

# **Centralloy<sup>®</sup> G 4852 Micro**

## **MATERIAL DATA SHEET**

Designation: **GX45NiCrSiNbTi35-25**

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## Features

Centralloy® G 4852 Micro is a cast austenitic steel with 35% nickel, 25% chromium plus niobium, titanium and others. The alloy possesses excellent structural stability, very good high temperature stress rupture strength and good carburisation/oxidation resistance.

The presence of carbon leads to the formation of a series of carbides:

- a) Intergranularly occurring primary carbides, nitrides or carbonitrides of the general form M(C,N) where M is usually niobium and titanium. These greatly affect the generation of good high temperature properties. The phase is visible in unetched micro specimens, its color varying from the orange/yellow of the nitride to the grey/mauve of the carbide.
- b) Chromium-rich intergranular carbides of the  $M_7C_3$  and  $M_{23}C_6$  types. These carbides have a profound influence on properties due to decomposition and re-precipitation reactions in service producing secondary carbides in a rather uniform dispersion. By this mechanism dislocation movement is impeded with the result of significant strengthening at elevated temperatures.

## Product Forms

Centralloy® G 4852 Micro was designed as centrifugal tube material to meet specific design criteria in terms of carburisation and oxidation resistance, creep rupture strength and weldability. It is available as centrifugal tubes, statically cast and investment cast product forms.

Other forms may be supplied upon request. Further information regarding these topics, and maximum and minimum sizes, may be obtained from the sales department.

## Chemical Composition(\*)

|                     | mass percentage |
|---------------------|-----------------|
| Carbon . . . . .    | 0.45            |
| Silicon . . . . .   | 1.50            |
| Manganese . . . . . | 1.00            |
| Chromium . . . . .  | 25.00           |
| Nickel . . . . .    | 35.00           |
| Niobium . . . . .   | 1.50            |
| Titanium . . . . .  | Additions       |
| Iron . . . . .      | Balance         |

(\*) This is a typical composition which may be slightly modified according to the application.

