

# DEF STAN 02-835

**COLUMBIA  
METALS**

Related specifications: C72420 / DGS357

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DEF STAN 02-835 is a hot forged, stress relieved high strength cupronickel developed primarily for marine and offshore applications. The alloy contains around 14.5% nickel, 4.5% manganese and smaller additions of aluminium and iron to increase the overall material strength and corrosion resistance. Specified as an MoD (Navy) grade, it combines the inherent corrosion resistance and anti-biofouling benefits of traditional cupronickels whilst offering higher strength and toughness levels than aluminium bronze. In addition to its high mechanical strength and general corrosion resistance, DEF STAN 02-835 also offers a good resistance to impingement, very good anti-galling properties, a freedom from hydrogen embrittlement and a high impact strength. These attributes have enabled this material to be utilised not only in marine and offshore environments but also for high strength critical components in the chemical processing, general engineering and automotive industries.



The heat-treated and stress relieved condition is the optimum condition for this alloy as it helps not only to improve the strength and toughness of the material but also to minimise the risk of stress corrosion cracking. Furthermore, this condition enables close machining tolerances to be held during final manufacture.

DEF STAN 02-835 is specified for its excellent marine corrosion resistance, outperforming the standard cupronickels 90/10 and 70/30 in fresh water, seawater, brackish water and also many polluted industrial waters. In addition, DEF STAN 02-835 exhibits a very good resistance to bio-fouling, waterline corrosion,

- **VERY HIGH MECHANICAL STRENGTH**
- **EXCELLENT CORROSION RESISTANCE**
- **HIGH GALLING RESISTANCE**
- **LOW MAGNETIC PERMEABILITY**
- **EXCELLENT CRYOGENIC PROPERTIES**
- **GOOD WELDABILITY**
- **RESISTANT TO HYDROGEN EMBRITTLEMENT**
- **HIGH DUCTILITY**
- **GOOD ANTI-FOULING RESISTANCE**
- **READILY MACHINATED/FABRICATED**

pitting and crevice corrosion. Like the aluminium bronzes, much of this corrosion performance can be attributed to the aluminium content, which allows the material to rapidly reform its protective oxide film under conditions of corrosion and erosion.

DEF STAN 02-835 is galvanically compatible with most other copper-based alloys. Despite being intrinsically less noble than duplex and austenitic stainless steels, the aluminium oxide film allows a certain protection against significant preferential corrosion; however, good design should be employed to minimise corrosion between dissimilar metals. Unlike most other high strength nickel-based alloys, titanium grades and stainless steels, DEF STAN 02-835 is not susceptible to

hydrogen embrittlement. This immunity gives the material a significant selection advantage in environments where dissimilar metals or cathodic protection are present or where hydrogen is continually evident.

DEF STAN 02-835 offers a very low magnetic permeability of <1.01 and is resistant to galling both operating against itself and against other materials such as duplex stainless steel and aluminium bronze. It can be fabricated reasonably well and has the capability to be hot formed, readily machined, brazed, soldered and welded. The MoD (navy) standard also calls for a high impact strength to be achieved and an ultrasonic inspection for Grade 1 material. When these are coupled with the material's high strength and toughness, the alloy becomes desirable for use in many safety critical components including critical fasteners, valve and pump trim, gears, sonar equipment, shafts, connectors, pipe couplings, flanges and subsea components.

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## Technical Data

### Nominal Composition (%)

Cu	Ni	Al	Fe	Mn	Cr	Imps
Rem	13.5-16.5	1.0-2.0	0.7-1.2	3.5-5.5	0.5 max	0.30 max

### Mechanical Properties (specification minima)

	≤15mm dia	15≤125mm dia	>125mm dia
Ultimate Tensile Strength (N/mm <sup>2</sup> )	725	725	710
0.2% Proof Strength (N/mm <sup>2</sup> )	430	430	400
Elongation (%)	18	18	18
Impact Strength	-	40J	40J

### Typical Physical Properties

Density (g/cm <sup>3</sup> )	8.53
Melting Range (°C)	1030 - 1085
Thermal conductivity (20°C; W/m <sup>2</sup> K)	25
Coeff. Thermal Exp. (0-400°C; m/m <sup>2</sup> K x 10 <sup>-6</sup> )	16.0
Electrical Resistivity (microhm/m)	0.35
Magnetic Permeability	<1.01

### Round Bar Weight and Stock Sizes

Diameter ins	Weight		Diameter ins	Weight		Diameter ins	Weight	
	kg/ft	kg/m		kg/ft	kg/m		kg/ft	kg/m
0.500	0.33	1.09	1.625	3.50	11.50	2.875	10.98	36.01
0.625	0.52	1.70	1.750	4.07	13.35	3.000	11.95	39.21
0.750	0.74	2.44	1.875	4.67	15.32	3.250	14.02	46.00
0.875	1.02	3.34	2.000	5.31	17.42	3.500	16.27	53.37
1.000	1.33	4.35	2.125	5.99	19.65	4.000	21.25	69.72
1.125	1.68	5.52	2.250	6.73	22.07	4.250	23.71	77.80
1.250	2.07	6.80	2.375	7.49	24.58	4.500	26.58	87.21
1.375	2.51	8.23	2.500	8.30	27.23	5.000	32.82	107.68
1.500	2.99	9.80	2.750	10.04	32.94	5.500	39.71	130.29

NB Weight data for guidance only