



CHRONIFER® Labor 18-2

1.4523/UNS S18235 - Free machining ferritic stainless steel for magnetic valve cores having a superior corrosion resistance

Features and peculiarities

The CHRONIFER® Labor 18-2 steel is the Sandvik 1802 ferritic stainless steel. Its high S addition improves its machinability. The Ti one stabilizes its microstructure and improves both its corrosion resistance and its machinability. The high Cr content enables to use this steel in the presence of still more aggressive mediums. This steel has specific soft magnetic properties in the annealed condition. Its high electrical resistance reduces the losses due to the eddy currents developed by AC excitation.

Uses

The CHRONIFER® Labor 18-2 steel is supplied in the annealed condition and has specific soft magnetic properties. It can be directly be into finished parts without any further treatment. Machined cores can be directly used as such, provided they are free of smut Fe-ions contamination accumulated during machining.

Standards

| | |
|-----------------|---------------|
| Material number | 1.4523 |
| EN/DIN | X2CrMoTiS18-2 |
| AISI | 444 FR |
| UNS | S18235 |

Chemical composition (%wt)

| C+N | Si | Mn | P | S | Cr | Mo | Ti | Fe |
|------|------|------|-------|-------|-------|------|------|---------|
| max. | max. | max. | max. | max. | 18.00 | 2.30 | 0.70 | balance |
| 0.04 | 0.50 | 0.50 | 0.020 | 0.300 | | | | |

Executions

- Bars Ø ≤3.00 mm: cold drawn: Rm 750-950 MPa; R_{0.2} 620-820; A 7%
- Bars Ø 3.01-12.00 mm: cold drawn: Rm 650-850 MPa; R_{0.2} 500-720; A 9%
- Bars Ø 12-15 mm: surface: ground
annealed: Rm 430-600 MPa; R_{0.2} 280; Hb 200
- Bars Ø 13-70 mm: surface: turned, shaved
annealed: Rm 430-600 MPa; R_{0.2} 280; Hb 200

Magnetic properties

- The optimal soft magnetic properties can only be achieved by annealing at 800°C/2h.
- Cold plastic deformation and forming affect negatively the relative magnetic permeability, increase the coercive force as well as the UTS/Rm and YS_{0.2}/R_{0.2}.

Uses

- Temperature range: -60°C to 300°C
- This steel is not adapted for use at low temperature and for uses requiring specific high impact resistance.

Availability

Dimensions courantes en stock, see: [Delivery program](#)

Machining

The CHRONIFER® Labor 18-2 steel exhibits good to very good machining properties. Machinability: very good

Cutting conditions

- Cutting speed: V_c ≈ 45 - 60 m/min
Lubricant-coolant: individual choice
- The optimal cutting conditions depend on the machine tool, the cutting tools, the chip dimensions, the lubricant-cooling fluid, as well as the tolerances and surface the roughness to be achieved.
 - Under given circumstances, the used cutting conditions may lead to the build up of surface internal stress patterns that may negatively influence the set magnetic properties by increasing the coercive force and decreasing the permeability.



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- Forming** Warm: Forging: 1065°C
Uniform heating up to the forging temperature
- The CHRONIFER Labor 18-2 steel exhibits a strong tendency to grain growth at the forging temperature level. Holding times at this temperature should always be limited or avoided.
- Cold: Limited. Not recommended
- This steel should always be used in the annealed condition. The best magnetic properties can only be achieved in this condition.
 - The numerous complex S inclusions limit its cold forming capability

Welding The numerous complex S inclusions of this steel impair strongly its welding. Welding is not recommended.

- Annealing** Solution anneal: 1050°C
Standard anneal: 800°C/2h slow cooling up to 600°C
Quenching: 850°C/5-30min/water; HV₅ ≈ 165
Stress relieving: < 500°C
- A stress relieving treatment can partially restore the original magnetic properties only, such as the coercive force set by the steel producer.