## Applications

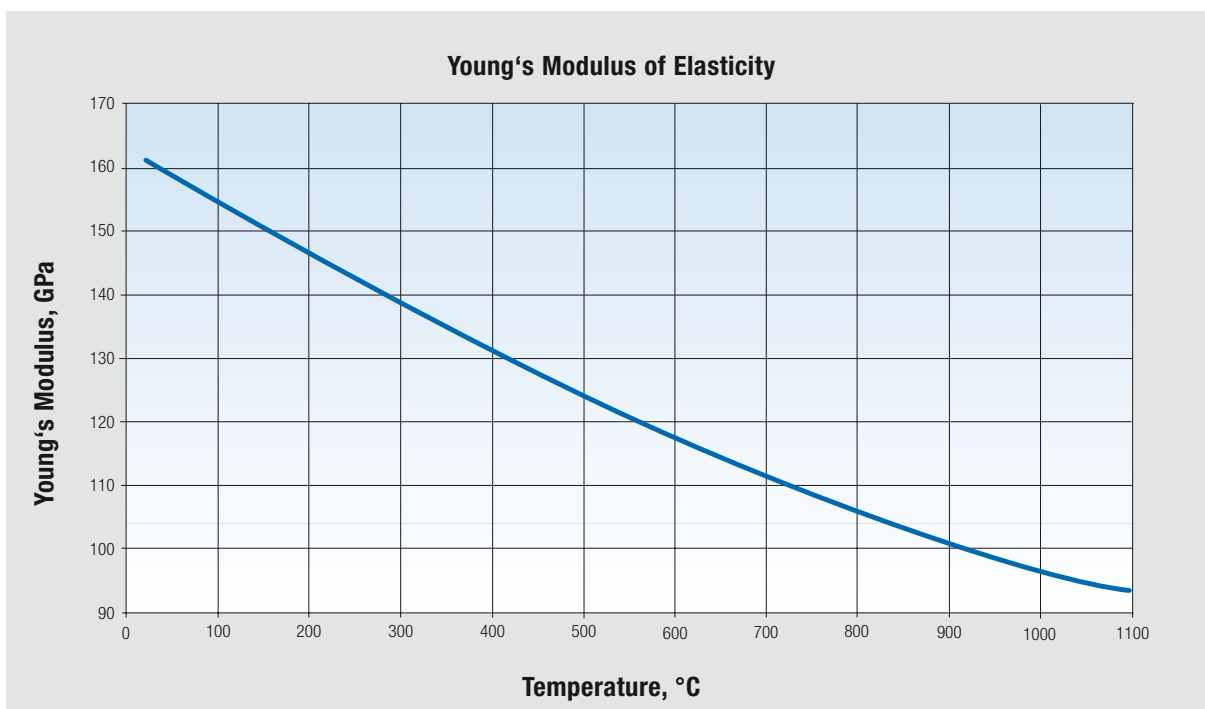
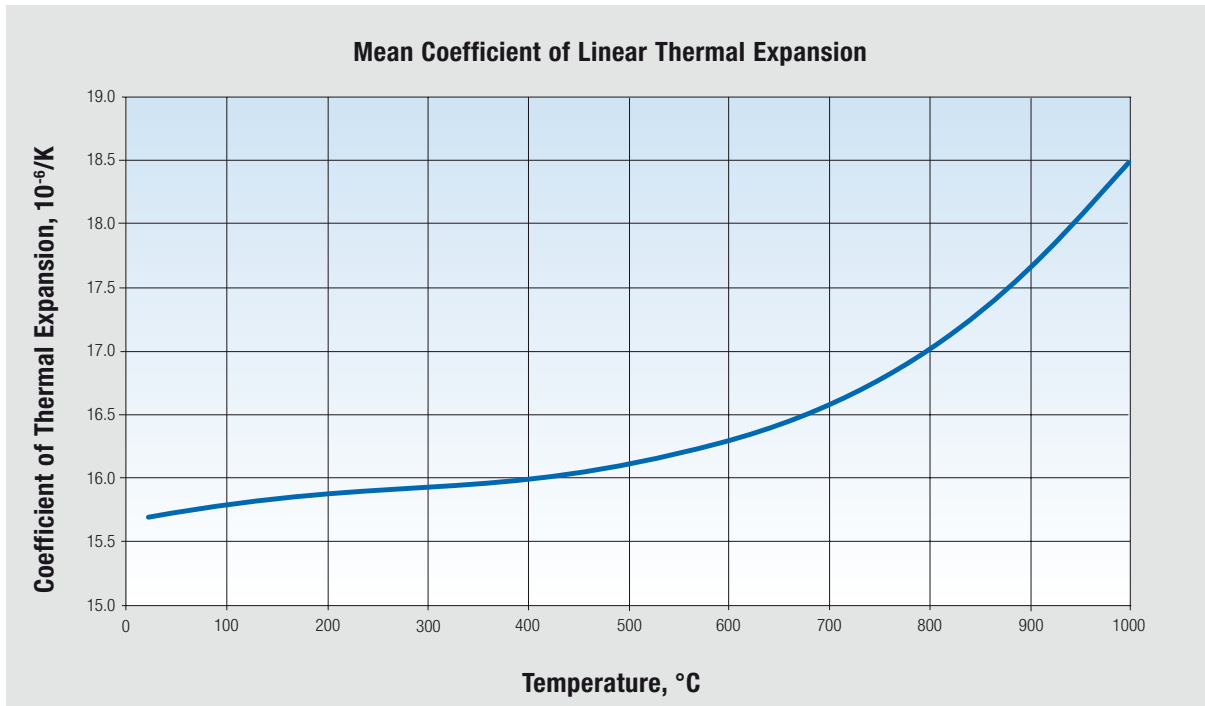
Tubular systems requiring very high creep rupture strength combined with good oxidation and carburisation resistance. No heat treatment is required for most applications of this alloy. Main high temperature applications for the material are:

| Process:                               | max. operating temperature, °C |
|--|--------------------------------|
| Steam cracking . . . . .               | 1130                           |
| Steam reforming . . . . .              | 1130                           |
| Direct reduction of iron ore . . . . . | 1130                           |

