



Langley Alloys

Copper
Alloys

Hidurel® 5

Specifications:

UNS S64700, CuNi2Si, ASTM B411 C64700, BS4577, BS 2B25, BS B25, DTD 498, MSRR 8501, CW111C, DIN 2.0855

Hidurel® 5 is a precipitation-hardening Copper-Nickel-Silicon alloy possessing high electrical and thermal conductivity with very good notch ductility and high mechanical strength. Annealing at elevated temperature creates a soft supersaturated alpha-phase structure, before subsequent age hardening at lower temperature precipitates finely dispersed nickel silicide in the matrix. Despite its high strength, the alloy is resistant to hydrogen embrittlement. Resistance to corrosion under marine and industrial conditions is excellent and the alloy has good anti-frictional and bearing properties. With a magnetic permeability of less than 1.001, the alloy is essentially non-magnetic.

The excellent combination of properties provided by Hidurel® 5 is the result of careful control of chemical composition and heat treatment. Tensile properties are uniform and virtually independent of section thickness. The heat treatment of the alloy also ensures dimensional stability of a high order.

Hidurel® 5 meets the mechanical and chemical properties of DTD 498, BS 4577 Type A3/2 and Rolls Royce MSRR 8501 to which Langley Alloys regularly supply so can therefore be specified in confidence for high integrity components. Cold worked material to DTD 504 can also be supplied to order.

Key Features:

- High strength with good electrical and thermal conductivity
- Resistant to hydrogen embrittlement
- Excellent bearing and anti-friction properties, particularly when operated against hardened steel
- Excellent corrosion resistance in marine environments
- Very low magnetic permeability - less than 1.001
- No loss of impact strength down to -196°C
- Spark resistance
- Good elevated temperature properties
- Ease of machining
- Good marine fouling resistance

Typical Applications:

- Naval applications including shafts, bolting for ships & submarines, flanges, swash plate pump components, mine detection equipment
- Automotive components such as valve guides & seats, small end bushes, camshaft bushes, brake caliper pads, fuel pump parts
- Resistance welding electrodes
- Plastic moulding dies, electrical forging dies, die grips on upsetting machines
- Aerospace components including engine bearing cages, undercarriage components, heavily loaded bearings, helicopter shafts, head-up display parts
- Gears, piston crowns, clutch plates in marine engines, electrical contacts, hose connectors
- Thrust pads, slipper pads, mechanical seals, bushes in subsea valves
- Valve bodies

Physical Properties:

Density (Kg/m ³)	8870
Magnetic Permeability (20°C)	< 1.001
Young's Modulus (kN/mm ²)	284
Modulus of Rigidity (kN/mm ²)	106
Poissons Ratio	0.39
Specific Electrical Resistance, 20°C (Ω-m)	0.043
Electrical Conductivity, 20°C (mΩ/mm ²)	6.9 / (40% IACS)
Mean coefficient of thermal expansion, 20-400°C (m/m/°C)	16 x 10 ⁻⁶
Specific Heat, 20°C (J/kg.K)	419
Thermal conductivity, 20°C (W/m.K)	190
Thermal conductivity, 200°C (W/m.K)	211
Thermal conductivity, 400°C (W/m.K)	232
Coefficient of static friction against mild steel	0.45 - 0.50
Coefficient of dynamic friction against mild steel	0.26 (dry) 0.33 (wet)

Product Forms Available:

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

Mechanical Properties:

	Supplied to BSB25		Supplied to DTD 504 (Cold Drawn)	
0.1% Proof Stress	417 N/mm ²	60.5ksi	417 N/mm ²	60.5ksi
0.2% Proof Stress	430 N/mm ²	62.4ksi		
Tensile Strength	587 N/mm ²	85.1ksi	587 N/mm ²	85.1ksi
Elongation, 4D	18%		15%	
Hardness (Brinell)	159-207		159-207	
Impact Strength (Room Temp)	27J		27J	

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		2.30									0.05		0.40				
Max		3.50							Bal		0.30		0.80			0.10	0.02

Note:

1. Total impurities <0.30%

Product Comparison:

Alloy Comparisons	Hidurel® 5	Nickel-Aluminium Bronze	Aluminium-Silicon Bronze	70/30 Copper-Nickel
0.2% Proof Strength (N/mm ²)	430	247	220	115
Impact Strength, Room Temp (J)	27	23	33	54
Electrical Conductivity, 20°C (% IACS)	40	8	9	5
Bearing 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)
Drilling	15-40 (50 - 130)	0.075 - 0.50 (0.003 - 0.020)	
Turning - Roughing	30 - 60 (100 - 200)	0.25 (0.01)	2.0 (0.08)
Turning - Finishing	120 - 180 (400 - 600)	0.12 (0.005)	0.3 (0.01)
Tooling	Carbide tipped using water-soluble lubricant A chip breaker may be found necessary for efficient operation		

Production Route:

Hidurel® 5 is produced through high-quality melting processes to ensure cleanliness and consistency.

- a) The minimum forging ratio utilised is at least 4:1
- b) Solution treatment shall be carried out to Langley Alloys internal specification
- c) This will be followed by immediate water quench
- d) Precipitation hardening shall be carried out to Langley Alloys internal specification
- 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.

Unique metals for your demanding applications

UK

The Wharf | 504-506 Lowfield Dr | Newcastle Under Lyme
Staffordshire | ST5 0UU | UK
+44 (0)1782 610250

sales@langleyalloys.com

USA

102 Longview Street | Conroe
Houston | Texas 77301 | USA
+001 (281) 819 5588

usa@langleyalloys.com

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Duplex
Stainless
Copper Alloys
Nickel Alloys**

www.langleyalloys.com