Mechanical properties

| Properties | Operating temperature (°C) | | |
|---|----------------------------|-----|-----|
| | 100 | 200 | 300 |
| UTS/Rm (MPa) | 495 | 335 | 24 |
| YS _{0.2} /R _{0.2} (MPa) | 460 | 300 | 22 |
| A (%) | 445 | 280 | 20 |

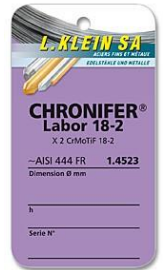
- Notch impact resistance** Charpy V Impact test (J):
At 20°C: ≈5 J
Transition temperature: 100°C
- The CHRONIFER® Labor 18-2 steel has a low impact resistance. It should not be used in applications specifically requiring high impact resistance.

- Hardening**
- Der CHRONIFER® Labor 18-2 Stahl cannot be hardened by heat treatment.
 - This steel can be hardened by cold work only. But, cold working increases its coercive force, which can only be properly restored by annealing.
 - Under given circumstances a stress relieving treatment can partially restore its soft magnetic properties.

- Laser marking**
- The numerous complex S inclusions may impair the laser marking.
 - The marking heat acting in the HAZ „Heat Affected Zone“ influences negatively the magnetic properties and the corrosion resistance. [More info](#)

- Oxidation**
- The formation of an oxide layer or an oxide scale can massively reduce the corrosion resistance. These oxide formations must be removed either mechanically or chemically by pickling.

- Polishing** This steel is not adapted to mirror polishing.
- The numerous complex S inclusions may impair the polishing by reducing its quality as well as output and economy.



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Passivation The adequacy of the selected passivation process should be checked with respect to the numerous S-inclusions of this free machining grade.

- The numerous Sulfide-inclusions can impair the passivation treatment.
- Pickling before passivation is recommended. It should not be omitted. [More info](#)

Elementary precautions Optimum: Clean surfaces, fine polished and passivized

- The numerous S-inclusions increase the susceptibility to pitting corrosion.
- The simplest protection is to keep the parts cleaned, fine polished and passivized.
- The parts should always be properly cleaned (no residues) and dried.
- Use adapted chloride free washing and cleaning products. [More info](#)

Corrosion resistance The corrosion resistance of the CHRONIFER Labor 18-2 steel compared to the Die ASTM/AISI 316L steel grade.

| Weak acids organic; H ₃ PO ₄ | Strong acids HNO ₃ ; HCl | Cl containing H ₂ O | Cl containing H ₂ O Risk of stress corrosion cracking |
|--|-------------------------------------|--------------------------------|--|
| similar | weaker | similar | better |

- The CHRONIFER Labor 18-2 steel significantly better than the ASTM/AISI 304 steel grade.

Physical properties

| Properties | Units | Temperature (°C) | | | | |
|--------------------------|--|------------------|-----------|-----|-----------|-----|
| | | 20 | 100 | 200 | 400 | 500 |
| Density | g cm ⁻³ | 7.70 | | | | |
| Young modulus E | GPa | 225 | 220 | 210 | 195 | |
| Thermal expansion | m m ⁻¹ K ⁻¹ 10 ⁻⁶ | 20-100°C | 20-200°C | | 20-400°C | |
| | | 10 | 11 | | 11.5 | |
| Specific heat | J kg ⁻¹ K ⁻¹ | 460 | 500 | 540 | 580 | |
| Saturation | T | 20-100°C | 20-200°C | | 20-400 | |
| | | 1.35-1.42 | 1.40-1.48 | | 1.25-1.35 | |
| Remanence Br | T | 20-100°C | 20-200°C | | 20-400°C | |
| | | 0.5-0.8 | 0.7-0.9 | | 0.3-0.4 | |
| Electrical resistance | μ Ω mm | 600 | 700 | 800 | 950 | |
| Coercive Field | Oe | 20-100°C | 20-200°C | | 20-400°C | |
| | | 4.7 | 2.5-3.5 | | 2-3 | |
| Coercive Field strength | A m ⁻¹ | 199 | | | | |
| Relative permeability μr | | annealed 800°C | | | | |
| | | ≈1000 | | | | |
| solution annealed | | 600-1000 | | | | |
| Delivery condition | | 400 | | | | |

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