TRAFITECH

| **Quality** | **X5CrNiMo17-12-2** | **Austenitic Stainless Steel** | *Technical card 2018* |
|---|---|---|---|
| Number | **1.4401** | | *Lucefin Group* |

## Chemical composition

| **C%** max | **Si%** max | **Mn%** max | **P%** max | **S%** [a] max | **Cr%** | **Ni%** | **N%** max | **Mo%** | |
|---|---|---|---|---|---|---|---|---|---|
| 0,07 | 1,00 | 2,00 | 0,045 | 0,030 | 16,5-18,5 | 10,0-13,0 | 0,10 | 2,0-2,5 | EN 10088-3: 2014 |
| ± 0.01 | + 0.05 | ± 0.04 | + 0.005 | ± 0.003 | ± 0.2 | ± 0.15 | + 0.01 | ± 0.1 | |

Product deviation are allowed

[a] for improving machinability, it is allowed a controlled sulphur content of 0,015 % - 0,030 %; for polishability, it is suggested a controlled sulphur content of max 0,015 %

## Temperature °C

| **Melting range** | **Hot-forming** | **Solution annealing** (Solubilization) **+AT** | **Stabilizing** | **Soft annealing +A** |
|---|---|---|---|---|
| 1400-1380 | 1200-925 | 1100-1050 water | unnecessary | not suitable |

| **Sensitization** | **Quenching +Q** | **Tempering +T** | **Stress relieving +SR** |
|---|---|---|---|
| sensitization test at 800-450 | not suitable | not suitable | 450-200 furnace |

MMA **welding –** AWS electrodes

*pre-heating* not necessary — *post welding* slow cooling

*joint with steel*

| carbon | CrMo alloyed | stainless |
|---|---|---|
| E309-E308 | E309-E308 | E308 |

*cosmetic welding* E 316 or E 16-8-2

**Chemical treatment** ▪ *Pickling* (6 - 25% $HNO_3$) + (0.5 - 8% HF) hot ▪ *Passivation* 20 - 50% $HNO_3$ hot

## Mechanical properties

**Heat-treated material** EN 10088-3: 2014 in conditions 1C, 1E, 1D, 1X, 1G, 2D

| size mm | | Testing at room temperature **R** | **Rp** 0.2 | **A%** | **A%** | **Kv₂** +20 °C | **Kv₂** +20 °C | **HBW** [a] | |
|---|---|---|---|---|---|---|---|---|---|
| from | to | N/mm² | N/mm² min | min (L) | min (T) | J min (L) | J min (T) | max | |
| | 160 | 500-700 | 200 | 40 | - | 100 | - | 215 | +AT |
| 160 | 250 | 500-700 | 200 | - | 30 | - | 60 | 215 | solubilization |

[a] for information only (L) = longitudinal (T) = transversal

**Bright bars of heat-treated material** EN 10088-3: 2014 in conditions 2H, 2B, 2G, 2P

| size mm | | Testing at room temperature **R** | **Rp** 0.2 | **A%** | **A%** | **Kv₂** +20 °C | **Kv₂** +20 °C | |
|---|---|---|---|---|---|---|---|---|
| from | to | N/mm² | N/mm² min | min (L) | min (T) | J min (L) | J min (T) | |
| | 10 [b] | 600-950 | 400 | 25 | - | - | - | |
| 10 | 16 | 580-950 | 380 | 25 | - | - | - | +AT |
| 16 | 40 | 500-850 | 200 | 30 | - | 100 | - | solubilization |
| 40 | 63 | 500-850 | 200 | 30 | - | 100 | - | |
| 63 | 160 | 500-700 | 200 | 40 | - | 100 | - | |
| 160 | 250 | 500-700 | 200 | - | 30 | - | 60 | |

[b] in the range of 1 mm ≤ d < 5 mm, values are valid only for rounds – the mechanical properties of non round bars of < 5 mm of thickness have to be agreed at the time of request and order

(L) = longitudinal (T) = transversal

**Forged** +AT solubilization

| size mm | | Testing at room temperature **R** | **Rp** 0.2 | **A%** | **A%** | **Kv** +20 °C | **Kv** +20 °C | **Kv** -196 °C | |
|---|---|---|---|---|---|---|---|---|---|
| from | to | N/mm² | N/mm² min | min (L) | min (T) | J min (L) | J min (T) | J min (T) | |
| | 250 | 500-700 | 200 | - | 30 | 100 | 60 | - | UNI EN 10250-4:01 |
| | 250 | 510-710 | 205 | 45 | 35 | 100 | 60 | 60 | UNI EN 10222-5:01 |

