## General information

### Designation

6151, wrought

| | |
|---|---|
| Condition | T6 (Solution heat-treated and artificially aged) |
| UNS number | A96151 |
| EN name | EN AW-6151 |

### Typical uses

Die forgings and rolled rings for crank cases, fuses, and machine parts. Applications requiring good forgeability, good strength, and resistance to corrosion

## Composition overview

### Compositional summary

Al96-99 / Si0.6-1.2 / Mg0.45-0.8 / Cr0.15-0.35 (impurities: Fe<1, Cu<0.35, Zn<0.25, Mn<0.2, Ti<0.15, Other<0.15)

| | |
|---|---|
| Material family | Metal (non-ferrous) |
| Base material | Al |

## Composition detail (metals, ceramics and glasses)

| | | | | | |
|---|---|---|---|---|---|
| Al (aluminum) | * | 95,6 | - | 98,8 | % |
| Cr (chromium) | | 0,15 | - | 0,35 | % |
| Cu (copper) | | 0 | - | 0,35 | % |
| Fe (iron) | | 0 | - | 1 | % |
| Mg (magnesium) | | 0,45 | - | 0,8 | % |
| Mn (manganese) | | 0 | - | 0,2 | % |
| Si (silicon) | | 0,6 | - | 1,2 | % |
| Ti (titanium) | | 0 | - | 0,15 | % |
| Zn (zinc) | | 0 | - | 0,25 | % |
| Other | | 0 | - | 0,15 | % |

## Price

| | | | | | |
|---|---|---|---|---|---|
| Price | * | 8,53 | - | 9,95 | BRL/kg |
| Price per unit volume | * | 2,3e4 | - | 2,72e4 | BRL/m^3 |

## Physical properties

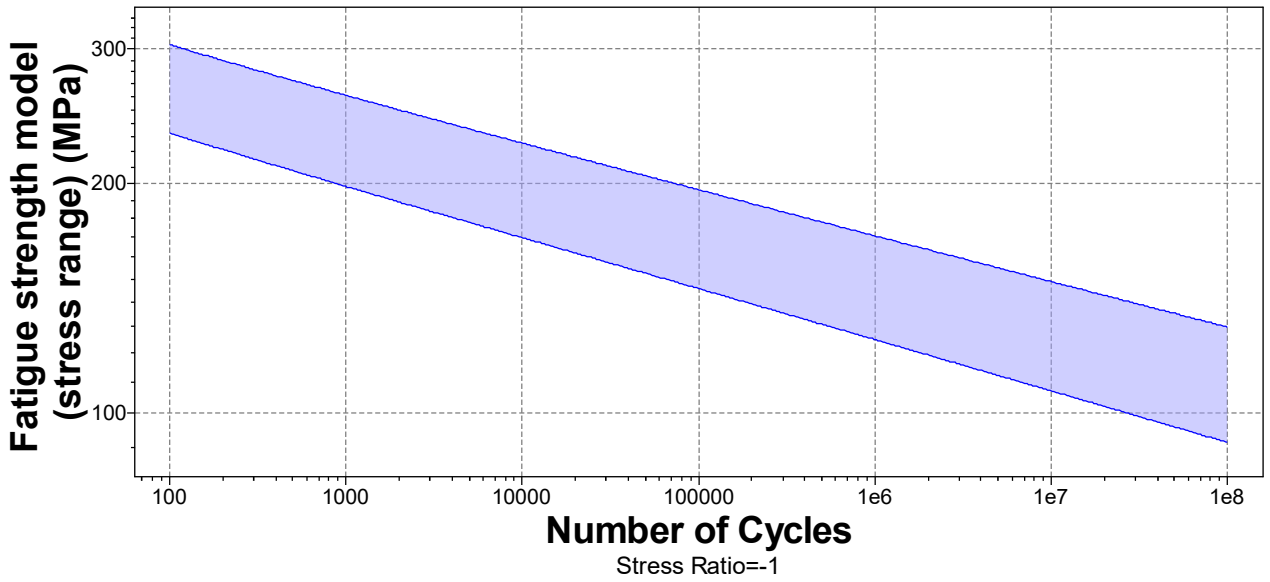
| | | | | |
|---|---|---|---|---|
| Density | 2,69e3 | - | 2,73e3 | kg/m^3 |

