



**HARDIALL®  
KEY FEATURES & BENEFITS**

- High strength & hardness
- Low friction
- Excellent lubricity
- Corrosion & erosion resistant
- Excellent wear resistance
- Excellent machinability
- Excellent galling resistance
- Pitting & spalling resistance
- No hydrogen embrittlement
- Non-magnetic
- High performance at both elevated and sub-zero temperatures -193°F up to 572°F
- Dimensional stability

Hardiall® is a wrought, spinodally hardened copper alloy CuNi15Sn8 (C72900) designed for high strength applications where toughness is required. It is non-magnetic and resists mechanical wear, galling, stress relaxation, corrosion and erosion.

It is easily machined into complex components and is environmentally friendly being both lead and beryllium free.

Hardiall® is used within the aerospace industry thanks to its outstanding physical and mechanical properties in many varied components. Lebronze alloys has developed a full range of Hardiall® products matching the stringent needs of the aerospace industry.

**Lebronze alloys' manufacturing process for Hardiall® is fully integrated: internal processes include casting, hot and cold working stage, heat treatment and non-destructive testing. Being fully integrated ensures reactivity and complete traceability.**

**Hardiall® Properties and Benefits**

**HARDIALL® PHYSICAL PROPERTIES**

Electrical Conductivity at 20°C (68°F)	7.5	% IACS
Thermal Conductivity at 20°C to 200°C (68°F to 392°F)	38 (22)	W/m/°C (Btu/ft/hr/°F)
Coefficient of Thermal Expansion at 20°C to 200°C (68°F to 392°F)	16.4 x10 <sup>-6</sup> (9.1 x 10 <sup>-6</sup> )	Per °C (Per °F)
Density	8.95 (0.323)	g/cm <sup>3</sup> (lb/in <sup>3</sup> )

**Hardiall® Key Applications in Aerospace**

**Bushings and bearings for landing gear**

In landing gear, bushings and bearings operate under severe conditions. They need to be lubricated and replaced frequently resulting in recurring maintenance downtime.

To reduce maintenance costs, Hardiall® is used for such applications as it demonstrates excellent lubricity, wear, and galling resistance, thus providing a longer service life and an improved total cost of ownership (TCO) compared to other copper and non-copper alloy materials.

Hardiall® is ideal for applications where the load required exceeds the performance of copper-nickel-aluminium based alloys or where lubricity is critical and titanium cannot satisfy the engineer's requirements.

**Other applications:**

- Landing gear attachments
- Engine and pylon attachments
- Flight control mechanisms
- Doors and hatches



## Hardiall® Products Portfolio

Hardiall® is available in various tempers and grades offering different mechanical properties. The following table indicates Hardiall® products available for the aerospace industry.

### MECHANICAL PROPERTIES OF HARDIALL® ALLOYS\*

LBA Designation	Minimal Yield Strength 0.2% Offset (MPa)	Minimal UTS (MPa)	Minimal Elongation 4D (%)	Typical Hardness (HRC)	Available Forms	Available Sizes
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#### Wrought and spinodally hardened Hardiall® rods

Hardiall TX 90	620	720	15	Contact us for more properties, customised products, size information and stock availabilities
Hardiall TX 100	710	862	5	
AMS 4596	738	910	9.5	
	745	876	3	
Hardiall TX 110	760	910	10	
	760	875	6	

#### Solution annealed, cold finished and spinodally hardened Hardiall® rods

Hardiall TS 160U	1035	1105	3	Contact us for more properties, customised products, size information and stock availabilities
	1020	1100	3	
AMS 4597	1069	1137	6	
	1020	1075	3	

#### Wrought and spinodally hardened Hardiall® hollow bars/tubes (length limited to 1000mm) Wall thickness: 10 to 20% of Ø

AMS 4598	717	903	8	Contact us for more properties, customised products, size information and stock availabilities
	745	896	5	
Hardiall TX 110	760	895	10	
	760	895	6	
	760	895	5	

\* Measurements made in laboratory conditions. Non contractual. TS 120U & TS 160U refer to UTS, other tempers refer to YS. All products can be ultrasonically tested at LBA upon customer request.

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