

Table 25 Mechanical Properties of Commonly Used Lead Alloys

Lead or lead alloy ^a (ConG. in wt.%)	Tensile strength (MPa)	Elongation (%)	Hardness ^b	Compression strength (25%) (MPa)	Yield strength (MPa)	Fatigue strength (MPa)	Creep strength (0.2%/year) (MPa)	Young's modulus (10 GPa)	Ref.
Pure lead [c]	13.1	45	*4.0	15.2	5.9	2.7°			167, 168
Pb 99.985	18.4	33	@28.5						169
Pb 99.95	18.2	35	@28.5		3.1				169
DSL	41.4	18.5	*13.5	44.8	40.0			2.0-2.2	170
Corroding [e]									167
Refined [r]	12.1	53	*3.8			3.2	1.2	2.0	167
Chemical [c]	17.9	45	*5.2	20.0	11.3				167
Chemical [r]	19.3	47	*5.5			6.9			167
Undersilverized [e]	17.2	50							167
Undersilverized [r]	16.5	51	*4.7	17.9	8.6	5.0	15.8	2.5	167
0.47 Ag + 0.18 Ca [e]	41.1	40							171
0.47 Ag + 0.18 Ca [a]	43.8	38							171
0.15 As + 0.1 Sn + 0.1 Bi						10.0°			171
0.77 Ba + 0.30 Ca [e]	51.2	38			17.7		1 hr at 20.7 MPa		168
0.77 Ba + 0.30 Ca [a]	58.5	32					30 h at		171
0.88 Ba + 0.94 Ca [e]	61.1	44					20.7 MPa		171
0.88 Ba + 0.94 Ca [a]	55.5	40					50 h at		171
0.1 Bi	21.6	45							171
0.2 Bi	20.6	33							169
0.025 Ca	25.1				31.8		20.7 MPa		172
0.050 Ca	37.2				29.0				172
0.065 Ca	42.5								172
0.075 Ca	46.4				35.3		40 h at 20.7 MPa		172
0.090 Ca	47.0				32.9		20 h at 20.7 MPa		172
0.100 Ca	47.5				32.5		100 h at 13.8 MPa		172
0.110 Ca	46.3						10 h at 20.7 MPa		172
0.120 Ca	43.2				30.5		40 h at 13.8 MPa		172
0.140 Ca	39.2				27.6		7 h at 20.7 MPa		172
0.025 Ca + 0.5 Sn	40.0	30			24.7		5 h at 20.7 MPa		172
0.025 Ca + 1.0 Sn	57.9	20			31.1		2 h at 20.7 MPa		172
0.025 Ca + 1.5 Sn	58.6	20			47.5		20.7 MPa		173
0.025 Ca + 2.5 Sn	51.7	20			50.2		27.6 MPa		173
0.050 Ca + 0.5 Sn	55.2	30			41.8		30 h at 27.6 MPa		173
0.050 Ca + 1.0 Sn	61.4	25			45.3		10 h at 27.6 MPa		173
0.050 Ca + 1.5 Sn	63.8	15			52.8		10 h at 27.6 MPa		173
					57.4		150 h at 27.6 MPa		173
							300 h at 27.6 MPa		173

