

Austenitic Stainless Steel

Aperam 301 17-7A / 17-7C / 17-7E

Chemical Composition

| Grades | C | Si | Mn | Cr | Ni | Mo |
|--------|------|------|------|-------|------|------|
| 17-7A | 0.11 | 0.90 | 1.20 | 16.80 | 6.55 | — |
| 17-7C | 0.10 | 0.60 | 0.85 | 17.30 | 7.25 | — |
| 17-7E | 0.10 | 1.15 | 1.20 | 16.65 | 6.65 | 0.70 |

Typical values (%)

| European designation | American designation |
|--|--|
| Type 1.4310 ⁽¹⁾ with a lower carbon content (better for stamping and corrosion resistance) | Type 301 ⁽²⁾⁽³⁾ with a higher Cr content (better for corrosion resistance) |
| ⁽¹⁾ Assimilated to EN10088-2 X10CrNi18-8 | ⁽²⁾ Assimilated to ASTM A240 ⁽³⁾ Our grade 17-7E is not compliant with 301 designation |

This grade complies with:

- > REACH safety data sheet (European regulation 1907/2006)
- > European Directive 2000/53/EC on end-of-life vehicles and later modifications
- > Standard NFA 36 711 "Stainless Steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption (non packaging steel)"
- > Requirements of NSF/ANSI 51 edition international standard for "Food Equipment Materials" and with F.D.A. (United States Food and Drug Administration) requirements regarding materials used for food contact
- > European Parliament and of the Council regulation N° 1935/2004 of the of 27 October 2004, on materials and articles intended to come into contact with food (and repealing Directives 80/590/EEC and 9/109/EEC)
- > French regulatory paper dated 13 January 1976 relating to materials and articles made of stainless steel in contact with foodstuffs

Key Features

- > High mechanical properties that can easily be enhanced by work hardening (temper rolling)
- > Very good corrosion resistance in atmospheric, urban and freshwater conditions
- > Limited corrosion resistance at elevated temperatures (400-800°C) due to high carbon content (risk of intergranular corrosion)

| | |
|-------|--|
| 17-7A | standard grade, cost-effective solution |
| 17-7C | ideal for projects where slightly lower mechanical properties are needed |
| 17-7E | well-suited for applications requiring bending properties and fatigue resistance |

Applications

- > Springs (for T < 300°C)
- > Building industry (hand tools, security shoe soles, etc.)
- > Automotive parts: cylinder head gaskets, connectors, braking system parts, etc.
- > Sink drainers
- > Catering equipment
- > Conveyor belts
- > Railway rolling stock
- > Lorry structures
- > Hubcaps
- > Medical and safety equipment

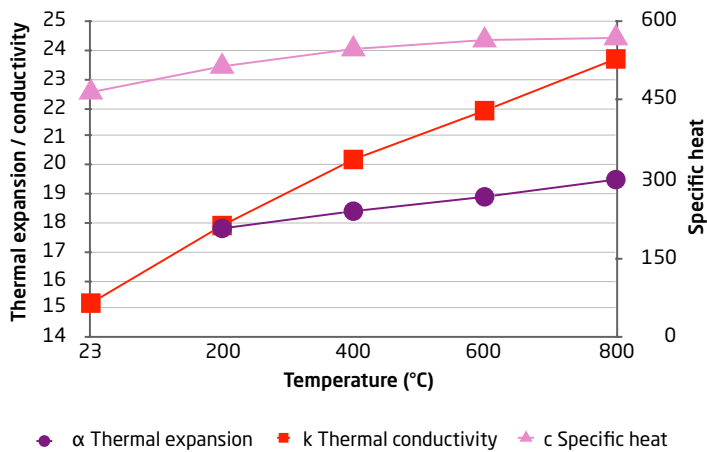
Product Range

| | Precision Strip | Precision Sheet | Coils & Sheets | | |
|----------------|-------------------|-------------------|---|---|---|
| | | | 17-7A | | 17-7C and 17-7E |
| Thickness (mm) | 0.06 up to 2.5 | 0.20 up to 2.5 | 2.5 up to 14 (1D) 0.4 up to 2 (2R) 0.4 up to 8 (2B) | 4.5 up to 14 (1D) 0.8 up to 2 (2R) 1 up to 8 (2B) | 2.5 up to 14 (1D) 0.4 up to 2 (2R) 0.4 up to 8 (2B) |
| Width (mm) | 3 up to 700 | 40 up to 670 | up to 1,250 | up to 1,500 | up to 1,250 |
| Finish | 2R / 2B / 2D / 2H | 2R / 2B / 2D / 2H | 1D / 2R / 2B | 1D / 2R / 2B | 1D / 2R / 2B |

