ASTM Specifications ASTM B-23

CHEMICAL COMPOSITION [1] (%)	TIN-BASE				LEAD-BASE			
	ALLOY NUMBER [2] (GRADE)							
	1	2	3	11	7	8	13	15
TIN	90.0 to 92.0	88.0 to 90.0	83.0 to 85.0	86.0 to 89.0	9.3 to 10.7	4.5 to 5.5	5.5 to 6.5	0.8 to 1.2
ANTIMONY	4.0 to 5.0	7.0 to 8.0	7.5 to 8.5	6.0 to 7.5	14.0 to 16.0	14.0 to 16.0	9.5 to 10.5	14.5 to 17.5
LEAD	0.35	0.35	0.35	0.50	remainder [3]	remainder [3]	remainder [3]	remainder [3]
COPPER	4.0 to 5.0	3.0 to 4.0	7.5 to 8.5	5.0 to 6.5	0.50	0.50	0.50	0.6
IRON	0.08	0.08	0.08	0.08	0.10	0.10	0.10	0.10
ARSENIC	0.10	0.10	0.10	0.10	0.30 to 0.60	0.30 to 0.60	0.25	0.8 to 1.4
BISMUTH	0.08	0.08	0.08	0.08	0.10	0.10	0.10	0.10
ZINC	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
ALUMINUM	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
CADMIUM	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TOTAL NAMED ELEMENTS, Min.	99.80	99.80	99.80	99.80				

1. All values not given as ranges are maximum unless shown otherwise.
2. Alloy Number 9 was discontinued in 1946 and numbers 4, 5, 6, 10, 11, 12, 16 and 19 were discontinued in 1959. A new number 11, similar to SAE Grade 11 was added in 1966.
3. To be determined by difference.

SAE J460e Specifications

Chemical Composition[a] (%)

	SAE No.	Tin, min.	Antimony	Lead	Copper	Iron	Arsenic	Bis-muth	Zinc	Alumi-num	Others, Total
Tin-Base Bearing	**11**	86.0	6.0-7.5	0.50	5.0-6.5	0.08	0.10	0.08	0.005	0.005	0.20
Bearing	**12[b]**	88.0	7.0-8.0	0.50	3.0-4.0	0.08	0.10	0.08	0.005	0.005	0.20
		Lead	**Tin**	**Antimony**	**Copper**	**Arsenic**	**Bis-muth**	**Zinc**	**Alumi-num**	**Cadmium**	**Others, Total**
Lead-Base Bearing	**13**	Remainder	5.0-7.0	9.0-11.0	0.50	0.25	0.10	0.005	0.005	0.05	0.20
Bearing	**14**	Remainder	9.2-10.7	14.0-16.0	0.50	0.6	0.10	0.005	0.005	0.05	0.20
Bearing	**15**	Remainder	0.9-1.3	14.0-15.5	0.50	0.8-1.2	0.10	0.005	0.005	0.02	0.20
Bearing	**16**	Remainder	3.5-4.7	3.0-4.0	0.10	0.05	0.10	0.005	0.005	0.005	0.40

a. All values not given as ranges are maximum except as shown otherwise.
b. Formerly SAE 110

QQ-T-390 Specifications

Chemical Composition (%)

Grade	Tin	Antimony	Lead	Copper	Iron, max.	Arsenic, max.	Zinc, max.	Alumi-num max.	Bis-muth max.	Other ele-ments max.
1	90.0-92.0	4.0-5.0	0.35[1]	4.0-5.0	0.08	0.10	0.005	0.005	0.08	0.10
2	88.0-90.0	7.0-8.0	0.35[1]	3.0-4.0	0.08	0.10	0.005	0.005	0.08	0.10
3	83.0-85.0	7.5-8.5	0.35[1]	7.5-8.5	0.08	0.10	0.005	0.005	0.08	0.10
4	80.5-82.5	12.0-14.0	0.25[1]	5.0-6.0	0.08	0.10	0.005	0.005	—	0.10
5	61.0-63.0	9.5-10.5	24.0-26.0	2.5-3.5	0.08	0.15	0.005	0.005	—	0.30
6	4.5-5.5	14.0-16.0	79.0-81.0	0.50[1]	0.10	0.20	0.005	0.005	—	0.50
7	9.3-10.7	14.0-16.0	74.0-76.0	0.50[1]	0.10	0.60	0.005	0.005	—	0.50
10	0.75-1.25	14.5-17.5[2]	78.0-83.0	0.60[1]	0.10	0.8-1.4	0.005	0.005	—	0.50
11	90-11.0	11.5-13.5	74.0-79.0	0.40-0.60	0.10	0.20	0.005	0.005	—	0.50
13	4.0-6.0	8.0-10.0	83.0-88.0	0.50[1]	0.10	0.20	0.005	0.005	—	0.75