# Physical Properties

Density: 8.0 g/cm<sup>3</sup>

Thermal Conductivity (20°C): 14.6 W/mK



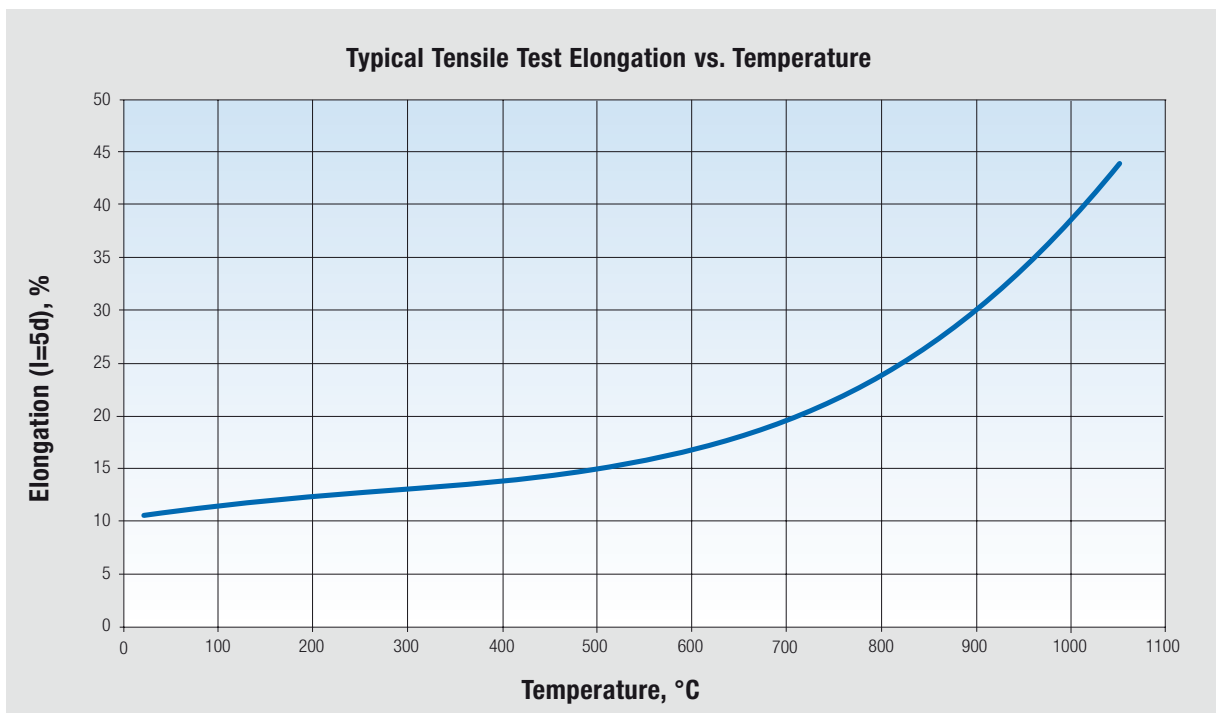
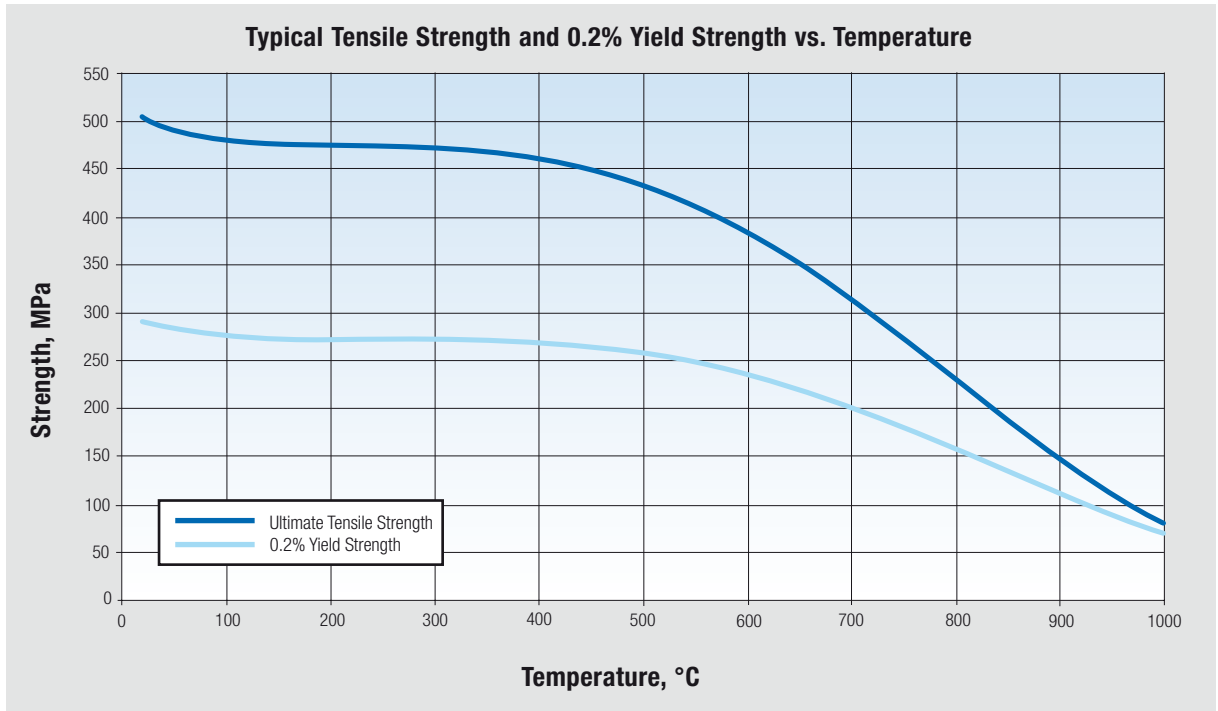
## Mechanical Properties