Physical Properties

Cold rolled and annealed sheet

| | | | | |
|---------------------------------------|---|------------------------------------|----------|-------|
| Density | d | kg/dm ³ | 23°C | 7.9 |
| Melting temperature | - | °C | Liquidus | 1,449 |
| Specific heat | c | J/kg.K | 23°C | 466 |
| Thermal conductivity | k | W/m.K | 23°C | 15.2 |
| Thermal diffusivity | D | 10 ⁻⁶ m ² /s | 23°C | 4.13 |
| Mean coefficient of thermal expansion | α | 10 ⁻⁶ /K | 20-200°C | 17.8 |
| | | | 20-400°C | 18.4 |
| | | | 20-600°C | 18.9 |
| | | | 20-800°C | 19.5 |



Mechanical Properties

Annealed condition

In accordance with ISO 6892-1, part 1

Test sample perpendicular to rolling condition

Test piece

Length = 50 mm

Typical values on 0.4 mm

| Grade | European designation | Condition | Rm ⁽¹⁾ (MPa) | Rp _{0.2} ⁽²⁾ (MPa) | A ⁽³⁾ % | Hardness (HV) |
|-------|----------------------|-------------|-------------------------|--|--------------------|---------------|
| 304 | 1.4301 | Cold-rolled | 650 | 300 | 54 | 170 |
| 17-7A | 1.4310 | Cold-rolled | 850 | 380 | 48 | 195 |
| 17-7C | 1.4310 | Cold-rolled | 750 | 330 | 50 | 180 |
| 17-7E | 1.4310 | Cold-rolled | 830 | 370 | 48 | 195 |

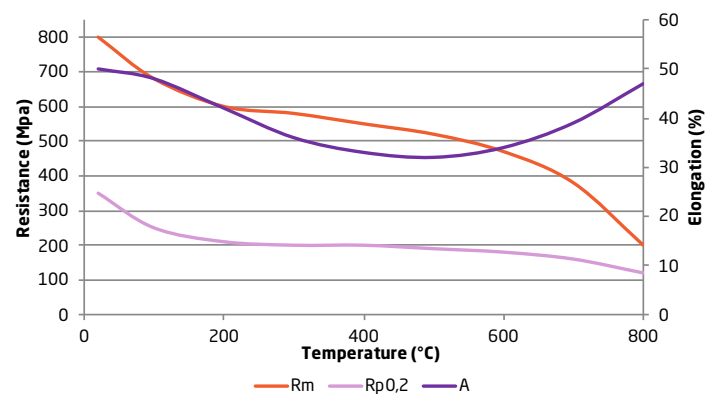
1MPa = 1N/mm²

⁽¹⁾ Ultimate Tensile Strength (UTS)

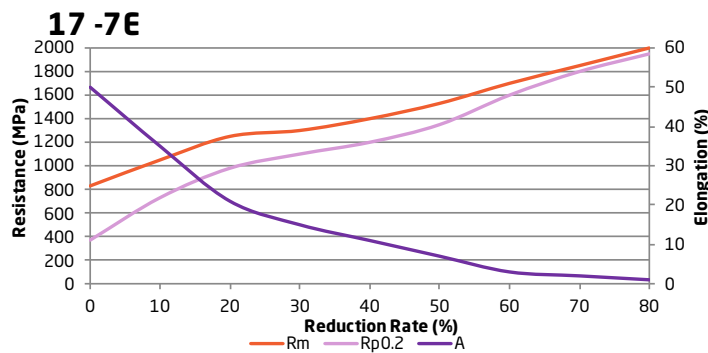
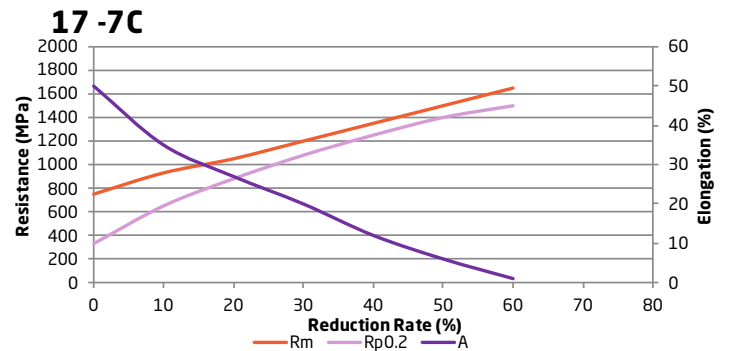
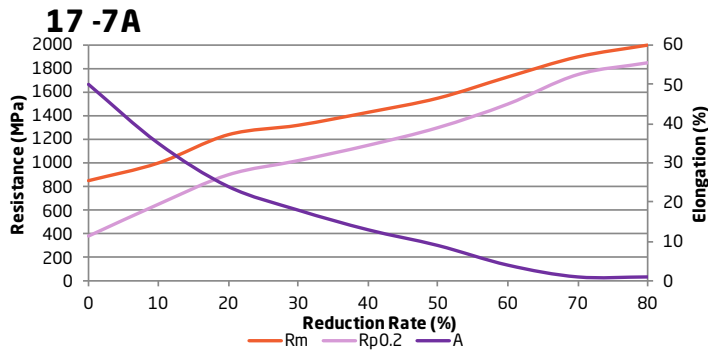
⁽²⁾ Yield Strength (YS)

