# HASTELLOY X

## Strong and Oxidation Resistance

HASTELLOY® X alloy (UNS N06002 (W86002) is a nickel-chromium-iron-molybdenum alloy that possesses an exceptional combination of oxidation resistance, fabricability and high-temperature strength. It has also been found to be exceptionally resistant to stress-corrosion cracking in petrochemical applications. X alloy exhibits good ductility after prolonged exposure at temperatures of 1200, 1400, 1600°F (650, 760 and 870°C) for 16,000 hours.

## Ease of Fabrication

HASTELLOY® X alloy has excellent forming and welding characteristics. It may be forged or otherwise hot-worked, providing it is held at 2150°F (1177°C) for a time sufficient to bring the entire piece to temperature. As a consequence of its good ductility, HASTELLOY® X alloy is also readily formed by cold- working. All hot- or cold- worked parts should be annealed and rapidly cooled in order to restore the best balance of properties.

The alloy can be welded by a variety of techniques, including gas tungsten arc (GTAW), gas metal arc (GMAW), shielded metal arc (SMAW), and resistance welding.

Additional information regarding fabrication can be found here.

## Heat Treatment

Wrought forms of HASTELLOY® X alloy are furnished in the solution heat-treated condition unless otherwise specified. X alloy is typically solution heat-treated at 2150°F (1177°C) and rapid cooled. Bright annealed products are cooled in hydrogen. Annealing at temperatures lower than the solution heat- treating may cause precipitation of secondary phases, which may affect the alloy's strength and ductility.

## Useful for Aircraft, Furnace and Chemical Process Components

X alloy has wide use in gas turbine engines for combustion zone components such as transition ducts, combustor cans, spray bars and flame holders as well as in afterburners, tailpipes and cabin heaters. It is recommended for use in industrial furnace applications because it has unusual resistant to oxidizing, reducing and neutral atmospheres. Furnace rolls of this alloy were still in good condition after operating for 8,700 hours at 2150°F (1177°C). HASTELLOY® X alloy is also used in the chemical process industry for retorts, muffles, catalyst support grids, furnace baffles, tubing for pyrolysis operations and flash drier components.

**Chemical properties(weight%)**

| Ni | Mo | Cr | Fe | W | Co | Mn |
|---|---|---|---|---|---|---|
| Balance | 8-10 | 20.5-23 | 17-20 | 1-2 | 0.5-2.5 | 1 Max. |
| C | P | S | Si | Al | B | Cu |
| 0.05-0.15 | 0.04 Max. | 0.03 Max. | 1 Max. | 0.5 Max. | 0.01 Max. | 0.5Max |

**Physical properties**

| Thermal Conductivity | Specific heat | Melting point | Density |
|---|---|---|---|
| 9.2 w/m-°c | 486 J/Kg-°c | 1260°c-1355°c | 8.22 g/cm³ |

**Mechanical properties for plate**

| Yield Strength | Ultimate Strength | Elongation | Hardness |
|---|---|---|---|
| 340 Mpa | 760 Mpa | 49% | 87 HBR |