

## HASTELLOY<sup>®</sup> C-4 alloy

### Welding and Fabrication

HASTELLOY<sup>®</sup> C-4<sup>®</sup> alloy is very amenable to the Gas Metal Arc (GMA/MIG), Gas Tungsten Arc (GTA/TIG), and Shielded Metal Arc (SMA/Stick) welding processes. For matching filler metals (i.e. solid wires and coated electrodes) that are available for these processes, and welding guidelines, please [click here](#).

Wrought products of HASTELLOY<sup>®</sup> C-4<sup>®</sup> alloy are supplied in the Mill Annealed (MA) condition, unless otherwise specified. This solution annealing procedure has been designed to optimize the alloy's corrosion resistance and ductility. Following all hot forming operations, the material should be re-annealed, to restore optimum properties. The alloy should also be re-annealed after any cold forming operations that result in an outer fiber elongation of 7% or more. The annealing temperature for HASTELLOY<sup>®</sup> C-4<sup>®</sup> alloy is 1066°C (1950°F), and water quenching is advised (rapid air cooling is feasible with structures thinner than 10 mm (0.375 in)). A hold time at the annealing temperature of 10 to 30 minutes is recommended, depending on the thickness of the structure (thicker structures need the full 30 minutes). For more details concerning the heat treatment of HASTELLOY<sup>®</sup> C-4<sup>®</sup> alloy, please [click here](#).

HASTELLOY<sup>®</sup> C-4<sup>®</sup> alloy can be hot forged, hot rolled, hot upset, hot extruded, and hot formed. However, it is more sensitive to strain and strain rates than the austenitic stainless steels, and the hot working temperature range is quite narrow. For example, the recommended start temperature for hot forging is 1177°C (2150°F) and the recommended finish temperature is 954°C (1750°F). Moderate reductions and frequent re-heating provide the best results, as described [here](#). This reference also provides guidelines for cold forming, spinning, drop hammering, punching, and shearing. The alloy is stiffer than most austenitic stainless steels, and more energy is required during cold forming. Also, HASTELLOY<sup>®</sup> C-4<sup>®</sup> alloy work hardens more readily than most austenitic stainless steels, and may require several stages of cold work, with intermediate anneals.

While cold work does not usually affect the resistance of HASTELLOY<sup>®</sup> C-4<sup>®</sup> alloy to general corrosion, and to chloride-induced pitting and crevice attack, it can affect resistance to stress corrosion cracking. For optimum corrosion performance, therefore, the re-annealing of cold worked parts (following an outer fiber elongation of 7% or more) is important.