Table 25 Continued

Lead or lead alloy ^a (ConG. in wt.%)	Tensile strength (MPa)	Elongation (%)	Compression			Creep strength (0.2%/year) (MPa)	Young's modulus (10 GPa)	Ref.
			Hardness ^b	Yield strength (MPa)	Fatigue strength (MPa)			
0.065 Ca + 0.5 Sn	48.2			40.0		200 h at 20.7 MPa		172
0.065 Ca + 1.5 Sn	58.6			49.4		750 h at 20.7 MPa		172
0.070 Ca + 0.5 Sn	62.1	30		45.0		20 h at 27.6 MPa		173
0.070 Ca + 1.0 Sn	68.9	15		64.0		400 h at 27.6 MPa		173
0.070 Ca + 1.5 Sn	71.0	14		65.3		1,000 h at 27.6 MPa		173
0.070 Ca + 2.0 Sn	74.4	12		68.9		8,000 h at 20.7 MPa		173
0.070 Ca + 2.0 Sn + 0.050 Ag	80.0	10		76.8		>20,000 h at 13.8 MPa		173
0.075 Ca + 0.5 Sn	50.3			40.2		>20,000 h at 27.6 MPa		172
0.075 Ca + 1.5 Sn	60.1			49.2		300 h at 20.7 MPa		172
0.080 Ca + 0.5 Sn	41.4	35				1,000 h at 20.7 MPa		172
0.080 Ca + 1.0 Sn	58.7	25		29.6		2,000 h at 13.8 MPa		173
				52.8		8 h at 27.6 MPa		173
						250 h at 27.6 MPa		
0.080 Ca + 1.5 Sn								
0.080 Ca + 2.0 Sn								
0.090 Ca + 0.5 Sn								
0.090 Ca + 1.5 Sn								
0.100 Ca + 0.5 Sn								
0.100 Ca + 1.5 Sn								
0.120 Ca + 0.5 Sn								
0.120 Ca + 1.5 Sn								
0.140 Ca + 0.5 Sn								
0.140 Ca + 1.5 Sn								
0.33 Ca + 0.32 Ba [e]								
0.33 Ca + 0.32 Ba [a]								
0.08 Ca + 0.2 Ag + 0.5 Sn								
1.77 Cd + 0.45 Ba [e]								
1.77 Cd + 0.45 Ba [a]								
0.06 Cu								
0.04 Cu + 0.03 Te								

Table 25 Continued

Lead or lead alloy ^a (ConG. in wt.%)	Tensile strength (MPa)	Elongation (%)	Hardness ^b	Compression strength (25%) (MPa)	Yield strength (MPa)	Fatigue strength (MPa)	Creep strength (0.2%/year) (MPa)	Young's modulus (10 GPa)	Ref.
0.64 Li [o]	20.8	56							175
0.65 Li [1]	37.8	39							175
0.65 Li [2]	52.8	22							175
0.66 Li [7]		26.6							175
0.66 Li [o]	24.5	55							175
0.67 Li [3]		1.8							175
0.67 Li [1]	43.5	22							175
0.67 Li [2]	44.8	16							175
0.68 Li [e]	37.8	99							171
0.68 Li [a]	38.4	67							171
0.68 Li [5]		10							175
0.68 Li [2]	47.4	14							175
0.70 Li [2]	47.3	11							175
0.71 Li [6]		30.3							171
0.71 Li [2]	54.4	29							175
0.72 Li [2]	49.9	23							175
1.15 Na [e]	54.5	36							171
1.15 Na [a]	53.6	36							168
0.9 PbO [eo]	29.8								168
1.4 PbO [eo]	32.8								168
1.9 PbO [eo]	35.4								168
3.7 PbO [eo]	40.5								168
0.9 PbO [e1]	25.6								168
1.9 PbO [e1]	28.3								168
2.2 PbO [e1]	30.1								168
3.9 PbO [e1]	34.3								168

0.9 PbO [e2]	19.9								168
2.1 PbO [e2]	21.0								168
2.6 PbO [e2]	21.9								168
5.3 PbO [e2]	26.3								168
0.9 PbO [ero]	29.4								168
1.4 PbO [ero]	31.9								168
1.9 PbO [ero]	35.3								168
3.7 PbO [ero]	40.9								168
0.9 PbO [er1]	28.9								168
1.9 PbO [er1]	33.6								168
2.2 PbO [er1]	30.6								168
3.9 PbO [er1]	37.1								168
0.9 PbO [er2]	26.3								168
2.1 PbO [er2]	27.2								168
2.6 PbO [er2]	29.4								168
5.3 PbO [er2]	34.6								168
0.13 Sb + 0.04 Cu	21.2	44	@40.2		5.2				168, 174
0.2 Sb + 0.015 As						8.1°			168
0.2 Sb + 0.4 Sn						6.3°			168
0.23 Sb + 0.03 Cu + 0.4 Sn	23.7	53	@40.2		5.5				169
0.4 Sb + 0.03 As						9.8°			168, 174
0.40 Sb + 0.05 Cu + 0.04 Te	27.1	40	@71.6		7.9				169
0.45 Sb									168
0.5 Sb	23.6	48	@41.2			7.2°			169
0.5 Sb + 0.15 As	26.5	43							169
0.5 Sb + 0.25 Cd						11.4			168
0.5 Sb + 0.04 Cu + 0.25 Cd	26.6	43	@63.8		8.3				169