1 Maximum.

2 A narrower range of antimony within the limits stated may be specified but the spread shall be not less than 1.00 per cent.

TABLE X1 Composition and Physical Properties[A] of White Metal Bearing Alloys

Alloy Number[B]	Specified Nominal Composition of Alloys, %					Specific Gravity[C]	Composition of Alloys Tested, %				Yield Point, psi[D] (MPa)	
	Tin	Antimony	Lead	Copper	Arsenic		Tin	Antimony	Lead	Copper	68°F (20°C)	212°F (100°C)
1	91.0	4.5		4.5		7.34	90.9	4.52	none	4.56	4400 (30.3)	2650 (18.3)
2	89.0	7.5		3.5		7.39	89.2	7.4	0.03	3.1	6100 (42.0)	3000 (20.6)
3	84.0	8.0		8.0		7.46	83.4	8.2	0.03	8.3	6600 (45.5)	3150 (21.7)
7	10.0	15.0	remainder		.45	9.73	10.0	14.5	75.0	0.11	3550 (24.5)	1600 (11.0)
8	5.0	15.0	remainder		.45	10.04	5.2	14.9	79.4	0.14	3400 (23.4)	1750 (12.1)
15	1.0	16.0	remainder		1.0	10.05						

Alloy Number[B]	Johnson's Apparent Elastic Limit, psi (MPa)[E]		Ultimate Strength in Compression[F]		Brinell Hardness[G]		Melting Point, °F (°C)	Temperature of Complete Liquefaction, °F (°C)	Proper Pouring Temperature, °F (°C)
	68°F (20°C)	212°F (100°C)	68°F (20°C)	212°F (100°C)	68°F (20°C)	212°F (100°C)			
1	2450 (16.9)	1050 (7.2)	12 850 (88.6)	6950 (47.9)	17.0	8.0	433 (223)	700 (371)	825 (441)
2	3350 (23.1)	1100 (7.6)	14 900 (102.7)	8700 (60.0)	24.5	12.0	466 (241)	669 (354)	795 (424)
3	5350 (36.9)	1300 (9.0)	17 600 (121.3)	9900 (68.3)	27.0	14.5	464 (240)	792 (422)	915 (491)
7	2500 (17.2)	1350 (9.3)	15 650 (107.9)	6150 (42.4)	22.5	10.5	464 (240)	514 (268)	640 (338)
8	2650 (18.3)	1200 (8.3)	15 600 (107.6)	6150 (42.4)	20.0	9.5	459 (237)	522 (272)	645 (341)
15					21.0	13.0	479 (248)	538 (281)	662 (350)

[A] The compression test specimens were cylinders 1.5 in. (38 mm) in length and 0.5 in. (13 mm) in diameter, machined from chill castings 2 in. (51 mm) in length and 0.75 in. (19 mm) in diameter. The Brinell tests were made on the bottom of parallel machined specimens cast in a mold 2 in. (51 mm) in diameter and 0.625 in. (16 mm) deep at room temperature.

[B] Data not available on Alloy Numbers 11 and 13.

[C] The specific gravity multiplied by 0.0361 equals the density in pounds per cubic inch.

[D] The values for yield point were taken from stress-strain curves at a deformation of 0.125 % of gage length.

[E] Johnson's apparent elastic limit is taken as the unit stress at the point where the slope of the tangent to the curve is ⅔ times its slope at the origin.

[F] The ultimate strength values were taken as the unit load necessary to produce a deformation of 25 % of the length of the specimen.

[G] These values are the average Brinell number of three impressions on each alloy using a 10-mm ball and a 500-kg load applied for 30 s.