



Langley Alloys

Copper
Alloys

Hiduron® 191

Specifications:

DEF STAN 02-835, NES 835, NACE MR0175 / ISO15156

Hiduron® 191 is a medium-strength precipitation hardened cupronickel alloy supplied in the hot worked condition. It contains about 14.5% Nickel and 4.5% Manganese strengthened by additions of Aluminium and Iron, which may be refined by controlled small amounts of Chromium.

In many critical marine applications, for example on oil platforms and naval ships, the requirement for instant service following periods of inactivity favours the anti-fouling and corrosion resistance characteristics of a cupronickel; but conventional cupronickels have the disadvantage of inherently low strength. A combination of reasonable strength with good corrosion resistance and impingement resistance is achieved with Nickel Aluminium Bronze but the higher strength levels are only achieved at the expense of toughness with consequent limited resistance to shock.

Hiduron® 191 was developed to provide both the corrosion resistance and anti-fouling characteristics of conventional cupronickels but with superior tensile and toughness properties compared to aluminium bronzes. Its resistance to marine corrosion is comparable with that of conventional cupronickels, the combination of tensile strength and toughness is far superior to that available with aluminium bronzes and its properties are largely independent of section size. In addition, Hiduron® 191 has the relatively high modulus of elasticity of a cupronickel compared with most other bronzes.

Hiduron® 191 has the inherent good resistance to bio-fouling of a cupronickel whilst the additional elements in its composition not only improve mechanical properties but also increase resistance to localised corrosion and to impingement attack in seawater. It is virtually non-magnetic and possesses excellent sub-zero properties. Hiduron® 191 has good machineability, good weldability and can also be forged, hot upset and thread rolled without difficulty. It meets the requirements of NACE MR0175.

Key Features:

- Excellent corrosion resistance in marine environments - superior to Nickel Aluminium Bronzes and 22% Chrome duplex stainless steels
- Superior strength, jet impingement resistance and general corrosion resistance compared to conventional copper nickels
- Greater strength and toughness than Nickel Aluminium Bronzes - strength is comparable to 22% Chrome duplex stainless steels
- No loss of impact strength down to -196°C
- Excellent anti-galling properties, particularly when operating against stainless steels
- Good anti-fouling properties
- Freedom from hydrogen embrittlement
- Low magnetic permeability
- Approved as a named alloy by the world's most prestigious Navies
- Galvanic compatibility with other copper alloys and stainless steels

Typical Applications:

- Naval and Defence applications such as fasteners for ships and submarines, control elements of submarines, pump shafts, mechanical seals, winch components, gears, hose couplings, weapons handling equipment, components in sonar devices, propeller shafts, drive bushes
- Oil & Gas industry components including subsea bolting, shafts for pumps & valves, valve spindles, hydraulic pistons and cylinders
- Process industry applications such as impellers, pump shafts, valve components, process control equipment
- Subsea mining application as hydraulic connectors, pistons and cylinders, pressure couplings

Physical Properties:

Density (Kg/m ³)	8500
Magnetic Permeability (20°C)	<1.01
Young's Modulus (kN/mm ²)	145
Modulus of Rigidity (kN/mm ²)	52
Electrical Conductivity, 20°C (mΩ / mm ²)	2.85 / (17% of IACS)
Mean coefficient of thermal expansion, 20 - 300°C (m/m/°C)	16.0 x 10 ⁻⁶
Specific Heat, 20°C (J/kg.K)	435
Thermal conductivity, 20°C (W/m.K)	16.3

Product Forms Available:

Bar	✓
Plate	Enquiry
Tube	Enquiry
Fittings	Enquiry
Forgings	To order
Castings	To order

Mechanical Properties:

	Bars up to and including 5" (125mm) diameter or section		Bars greater than 5" (125mm) diameter or section	
0.2% Proof Stress	430 N/mm ²	62.4 ksi	400 N/mm ²	58 ksi
Tensile Strength	725 N/mm ²	105.1 ksi	710 N/mm ²	103 ksi
Elongation, 5.65√S0	18%		18%	
Hardness (Brinell)	163 min		170-280	
Impact Strength (Room Temp)	40J min		40J min	

Notes:

1. Testing shall be carried out in accordance with ASTM A370 or EN ISO 6892-1 (tensile), EN ISO 6506-1 (hardness)
2. Minimum properties quoted (tested at room temperature in a longitudinal direction)
3. Testing performed on each melt of material per heat treatment batch

Chemical composition:

	Cr	Ni	Mo	Co	Nb (+Ta)	Ti	V	W	Cu	C	Mn	N	Si	P	S	Fe	Al
Min		13.50									3.50					0.70	1.00
Max	0.50	16.50							Bal	0.05	5.50		0.15	0.01	0.15	1.20	2.00

Note:

1. Pb < 0.02%, Sn < 0.20%, Zn < 0.20%, Mg < 0.05%
2. Total impurities < 0.30%

Product Comparison:

Alloy Comparisons	Hiduron® 191	Nickel-Aluminium Bronze	Aluminium-Silicon Bronze	70/30 Copper-Nickel
0.2% Proof Strength (N/mm ²)	430	247	220	115
Impact Energy (J), minimum	40	23	33	54
Corrosion resistance in seawater (mm/year)	0.02	0.075	0.06	0.025
Anti-Galling properties	Good	Inferior	Inferior	Poor

Machining Advice:

Operation	Cutting Speed m/min (ft/min)	Feed Rate mm/rev (in/rev)	Depth of cut mm (in)
Milling	45 - 60 (150 - 200)	0.05 - 0.13 mm/tooth (0.02 - 0.005 in/tooth)	0.5 - 6.0 (0.02 - 0.25)
Drilling	25 - 75 (80 - 250)	0.075 - 0.50 (0.003 - 0.020)	
Turning - Roughing	120 - 180 (400 - 600)	0.40 - 0.75 (0.01 - 0.03)	3.0 (0.125)
Turning - Finishing	150 - 300 (500 - 1000)	0.15 - 0.40 (0.006 - 0.015)	0.5 (0.02)
Tooling	Carbide tipped using water-soluble lubricant		

Production Route:

Hiduron® 191 is produced through high-quality melting processes to ensure cleanliness and consistency.

- a) The minimum forging ratio utilised is at least 4:1
- b) Heat treatment is not mandatory, but may be applied in order to achieve the required mechanical properties
- c) Bars are supplied peeled and polished to a surface finish of 125CLA or better
- d) Each bar is ultrasonically tested and visually inspected
- e) This will be followed by air cooling
- f) Each bar is ultrasonically tested and visually inspected

Further Processing:

- Order processing and stock control is facilitated by a fully-integrated computer system which links to item production and inspection.
- Automated band saws are available for accurate stock cutting up to a section size of 650mm (25").
- First-stage processing, including water jet cutting, turning, boring and grinding can be undertaken to help manage your overall supply chain.
- Additional documentation and certification can be supplied as required.

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