Engineering Guide to Alloy Selection

Most Popular Aluminum Alloys and their characteristics
**ANSI AA 308.0-F (Permanent Mold)**

**Former Numbers**
- Former AA: A108
- Former ASTM: FedSpec: A03080
- Former SAE: MilSpec:

**Elemental Composition (%)**
- Aluminum (Al): 5.0-6.0
- Beryllium (Be):
- Cobalt (Co):
- Chromium (Cr):
- Copper (Cu):
- Iron (Fe):
- Magnesium (Mg):
- Manganese (Mn):
- Nickel (Ni):
- Silicon (Si):
- Silver (Ag):
- Tin (Sn):
- Titanium (Ti):
- Vanadium (V):
- Zinc (Zn):
- Zirconium (Zr):
- Other:

**Physical Properties**
- Specific Gravity: 2.79
- Density: 0.101 lb/in³
- Melting Temperature: 970-1140 °F
- Electrical Conductivity (% IACS): 37
- Thermal Conductivity (@ 25 °C, SI units): 0.34
- Coef. of Thermal Expansion (68-212 °F): 11.9°F x 10⁻⁶

**Mechanical Properties**
- Modulus of Elasticity: 28 ksi
- Tensile Strength (Ultimate): 16 ksi
- Tensile Strength (Yield): 17 ksi
- Compressive Strength (Yield): 22 ksi
- Shear Strength:
- Endurance Limit:
- Elongation (% in 2 inches):
- Hardness (BHN):

**Heat Treatment (Temper)**
- F - AS CAST
- Cool from mold in still air at room temperature

**Important Characteristics**

**Typical Applications**
- General purpose permanent mold castings, ornamental grilles and reflectors

**ANSI AA 319.0-F (Sand)**

**Former Numbers**
- Former AA: 319 Alcast
- Former ASTM: SC640
- Former SAE: 326
- Formed Spec: 319

**Elemental Composition (%)**
- Aluminum (Al):
- Beryllium (Be):
- Cobalt (Co):
- Chromium (Cr):
- Copper (Cu):
- Iron (Fe):
- Magnesium (Mg):
- Manganese (Mn):
- Nickel (Ni): 0.35
- Silicon (Si): 5.5-6.5
- Silver (Ag):
- Tin (Sn):
- Titanium (Ti): 0.25
- Vanadium (V):
- Zinc (Zn): 1.00
- Zirconium (Zr):
- Other:

**Physical Properties**
- Specific Gravity: 2.79
- Density: 0.101 lb/in³
- Melting Temperature: 970-1120 °F
- Electrical Conductivity (% IACS): 27
- Thermal Conductivity (@ 25 °C, SI units): 0.27
- Coef. of Thermal Expansion (68-212 °F): 12.0°F x 10⁻⁶

**Mechanical Properties**
- Modulus of Elasticity: 10.7 x 10⁶ psi
- Tensile Strength (Ultimate): 27 ksi
- Tensile Strength (Yield): 18 ksi
- Compressive Strength (Yield): 19 ksi
- Shear Strength:
- Endurance Limit:
- Elongation (% in 2 inches):
- Hardness (BHN):

**Heat Treatment (Temper)**
- F - AS CAST
- Cool from mold in still air at room temperature

**Important Characteristics**

**Typical Applications**
- Engine crankcases, gas and oil tanks, engine oil pans, typewriter frames, engine parts
ANSI AA 356.0-T6 (Sand)

Former Numbers
Former AA: 356
Former ASTM: S670A
Former SAE: 323

Elemental Composition (%)
Aluminum (Al): 13.8
Beryllium (Be): 0.001
Cobalt (Co): 0.35
Chromium (Cr): 0.95
Copper (Cu): 0.25
Iron (Fe): 0.6
Magnesium (Mg): 0.20-0.45
Manganese (Mn): 0.35
Other: 1%

Physical Properties
Specific Gravity: 2.68
Density: 0.097 lb/in³
Melting Temperature: 1040-1140 °F
Electrical Conductivity (% IACS): 39
Thermal Conductivity (at 25 °C, SI units): 0.36
Coeff. of Thermal Expansion (68-212 °F): 11.9°F x 10⁻⁶

