# UGINOX

# F 17 T

## Titanium stabilized 17% chromium ferritic stainless steel

| European désignation (1) | |
|---|---|
| | Variant |
| X3CrTi17 | X2CrTi17 |
| 1.4510 | 1.4520 |

| American désignation (2) | |
|---|---|
| 430 (2) | AISI 439 (3) |

(1) According to NF EN 10088-2
(2) According to ASTM A 268
(3) According to ASTM A 240

## Chemical composition

Mean values

| Element | C | Mn | Si | Cr | Ti |
|---|---|---|---|---|---|
| Weight % | 0.02 | 0.40 | 0.35 | 16.5 | 0.40 |

## General characteristics

UGINOX F 17 is derived from UGINOX F 17 by the addition of titanium. This grade enables good toughness and ductility to be obtained in welds. Stabilization with titanium leads to very good resistance to intergranular and pitting corrosion. UGINOX F 17 T also has good drawability.

## Typical applications

- Domestic appliances.
- Dairy equipment.
- Tubes for the sugar industry.
- Superheater dryer tubes.
- Sink units.
- Hot water tanks.

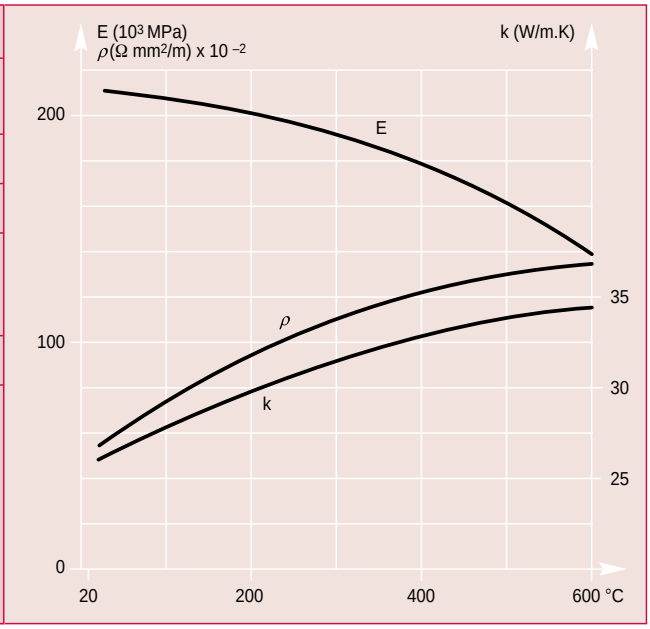
## Product range

- Forms : sheets, blanks, coils, oscillated coils, strips, circle.
- Thicknesses : 0.05 to 4 mm.
- Width : according to thickness, maximum 1500 mm.
- Finish : cold rolled.

## Physical properties

(cold rolled sheet)

| | | | | |
|---|---|---|---|---|
| Density | d | – | 4 °C | 7,7 |
| Melting temperature (solidus) | | °C | | 1460 |
| Specific heat | c | J/kg.K | 20 °C | 460 |
| Thermal conductivity | k | W/m.K | 20 °C | 26 |
| Mean coefficient of thermal expansion | $\alpha$ | $10^{-6}$ .$K^{-1}$ | 20 - 100 °C<br>20 - 200 °C<br>20 - 400 °C | 10,2<br>10,5<br>11,0 |
| Electrical resistivity | $\rho$ | $\Omega mm^2/m$ | 20 °C | 0,60 |
| Young's modulus | E | MPa x $10^3$ | 20 °C | 205 |




## Tensile properties

**Annealed condition**
According to NF EN 10002-1 (Oct. 1990), specimen perpendicular to the rolling direction

Specimen
Lo = 80 mm (thickness < 3 mm)
Lo = 5,65 $\sqrt{So}$ (thickness ≥ 3 mm).

