

Materials Park, Ohio 44073-0002, USA :: +1.440.338.5151 :: www.asminternational.org :: matinfo@asminternational.org

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Raffmetal EN AB-AL Si10Mg(Fe) (EN AB-43400) is an aluminum-silicon-magnesium casting alloy in ingot form for remelting. It is used extensively for producing high pressure die castings and low pressure die castings for applications requiring a combination of excellent casting characteristics, good strength with fair ductility, and good corrosion resistance.

Chemical Composition

| Element | Composition, wt%(a) | |
|---------------|---|---|
| | Ingots for remelting | Castings |
| | Raffmetal EN AB-AL Si10Mg(Fe) (EN AB-43400) | EN AC-AL Si10Mg(Fe) (EN AC-43400)(b) |
| Silicon | 9.0–11.0 | 9.0–11.0 |
| Iron | 0.45–0.9 | 1.0 |
| Copper | 0.08 | 0.10 |
| Manganese | 0.55 | 0.55 |
| Magnesium | 0.25–0.50 | 0.20–0.50 |
| Nickel | 0.15 | 0.15 |
| Zinc | 0.15 | 0.15 |
| Lead | 0.15 | 0.15 |
| Tin | 0.05 | 0.05 |
| Titanium | 0.15 | 0.20 |
| Others, each | 0.05 | 0.05 |
| Others, total | 0.15 | 0.15 |
| Aluminum | bal | bal |

(a) Maximum values unless indicated otherwise. (b) Source: EN 1706:2020

Physical Properties

| Property | Unit | At | Value |
|---|---|--------------------------|------------------------|
| Melting range | °C (°F) | ... | 550–600 (1022–1112) |
| Density | kg/m ³ (lb/in. ³) | RT | 2680 (0.097) |
| Coefficient of linear thermal expansion | 10 ⁻⁶ /K (10 ⁻⁶ /°F) | 20–100 °C (68–212 °F) | 21.0 (11.7) |
| | | 20–200 °C (68–392 °F) | 22.0 (12.2) |
| Thermal conductivity | W/(m·K) (Btu/(h·ft·°F)) | 20 °C (68 °F) | 130–150 (75–87) |
| Specific heat capacity | J/(kg·K) (cal/(g·°C)) | 100 °C (212 °F) | 910 (0.217) |
| Electrical conductivity | MS/m (%IACS) | RT | 16–21 (28–36) |

Typical values. RT = room temperature

Mechanical Properties

See Tables 1 and 2.

Casting

| Parameter | Unit | Value |
|---------------------|---------|---------------------|
| Casting temperature | °C (°F) | 630–700 (1165–1290) |
| Linear shrinkage | % | 0.4–0.6 |

For high pressure die castings

Precautions during Casting

- Ensure a high level of cleanliness of the melting furnaces.
- The recycling of risers and casting appendices is allowed but should be limited to 50% of the total weight of the load.
- The iron tools that can come into contact with the molten metal must be appropriately painted to prevent contamination of the alloy.
- Overheating of the molten metal should be avoided. The maximum temperature of the molten metal should be 740 °C (1365 °F).
- The best results for refining the alloy are reached by treatment with inert gases such as nitrogen and/or argon, with the intent of removing the dissolved hydrogen and the oxides present in the molten metal. Better distribution of the gas in the molten metal is obtained by the use of relevant rotors.
- Ensure that all transfer operations of the molten metal are performed with minimum turbulence. It is recommended to leave the molten metal at rest for a few minutes before starting casting. Careful skimming operations of the bath are recommended.

Heat Treatment

Annealing: Heat to 260–370 °C (500–700 °F). Wait for equalization of the temperature. Soak for 4 to 6 h. Cool to room temperature in the furnace or in still air.

Stress Relieving: Heat to 175–260 °C (350–500 °F). Wait for equalization of the temperature. Soak for 4 to 6 h. Cool to room temperature in still air.

