## GENERAL INFORMATION

Fechral Fechroma®23H has a very high maximal working temperature (up to 1300°C) and it is several times more durable in comparison with nichrome at operation at high temperatures (1000-1350°C) in commonly occurring oxidizing, sulfur-containing and other environments.

The manufacturing techniques of fechral Fechroma®23H provide uniform structure, uniformity of protective oxidic layer and high adhesion of this layer to a surface. In a combination with decrease of carbon level, the high wire ductility, lack of tendency to intercrystalline high-temperature corrosion, high creep strength and also resistance against oxidation, sulfidization and carburizing at increased temperatures are guaranteed.

High resistance to oxidation and corrosion in the most widespread industrial oxidizing, sulfur-containing, etc. hostile environment, is caused by the nature of chemically inert, dense superficial protective layer on a basis $Al_2O_3$.

Preoxidizing of fechral wire (2 hours of holding at temperature more than 1000°C on air) provides a possibility of operation even in the recovery atmospheres. The light gray protective film of oxide of aluminum, which is formed on a surface, effectively prevents possible corrosion of metal. Properties of Fechroma®23H alloy are caused, in particular, by the fact that on the surface of alloy the high-strength film of $Al_2O_3$, which is the excellent insulator, is formed and it prevents corrosion more effectively in comparison with the oxide of chrome ($Cr_2O_3$), which is formed on the surface of nichrome. It is known that the chrome oxide film (nichromes) is less steady, exfoliates and evaporates faster, that leads to reduction of service life of the heater. Use of nichrome on limit temperatures can lead to the fact that above-mentioned products of evaporation can even pollute the heated surfaces of the working equipment and the thermoprocessed products. Thermal evaporation of nichrome in nonoxidizing and other atmospheres can cause additional thermal instability and even short circuit of the accompanying electric chains.

| Classification | |
|---|---|
| DIN | 1.4765* CrAl 23 5 T (SE) |
| UNS | K 92500* |
| | |

* closest specification

## PHYSICAL PROPERTIES

| Temperature, °C | Resistance μΩm | Exten. $10^{-6}$/K |
|---|---|---|
| 20 | 1,44 | - |
| 200 | 1,44 | 11,0 |
| 400 | 1,45 | 12,0 |
| 500 | 1,45 | - |
| 600 | 1,46 | 13,0 |
| 800 | 1,48 | 14,0 |
| 1000 | 1,49 | 15,0 |
| 1200 | 1,49 | - |

## CREEP CHARACTERISTICS

| Temperature, °C | Creep resistance, $10^{-6}$/K |
|---|---|
| 600 | 40 |
| 800 | 15 |
| 1000 | 6 |
| 1200 | 1 |

## PROCESSING PROPERTIES

| | |
|---|---|
| Melting point | 1500°C |
| Density | 7,1 g/cm$^3$ |
| Heat conductivity | 45,2 W/m·K |
| Elastic modulus | 210 KN/mm$^2$ |
| Maximal work temperature | 1400°C |
| Operating time | 3500 hours |

## Chemical composition, %

| Cr | Fe | Al | C |
|---|---|---|---|
| 22.5-25 | rest | 5.0-5.8 | ≤0.08 |

| Mn | Si | Ni | S | Ti |
|---|---|---|---|---|
| ≤0.70 | ≤0.70 | 0.30 | ≤0.015 | 0.2-0.5 |

## Mechanical properties at 20°C

| Diameter, mm | Elongation,% not less | Tensile strength, MPa |
|---|---|---|
| 0,12 – 0,5 | 10 | |
| 0,5 – 1,00 | 10 | 637-784 |
| 1,0 – 12,0 | 12 | |

## DELIVERY CONDITION

Fechroma®23 is delivered in shapes of wire and strip Cold-rolled wire from alloy of grade Fechroma®23H produce in soft heat-treated (HT) conditions with diameters 0,1-10 mm according standard DIN17470.

Diameter tolerance of wire is ±0,1 mm, and wire ovality is within half of diameter tolerance limit.

