C355.0 (5Si-1.3Cu-0.5Mg) Aluminum Alloy

- AMS. 4210, 4212, 4214, 4280, 4281
- Former ASTM. 355.0, SC51A; C355.0, SC51B
- SAE. 322
- UNS number. A03550, A33550
- Government. QQ-A-601, QQ-A-596, MIL-C-21180
- Foreign. ISO: CSA SC51, AC 4D, 3600, A-S4UG, EN AC-45300, Al-Si5Cu1Mg, LM 16
- Description: C355 is commonly heat treated. We typically always use C355.2 aluminum alloy. Aluminum sand casting alloy 355 uses copper to greatly improve its strength over the more common aluminum casting alloy A356. The 355 aluminum alloy is great for pressure tight applications and the alloy also maintains its strength at higher temperatures than A356. The trade off is typically C355.2 is more expensive than 355.1. Consequence of exceeding impurity limits. High iron decreases ductility. Nickel decreases resistance to corrosion. Tin reduces mechanical properties.

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Typical Properties & Characteristics of Aluminum Sand Castings

Typical Aluminum Alloys (a)					...	Resistance to Corrosion (b)		...	...	...	Typical Mechanical Properties					
AA	Former AA Designation	ASTM Spec. No.	Federal Spec. No.	SAE Alloy No.	Approx. Weight, lb./in.3	General	Stress Corrosion Cracking	Relative Machinability (c)	Castability (k)	Weldability (Arc) (d)	Ultimate Tensile Strength, ksi (i)	Yield Strength Tension, ksi (e) (i)	Elongation, Percentage in 2 in. (Round Specimen, 1/2" Dia.) (f) (i)	Shear Strength, ksi (g)	Fatigue Endurance Limit, ksi (h)	Brinell Hardness (500-kg Load, 10-mm Ball) (j)
355.0-T6	355	B26	...	322	0.098	3	A	3	1	2	35	25	3	28	9	80
355.0-T7	355	B26	QQ-A-601	...	0.098	3	A	3	1	2	38	36	0.5	38	10	85
C355.0-T6	C355	B26	...	...	0.098	3	A	3	1	2	38	28	5	28	10	90

Footnotes:

(a) For all Alcoa casting alloys, the following data apply: (a) Young's modulus of elasticity may be taken as 10,300,000 pounds per square inch (710 gram-pascals); (b) Modulus of rigidity may be taken as 3,800,000 pounds per square inch (262 gram-pascals); (c) Poisson's ratio is 33; (d) Bearing strength is equal to 1.8 times tensile strength, provided edge distance, in direction of stressing, is not less than twice the diameter of the hole.

(b) Relative ratings of general corrosion resistance 1 through 5 are in decreasing order of merit, based on exposures to sodium chloride solution intermittent spray or immersion. Relative ratings of resistance to stress corrosion cracking are based on service experience and on laboratory tests of specimens exposed to the 3.5 percent sodium chloride alternate immersion test.

A – No known instance of stress corrosion cracking in service when properly manufactured; B – Stress corrosion cracking not anticipated in service from residual stresses or from design and assembly stresses kept below about 45 percent of the minimum guaranteed yield strength given in applicable specifications; C – Stress corrosion failures have occurred in service with either the specific alloy and temper or with alloys and tempers of this type. Designers should be aware of the potential stress corrosion cracking problem that exists when using these alloys and tempers under adverse conditions.

(c) Composite rating based on ease of cutting, chip characteristics, quality of finish and tool life. 1 – indicates best; 5 – indicates not recommended

(d) Based on ability of alloy to be fusion welded prior to heat treatment with filler rod of same alloy. 1 – indicates best; 5 – indicates welding not recommended

(e) Yield strength is the stress at which the material exhibits a permanent set of 0.2 percent.

(f) For die casting alloys, 1/4 inch (6.35 mm) diameter.

(g) Shearing strengths are single-shear values obtained from double-shear tests.

(h) Fatigue endurance values are based on withstanding 500 million cycles of completely reversed stress using the R.R. Moore type of machine and specimen.

(i) Mechanical properties are obtained on separately cast ASTM specimens. Since minimum guaranteed values vary with the applicable specifications, they are not given on this table.

(j) From tests made approximately 30 days after casting.

(k) Castability is rated on a scale of 1 through 5, in which higher numbers indicate lower merit. For sand and permanent-mold alloys, the ratings take into account resistance to hot cracking, fluidity and feeding ability. For die castings, the resistance to hot cracking, fluidity, die soldering and cast surface finish are considered. Even the alloys with the lowest rating of 5 may be successfully used with the proper techniques to produce commercial castings.

Designations and nominal compositions of common aluminum alloys used for sand casting							
AA Number	Former AA designations	Former ASTM number	Cu	Mg	Mn	Si	Others
C355.0	C355	SG51B	1.20	0.50	0.10 (Max)	5.00	0.60 Fe (Max), 0.35 Zn (Max)

Characteristics of common aluminum alloys used in sand casting										
Alloy	Fluidity	Resistance to hot cracking	Pressure tightness	Heat Treatment	Strength at elevated temperatures	General corrosion resistance	Machining	Polishing	Anodizing Appearance	Weldability
C355.0	1	1	1	Yes	2	3	3	3	4	1

Alloy	Uses
C355.0	Air-compressor fittings, crankcase, gear housings, hydraulic fittings

Typical Tensile Properties for separately cast test bars of comon aluminum casting alloys									
Alloy	Temper	Tensile strength		Yield strength		Shear strength		Compressive yield strength		Elongation %
		Mpa	ksi	Mpa	ksi	Mpa	ksi	Mpa	ksi	
355.0	T6	240	35	175	25	195	28	180	26	3
355.0	T7	265	38	250	36	195	28	260	38	0.5

Other Aluminum Specs:

- 319

- A356
- 535
- 713

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