**Work-hardned by cold-drawing** EN 10088-3: 2014 in condition 2H (es. +AT+C)

| size mm | | Testing at room temperature **R** | **Rp** 0.2 | **A%** | |
|---|---|---|---|---|---|
| from | to | N/mm² | N/mm² min | min | |
| | 35 | 700-850 | 350 | 20 | +AT+C700 cold-drawn material |
| | 25 | 800-1000 | 500 | 12 | +AT+C800 cold-drawn material |

**Transition curve** determined by Kv impacts. Material solubilized at 1050 °C

| Average | J | 198 | 206 | 218 | 225 | 238 | 245 | 250 |
|---|---|---|---|---|---|---|---|---|
| Test at | **°C** | **-160** | **-120** | **-80** | **-40** | **0** | **+40** | **+80** |

**Approximate mechanical properties at low temperatures.** Material solubilized at 1080 °C

| | | | | | |
|---|---|---|---|---|---|
| **R** | N/mm² | 580 | 820 | 1270 | 1440 |
| **Rp** 0.2 | N/mm² | 245 | 330 | 520 | 580 |
| **A** | % | 55 | 50 | 45 | 40 |
| Test at | **°C** | **+24** | **-74** | **-196** | **-254** |

X5CrNiMo17-12-2 **n° 1.4401** austenitic stainless steel *Lucefin Group*

Effect of **cold-working** (hot-rolled +AT+C). Approximate values

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **R** | N/mm² | 550 | 660 | 800 | 1000 | 1110 | 1220 | 1320 | 1430 |
| **Rp** 0.2 | N/mm² | 260 | 510 | 640 | 790 | 840 | 920 | 1020 | 1120 |
| **A** | % | 50 | 22 | 14 | 13 | 10 | 8 | 8 | 8 |
| Reduction | **%** | **0** | **10** | **20** | **30** | **40** | **50** | **60** | **70** |

**Minimum yield stress and tensile strength values at high temperatures** on material +AT, EN 10088-3: 2014/EN 10269: 2001

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rp** 0.2 | N/mm² | 175 | 158 | 145 | 135 | 127 | 120 | 115 | 112 | 110 | 108 |
| **R** | N/mm² | 460 | 440 | 420 | 415 | 410 | 410 | 410 | 405 | 390 | 375 |
| Test at | **°C** | **100** | **150** | **200** | **250** | **300** | **350** | **400** | **450** | **500** | **550** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Thermal expansion** | $10^{-6} \cdot K^{-1}$ | 12.8 | 13.3 | 14.1 | ► | 16.0 | 16.5 | 17.0 | 17.5 | 18.8 | 20.2 |
| **Modulus of elasticity** | longitudinal GPa | | | | 200 | 194 | 186 | 179 | 172 | | 127 |
| **Poisson number** | *v* | | | | 0.256 | 0.280 | | | | | |
| **Electrical resistivity** | Ω • mm²/m | 0.58 | | 0.66 | 0.75 | | 0.86 | | 0.97 | 1.07 | 1.15 |
| **Electrical conductivity** | Siemens•m/mm² | | | | 1.33 | | | | | | |
| **Specific heat** | J/(Kg•K) | | | | 500 | | 510 | | 550 | 585 | 630 |
| **Density** | Kg/dm³ | | | | 8.00 | | | | | | |
| **Thermal conductivity** | W/(m•K) | | | | 15.0 | | 17.5 | 19.9 | | | 25.1 |
| **Relative magnetic permeability** | μr | | | | 1.02 | | | | | | |
| **°C** | | **-184** | **-128** | **-74** | **20** | **100** | **200** | **300** | **400** | **600** | **800** |

The symbol ► indicates between 20 °C and 100 °C, 20 °C and 200 °C .....

| **Corrosion resistance** | Atmospheric | | Chemical | | | **x** halides, sulfuric acid, phosphoric, organic and formic acids |
|---|---|---|---|---|---|---|
| Fresh water | *industrial* | *marine* | *medium* | *oxidizing* | *reducing* | |
| **x** | **x** | **x** | **x** | **x** | **x** | |

| | |
|---|---|
| **Magnetic** | no |
| **Machinability** | low |
| **Hardening** | cold-drawn and other cold plastic deformations |
| **Service temperature in air** | continuous service up to 850 °C; intermittent service up to 800 °C |

| **Europe** EN | **USA** UNS | **USA** ASTM | **China** GB | **Russia** GOST | **Japan** JIS | **India** IS | **Rep. of Korea** KS |
|---|---|---|---|---|---|---|---|
| X5CrNiMo17-12-2 | S31600 | **316** | 0Cr17Ni12Mo2 | 08Ch17N13M2 | SUS 316 | X04Cr17Ni12Mo2 | STS 316 |

*Approximate diagram of cold-drawn hardening*