(only for wall thickness less than 25 mm in the as cast condition)

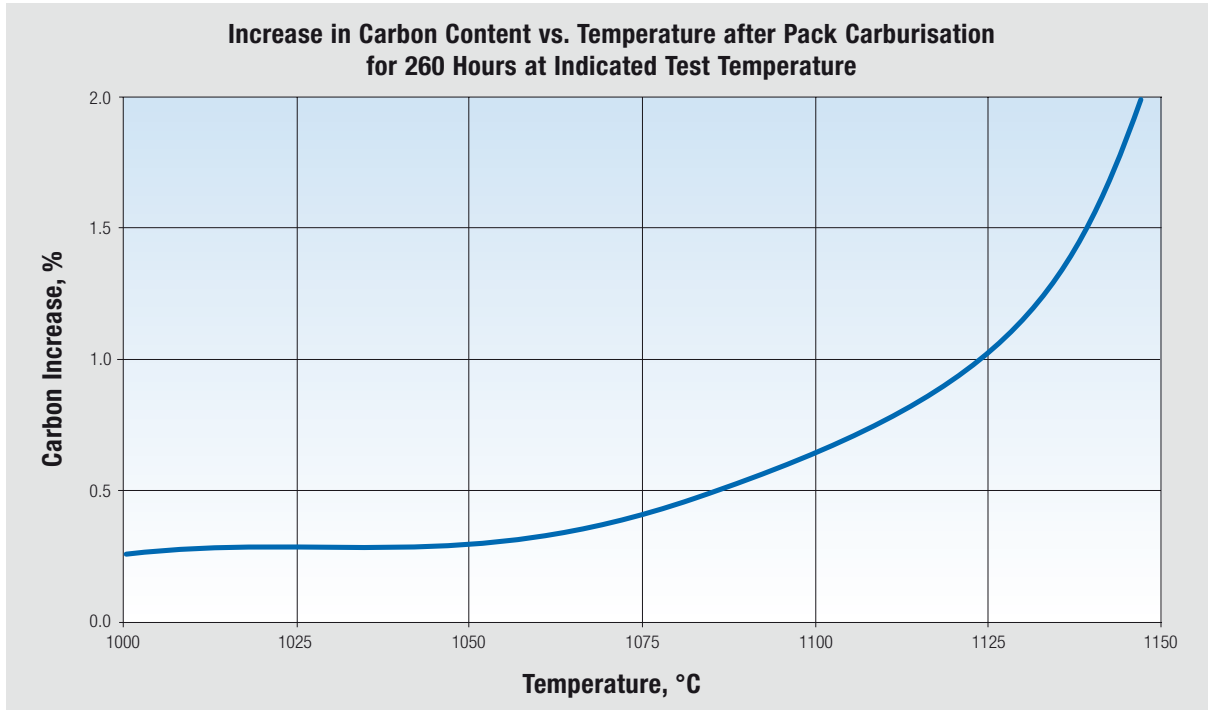
### Tensile properties

Minimum tensile properties at 20°C:

