



AUTOMOTIVE INDUSTRY

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APPLICATIONS OF NICKEL ALLOY

High performance nickel alloys are used widely in automotive applications from manifolds and exhaust pipes to high temperature fasteners. The drive for more fuel-efficient engines and the associated increases in operating temperatures is pushing designers to look beyond traditional steel grades. Nickel alloys which can offer high temperature strength, resistance to thermal fatigue, hot salt corrosion and stress corrosion cracking resistance as well as resistance to the hot combustion gases are the solution. Here we look at just some of the automotive alloys and their application.

Flexible couplings and bellows must resist high temperatures, fatigue, corrosion by road salts and offer a long life – a combination of factors that is beyond stainless steels. **Alloy 625 LCF/625HP** is the premier material for use in flexible couplings in the automotive industry. Thanks to the high nickel content the alloy has excellent resistance to hot salt stress corrosion cracking and the chromium and molybdenum additions provide a high level of pitting and crevice corrosion resistance. Combined with excellent fatigue resistance – critical to the endurance of flexible coupling bellows and its deep drawing capability this alloy is an ideal candidate for automotive exhaust systems.

Alloys 800 and 601 find application in exhaust systems where their resistance to oxide spalling is essential to maintain a protective surface for a long operating life. This is of importance in the manifold where some of the highest temperatures are experienced and stainless grades can experience

rapid and severe oxidation resulting in failure of the base metal. In addition to corrosive attack from hot combustion gases the exhaust system is also exposed to road salt resulting in hot salt corrosion failures in inadequately alloyed materials. In addition to excellent oxidation resistance **Alloys 601 and 800** have good resistance to intergranular oxidation and chloride stress corrosion cracking.

The shaft connecting the turbine and compressor in a turbo charger is exposed to hot exhaust gases at 750-860 °C so a material that retains its mechanical properties at elevated temperatures and can resist corrosion by the exhaust gases is required. **Alloys 80A, 90 and 625** are often used in this application due to their excellent high temperature mechanical properties.

High temperature fasteners are required as part of the exhaust system and **Alloy 80A** is used in critical applications where high stress rupture strength is required. The alloy also finds application as exhaust valves in high performance diesel and petrol engines where material is exposed to high temperatures and high pressures thus alloys with excellent elevated temperature properties and good hot corrosion resistance are required. For enhanced hot corrosion resistance **Alloy 81** can be considered. It is comparable in mechanical properties and formability to Alloy 80A but has enhanced high temperature corrosion resistance due to the high chromium content. For more information please contact us via info@bibusmetals.com

ALLOY PROPERTIES

	Composition (%)	Key attributes	Application
Alloy 625 LCF / HP N06626	61Ni – 21.5Cr – 2.5Fe – 9.0 Mo – 3.6Nb	Excellent resistance to oxidation and corrosion in a range of environments. Highly formable and readily welded.	Flexible couplings and bellows
Alloy 800 N08800 1.4876	32.5Ni – 21Cr – 46Fe	Resistant to high temperature oxidation, carburisation and nitridation	Exhaust manifolds and piping
Alloy 601 N06601 2.4851	60.5Ni – 23Cr – 14Fe – 1.4Al	Good mechanical properties and outstanding oxidation resistance	Bellows expansion joints, exhaust manifolds and piping, catalytic converters, fuel sensors
Alloy 80A N07080 2.4952	76Ni – 19.5Cr – 1.4Al – 2.4Ti	Highly alloyed, age hardenable alloy with excellent high temperature strength	High temperature fasteners, turbo charger shafts and exhaust valves
Alloy 81	66Ni – 30Cr – 2Ti – 1.1Al	Mechanical properties comparable to Alloy 80A but with enhanced hot corrosion resistance due to the high chromium content	High temperature fasteners and exhaust valves

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