

# R868.11

EN: 1.4887\*

Type 330Cb\*

\*) Cr and Nb not according to norm

R868.11 (330 Cb) is similar to R860.13 (Type 330) with Columbium added as a stabilizing agent to prevent precipitation of carbides and with improved mechanical properties. A higher Silicon content also improves its resistance to oxidation and carburization. This grade is recommended for products extended exposure in the 650-930°C (1200-1700°F) range where the maximum temperature does not exceed 1120°C (2050°F). It has good resistance to carburizing and carbonitriding at temperatures up to 980°C (1800°F). Like R860.13 can suffer from excessive grain growth. Typical applications are wire for heat-treating baskets, furnace fans and shafts, conveyors and for gas turbine parts.

## CHEMICAL COMPOSITION (Nominal) %

| C      | Si   | Mn   | Cr   | Ni   | Mo    | N     | Nb   |  |
|--------|------|------|------|------|-------|-------|------|--|
| <0.030 | 1.85 | 0.50 | 19.5 | 34.5 | <0.30 | 0.060 | 0.85 |  |

PRE: 21 (PRE = Cr + 3.1 x Mo + 25 x N)

Comments:

## PHYSICAL PROPERTIES

Condition: Annealed

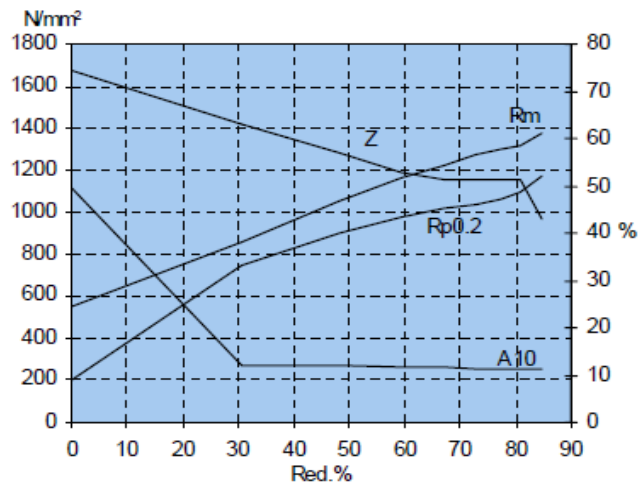
|                          |                         |
|--------------------------|-------------------------|
| Density                  | 8.0 g / cm <sup>3</sup> |
| Modulus of elasticity, E | 196 GPa                 |
| Specific heat 0-100°C    | 460 J / kg°C            |

## TYPICAL MECHANICAL PROPERTIES

Condition: Annealed

|                  |       |                             |
|------------------|-------|-----------------------------|
| Proof strength   | Rp0.2 | min 180 N / mm <sup>2</sup> |
| Tensile strength | Rm    | 500-620 N / mm <sup>2</sup> |
| Elongation       | A10   | min 40 %                    |

## DEFORMATION GRAPH



## THERMAL TREATMENT

|                       | °C        | °F        |
|-----------------------|-----------|-----------|
| Annealing temperature | 1050-1100 | 1920-2010 |

## MAX. OPERATING TEMPERATURE

|                                   | °C          | °F          |
|-----------------------------------|-------------|-------------|
| Oxidizing atm. intermitt. / cont. | 1070 / 1150 | 1958 / 2102 |
| Oxidizing sulphurous atm.         | 930         | 1700        |
| Reducing sulphurous atm.          | 930         | 1700        |
| Carburizing/carbonitriding atm.   | 980         | 1800        |
| Diss. ammonia and hydrogen at.    | 1095        | 2000        |

## THERMAL CONDUCTIVITY

|         |             |
|---------|-------------|
| 20 °C   | 12.4 W / mK |
| 400 °C  | 19.0 W / mK |
| 650 °C  | 23.4 W / mK |
| 750 °C  | 23.8 W / mK |
| 870 °C  | 24.6 W / mK |
| 1000 °C | 26.2 W / mK |

## THERMAL EXPANSION

Thermal expansion per °C x 10-6 from 20°C to:

|         |      |
|---------|------|
| 200 °C  | 15.5 |
| 400 °C  | 16.0 |
| 600 °C  | 17.0 |
| 800 °C  | 17.7 |
| 1000 °C | 18.0 |

## RESISTIVITY

|         |           |
|---------|-----------|
| 20 °C   | 1200 μΩmm |
| 400 °C  | 1110 μΩmm |
| 650 °C  | 1130 μΩmm |
| 750 °C  | 1200 μΩmm |
| 870 °C  | 1240 μΩmm |
| 1000 °C | 1270 μΩmm |