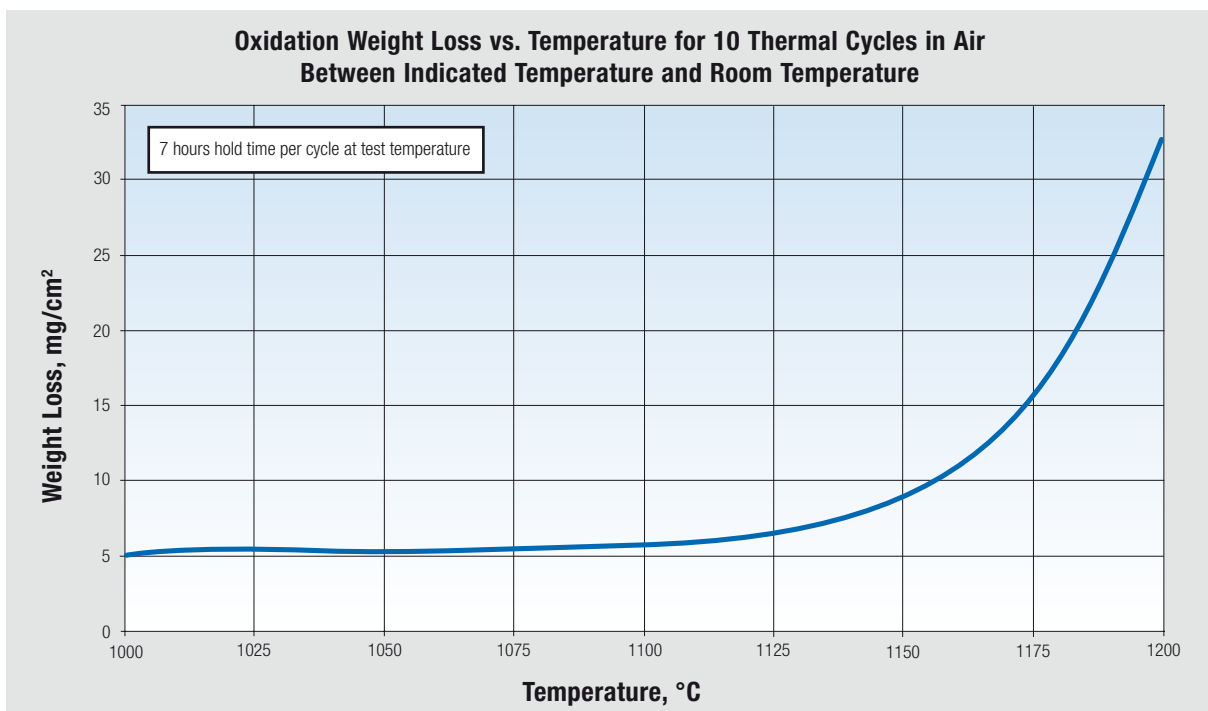
|                            |   |
|----------------------------|---|
| 0.2% Yield strength:       | 230 MPa   |
| Ultimate tensile strength: | 470 MPa   |
| Elongation (l = 5d):       | 8% for centricast tubes<br>6% for static castings |