Mechanical Properties
Modulus of Elasticity: 10.5 x 10⁶ psi
Tensile Strength (Ultimate): 33 ksi
Tensile Strength (Yield): 24 ksi
Compressive Strength (Yield): 25 ksi
Shear Strength: 26 ksi
Endurance Limit: 8.5 ksi
Elongation (% in 2 inches): 3.5
Hardness (BHN): 70

Heat Treatment (Temper)
T6 - SOLUTION HEAT TREAT, QUENCH, AGE ARTIFICIALLY
Heat to 1000 °F and hold for 12 hours; quench in water at 150-212 °F; age at 310 °F for 3-5 hours

Important Characteristics
If iron content exceeds 0.45%, manganese content shall not be less than one-half the iron content

Typical Applications
Flywheel castings, automotive transmission cases, oil pans, pump bodies

ANSI AA 356.0-T6 (Permanent Mold)

Former Numbers
Former AA: 356
Former ASTM: S670A
Former SAE: 323

Elemental Composition (%)
Aluminum (Al): 13.8
Beryllium (Be): 0.001
Cobalt (Co): 0.35
Chromium (Cr): 0.95
Copper (Cu): 0.25
Iron (Fe): 0.6
Magnesium (Mg): 0.20-0.45
Manganese (Mn): 0.35
Other: 1%

Physical Properties
Specific Gravity: 2.68
Density: 0.097 lb/in³
Melting Temperature: 1040-1140 °F
Electrical Conductivity (% IACS): 41
Thermal Conductivity (at 25 °C, SI units): 0.37
Coeff. of Thermal Expansion (68-212 °F): 11.9°F x 10⁻⁶

Mechanical Properties
Modulus of Elasticity: 10.5 x 10⁶ psi
Tensile Strength (Ultimate): 38 ksi
Tensile Strength (Yield): 27 ksi
Compressive Strength (Yield): 27 ksi
Shear Strength: 30 ksi
Endurance Limit: 13 ksi
Elongation (% in 2 inches): 5.0
Hardness (BHN): 80

Heat Treatment (Temper)
T6 - SOLUTION HEAT TREAT, QUENCH, AGE ARTIFICIALLY
Heat to 1000 °F and hold for 4-12 hours; quench in water at 150-212 °F; age at 310 °F for 2-5 hours

Important Characteristics
If iron content exceeds 0.45%, manganese content shall not be less than one-half the iron content

Typical Applications
Machine tool parts, aircraft wheels, airframe castings, bridge railings
Precision Enterprise Foundry & Machine
1000 E. Precision Drive
Somona, Illinois 60552
815.797.1000

ANSI AA 535.0-F
(Sand)

Former Numbers
Former AA: Almag 35
Former ASTM: G170B
Former SAE: Almag 35
UNS: A5350
FedSpec: Almag 35
Milspec: Almag 35

Elemental Composition (%
Aluminum (Al): 2.62
Beryllium (Be): 0.003-0.007
Cobalt (Co): 1.5
Chromium (Cr): 0.15
Copper (Cu): 0.15
Iron (Fe): 0.15
Magnesium (Mg): 3.5-4.5
Manganese (Mn): 0.35
Other: Boron (B): 0.0005 max

Physical Properties
Specific Gravity: 2.62
Density: 0.095 lb/in³
Melting Temperature: 1020-1165 °F
Electrical Conductivity (% IACS): 23
Thermal Conductivity (at 25 °C): 0.23
Coeff. of Thermal Expansion (68-212 °F): 13.1/°F x 10⁶

Mechanical Properties
Modulus of Elasticity:
Tensile Strength (Ultimate): 35 ksi
Tensile Strength (Yield): 18 ksi
Compressive Strength (Yield): 18 ksi
Shear Strength:
Endurance Limit:
Elongation (% in 2 inches): 9.0
Hardness (BHN): 60-90

Heat Treatment (Temper)
F - AS CAST
Cool naturally from mold in still air at room temperature

Important Characteristics
The T5 temper imparts improved mechanical properties and dimensional stability. Mechanical properties are the same for both the F and T5 tempers.