## Mechanical properties

| | | | | | |
|---|---|---|---|---|---|
| Young's modulus | | 67,9 | - | 71,3 | GPa |
| Specific stiffness | | 25 | - | 26,3 | MN.m/kg |
| Yield strength (elastic limit) | | 255 | - | 297 | MPa |
| Tensile strength | | 303 | - | 353 | MPa |
| Specific strength | | 94 | - | 110 | kN.m/kg |
| Elongation | | 10 | - | 14,4 | % strain |
| Compressive modulus | | 69,3 | - | 72,8 | GPa |
| Compressive strength | * | 255 | - | 297 | MPa |
| Flexural modulus | * | 67,9 | - | 71,3 | GPa |
| Flexural strength (modulus of rupture) | * | 255 | - | 297 | MPa |
| Shear modulus | | 25,9 | - | 27,2 | GPa |

| | | | | |
|---|---|---|---|---|
| Shear strength | 193 | - | 225 | MPa |
| Bulk modulus | * 67,9 | - | 71,3 | GPa |
| Poisson's ratio | 0,325 | - | 0,335 | |
| Shape factor | 23,9 | | | |
| Hardness - Vickers | 103 | - | 108 | HV |
| Elastic stored energy (springs) | 469 | - | 632 | kJ/m^3 |
| Fatigue strength at 10^7 cycles | * 117 | - | 136 | MPa |
| Fatigue strength model (stress range) | * 107 | - | 149 | MPa |

Parameters: Stress Ratio = -1, Number of Cycles = 1e7cycles




## Impact & fracture properties

| | | | | |
|---|---|---|---|---|
| Fracture toughness | * 30 | - | 36 | MPa.m^0.5 |
| Toughness (G) | 13 | - | 18,5 | kJ/m^2 |

## Thermal properties

| | | | | |
|---|---|---|---|---|
| Melting point | 588 | - | 650 | °C |
| Maximum service temperature | 130 | - | 150 | °C |
| Minimum service temperature | -273 | | | °C |
| Thermal conductivity | 173 | - | 188 | W/m.°C |
| Specific heat capacity | 963 | - | 1e3 | J/kg.°C |
| Thermal expansion coefficient | 23 | - | 24,2 | µstrain/°C |
| Thermal shock resistance | 154 | - | 182 | °C |
| Thermal distortion resistance | * 7,29 | - | 8,01 | MW/m |
| Latent heat of fusion | 384 | - | 393 | kJ/kg |

## Electrical properties

| | | | | |
|---|---|---|---|---|
| Electrical resistivity | 3,8 | - | 4,2 | µohm.cm |
| Electrical conductivity | 41,1 | - | 45,4 | %IACS |
| Galvanic potential | * -0,78 | - | -0,7 | V |

## Magnetic properties

| | |
|---|---|
| Magnetic type | Non-magnetic |

## Optical, aesthetic and acoustic properties

| | | | | |
|---|---|---|---|---|
| Transparency | Opaque | | | |
| Acoustic velocity | 5e3 | - | 5,13e3 | m/s |
| Mechanical loss coefficient (tan delta) | * 1e-4 | - | 0,002 | |

## Critical materials risk

| | |
|---|---|
| Contains >5wt% critical elements? | Yes |
| Notes | Al (aluminum) added to the 2018 US critical minerals list |

## Processing properties

| | | |
|---|---|---|
| Metal casting | Unsuitable | |
| Metal cold forming | Acceptable | |
| Metal hot forming | Acceptable | |
| Metal press forming | Acceptable | |
| Metal deep drawing | Limited use | |
| Machining speed | 73,2 | m/min |
| Weldability | Excellent | |
| Notes | Preheating is not required, post weld heat treatment is required | |

## Durability

| | |
|---|---|
| Water (fresh) | Excellent |
| Water (salt) | Acceptable |
| Weak acids | Excellent |
| Strong acids | Excellent |
| Weak alkalis | Acceptable |
| Strong alkalis | Unacceptable |
| Organic solvents | Excellent |
| Oxidation at 500C | Unacceptable |
| UV radiation (sunlight) | Excellent |
| Galling resistance (adhesive wear) | Limited use |