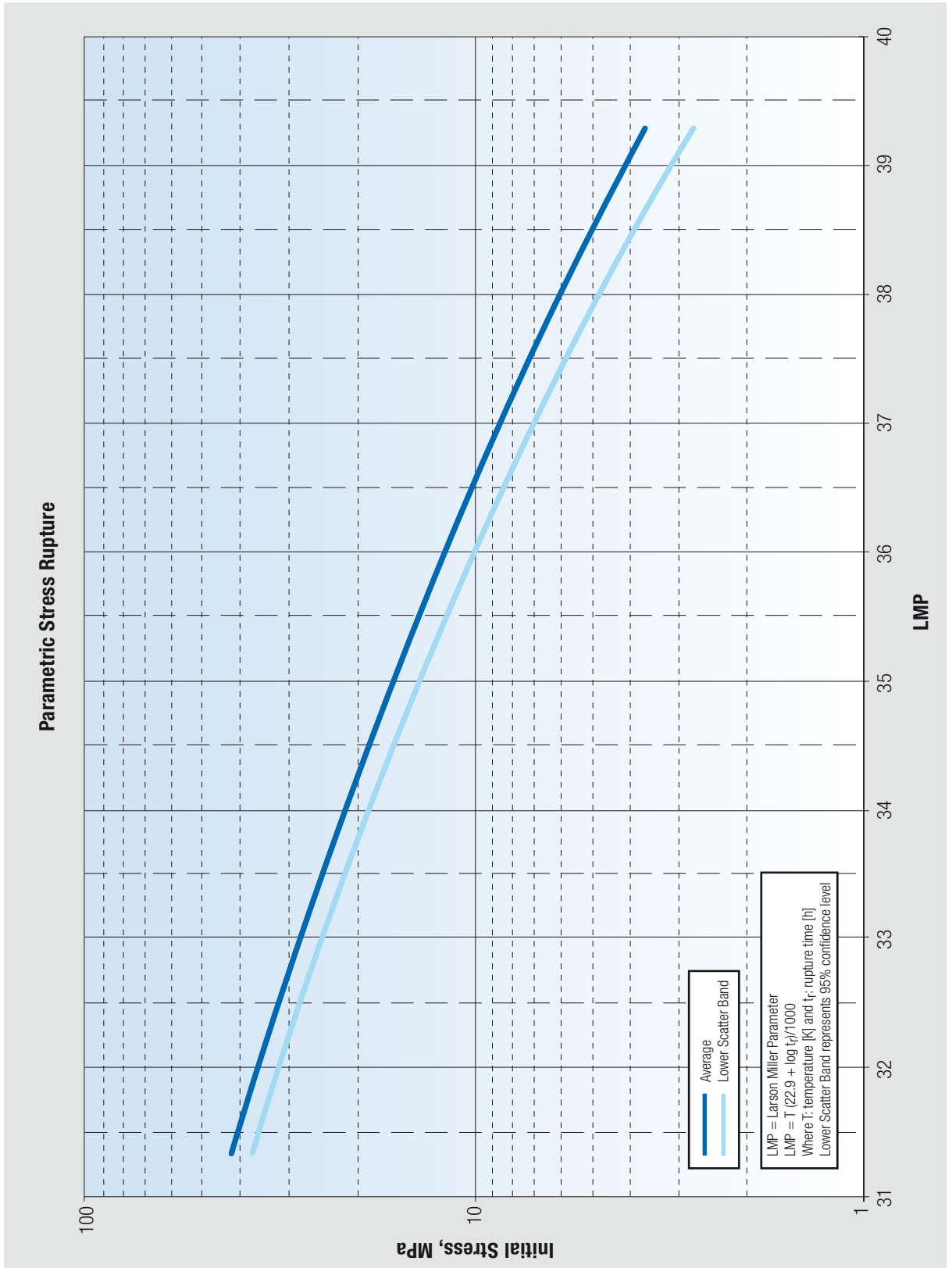
## Carburisation Resistance



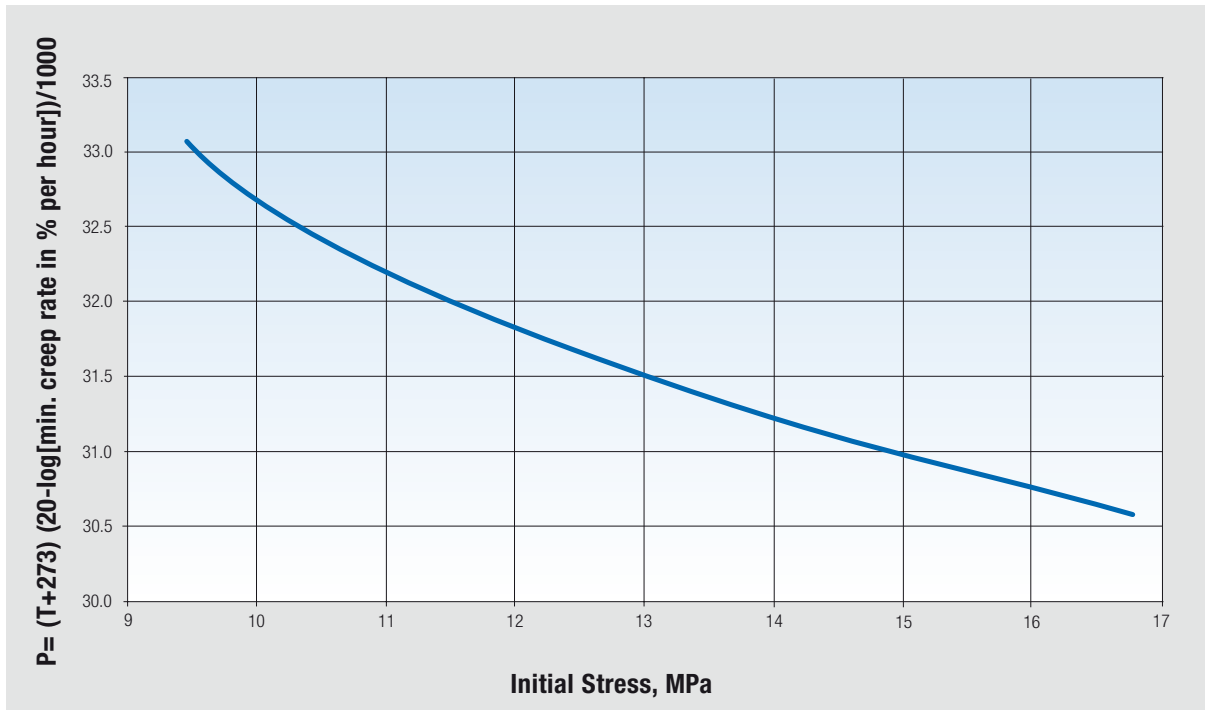
## Oxidation Resistance



## Parametric Stress Rupture Strength



## Parametric Minimum Creep Rate



## Manufacturing Characteristics

### Machining

In general terms the machinability of Centralloy® G 4852 Micro is similar to that of other heat resistant alloys.

### Welding

For critical, highly stressed and corrosion resistant joints coated electrodes, flux cored wire and bare filler material are commercially available. These welding consumables have high strength properties at elevated temperatures with good retained ductilities. Besides fillerless PAW, TIG and MAW have been used satisfactorily for component fabrication or repair welding. Pre-heating and postweld heat treatment of the joint is not necessary. For dissimilar weld joints to austenitic materials the same filler materials are recommended. Further information will be supplied upon request.

## Health, Safety and Environmental Information

The operation and maintenance of welding equipment should conform to the provisions of relevant national standards for the protection of personnel and environment.

Mechanical ventilation is advisable and, under certain conditions in confined spaces, is necessary during welding operations in order to prevent possible exposure to hazardous fumes, gases or dust that may occur.

Nickel- and iron-base materials may contain, in varying concentrations, elemental constitutions of chromium, iron, manganese, molybdenum, cobalt, nickel, tungsten and aluminium. Metal dust from welding, grinding, melting and dross handling of these alloy systems may cause adverse environmental and in case of inhalation health effects.

The information in this publication is as complete and accurate as possible at the time of publication. Variations in properties can occur to production and process routes. However, no warranty or any legal liability for its accuracy, completeness and results to be obtained for any particular use of the information herein contained is given. Where possible the test conditions are fully described. Where reference, is made to the balance of the alloy's composition it is not guaranteed that this balance is composed exclusively of the element mentioned, but that it predominates and others are present only in minimal quantities. The creep rupture data are frequently insufficient to be directly translatable to specific design or performance applications without examination and verification of their applicability and suitability by professionally qualified personnel. The primary units for property data are based on those of the SI-system.



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### Industries

- Petrochemicals
- Iron-ore direct reduction

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### Services

- Metallurgy and material engineering
- Material analysis and examinations
- Metallurgical defect analysis
- Process and material consulting
- Design of tubes and tube systems

### Industries

- On- and Offshore

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### Industries

- Power technology
- Industrial furnace construction
- Separation technology
- Pump manufacturing
- Machine and plant construction

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- Material welding services
- Mechanical machining
- Heat treatment
- Convection zones
- Site services and logistics

### Production sites

Germany, Spain, United Kingdom, Czech Republic, Malaysia, Saudi Arabia