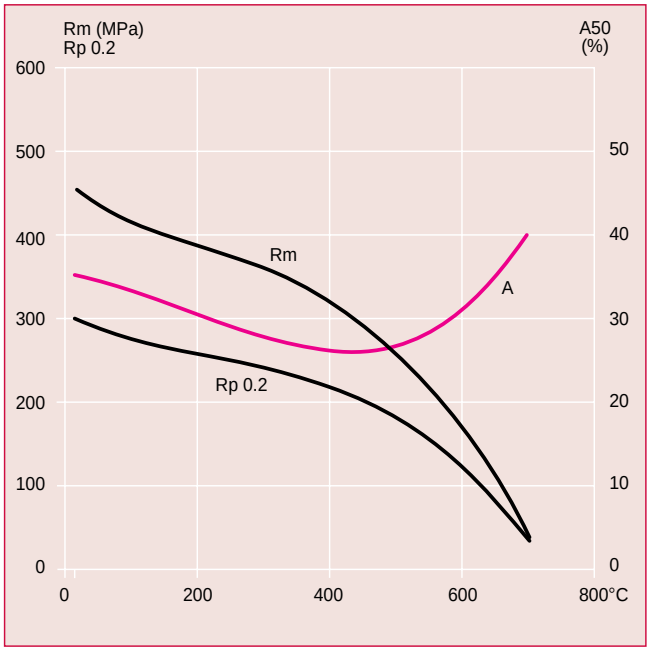
1 MPa = 1 N/mm²

| | Rm(1) (MPa) | Rp 0.2(2) (MPa) | A(3) (%) | Brinell hardness |
|---|---|---|---|---|
| Annealed | 450 (1) | 300 (1) | 30 (1) | ≤ 78 |

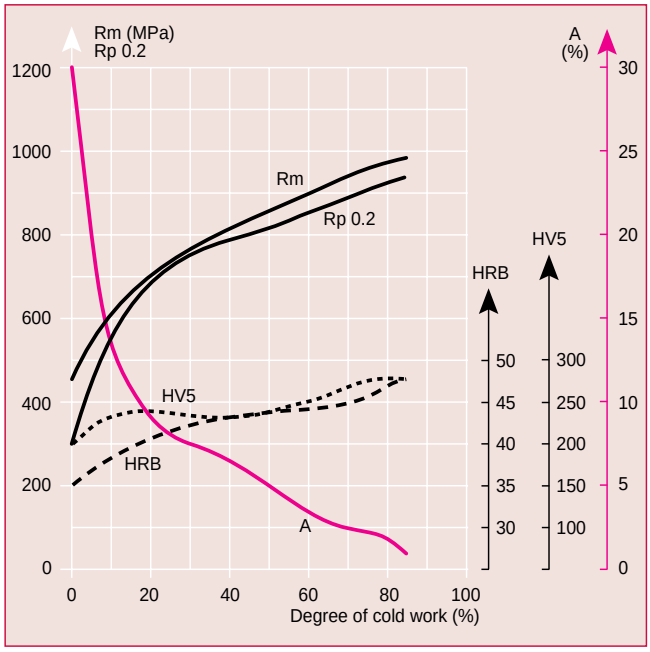
(1) Mean values

(1) Ultimate Tensile Strength (UTS)
(2) Yield Strength
(3) Elongation (El)

### At high temperature




### Effect of cold work




(typical values)

## Corrosion resistance

UGINOX F 17 T extends the range of applications of UGINOX F 17. The stabilization of carbon and nitrogen confers good resistance to intergranular corrosion. Furthermore, titanium also ties up sulfur, leading to improved resistance to pitting corrosion. Like all ferritic stainless steels, UGINOX F 17 T is insensitive to stress corrosion cracking. The corrosion resistance of welds is similar to that of the base metal.

UGINOX F 17 T has good resistance to mineral acids (HNO3), cold dilute organic acids and cold oxidizing and alkaline salt solutions. It also has good resistance to atmospheric corrosion, high temperature oxidation and hot water.

After cleaning with chloride containing reagents, thorough rinsing is essential.

