HAYNES® HR-160® alloy

Principal Features

Resistance to High-Temperature Corrosion

HAYNES® HR-160® alloy (UNS N12160) alloy is a solid-solution-strengthened nickel-cobalt-chromium-silicon alloy with outstanding resistance to various forms of high-temperature corrosion attack. HR-160® alloy has excellent resistance to sulfidation and chloride attack in both reducing and oxidizing atmospheres. The alloy also has exceptionally good resistance to oxidation, hot corrosion, carburization, metal dusting, nitridation, and corrosion attack by low melting point compounds such as those formed by phosphorus, vanadium, and other impurities. The alloy is especially suited for applications in high temperature corrosive environments generated by combustion of low grade fuels or processing of chemical feed stocks with corrosive contaminants such as sulfur, chlorine, fluorine, vanadium, phosphorus, and others. The alloy is capable of withstanding temperatures up to 2200°F (1204°C).

Ease of Fabrication

HAYNES® HR-160® alloy has excellent forming and welding characteristics. It may be forged or otherwise hot-worked, providing it is held at 2050°F (1121°C) for time sufficient to bring the entire piece to temperature. As a consequence of its good ductility, HR-160® alloy is also readily formed by cold working. Cold- or hot-worked parts should be annealed and rapidly cooled in order to restore the best balance of properties. HR-160® alloy can be welded by a variety of techniques, including gas tungsten arc (TIG), gas metal arc (MIG), and resistance welding.

Heat Treatment

HR-160® alloy is furnished in the solution annealed condition, unless otherwise specified. The alloy is solution annealed at 2050°F (1121°C) and rapidly cooled for optimum properties. Intermediate annealing, if required during fabrication and forming operations, can be performed at temperatures as low as 1950°F (1066°C).HR-160® alloy is furnished in the solution-annealed condition, unless otherwise specified. The alloy is solution annealed at 2050°F (1121°C) and rapidly cooled for optimum properties. Intermediate annealing, if required during fabrication and forming operations, can be performed at temperatures as low as 1950°F (1066°C).

ASME Vessel Code

HR-160® is covered in ASME Section VIII Division 1 for construction up to 1500°F (815°C). Code Case 2385 covers HR-160® for construction up to 1800°F (982°C). The thickness of the plate at welded joints is limited to 0.50 inches.

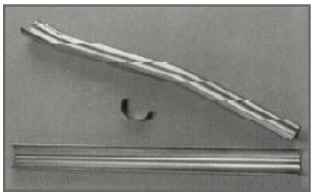
Applications

HAYNES® HR-160® alloy combines properties which make it highly useful for service in severe high-temperature corrosive environments. Applications include a variety of fabricated components in municipal, industrial, hazardous, and nuclear waste incinerators. It is widely used in recuperators, heat exchangers and waste heat recovery systems. HR-160® alloy is also suitable for utility boilers, sulfur plants, high-temperature furnaces, kilns, calciners, resource recovery units, cement kilns, pulp and paper recovery boilers, coal gasification systems, and fluidized-bed combustion systems.

Cross-section of HR-160® flue-gas stack Rosemount Annubar™ averaging pitot tube for waste incineration and chemical process industries.

Lining (inner cylinder) of exhaust ducting in pulp and paper recovery boiler made from HR-160® alloy. Outer shell is carbon steel.

Many waste incineration and chemical process facilities have used HR-160® thermocouple protection tubes with outstanding success. Life extensions greater than 10X compared to Ni-Cr alloys and stainless steels are common.



HR-160® tube shields are considered the premier superheater tube shield material for municipal and industrial waste incineration systems. The use of HR-160® alloy has resulted in greatly improved life in municipal waste incinerators where high-temperature corrosion and fly ash erosion are major considerations.