# Alloy X750

| | | EN | UNS | AISI | LMSA |
|---|---|---|---|---|---|
| **Designation** | **NiCr15.5Fe7Ti2.5MnCo** | 2.4669 | N07750 | - | B630 |

## Chemical composition (Weight %)

| Ni | C | Cr | Ti | Fe | Cu | Si | Mn | Co | Nb + Ta | S | Al |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ≥ 70.0 | < 0.08 | 14.0-17.0 | 2.25-2.75 | 5.0-9.0 | ≤ 0.5 | ≤ 0.5 | ≤ 1.0 | ≤ 1.00 | 0.70-1.20 | ≤ 0.010 | 0.40-1.00 |

In order to achieve maximum homogeneity and consistent quality, the actual tolerances on both alloy components and impurities are significantly tighter and more precisely defined than the standard composition indicated.

## Main technical properties and features

**Common Trade Names:** Inconel X750®, Haynes X750®, Pyromet® X750, Nickelvac® X750, Nicorros® 7016, Altemp® X-750

Lamineries MATTHEY SA produces Alloy X750 in precision cold-rolled product forms (strip and sheet). Alloy X750 (UNS N07750) is a precipitation hardenable nickel-chromium superalloy, which is used in applications requiring high strength to approximately 700°C (1300°F) and oxidation resistance to approximately 980°C (1800°F). Following heat treatment, Alloy X750 possesses high stress-rupture strength and a low creep rate at temperatures up to approximately 815°C (1500°F). This alloy is used in the aerospace industry for items such as gas turbine rotor blades, gas turbine wheels, bolts, thrust reversers, hot-air ducting systems and other gas turbine structural parts. Non-aerospace applications include heat treat fixtures, forming tools, extrusion dies, pressure membranes, etc.

Alloy X750 is typically supplied in the annealed condition. Annealing from cold worked condition is done at 980-1100°C (1800°F to 2000°F) in a continuous furnace. A variety of heat treatments are available for this alloy depending upon the end result properties that are to be optimized. All involve a solution anneal at high temperatures and then a single or double precipitation-treating time at lower temperatures. For strip and sheet the typical precipitation hardening treatment is given in the specification AMS-5598: 730°C (1350°F) for 8 hours, furnace cool to 620°C (1150°F) and hold at 620°C (1150°F) for 10 hours and air cool. This treatment promotes high strength for applications at temperatures up to about 700°C (1300°F).

This alloy has good ductility and may be readily formed by all conventional methods. Because the alloy is stronger than regular steel it requires more powerful equipment to accomplish forming. Heavy-duty lubricants should be used during cold forming. It is essential to thoroughly clean the parts of all traces of lubricant after forming as embrittlement of the alloy may occur at high temperatures if lubricant is left on. The alloy also has excellent properties and ductility at cryogenic temperatures.

## Typical manufacturing range

| | | Thickness (mm) | Width (mm) | Length (mm) |
|---|---|---|---|---|
| **Rolled products** | Strip in coils [1)] | 0.010 - 2.000 | 1.5 - 200.0 | - |
| | Strip as sheets [1)] | 0.015 - 1.500 | 10.0 - 200.0 | 100 - 3000 |

1) Not all our production possibilities are presented here. Other dimensions or other product forms available upon request. Certain combinations of thicknesses and widths are not possible.

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## Mechanical properties of strips

| Temper | Tensile strength, Rm ($N/mm^2$) | Yield strength, $Rp_{02}$ ($N/mm^2$) | Elongation, A (%) | Hardness HV |
|---|---|---|---|---|
| Annealed | 650-895 | 300-500 | > 20 | 180-290 |
| ½ hard | 1000-1300 | > 700 | > 5 | 310-420 |
| Hard | > 1300 | > 900 | - | > 410 |

After suitable heat treatment, see AMS-5598, high stress-rupture strength and low creep rates under high stresses at temperature up to 815°C can be achieved. Values of tensile strength higher than 1100 $N/mm^2$ (typical value 1250 $N/mm^2$) and elongation higher than 12% can be obtained by age hardening of annealed delivered material.

