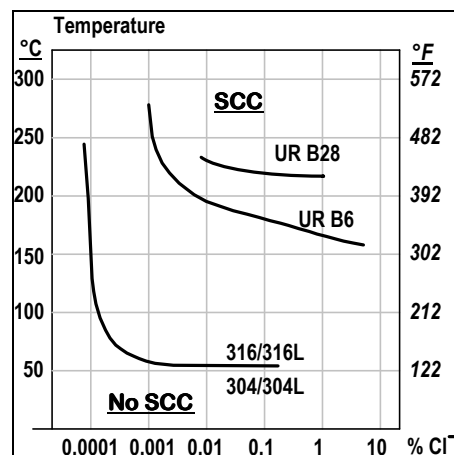
### Intergranular corrosion

The very low carbon content of UR B6 makes this steel almost insensitive to this type of corrosion. After welding, avoid PWHT. An annealing heat treatment may be advisable for equipments required to work in reducing acid environments, such as extremely aggressive, hydrochloric-hydrofluoric acids).

### Stress corrosion

Due to its high nickel content, UR B6 is more resistant to stress corrosion cracking than other austenitic steels, and has proved safe in many industrial media.

Practical experience and laboratory SCC tests show that UR B6 performs much better than 304-316L grades. This is particularly true in high temperature chloride containing solutions where early failures are reported for 304 and 316L grades



Practical experience and laboratory results of SCC in stainless steels

## WELDING

UR B6 can be welded by the following processes : TIG/GTAW, MIG/GMAW, MMAW with covered electrodes, and SAW.

This grade must be welded with matching filler metal or with Ni based alloys. Basic electrodes or fluxes should be used preferably to rutile ones.

Due to the fully austenitic structure, precautions must be taken when welding UR B6N.

- Minimize heat input (string beads, no oscillation, diameter of covered electrodes limited to 3,2 mm). The heat input should preferably be limited to 15 kJ/cm,
- Interpass temperature must be controlled to less than 140°C (284 °F),
- No preheating nor PWHT,
- Protection against weld spatter, careful cleaning and degreasing of weld area and descaling and cleaning of finished weld are highly recommended. Carefully grind strike marks and other welding defects,
- Use run-on and run-off plates and anti-spatter protection as practicable,
- Dry electrodes according to manufacturer's instructions.

UR B6 must be welded with matching filler metal (E 20 25 5 L Cu B) or nickel alloyed filler metal such as INCONEL<sup>®</sup> 625 or PHYWELD NCM (Nb free 625) Suitable electrodes and welding wire are available from various manufacturers.

## MACHINING

|                      |                        |                          | CONDITIONS                 |                        |                                   |                      |                    |
|----------------------|------------------------|--------------------------|----------------------------|------------------------|-----------------------------------|----------------------|--------------------|
| Operation            | Tool                   | Lubri-<br>cation         | Depth of cut<br>(mm)(inch) | Feed<br>(mm)(inch)     | SPEED (m/min)<br>SPEED (feet/min) |                      |                    |
|                      |                        |                          |                            |                        | 18/8                              | 18/12 Mo             | Ur B6              |
| Parting<br>off       | High<br>speed<br>steel | Cutting<br>oil           | Blade width<br>mm - inch   | Feed<br>mm - inch      | SPEED (m/min)<br>SPEED (feet/min) |                      |                    |
|                      |                        |                          | 1.5<br>0.06                | 0.03<br>0.0012         | 21-26<br>68.9-85.3                | 17-22<br>55.8-72.2   | 10-13<br>32.8-42.7 |
|                      |                        |                          | 3<br>0.11                  | 0.04<br>0.0016         | 22-27<br>72.2-88.6                | 18-23<br>59.1-75.5   | 11-14<br>36.1-45.9 |
|                      |                        |                          | 6<br>0.23                  | 0.05<br>0.0020         | 23-28<br>75.5-91.9                | 19-24<br>62.3-78.7   | 12-15<br>39.4-49.2 |
|                      |                        |                          | Drilling                   | High<br>speed<br>steel | Cutting<br>oil                    | Drill Ø<br>mm - inch | Feed<br>mm - inch  |
| 1.5<br>0.06          | 0.025<br>0.0010        | 10-14<br>32.8-45.9       | 10-14<br>32.8-45.9         | 6-10<br>19.7-32.8      |                                   |                      |                    |
| 3<br>0.11            | 0.06<br>0.0024         | 11-15<br>36.1-49.2       | 11-15<br>36.1-49.2         | 7-11<br>23.-26.1       |                                   |                      |                    |
| 6<br>0.23            | 0.08<br>0.0031         | 11-15<br>36.1-49.2       | 11-15<br>36.1-49.2         | 7-11<br>23.-26.1       |                                   |                      |                    |
| 12<br>0.48           | 0.10<br>0.0039         | 11-15<br>36.1-49.2       | 11-15<br>36.1-49.2         | 7-11<br>23.-26.1       |                                   |                      |                    |
| Milling<br>profiling | High<br>speed<br>steel | Dry or<br>Cutting<br>oil |                            | Feed<br>mm- inch       | SPEED (m/min)<br>SPEED (feet/min) |                      |                    |
|                      |                        |                          |                            | .05/0.10<br>.002/.0039 | 12-22<br>39.4-72.2                | 10-20<br>32.8-65.6   | 10-20<br>32.8-65.6 |

## APPLICATIONS

- Phosphoric acid, fertilizers, phosphate industries,
- Sulphuric acid solutions and hydrometallurgy,
- Saline solutions and, with some restrictions, seawater applications,
- Sour gas applications (separators...),
- Pollution control equipments,
- Chemical plants (medium to severe conditions)

## SIZE RANGE

|           | Hot rolled plates            | Cold rolled plates           | Clad plates                  |
|-----------|------------------------------|------------------------------|------------------------------|
| Thickness | 5 to 150 mm<br>3/16" to 6"   | 2 to 14 mm<br>5/64" to 5/8"  | 6 to 150 mm<br>1/4" to 6"    |
| Width     | Up to 3300 mm<br>Up to 130"  | Up to 2300 mm<br>Up to 90.5" | Up to 3300 mm<br>Up to 130"  |
| Length    | Up to 12000 mm<br>Up to 472" | Up to 8250 mm<br>Up to 325"  | Up to 14000 mm<br>Up to 551" |

Other sizes are available on request, including 4100mm (161,4") width plates

### 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 programme on corrosion resistant 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.

Further information may be obtained from the following address.

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