Centralloy® G 4852
MATERIAL DATA SHEET

Designation: GX40NiCrSiNb35-25
Centralloy® G 4852 is a cast austenitic steel with 35% nickel, 25% chromium plus niobium. The alloy possesses excellent structural stability, good high temperature stress rupture strength, oxidation and carburisation 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. 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 M₇C₃ and M₂₃C₆ 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 was designed as centrispun tube material to meet specific design criteria in terms of carburisation and oxidation resistance, creep rupture strength and weldability. It is available as centrispun 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 (*)

<table>
<thead>
<tr>
<th>Element</th>
<th>Mass Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>0.40</td>
</tr>
<tr>
<td>Silicon</td>
<td>1.50</td>
</tr>
<tr>
<td>Manganese</td>
<td>1.50</td>
</tr>
<tr>
<td>Chromium</td>
<td>25.00</td>
</tr>
<tr>
<td>Nickel</td>
<td>35.00</td>
</tr>
<tr>
<td>Niobium</td>
<td>1.50</td>
</tr>
<tr>
<td>Iron</td>
<td>Balance</td>
</tr>
</tbody>
</table>

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

Applications

Tubular systems requiring 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:

<table>
<thead>
<tr>
<th>Process</th>
<th>Max. Operating Temperature, °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam cracking</td>
<td>1100</td>
</tr>
<tr>
<td>Steam reforming</td>
<td>1100</td>
</tr>
<tr>
<td>Direct reduction of iron ore</td>
<td>1100</td>
</tr>
</tbody>
</table>
Physical Properties

**Density:** 8.0 g/cm³

**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: 450 MPa
- Elongation (l = 5d):
  - 8% for centrifugal tubes
  - 6% for static castings

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**Typical Tensile Strength and 0.2% Yield Strength vs. Temperature**

**Typical Tensile Test Elongation vs. Temperature**
Carburisation Resistance

Increase in Carbon Content vs. Temperature after Pack Carburisation for 260 Hours at Indicated Test Temperature

Oxidation Resistance

Oxidation Weight Loss vs. Temperature for 10 Thermal Cycles in Air Between Indicated Temperature and Room Temperature

7 hours hold time per cycle at test temperature
Parametric Stress Rupture Strength

**LMP = Larson Miller Parameter**

\[ \text{LMP} = \frac{T (18.6 + \log t_r)}{1000} \]

Where:
- \( T \) is the temperature [K]
- \( t_r \) is the rupture time [h]

Lower Scatter Band represents 95% confidence level.
Manufacturing Characteristics

Machining
In general terms the machinability of Centralloy® G 4852 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. Preheating 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 can be supplied upon request.

Health and Safety Information

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

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. Inhalation of metal dust from welding, grinding, melting and dross handling of these alloy systems may cause adverse health effects.
Sprung Casting – Petrochemical Industry

Germany
Schmidt + Clemens GmbH + Co. KG
Edelstahlwerk Kaiserau
Kaiserau 2, 51789 Lindlar
Phone: +49 2266 920
Fax: +49 2266 92370
E-Mail: info@schmidt-clemens.com

Spain
Schmidt - Clemens Spain S.A.U.
Ctra. Estella-Vitoria, Km. 12
31280 Murieta, Navarra
Phone: +34 946 53 46 00
Fax: +34 946 53 46 01
E-Mail: centracero@schmidt-clemens.com

Brazil
Schmidt + Clemens Brasil Ltda.
Avenida Beta, 351
13213-070, Jundiaí, São Paulo
Phone: +55 11 3378 3901
Fax: +55 11 4582 9888
E-Mail: scbrasil@schmidt-clemens.com.br

Malaysia
Schmidt + Clemens (Asia) Sdn. Bhd.
No. 15, Jalan Pemaju U1/15, Section U1
Hicom Glenmarie Industrial Park
40150 Shah Alam, Selangor Darul Ehsan
Phone: +60 3 5569 1945
Fax: +60 3 5569 1425
E-Mail: sc-asia@schmidt-clemens.com

Czech Republic
S+C Alfanametal s.r.o koncern
783 57 Tršice c. 126
Phone: +420 58 59 57 428
Fax: +420 58 59 57 430
E-Mail: alfa@alfanametal.cz

USA
Schmidt & Clemens Inc.
24 Greenway Plaza Suite 1840
Houston, Texas 77046
Phone: +1 713 629 7770
Fax: +1 713 629 7373
E-Mail: sales-us@schmidt-clemens.com

India
Schmidt + Clemens GmbH + Co. KG
India Liaison Office
A 214 Mahindra Gardens, S.V. Road
Goregaon (W), Mumbai 400 062
Phone: +91 22 8748 445
Fax: +91 22 8791 226
E-Mail: scindia@vsnl.net

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