## Physical properties

| | | |
|---|---|---|
| Modulus of elasticity | $kN/mm^2$ | 214 (201 at 200°C, 189 at 400°C, 184 at 600°C ) |
| Poisson ratio | | 0.32 |
| Density | $kg/dm^3$ | 8.28 |
| Melting point / Melting range | °C | 1400-1440 |
| Linear dilatation coefficient (20-90°C) | $10^{-6}$/ °C | 12.6 (15.8 from 20 to 700°C) |
| Thermal conductivity at 20°C | W/m °K | 12.5 (16.9 at 400°C, 21.3 at 700°C) |
| Electrical resistivity | μΩcm | 121 |
| Electrical conductivity | MS/m | 0.83 |
| Electrical conductivity | %IACS | 1.41 |
| Specific heat J/kg K | J/kg K | 432 |
| Magnetic properties | | Non magnetic (slightly diamagnetic) |
| Permeability | | μ = 1.003 |

## Typical uses

Thanks to its corrosion and oxidation resistance, its high stress-rupture strength and its low creep rates under high stresses at temperature up to 815°C, the Alloy X750 is used in the aerospace industry as gas turbine rotor blades, gas turbine wheels, bolts, thrust reversers, hot-air ducting systems and in non-aerospace applications for items like treat fixtures, forming tools, extrusion dies, pressure membranes, etc.

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## Tolerances

### Thickness

The table shown is an outline of our typical thickness tolerances available. They are tighter than industry standards.

Our "Precision" and "Extreme" tolerances are available upon request.

| Thickness (mm) | | Lamineries MATTHEY SA | | |
|---|---|---|---|---|
| ≥ | < | LMSA Standard | LMSA Precision | LMSA Extreme |
| | 0.025 | - | - | ± 0.001 |
| 0.025 | 0.050 | ± 0.003 | ± 0.002 | ± 0.0015 |
| 0.050 | 0.065 | ± 0.004 | ± 0.003 | ± 0.002 |
| 0.065 | 0.100 | ± 0.006 | ± 0.004 | ± 0.003 |
| 0.100 | 0.125 | ± 0.008 | ± 0.006 | ± 0.003 |
| 0.125 | 0.150 | ± 0.008 | ± 0.006 | ± 0.004 |
| 0.150 | 0.250 | ± 0.010 | ± 0.008 | ± 0.004 |
| 0.250 | 0.300 | ± 0.012 | ± 0.008 | ± 0.005 |
| 0.300 | 0.400 | ± 0.012 | ± 0.009 | ± 0.005 |
| 0.400 | 0.500 | ± 0.015 | ± 0.010 | ± 0.006 |
| 0.500 | 0.600 | ± 0.020 | ± 0.012 | ± 0.007 |
| 0.600 | 0.800 | ± 0.020 | ± 0.014 | ± 0.007 |
| 0.800 | 1.000 | ± 0.025 | ± 0.015 | ± 0.009 |
| 1.000 | 1.200 | ± 0.025 | ± 0.018 | ± 0.0012 |
| 1.200 | 1.250 | ± 0.030 | ± 0.020 | ± 0.0012 |
| 1.250 | 1.500 | ± 0.035 | ± 0.025 | ± 0.0014 |

### Width

Our width tolerance is + 0.2 -0.0 mm (or ± 0.1 mm upon request). They are available for slit widths < 125 mm and thicknesses < 1.00 mm. Special tolerances upon request.

### Camber

Our tolerance "standard" respects the EN Standard 1654 (Length of measurement 1000 mm). Other tolerances upon request.

| Width (mm) | | Camber max. (mm/m) | | | |
|---|---|---|---|---|---|
| | | LMSA standard | | LMSA extreme | |
| > | ≤ | ≤ 0.5 mm | > 0.5 mm | ≤ 0.5 mm | > 0.5 mm |
| 3 | 6 | 12 | - | 6 | - |
| 6 | 10 | 8 | 10 | 4 | 5 |
| 10 | 20 | 4 | 6 | 2 | 3 |
| 20 | 250 | 2 | 3 | 1 | 1.5 |

### Surface

Special surface qualities upon request

### Flatness

Special requirement on the longitudinal or transversal flatness upon request

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