Typical Applications
Applications where dimensional stability is important, such as instrument parts.

ANSI AA 535.0-T5
(Sand)

Former Numbers
Former AA: Almag 35
Former ASTM: G170B
Former SAE: Almag 35
UNS: A5350
FedSpec: Almag 35
Milspec: Almag 35

Elemental Composition (%
Aluminum (Al): 2.62
Beryllium (Be): 0.003-0.007
Cobalt (Co): 1.5
Chromium (Cr): 0.15
Copper (Cu): 0.15
Iron (Fe): 0.15
Magnesium (Mg): 3.5-4.5
Manganese (Mn): 0.35
Other: Boron (B): 0.0005 max

Physical Properties
Specific Gravity: 2.62
Density: 0.095 lb/in³
Melting Temperature: 1020-1165 °F
Electrical Conductivity (% IACS): 23
Thermal Conductivity (at 25 °C): 0.23
Coeff. of Thermal Expansion (68-212 °F): 13.1/°F x 10⁶

Mechanical Properties
Modulus of Elasticity:
Tensile Strength (Ultimate): 35 ksi
Tensile Strength (Yield): 18 ksi
Compressive Strength (Yield): 18 ksi
Shear Strength:
Endurance Limit:
Elongation (% in 2 inches): 9.0
Hardness (BHN): 60-90

Heat Treatment (Temper)
T5 - COOL NATURALLY FROM MOLD; AGE ARTIFICIALLY
Cool naturally from the mold at room temperature; age artificially at 750 °F for 5 hours; cool outside the furnace in still air; no quench is required

Important Characteristics

Typical Applications
Precision Enterprise Foundry & Machine
1000 E. Precision Drive
Somonaun, Illinois 60552
815.797.1000

ANSI AA B535.0-F
(Sand)

**Former Numbers**
- Former AA: B218
- Former ASTM: 
- Former SAE: 
- UNS: 
- FedSpec: 
- MilSpec: 

**Elemental Composition (%)**
- Aluminum (Al): 
- Beryllium (Be): 
- Cobalt (Co): 
- Chromium (Cr): 
- Copper (Cu): 0.10
- Iron (Fe): 0.15
- Magnesium (Mg): 6.5-7.5
- Manganese (Mn): 0.05
- Other: 
- Nickel (Ni): 
- Silicon (Si): 0.15
- Silver (Ag): 
- Tin (Sn): 
- Titanium (Ti): 0.10-0.25
- Vanadium (V): 
- Zinc (Zn): 
- Zirconium (Zr): 

**Physical Properties**
- Specific Gravity: 2.62
- Density: 0.095 lb/in³
- Melting Temperature: 1020-1170 °F
- Electrical Conductivity (% IACS): 24
- Thermal Conductivity (at 25 °C, SI units): 0.23
- Coef. of Thermal Expansion (68-212 °F): 13.6/°F x 10⁻⁶

**Mechanical Properties**
- Modulus of Elasticity: 
- Tensile Strength (Ultimate): 
- Tensile Strength (Yield): 
- Compressive Strength (Yield): 
- Shear Strength: 
- Endurance Limit: 
- Elongation (% in 2 inches): 
- Hardness (BHN): 

**Heat Treatment (Temper)**
- F - AS CAST
  Cool naturally from mold in still air at room temperature

**Important Characteristics**

**Typical Applications**

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ANSI AA 705.0-F
(Sand)

**Former Numbers**
- Former AA: 603, Ternalloy 5
- Former ASTM: ZG32A
- Former SAE: 311
- UNS: A07050
- FedSpec: Ternalloy 5
- MilSpec: 