## Welding

| Welding process | No filler metal<br>Typical thicknesses | With filler metal | | | Shielding gas* |
|---|---|---|---|---|---|
| | | Thickness | Filler metal | | |
| | | | Rod | Wire | |
| Resistance - spot<br>- seam | ≤ 2 mm<br>≤ 2 mm | | | | |
| TIG | < 1.5 mm | > 0.5 mm | W. Nr 1.4370<br>ER 308 L (Si)<br>ER 316 L (Si) | W. Nr 1.4370<br>ER 308 L (Si)<br>ER 316 L (Si) | Argon<br>Argon + helium |
| PLASMA | < 1.5 mm | > 0.5 mm | | W. Nr 1.4370<br>ER 308 L (Si)<br>ER 316 L (Si) | Argon<br>Argon + helium |
| MIG | | > 0.8 mm | | W. Nr 1.4370<br>ER 308 L Si<br>ER 316 L Si | Argon + 2 % $CO_2$<br>Argon + 2 % $O_2$<br>Argon + 2 % $CO_2$ + helium |
| S.A.W. | | > 2 mm | | ER 308 L<br>ER 316 L | |
| Electrode | | Repairs | E 308 L<br>E 316 L | | |
| Laser | < 5 mm | | | | Helium<br>In certain conditions, argon |

* Hydrogen and nitrogen forbidden in all cases

**Mechanical properties of welds**
(GTAW process without filler metal).

Comparison with UGINOX F 17, 18-10 L and 18-9 E

| EN 10088.2 | Grade | AISI | Weld joint* | | | Rupture |
|---|---|---|---|---|---|---|
| | | | Rm (MPa) | Rp 0.2 (MPa) | A (%) | |
| 1.4016 | UGINOX F 17 | 430 | 500 | 340 | 15 | BM |
| 1.4510 | UGINOX F 17 T | 430 Ti | 450 | 300 | 25 | BM |
| 1.4306 | UGINOX 18-10 L | 304 L | 600 | 300 | 35 | BM |
| 1.4301 | UGINOX 18-9 E | 304 | 630 | 300 | 35 | FZ |

* Typical values for transverse tensile tests in the as-welded condition. Results obtained at room temperature after grinding flat a 2 mm thick weld.

** BM = base metal, FZ = fusion zone

In the above example, since rupture occurs in the base metal, the Rm and Rp 0.2 can be taken equal to those in the base metal. Only the elongation falls.

No heat treatment is necessary after welding. The welds must be mechanically or chemically descaled, then passivated (decontaminated).

## Forming

UGINOX F 17 T can be readily cold formed by all standard processes (bending, contour forming, drawing, etc.). Most deep drawing operations can be performed in a single pass.

**Swift test**
(drawing)

| Grade | European designation | AISI | LDR* (0.8 mm thick sheet) |
|---|---|---|---|
| UGINOX F 17 | 1.4016 | 430 | 2.05-2.10 |
| UGINOX F 17 T | 1.4510 | 430 Ti | 2.15-2.20 |
| UGINOX 18-9 E | 1.4301 | 304 | 1.95-2.00 |

* Limiting drawing ratio

**Erichsen test**
(expansion)

| Grade | European designation | AISI | Erichsen deflection (0.8 mm thick sheet) |
|---|---|---|---|
| UGINOX F 17 | 1.4016 | 430 | 8.7 |
| UGINOX F 17 T | 1.4510 | 430 Ti | 9.6 |
| UGINOX 18-9 E | 1.4301 | 304 | 11.5 |

## Heat treatment and finishing

**Annealing**
At 825°C after cold working.

**Pickling**
Nitric-hydrofluoric acid mixture (10 % $HNO_3$ + 2% HF).
Descaling pastes for weld zones.

**Passivation**
20-25 % $HNO_3$ solution at 20°C.
Passivating pastes for weld zones.

Ugine document :
Ref. no 306 - Version 1
Date of issue 6/97

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