Notes

Aluminum alloys perform poorly when self-mated but can be processed without galling when mated with steels.

| | |
|---|---|
| Flammability | Non-flammable |

## Corrosion resistance of metals

| | |
|---|---|
| Stress corrosion cracking | Not susceptible |
| Notes | Rated in chloride; Other susceptible environments: Halide, water |

## Primary production energy, CO2 and water

| | | | | |
|---|---|---|---|---|
| Embodied energy, primary production | * 190 | - | 209 | MJ/kg |
| CO2 footprint, primary production | * 12,4 | - | 13,7 | kg/kg |
| Water usage | * 1,11e3 | - | 1,23e3 | l/kg |

## Processing energy, CO2 footprint & water

| | | | | |
|---|---|---|---|---|
| Roll forming, forging energy | * 6,22 | - | 6,88 | MJ/kg |
| Roll forming, forging CO2 | * 0,467 | - | 0,516 | kg/kg |
| Roll forming, forging water | * 4,21 | - | 6,32 | l/kg |
| Extrusion, foil rolling energy | * 12,2 | - | 13,4 | MJ/kg |
| Extrusion, foil rolling CO2 | * 0,912 | - | 1,01 | kg/kg |
| Extrusion, foil rolling water | * 6,75 | - | 10,1 | l/kg |
| Wire drawing energy | * 44,8 | - | 49,6 | MJ/kg |
| Wire drawing CO2 | * 3,36 | - | 3,72 | kg/kg |

| | | | | |
|---|---|---|---|---|
| Wire drawing water | * 16,9 | - | 25,3 | l/kg |
| Metal powder forming energy | * 23,7 | - | 26,2 | MJ/kg |
| Metal powder forming CO2 | * 1,9 | - | 2,1 | kg/kg |
| Metal powder forming water | * 25,9 | - | 38,8 | l/kg |
| Vaporization energy | * 1,55e4 | - | 1,71e4 | MJ/kg |
| Vaporization CO2 | * 1,16e3 | - | 1,28e3 | kg/kg |
| Vaporization water | * 6,46e3 | - | 9,69e3 | l/kg |
| Coarse machining energy (per unit wt removed) | * 1,37 | - | 1,51 | MJ/kg |
| Coarse machining CO2 (per unit wt removed) | * 0,102 | - | 0,113 | kg/kg |
| Fine machining energy (per unit wt removed) | * 9,38 | - | 10,4 | MJ/kg |
| Fine machining CO2 (per unit wt removed) | * 0,704 | - | 0,778 | kg/kg |
| Grinding energy (per unit wt removed) | * 18,3 | - | 20,2 | MJ/kg |
| Grinding CO2 (per unit wt removed) | * 1,37 | - | 1,52 | kg/kg |
| Non-conventional machining energy (per unit wt removed) | * 155 | - | 171 | MJ/kg |
| Non-conventional machining CO2 (per unit wt removed) | * 11,6 | - | 12,8 | kg/kg |

## Recycling and end of life

| | | | | |
|---|---|---|---|---|
| Recycle | ✓ | | | |
| Embodied energy, recycling | * 32,3 | - | 35,7 | MJ/kg |
| CO2 footprint, recycling | * 2,54 | - | 2,8 | kg/kg |
| Recycle fraction in current supply | 40,5 | - | 44,7 | % |
| Downcycle | ✓ | | | |
| Combust for energy recovery | ✗ | | | |
| Landfill | ✓ | | | |
| Biodegrade | ✗ | | | |

## Notes

### Keywords

BAW 6061, Alcan Wire (WALES); ANTICORODAL-100, Alusuisse-Lonza Group (SWITZERLAND); ANTICORODAL-062, Alusuisse-Lonza Group (SWITZERLAND);

### Standards with similar compositions

• Canada:
0.6151 to CSA HA.8, SG11P to CSA
• France:
6181 to NF A50-411, 6181 to NF A50-451
• Japan:
A6151FD to JIS H4140, A6151FH to JIS H4140
• USA:
6151, 6151 to AMS 4125, 6151 to ASTM B247M, 6151 to MIL A-22771, 6151 to QQ A-367, UNS A96151

## Links

ProcessUniverse
Producers
Reference
Shape