Table 25 Continued

Lead or lead alloy ^a (ConG. in wt.%)	Tensile strength (MPa)	Elongation (%)	Hardness ^b	Compression strength (25%) (MPa)	Yield strength (MPa)	Fatigue strength (MPa)	Creep strength (0.2%/year) (MPa)	Young's modulus (10 GPa)	Ref.
0.5 Sb + 0.05 Te	26.5	42							169
0.5 Sb + 0.05 Se	24.5	48							169
0.5 Sb + 0.1 Se	24.5	45							169
0.58 Sb + 0.06 Cu	24.5	43	@41.2		6.6				169
0.59 Sb + 0.04 Cu	24.1	44	@42.2		5.9				169
0.6 Sb	19.3	35	#10.0				2.8	2.4–3.6	170
0.78 Sb + 0.03 Cu	24.7	46	@51.0		6.8				169
0.8 Sb	25.2	44	@52.0						169
0.08 Sb + 0.5 Sn	21.6	47							169
0.08 Sb + 0.5 Sn	22.6	47							169
+ 0.06 Cu									169
0.84 Sb + 0.05 Cu	25.4	46	@49.1		7.4				169
0.9 Sb + 0.06 Cu						9.2°			168
1 Sb [c]	37.9	20			19.3	7.6 ^d	3 h at		173
							27.6 MPa		
2 Sb [c]	46.9	15			37.9		190 h at		173
							27.6 MPa		
2.9 Sb + 2.9 Sn [e]	39.6	43							171
2.9 Sb + 2.9 Sn [a]	27.0	59							171
3 Sb [c]	65.5	10			55.2		630 h at		173
							27.6 MPa		
3 Sb [r]	24.6	40			16.3				173
4 Sb [c]	37.2	25	#10.0	49.6	18.6	14.5	1.6	3.0	167
5 Sb [c]	42.1	23	#10.8	55.2	19.3	15.9	1.6	3.3	167
6 Sb [c]	45.5	22	#11.6	59.3	20.7	17.2	1.7	3.5	167
6 Sb [e]		31.0	41						167
									167
6 Sb [r]	29.6	42	#8.7		15.2	10.3			167
10 Sb [c]	51.0	16	#13.8	67.6	22.1	18.6	1,200 h at	4.0	167
11 Sb [c]	75.9	5			74.4		27.6 MPa		173
							8,000 h at		
							20.7 MPa		
11 Sb [r]	23.8	35			23.8		4.5 h at		173
							20.7 MPa		
0.0225 Sn [e]									174
0.05 Sn + 0.03 As [e]									174
0.055 Sn									174
0.1 Sn + 0.03 As [e]									174
0.1 Sn + 0.1 Bi	27.5	40				7.2			169
+ 0.15 As									
0.2 Sn + 0.03 As [e]									174
0.2 Sn + 0.07 Cd						7.6			168
0.2 Sn + 0.075 Cd						6.5°			174
+ 0.03 As						7.7			
0.4 Sn + 0.2 Sb	18.6–20.1	32–49				8.7			173,
(Alloy E Shealth)									174
0.5 Sn	19.6	39							169
0.89 Sn + 0.88 Ba [e]	71.15	31							171
0.89 Sn + 0.88 Ba [a]	68.33	23							171
0.93 Sn + 0.07 Ca [e]	42.5	36							171
0.93 Sn + 0.07 Ca [a]	56.3	46							171
0.0975 Sn									69
1.72 Sn + 0.35 Ba [e]	61.2	47							171
1.72 Sn + 0.35 Ba [a]	30.5	46							171
1.75 Sn + 0.21 Ca	60.0	46							171
+ 0.20 Ba [e]									
1.75 Sn + 0.21 Ca	62.3	42							171