Sandvik Zr 702 is a zirconium grade characterized by immunity to stress corrosion cracking and high resistance to pitting and crevice corrosion. The grade has very good corrosion resistance in most organic acids, excellent corrosion resistance in mineral acids, good corrosion resistance in strong alkalis and moderate mechanical strength.

Sandvik Zr 702 main characteristics:

- High heat transfer efficiency
- Very low thermal expansion
- Immunity to stress corrosion cracking (SCC).
- High resistance to localized (pitting and crevice) forms of corrosion
- Very good corrosion resistance in most organic acids
- Exceptional corrosion resistance in mineral acids
- Good corrosion resistance in strong alkalis

Sandvik Zr 702 is used in environments where even the best stainless steels are not sufficiently corrosion resistant. Zirconium is in many cases the ideal choice from both technical and economical point of view (the price/life time relation).

STANDARDS

- UNS: R 60702

Product standards
ASTM B523 or equivalent

Approvals
ASME SB- 523
Vd TÜV Werkstoffblatt 480 (plate specification)

Other specifications on request.

CHEMICAL COMPOSITION (NOMINAL) %

<table>
<thead>
<tr>
<th>Chemical composition (nominal) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zr+Hf</td>
</tr>
<tr>
<td>≥99.2</td>
</tr>
</tbody>
</table>

FORMS OF SUPPLY

Product sizes and type
Tube and pipe are supplied in the cold reduced and annealed or partially annealed condition. Tubing can be delivered in the following surface conditions: mill finish, acid etched, or belt polished. Seamless zirconium tubing can be delivered in the following principle size range:

OD 8-40 mm

WT 0.7-3.5 mm

L up to 14.70 m

(Other dimensions can be quoted for special projects.)

Due to manufacturing limitations OD/WT ratios over 25 can only be quoted under certain circumstances.

MECHANICAL PROPERTIES

Tensile properties at 20°C for Sandvik Zr 702, as specified by ASTM B 523, are shown below.

<table>
<thead>
<tr>
<th>Yield strength*</th>
<th>Tensile strength</th>
<th>Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{p0.2}$</td>
<td>$R_m$</td>
<td></td>
</tr>
<tr>
<td>MPa</td>
<td>ksi</td>
<td>MPa</td>
</tr>
<tr>
<td>$\geq 205$</td>
<td>$\geq 30$</td>
<td>$\geq 380$</td>
</tr>
</tbody>
</table>

*R$_{p0.2}$ corresponds to 0.2% offset yield strength.

A comparison of the yield strength of Sandvik Zr 702 with other corrosion resistant tubing alloys is shown in figure 1.

![Figure 1 Yield strength vs. tubing material.](image-url)

At high temperatures

The strength of Sandvik Zr 702 at high temperatures is shown in figure 2.
PHYSICAL PROPERTIES
Density: 6.5g/cm³
Melting point: 1852°C
Thermal conductivity: 22 W/(m °C)
Elastic bending modulus: 99.3 GPa
Thermal expansion: 5.4x10⁻⁶/°C

The coefficient of thermal expansion for zirconium 702, in comparison to other corrosion resistant tubing alloys, is shown in figure 3.

CORROSION RESISTANCE
Zirconium is immune to SCC (Stress Corrosion Cracking) and has very good corrosion resistance in, for example, the following environments.

- Dry chlorine gas
- Bromine and iodine gas
- Hydrochloric acid, all concentrations up to boiling temperature
- Nitric acid, all concentrations up to boiling temperature
- Sulphuric acid up to 70% concentration at boiling temperature
- Phosphoric acid up to 60% concentration at boiling temperature
- Most organic acids (e.g. acetic, formic), all concentrations up to boiling temperature
- Salt melts
- Metal melts

Detailed corrosion data on zirconium 702 in various environments taken from the open literature will be provided on request.

**WELDING**
The weldability of Sandvik Zr 702 tubing is very good as long as the necessary precautions are taken. Due to the reactive nature of zirconium, inert gas shielding must be in place on both the OD and ID surface of the tubes. The material must also be free from any grease or oil contamination. Manual or automatic TIG welding is regularly used to weld zirconium tubing either with or without filler wire.

**FABRICATION**

**Bending**
Zirconium tubing can be bent at room temperature using standard bend tooling and techniques. When bending thin walled tubing or if a tight bend radius is needed, a mandrel should be used for adequate support of the ID. The mandrel should be well lubricated in order to prevent galling of the ID surface. Due to moderate strength and low elastic modulus of this alloy, springback is greater than that of stainless steel and must be taken into account.

**Machining and cutting**
Machining and cutting zirconium tubing is routine when the following procedures are used:
- Use low cutting speeds and high feed rates
- Use large volumes of coolant
- Use sharp tools and replace as soon as worn
- Never stop feeding while tool is in contact with workpiece

**APPLICATIONS**
Zirconium 702 tubing is resistant in most organic acids and mineral acids. Typical applications for seamless zirconium tubing are as heat exchangers, coolers, condensers and piping systems in the production of urea, acetic acid, formic acid, nitric acid and methyl methacrylate.

*Disclaimer: Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for Sandvik materials.*