

# HAYNES<sup>®</sup> 188 alloy

## Principal Features

### **Excellent High-Temperature Strength and Environment Resistance**

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HAYNES<sup>®</sup> 188 alloy (UNS R30188) is a cobalt-nickel-chromium-tungsten alloy that combines excellent high-temperature strength with very good resistance to oxidizing environments up to 2000°F (1095°C) for prolonged exposures, and excellent resistance to sulfate deposit hot corrosion. It is readily fabricated and formed by conventional techniques, and has been used for cast component. Other attractive features include excellent resistance to molten chloride salts, and good resistance to gaseous sulfidation.

### **Readily Fabricated**

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HAYNES<sup>®</sup> 188 alloy has good forming and welding characteristics. It may be forged or other hot-worked, providing that it is held at 2150°F (1175°C) for a time sufficient to bring the entire piece to temperature. As a consequence of its good ductility, 188 alloy is also readily formed by cold working. The alloy does work-harden rapidly, however, so frequent intermediate annealing treatments may be needed for complex component forming operations. 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 both manual and automatic welding methods, including gas tungsten arc (TIG), gas metal arc (MIG), electron beam and resistance welding. It exhibits good restraint welding characteristics.

### **Heat Treatment**

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Wrought HAYNES<sup>®</sup> 188 alloy is furnished in the solution heat treated condition, unless otherwise specified. The alloy is normally solution heat-treated at 2125-2175°F (1163-1191°C) and rapidly cooled or water quenched for optimal properties.

Annealing at temperatures less than the solution heat-treating temperature will produce some carbide precipitation in alloy 188, which may affect the alloy's properties.

### **Applications**

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HAYNES<sup>®</sup> 188 alloy combines properties which make it suitable for a variety of fabricated component applications in the aerospace industry. It is widely used in established military and commercial gas turbine engines for combustion cans, transition ducts, and afterburner components. It shares applications in newer engine programs with a more recently developed material, 230<sup>®</sup> alloy, which possesses improved properties.

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