NILO® alloy 36

A nickel-iron low-expansion alloy containing 36% nickel. It maintains nearly constant dimensions over the range of normal atmospheric temperatures, and has a low coefficient of expansion from cryogenic temperatures to about 500°F (260°C). The alloy also retains good strength and toughness at cryogenic temperatures. Used for standards of length, measuring devices, laser components, bi-metal thermostat strip, thermostat rods, and tanks and piping for storing and transporting liquefied gases.

### Physical Constants and Thermal Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, g/cm³</td>
<td>8.11</td>
</tr>
<tr>
<td>Melting Temperature (Approximate), °C</td>
<td>2610</td>
</tr>
<tr>
<td>Inflection Point, °C</td>
<td>430</td>
</tr>
<tr>
<td>Thermal Conductivity, Btu • in² • h • °F</td>
<td>59.3</td>
</tr>
<tr>
<td>Coefficient of Expansion, 68 – 392°F, 10⁻⁶ in/in • °F, 20 – 100°C, μm/m • °C</td>
<td>0.83</td>
</tr>
<tr>
<td>Coefficient of Expansion, 68 – 392°F, 10⁻⁶ in/in • °F, 20 – 200°C, μm/m • °C</td>
<td>1.4</td>
</tr>
<tr>
<td>Electrical Resistivity, ohm · circ mil/ft, μΩ · m</td>
<td>480</td>
</tr>
</tbody>
</table>

### Typical Mechanical Properties

**Annealed**

- Tensile Strength, ksi: 71
- Yield Strength (0.2% Offset), ksi: 35
- Elongation, %: 42

**Precipitation Hardened**

- Tensile Strength, ksi: 184
- Yield Strength (0.2% Offset), ksi: 146
- Elongation in 2” (50 mm), %: 16
- Reduction of Area, %: 36

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NILO® alloy 365

This alloy was developed to meet the demand by the aerospace industry for improved manufacture of durable, close-tolerance tooling for composite components. It is an age-hardenable, low-expansion alloy, strengthened by heat treatment to reach property levels well above those of conventional nickel-iron alloys. It is the first high-strength, low-expansion alloy produced specifically for tooling applications.

### Standard Product Forms

- Pipe, tube, sheet, plate, round bar, forging stock and wire.

### Major Specifications

- UNS K93600
- ASTM F 30
- DIN 385, 1715

### Limiting Chemical Composition, %

- Ni: 35.0 – 38.0
- Fe: Remainder
- C: 0.10 max.
- Mn: 0.60 max.
- Co: 0.50 max.
- Pb: 0.025 max.
- S: 0.012 max.
- P: 0.025 max.
- Cu: 0.60 max.
- Mn: 1.0 max.
- Cr: 0.50 max.
- Si: 0.35 max.
- S: 0.025 max.
- P: 0.025 max.
- Co: 0.10 max.
- Al: 0.50 max.
- Ti: 1.15 – 1.8
- Nb: 3.0 – 4.25

### Physical Constants and Thermal Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, g/cm³</td>
<td>8.11</td>
</tr>
<tr>
<td>Melting Temperature (Approximate), °C</td>
<td>2430 – 2570</td>
</tr>
<tr>
<td>Specific Heat, Btu/lb • °F</td>
<td>0.12</td>
</tr>
<tr>
<td>Curie Temperature, °F</td>
<td>515</td>
</tr>
<tr>
<td>Thermal Conductivity, Btu • in² • h • °F</td>
<td>86</td>
</tr>
<tr>
<td>Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in • °F, 21 – 93°C, μm/m • °C</td>
<td>2.35 (4.23)</td>
</tr>
<tr>
<td>Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in • °F, 21 – 121°C, μm/m • °C</td>
<td>2.39 (4.30)</td>
</tr>
<tr>
<td>Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in • °F, 21 – 149°C, μm/m • °C</td>
<td>2.40 (4.32)</td>
</tr>
<tr>
<td>Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in • °F, 21 – 204°C, μm/m • °C</td>
<td>2.51 (4.52)</td>
</tr>
<tr>
<td>Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in • °F, 21 – 316°C, μm/m • °C</td>
<td>2.69 (4.84)</td>
</tr>
<tr>
<td>Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in • °F, 21 – 316°C, μm/m • °C</td>
<td>2.70 (4.94)</td>
</tr>
</tbody>
</table>

### Typical Mechanical Properties

**Annealed**

- Tensile Strength, ksi: 71
- Yield Strength (0.2% Offset), ksi: 35
- Elongation, %: 42

**Precipitation Hardened**

- Tensile Strength, ksi: 184
- Yield Strength (0.2% Offset), ksi: 146
- Elongation in 2” (50 mm), %: 16
- Reduction of Area, %: 36

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