**Elemental Composition (%)**
- Aluminum (Al): 
- Beryllium (Be): 
- Cobalt (Co): 
- Chromium (Cr): 0.20-0.40
- Copper (Cu): 0.20
- Iron (Fe): 0.8
- Magnesium (Mg): 1.4-1.8
- Manganese (Mn): 0.40-0.6
- Other: 
- Nickel (Ni): 
- Silicon (Si): 0.20
- Silver (Ag): 
- Tin (Sn): 
- Titanium (Ti): 0.25
- Vanadium (V): 
- Zinc (Zn): 2.7-3.3
- Zirconium (Zr): 

**Physical Properties**
- Specific Gravity: 2.76
- Density: 0.100 lb/in³
- Melting Temperature: 1110-1180 °F
- Electrical Conductivity (% IACS): 25
- Thermal Conductivity (at 25 °C, SI units): 0.25
- Coef. of Thermal Expansion (68-212 °F): 13.1/°F x 10⁻⁶

**Mechanical Properties**
- Modulus of Elasticity: 
- Tensile Strength (Ultimate): 30 ksi
- Tensile Strength (Yield): 17 ksi
- Compressive Strength (Yield): 
- Shear Strength: 
- Endurance Limit: 
- Elongation (% in 2 inches): 5.0
- Hardness (BHN): 50-80

**Heat Treatment (Temper)**
- F - AS CAST
  Cool naturally from mold in still air at room temperature

**Important Characteristics**

**Typical Applications**
ANSI AA 712.0-T5
(Sand)

Former Numbers
Former AA: 0712.0
Former ASTM: 7661A
Former SAE: 310

Elemental Composition (%)
Aluminum (Al): 0.40-0.6
Beryllium (Be): 0.35-0.65
Cobalt (Co): 0.50
Chromium (Cr): 1.1
Copper (Cu): 5.0-6.5
Magnesium (Mg): 0.10
Manganese (Mn): 0.10
Other:

Physical Properties
Specific Gravity: 2.82
Density: 0.102 lb/in³
Melting Temperature: 1100-1180 °F
Electrical Conductivity (% IACS): 40
Thermal Conductivity (at 25 °C, SI units): 0.38
Coeff. of Thermal Expansion (68-212 °F): 13.1/°F x 10⁶

Mechanical Properties
Modulus of Elasticity:
Tensile Strength (Ultimate): 34 ksi
Tensile Strength (Yield): 25 ksi
Shear Strength:
Endurance Limit:
Elongation (% in 2 inches): 4.0
Hardness (BHN): 60-90

Heat Treatment (Temper)
T5 - COOL NATURALLY FROM MOLD; AGE NATURALLY
Cool naturally from mold in still air at room temperature; age at room temperature for 21 days.

Important Characteristics
The T5 temper imparts improved mechanical properties and dimensional stability. Mechanical properties are the same for both the F and T5 tempers.

Typical Applications
Automotive parts, trailer parts, pumps, mining equipment

ANSI AA 713.0-F
(Sand)

Former Numbers
Former AA: 613, Tenzalloy
Former ASTM: 2C81A
Former SAE: 315

Elemental Composition (%)
Aluminum (Al): 0.15
Beryllium (Be): 0.25
Cobalt (Co): 0.35
Chromium (Cr): 1.1
Copper (Cu): 7.0-8.0
Iron (Fe): 60-90
Magnesium (Mg): 1.0
Manganese (Mn): 0.6
Other:

Physical Properties
Specific Gravity: 2.84
Density: 0.104 lb/in³
Melting Temperature: 1100-1170 °F
Electrical Conductivity (% IACS): 37
Thermal Conductivity (at 25 °C, SI units): 0.37
Coeff. of Thermal Expansion (68-212 °F): 13.3/°F x 10⁶

Mechanical Properties
Modulus of Elasticity:
Tensile Strength (Ultimate): 32 ksi
Tensile Strength (Yield): 22 ksi
Shear Strength:
Endurance Limit:
Elongation (% in 2 inches): 3.0
Hardness (BHN): 60-90

Heat Treatment (Temper)
F - AS CAST
Cool naturally from mold in still air at room temperature.

Important Characteristics
The T5 temper imparts improved mechanical properties and dimensional stability. Mechanical properties are the same for both the F and T5 tempers.

Typical Applications
Automotive parts, trailer parts, pumps, mining equipment