Aircraft Aluminium Alloy | Haomei Aluminium Alloys In Aircraft

Aircraft aluminium alloy has three excellent properties in particular that make it so useful in the aviation industry; high strength to weight ratio, ductility and resistance to corrosion. It is also non-magnetic. There is a wide range of variations in the compositions of aluminium alloys for specific functions in an aircraft.

Aluminium grades in aircraft

Aluminium alloys are designated via a 4 digit numbering system with the first digit representing the alloy group and the other numbers representing the other metals that are present in the alloy. Temper designations are denoted by a prefix such to indicate what type of treatment it has undergone and to what degree. The letters are F, O, H, W, or T to indicate fabrication, annealing, strain hardening, solution heat treatment and heat treatment respectively.

The proportions and constituents of an aluminium alloy determine the specific properties it exhibits. There are literally hundreds of aluminium alloys in use today in different fields of application. For aircraft, below are the most commonly used ones and why they have been chosen for their respective applications.

2024-T3

2024-T3 is made up of 4.5% copper, 0.6% manganese and 1.5% magnesium. This is a top tier high strength aluminium alloy and coupled with its fatigue resistance, it is one of the most common aircraft alloys. It doesn't do well with welding but is a good option for repair works as it has an excellent finish. It is not heat treatable.

6061-T6

6061-T6 is made up of 0.25% copper, 0.6% silicon, 1.0% magnesium and 0.25% chromium. This alloy also has good finishing. In addition to that, it offers good corrosion resistance and is very good for welding. Its strength and workability are comparable to mild steel. It is heat treatable.

3003-H14

3003-H14 contains 1.2% manganese and is the most widely used aluminium alloy. It is very easy to work with as it can be extruded, brazed, machined and welded. It is not heat treatable but can develop increased strength from cold working.

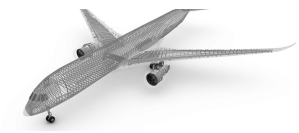
7075-T6

7075-T6 is made up of 1.6% copper, 2.5% magnesium and 5.6% zinc. It is commonly used by aircraft manufacturers to strengthen the structure of the aircraft. It has poor weldability due to its copper content but it has great machinability. It is heat treatable.

5052-H32

5052-H32 is made up of 2.5% magnesium and 0.25% chromium. This alloy offers the highest strength in the non-heatable alloy series and can develop increased strength from cold working. It also has excellent fatigue strength, corrosion resistance and workability which makes it suitable for aviation and marine purposes.

Application of Aluminium alloys in Aircraft Components




AIRCRAFT ALUMINUM

nydia@aluminumhm.com

Component	Material	Alloy elements	Properties
Front legs of seat	Al 2017, Al 2024	Copper, Magnesium	Good machining, high strength, high fatigue strength, corrosion resistance
Wing leading edge	Al 2024		
Seat ejectors	Al 2024		
Backrests and armrests	Al 6xxx	Magnesium, Silicon	High strength, good formability and weldability, corrosion resistance
Fuselage skins, stringers and bulkheads	Al 6013, Al 6050, Al 7050, Al 7079		
Wing skins, panels and covers	Al 7075	Zinc, Magnesium, Copper	Highest strength, high toughness, good formability
Rear legs of seat and seat spreaders	Al 7075		
Wing spars, ribs	7055-T77		
Wheels and loading gear links	7055-T77		
Horizontal and vertical stabilisers	Al 7xxx		
Upper and lower wing skins	8090-T86, 2055-T8, 2199-T8E80	Lithium, Copper, Magnesium	Low density, excellent fatigue and toughness, crack growth resistance
Floor sections of the aircraft	2090-T83, 2090-T62		
Sear structure	2090-T83		
Supporting members of fuselage structure	8090-T651, 2090-T651		

Aluminium material properties: Comparison of Aluminium, Beryllium and Magnesium

	Aluminium	Beryllium	Magnesium
Boiling point	2494oC	2770oC	1107oC
Density	Low	Low	Low
Strength	High	High	High
Toxicity	Non-toxic	Highly toxic	Low toxicity
Flammability	Nil	Flammable	Highly flammable
Integrity at elevated	Maintains its structure at	Relative stability at high	Obeys a unary phase diagram
Corrosion resistance	High	Medium	Highly corrosive
Reaction with water and	Nil	High	High

Benefits of Aluminum in the Aircraft Industry

Aluminum used in the construction of aircraft has three main benefits:

• Aluminum is lightweight. Using aluminum significantly decreases the weight of an airplane. Not only does this help the plane stay in the air, but it also makes it more fuel-efficient and able to carry bigger loads.

• Aluminum is strong. The strength of aluminum makes it an ideal replacement for heavier metals.

• Aluminum is extremely resistant to corrosion, which is important in maintaining the safety of an airplane's structure as it flies through a wide variety of environments.