



7MG.013 Aluminium

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Final Advanced Materials Sàrl
4 avenue de Strasbourg
68350 Didenheim – France
Tel : +33 (0) 3 67 78 78 78

Final Advanced Materials GmbH
Basler Strasse 115
79115 Freiburg – Deutschland
Tel: + 49 (0) 761 47 87 336

www.final-materials.com

Aluminium is a non-ferrous material. It has a low density and is a good thermal and electrical conductor. Aluminium is also a material which is easy to work. Its lightness makes it a preferential material: it has a very good density/mechanical performance ratio. Finally, aluminium can be recycled completely and infinitely, facilitating eco-design.

It is available in a wide range of sizes. When it is manufactured, various heat and mechanical treatments can improve its properties, depending on the expected performance characteristics.

Applications

- Industrial structures: rods, bars, plates, profiles, machine parts, etc.
- Electronic accessories
- General mechanics
- Motor vehicles
- Energy
- Rail
- Aeronautics
- Construction

info@final-materials.com



Benefits (depending on grade)

- Very resistant to corrosion (depending on alloy and surface treatment)
- Good thermal and electrical conductor
- Low density
- Very good weight/performance ratio
- Easily machinable
- Weldable
- Cold transformable
- Castable
- Long lifetime
- Recyclable

Families of aluminium alloys

In accordance with the directives of the Aluminium Association (Washington DC 2006, United States), aluminium alloys are designated using a four-figure numerical system. The first figure identifies a series characterised by its main alloy elements.

Non-alloy aluminium

1000 series

Alloys in the 1000 series consist of aluminium which is 99% pure or higher. This series has very good plastic deformation properties, and excellent characteristics with regard to chemical agents and different atmospheres. It also has good welding, brazing and anodisation properties, and relatively low mechanical resistance.

The properties depend mainly on the quantity of impurities and the level of strain hardening or softening (annealing or recovery).

Thermosetting alloys

2000 series

In the 2000 series copper is used as the main alloy element and enables traction resistance to be increased using solution heat treatment. These alloys have an average mechanical resistance which depends on the heat treatment (T6 recommended). They have good heat resistance but poor welding properties and relatively low corrosion resistance in corrosive atmospheres. The most commonly used grades are 2017, 2011 and 2030.

6000 series

The alloys in this series contain silicon and magnesium. They have very good properties for hot deformation by lamination, and above all by extrusion and swaging and cold forming. They have very good corrosion resistance and good welding properties. Conversely, heat resistance is limited. Grades 6060 and 6082 are the most commonly used ones.

**7000 series**

Zinc is the main alloy agent of this series. It has very high mechanical resistance, but low stiffness and stress corrosion resistance.

The most commonly used grade is 7075 (FORTAL).

Non-thermosetting alloys**3000 series**

Manganese is the main alloy element in this series, often with a small quantity of magnesium. However, only a small percentage of manganese can be added effectively to aluminium, i.e. 1.0% to 1.5%.

4000 series

The 4000 series is a special case, since it is both heat treatable and not heat treatable. Alloys in the 4000 series are combined with silicon, which can be added in sufficient quantities to reduce the melting point of aluminium, without affecting its fragility.

5000 series

Magnesium is the main alloy agent of the 5000 series, and is one of the most effective alloy elements, and one of the most commonly used for aluminium. Alloys in this series have good mechanical resistance, and effective weldability. They also have high corrosion resistance in marine environments. For this reason, aluminium and magnesium alloys are widely used in structural applications. The most commonly used grades are 5083 and 5754.

Machining capacities

Specific capacity limits:

Turning: Up to Ø90 mm and 600 mm in length
Loading of max. length 3,000 mm bar material

Milling: Up to a thickness of 200 mm (must be approved according to the plan)

Free-cutting: Up to Ø32 mm max.

Alloy		Technological and usage properties						
		Mechanical resistance	Machinability	Weldability	Cold malleability	Hot malleability	Corrosion resistance	Suitability for anodising
1000	Al	★	★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
2000	Al Cu	★★★★★	★★★★★	-	★	★★★	★	★★
3000	Al Mn	★★	★★★★★	★★★★★	★★★	★★★	★★★★★	★★★
5000	Al Mg	★★★★★	★★	★★★★★	★★★	★	★★★★★	★★★★★
6000	Al Si Mg	★★	★	★★★	★★★	★★★★★	★★★★★	★★★★★
7000	AL Zn Mg Cu	★★★★★	★★★★	-	★	★★	★	★★★