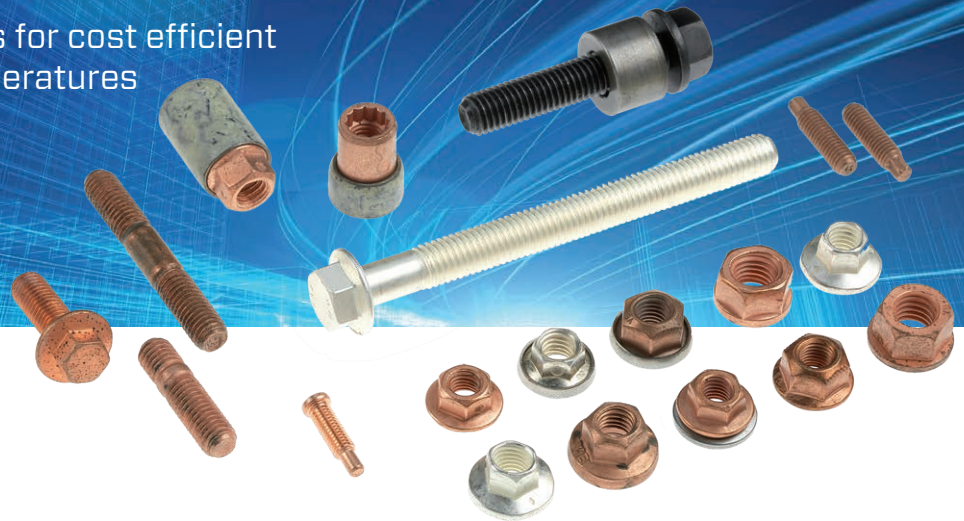


Heat Resistant Fasteners

Innovative solutions for cost efficient joining at high temperatures



With each new generation of engines, operating temperatures in the engine compartment become higher. The increased heat does not cause any problems for the fasteners in most engine and drivetrain components. Temperatures generally stay well below the 300°C limit that can be sustained by standard ISO 898 fasteners. For exhaust systems, however, temperatures between the engine block and first muffler can reach 600°C. Another “hot” component - the common three-way catalyst found on petrol engines - is also located here. Turbochargers may even become as hot as 800°C.

Nedschroef can offer a full range of heat resistant fasteners according to international standards as well as innovative solutions for cost efficient joining at high temperatures.

FIELD OF APPLICATION

Typical applications with our bolts, nuts and studs are the connection of the exhaust manifold to the cylinder head, the turbo charger, the exhaust gas recirculation (EGR) and the exhaust system.

Although standard steel fasteners obviously don't melt yet at such temperatures, they do lose strength dramatically. In particular, prolonged heat exposure may cause problems, as standard fastener materials have relatively poor creep characteristics. Also, these materials oxidise rapidly and critically. The oxidation often makes it difficult or even impossible to disassemble components, which is a problem for the after-sales market and repair shops. Fasteners might also lose preload as a result of a mismatch between the thermal expansion of components and fasteners. In fact, if this last problem occurs, it is likely to be the first to appear, as only one thermal cycle is needed to cause differential expansion.

For more information: www.nedschroef.com

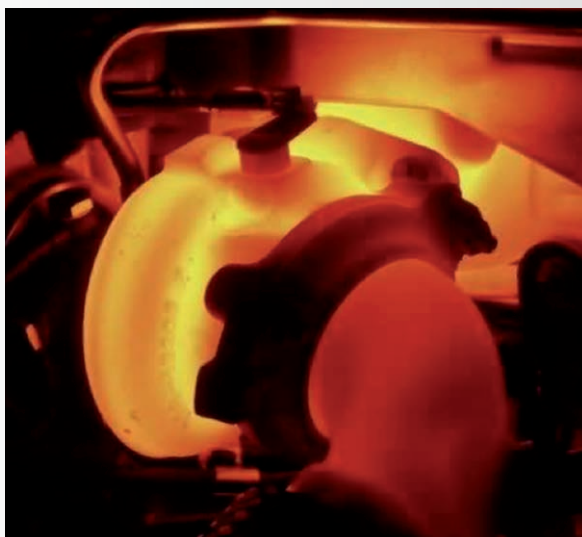
HEAT RESISTANT FASTENERS

Material	Composition	CLTE [10^{-6} K ⁻¹] RT-500°C	UTS [MPa] RT	Maximum Temperature [°C]
1.7709	21CrMoV5-7	13.9	700-850	550
1.4923	X22CrMoV12-1	12.3	900-1050	600
1.4980	X6NiCrTiMoVB25-15-2	18.2	900-1050	650
2.4668	NiCr19Fe19Nb5Mo3 (Inconel 718)	14.4	min. 1230	800
2.4952	NiCrTiAl (Nimonic 80a)	14.7	1000-1300	800

CLTE: Coefficient of Linear Thermal Expansion

UTS: Ultimate Tensile Strength

RT: Room Temperature



To heat resistant fasteners, standard EN 10269 applies. This specifies all relevant properties of these materials as well as many others. Some remarks per material:

ADVANTAGES

- 1.7709 is a ferritic/perlitic heat-resistant steel. It is heat-treatable by quenching and tempering
- 1.4923 is a martensitic stainless steel; hence its low thermal expansion. It is heat treatable by quenching and tempering in different ways, with different degrees of hardness and strength as result
- 1.4980 is an austenitic stainless steel. After cold heading, a fastener made of this material can be heat-treated by precipitation hardening in two different ways. One method produces very high strength but low ductility, the other high strength and high ductility
- Nimonic 80A (2.4952) and Inconel 718 (2.4668) are nickel-based super-alloys. They can be hardened by precipitation hardening.

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For more than 130 years, Koninklijke Nedschroef Holding B.V. has developed, manufactured and supplied fasteners and special parts for the automotive industry. In addition, we design and produce superior forming machines and tools for the metal forming industry. Nedschroef delivers world-class services and innovative, cost-effective solutions. Our expanding global operations offer everything from product design and development to delivery, installation and service, supported by a vast global partner network. 2,400 people at 22 facilities in 11 countries worldwide are committed to our Full Service Provision concept.