⁽³⁾ Elongation (A)

At high temperatures



Mechanical properties as a function of degree of work-hardening at ambient temperature



Mechanical properties in the work-hardened condition

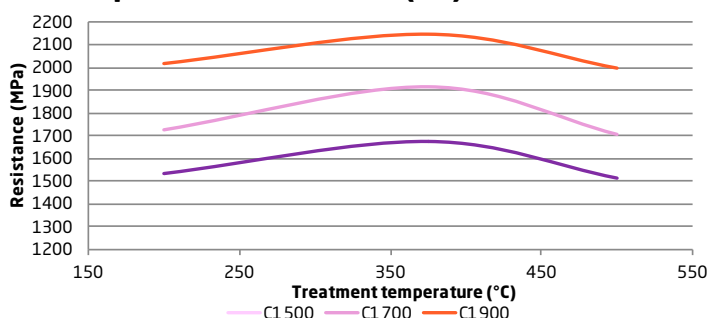
| Strain hardening (temper class) | 17-7A | | | 17-7E | | | 17-7C | | |
|---------------------------------|----------|-------------------------|-------|----------|-------------------------|-------|----------|-------------------------|-------|
| | Rm (MPa) | Rp _{0.2} (MPa) | A (%) | Rm (MPa) | Rp _{0.2} (MPa) | A (%) | Rm (MPa) | Rp _{0.2} (MPa) | A (%) |
| C850 | 850 | 380 | 50 | 850 | 390 | 48 | 850 | 600 | 40 |
| | 1,000 | 650 | 35 | 1,000 | 650 | 37 | 1,000 | 700 | 30 |
| C1000 | 1,000 | 650 | 35 | 1,000 | 650 | 37 | 1,000 | 700 | 30 |
| | 1,150 | 800 | 26 | 1,150 | 850 | 26 | 1,150 | 950 | 20 |
| C1150 | 1,150 | 800 | 26 | 1,150 | 850 | 26 | 1,150 | 950 | 20 |
| | 1,300 | 1,050 | 16 | 1,300 | 1,050 | 16 | 1,300 | 1,120 | 14 |
| C1300 | 1,300 | 1,050 | 16 | 1,300 | 1,050 | 16 | 1,300 | 1,120 | 14 |
| | 1,500 | 1,300 | 6 | 1,500 | 1,300 | 8 | 1,500 | 1,350 | 4 |
| C1500 | 1,500 | 1,300 | 6 | 1,500 | 1,300 | 8 | 1,500 | 1,350 | 4 |
| | 1,700 | 1,500 | 3 | 1,700 | 1,450 | 2 | 1,700 | 1,500 | 1 |
| C1700 | 1,700 | 1,500 | 3 | 1,700 | 1,450 | 2 | — | — | — |
| | 1,900 | 1,750 | 1 | 1,900 | 1,750 | 1 | — | — | — |
| C1900 | ≥ 1,900 | ≥ 1,750 | ≤ 1 | ≥ 1,900 | ≥ 1,750 | ≤ 1 | — | — | — |

The elevated mechanical properties of our 17-7A, 17-7C and 17-7E grades, which are obtained through work hardening, give these three grades with excellent fatigue resistance.

Indicative typical values. For more information, please contact us.

Secondary hardening capability

Example for Grade 17-7A (3h)



In addition to their high work hardenability, our 17-7A and 17-7E grades exhibit a “bake-hardening” or secondary hardening effect that can be obtained using post-forming heat treatment on the components. This hardening effect is directly related to the degree of prior cold forming.

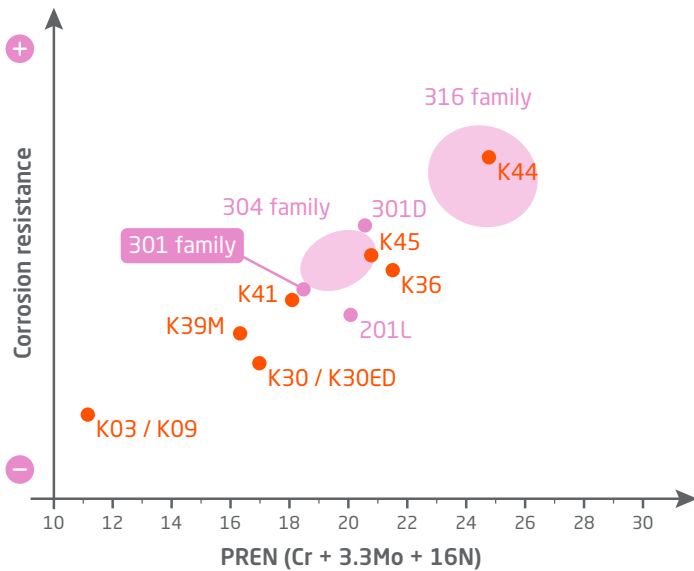
Influence of temperature on strain-hardened conditions