Strip*

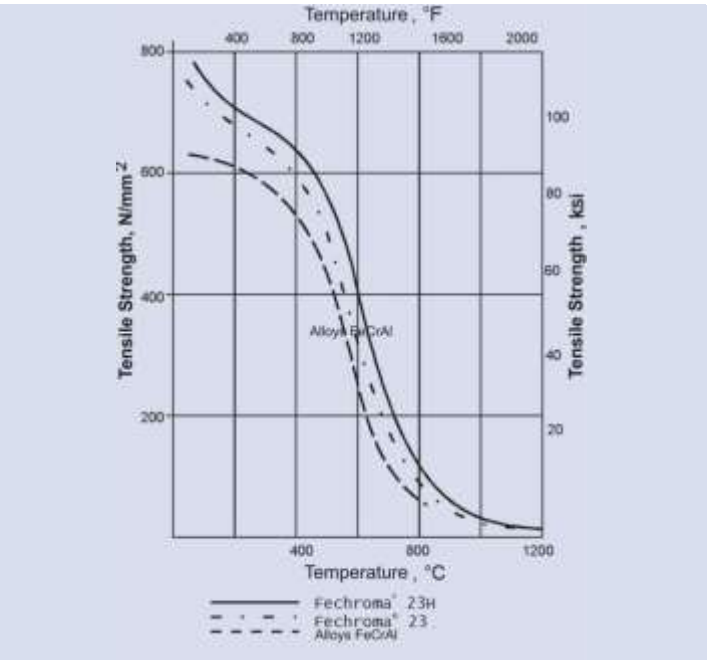
Delivery condition:

Cold-rolled oxidized with bright annealing or oxidized.

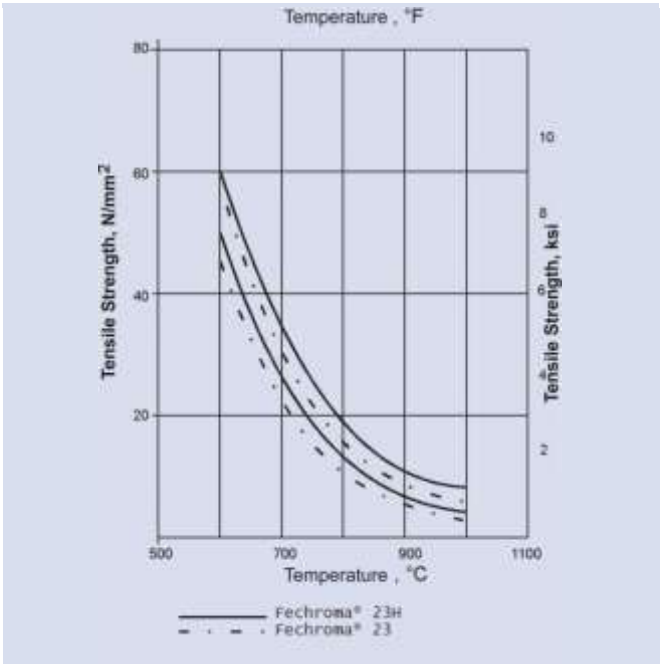
| Short-term mechanical properties of strip Fechroma®23H with thickness up to 2 mm after soft annealing | | | | | |
|---|---|---|---|---|---|
| Temperature (T) | | Yield strength, $\sigma_{0,2}$ | Yield strength, $\sigma_{0,1}$ | Tensile strength, $\sigma_в$ | Elongation, $\delta_{50}$ |
| °C | °F | N/mm$^2$ | N/mm$^2$ | N/mm$^2$ | % |
| 20 | 68 | 480-580 | 520-630 | 670-790 | 20-26 |

| Thickness, mm | Width, mm | Coils with inner Ø, mm | | | | |
|---|---|---|---|---|---|---|
| 0,04 ≤ 0,10 | 30-120 | 100 | 300 | | | |
| >0,10 ≤ 0,20 | 4-200 | | 300 | 400 | | |
| >0,20 ≤ 0,25 | 4-400 | | 300 | 400 | | |
| >0,25 ≤ 0,60 | 5-635 | | 300 | 400 | | |
| >0,60 ≤ 1,0 | 8-635 | | | 400 | 500 | |
| >1,0 ≤ 2,0 | 15-635 | | | 400 | 500 | 600 |

*specified lengths of strip are in range from 500 to 3000 mm




**Pic.1** – Comparison of typical tensile strengths depending on temperature.




**Pic.2** – Comparison of typical indicators of creep-rupture strength ($10^3$ and $10^4$ hour)

**Metallurgical structure**
Alloy Fechroma®23H has body-centered cubic lattice

**Corrosion resistance**
Alloy Fechroma®23H – is heat resisting alloy on iron basis with addition about 5% on the mass of aluminum

Resistance to oxidation allows to apply products from Fechroma®23H at temperatures up to 1300°C. Even under extreme conditions, such as cyclic heating and cooling, quality of Fechroma®23H remains due to an oxide layer of aluminum.