Information on heat treatment sourced from 360.0 and A360.0: Al-Si-Mg General-Purpose Die-Casting Alloys, *Properties and Selection of Aluminum Alloys*, Volume 2B, ASM Handbook, ASM International, 2019, p 558–559.

Table 1 Mechanical properties at room temperature

| Casting method | Temper | Tensile strength, min | | 0.2% proof strength, min | | Elongation, min | Hardness, min |
|---------------------------|--------|-----------------------|-----|--------------------------|-----|-----------------|---------------|
| | | MPa | ksi | MPa | ksi | % | HBW |
| High pressure die casting | F | 240 | 35 | 140 | 20 | 1 | 70 |

The mechanical properties are measured on separately cast test pieces. Source: *EN AB-Al Si10Mg(Fe) (EN AB-43400)*, Raffmetal S.p.A., and EN 1706:2020

Table 2 Modulus of elasticity at room temperature

| Property | Unit | Value |
|-----------------------|---------------------------|-----------|
| Modulus of elasticity | GPa (10 ⁶ psi) | 74 (10.7) |

Comparable Grades

Ingots for Remelting

| Raffmetal S.p.A. | Raffmetal EN AB-Al Si10Mg(Fe) (EN AB-43400) |
|------------------|---|
| EN 1676:2020 | EN AB-Al Si10Mg(Fe) (EN AB-43400) |
| ISO 17615:2007 | ISO AB-Al Si10Mg(Fe) |
| JIS H 2211:2010 | AC AlSi10Mg(Fe) |

Castings

| | |
|-----------------|-----------------------------------|
| EN 1706:2020 | EN AC-Al Si10Mg(Fe) (EN AC-43400) |
| ISO 3522:2007 | ISO AC-Al Si10Mg(Fe) |
| JIS H 5202:2010 | Al Si10Mg(Fe) |

General Characteristics

Excellent castability; good strength; fair ductility (shock resistance); good-to-fair corrosion resistance; good machinability; fair weldability. See Table 3 for ratings of casting characteristics and other properties.

Product Forms

(a) EN AB-Al Si10Mg(Fe) (EN AB-43400): Ingot for remelting.
 (b) EN AC-Al Si10Mg(Fe) (EN AC-43400): High pressure / low pressure die castings.

Applications

Some of the uses of EN AC-Al Si10Mg(Fe) (EN AC-43400) are outboard motor parts, instrument cases, cover plates, a wide variety of general-purpose castings, and aircraft and marine items of many types. Information on applications sourced from 360.0 and A360.0: Al-Si-Mg General-Purpose Die-Casting Alloys, *Properties and Selection of Aluminum*

Table 3 Ratings of casting characteristics and other properties

| Characteristic or property | Rating |
|-------------------------------------|---------------------|
| Castability | |
| Fluidity | Excellent |
| Resistance to hot tearing | Excellent |
| Pressure tightness | Fair |
| Mechanical properties | |
| Strength at room temperature | Good |
| Strength at elevated temperature(a) | Fair |
| Ductility (shock resistance) | Fair |
| Fatigue strength, MPa (ksi) | 60–90 (8.7–13.1)(b) |
| Other properties | |
| Resistance to corrosion | Good / Fair |
| Machinability (as cast) | Good |
| Ability to be polished | Good / Fair |
| Ability to be welded | Fair |
| Decorative anodizing | Not recommended |

(a) At 200 °C (390 °F). (b) Values for rotating bending conditions up to 10⁷ cycles (Wöhler curve). Source: EN 1706:2020 and *EN AB-Al Si10Mg(Fe) (EN AB-43400)*, Raffmetal S.p.A.

Alloys, Volume 2B, *ASM Handbook*, ASM International, 2019, p 558-559.

Supplier

Raffmetal S.p.A.
 Via Malpaga, 82
 Casella postale n°43
 25070 Casto, Brescia, Italy
 Tel: +39 0365 8901
 Web: www.raffmetal.com

All data from *EN AB-Al Si10Mg (EN AB-43400)*, Raffmetal S.p.A., except where noted.