When our 17-7A, 17-7C and 17-7E grades are exposed to temperatures below 0°C, a slight increase in Rm and Rp_{0.2} is observed, accompanied by a reduction in A%. Conversely, exposure to high temperatures brings about a rapid reduction in Rm and Rp_{0.2}, accompanied by an appreciable increase in A%.

Corrosion Resistance

Our 17-7A, 17-7C and 17-7E grades are slightly less resistant than our 304 type 1.4301 alloy. They are well-suited to freshwater, urban atmospheres and foodstuffs. It should be noted that these three grades are highly susceptible to the intergranular corrosion caused by precipitation of chromium carbides when exposed to temperatures in the range 400-800°C.

Pitting potential in various temperatures and chloride concentrations



Forming

17-7A, 17-7C and 17-7E grades, in the strain-hardened (tempered) condition, respond well to common cold forming operations (bending, profiling, curving, drawing, metal spinning, etc.). As a result, they are also well-suited to ironing, but their drawability is less than that of our 304 type 1.4301 grade.

Cold work-hardening absorbs considerable power on the forming tools.

Component designs must compensate for springback, which increases with the use of higher classes of strain hardening.

Welding

Our 17-7A, 17-7C and 17-7E grades are weldable in thin gauges using either resistance spot or seam welding. Please contact us about all other processes, particularly in the case of heavy gauges and/or strain-hardened condition. This is because welding operations can significantly reduce mechanical properties in the heat affected zones, leading to risks of intergranular corrosion.

| Welding process | No filler material | | With filler metal | | Shielding gas |
|------------------------|---------------------|-------------|---|---|---|
| | Typical thicknesses | Thicknesses | Filler material | | Hydrogen and nitrogen forbidden in all cases |
| | | | Rod | Wire | |
| Resistance: spot, seam | < 2 mm | | | | |
| TIG | < 1.5 mm | > 0.5 mm | ER 308L ⁽¹⁾ ER 347L ⁽¹⁾⁽²⁾ | ER 308L ⁽¹⁾ ER 347L ⁽¹⁾⁽²⁾ | Ar Ar + 5% H Ar + He |
| PLASMA | < 1.5 mm | > 0.5 mm | | ER 308L ⁽¹⁾ ER 347L ⁽¹⁾⁽²⁾ | Ar Ar + 5% H Ar + He |
| MIG | | > 0.8 mm | | ER 308L ⁽¹⁾ ER 347L ⁽¹⁾⁽²⁾ | Ar + 2% CO ₂ Ar + 2% O ₂ Ar + 2% CO ₂ + 1% H ₂ Ar + He |
| SAW | | > 2 mm | | ER 308L ⁽¹⁾ | |
| Electrode | | Repairs | ER 308L ⁽¹⁾ ER 347L ⁽¹⁾⁽²⁾ | | |
| Laser | < 5 mm | | | | He Under certain circumstances: Ar N |

⁽¹⁾ AWS A5.9 - ⁽²⁾ EN ISO 14343 - ⁽³⁾ EN 439

No heat treatment is necessary after welding. In order to fully restore the corrosion resistance of the metal, the welds must be mechanically or chemically descaled and then passivated and decontaminated.

However, depending on the application, this operation may be not essential.

If there is a risk of intergranular corrosion, a solution annealing treatment at 1,075°C ±25°C must be carried out.

Heat Treatment and Finishing

Annealing

After cold forming (work hardening) and welding (risk of intergranular corrosion in the weld joint), using an annealing treatment for a couple of minutes at 1,075 ±25°C, followed by water quenching or air cooling, restores the microstructure (recrystallisation and dissolution of carbides) and eliminates internal stresses. After annealing, pickling, followed by passivation, are necessary.

Pickling

- > Nitric-Hydrofluoric acid mixture (10% HNO₃ + 2% HF) at ambient temperature or up to 60°C

- > Sulfuric-nitric acid mixture (10% H₂SO₄ + 0.5% HNO₃) at 60°C
- > Use descaling pastes for weld areas

Passivation

- > 20-25% HNO₃ solution (36° Baumé) at 20°C
- > Use passivating pastes for weld zones

Polishing

The surfaces of our 17-7A, 17-7C and 17-7E grades are suitable for all kinds of polishing (grit scotch-brite, electro polishing).



www.aperam.com
stainless@aperam.com

