

DATA SHEET

Lead

general properties

Color Bluish gray
 Patina On atmospheric exposure lead takes on a silvery gray patina except in industrial atmosphere where it changes to dark gray to black
 Atomic number 82
 Atomic arrangement Cubic face-centered
 Length of lattice edge 4.9398 Å
 Atomic weight 207.21

weight and density

weight
 Cast lead, 20°C., calculated 0.4092 lb. per cu. in.
 equivalent to 707 lb. per cu. ft.
 Rolled, 20°C. (density 11.37) calculated 0.4103 lb. per cu. in.
 equivalent to 709 lb. per cu. ft.
 Liquid, 327.4°C., calculated 0.3854 lb. per cu. in.
 equivalent to 666 lb. per cu. ft.
 Sheet lead, 1 ft. square by 1/64 in. thick approximately 1 lb.
 Volume of 1 lb. cast lead, 20°C., calculated 2.44 cu. in.

density

Cast lead, 20°C 11.34 g. per c.c.
 Rolled, 20°C 11.35 to 11.37 g. per c.c.
 Just solid, 327.4°C 11.005 g. per c.c.
 Just liquid, 327.4°C 10.686 g. per c.c.
 Density, vapor (Hydrogen 1), calculated 103.6

thermal properties

Melting point, common lead 327.4°C. (621°F.)
 Melting point, chemical lead 325.6°C. (618°F.)
 Elevation of melting point for each
 150 atm. increase in pressure 1°C. (2.16°F.)
 Casting temperature 790 to 830°F.

boiling point at different pressures

Pressure, in atmospheres	0.14	0.35	1.0	6.3	11.7
Boiling point, °C.	1325	1410	1525	1873	2100
Boiling point, °F.	2417	2570	2777	3403	3812

vapor pressure

Temperature, °C.	808	1000	1200	1365	1525	1870	2100
Pressure, mm. Hg.	0.08	1.77	23.29	166.	760.	6.3 atm.	11.7 atm.

specific heat (cal. per g.)

Temp °C	specific heat
-150	0.02805
-100	0.02880
-50	0.0298
0	0.0303
50	0.0309
100	0.0315
200	0.0325
300	0.0338
327.4 (solid)	0.0340
327.4 (liquid)	0.0333
378	0.0338
418	0.0335
459	0.0335

thermal conductivity (cal./cm²/°C./sec.)

Temp °C	specific heat
-247.1	0.117
-160	0.092
0	0.083
100	0.081
200	0.077
300	0.074
400	0.038
500	0.037
600	0.036

Latent heat of fusion 6.26 cal. per g. or 11.27 B.T.U. per lb.
 To melt 1 lb. of lead heating from 20°C requires 7100 g. cal. or 28.2 B.T.U.
 Latent heat of vaporization 202 cal. per g.
 Relative thermal conductivity (silver 100) 8.2

coefficient of expansion

Linear (-190 to 19°C. mean) 0.0000265 per °C.
 Linear (17 to 100°C. mean) 0.0000293 per °C.
 or 0.0000163 per °F.
 Cubical (liquid at melting point to 357°C.) 0.000129 per °C.
 Increase in volume from 20°C. to liquid at melting point 6.1%
 Decrease in volume from liquid at melting point to 20°C. calculated 5.8%
 Increase in volume on melting 4.01%
 Decrease in volume on solidification 3.85%
 Shrinkage on casting taken in practice as 7/64 to 5/16 in. per ft.

low temperature properties

temperature °F.	tensile strength psi	elongation percent	Brinell	impact
cast lead				
room	3000	33	4.3	2.3
-300	6200	40	9.0	3.8
rolled lead				
59	3600	52
-4	7200	40
-40	13300	31
-103	15200	24

electrical properties

Specific electrical conductance
 at 0°C. 5.05 x 10⁴ cm.⁻¹ ohms⁻¹
 18°C 4.83
 melting point 1.06
 Atomic electrical conductance, calculated 1.139 x 16⁶
 Relative electrical conductance (copper 100) 7.82
 Relative electrical resistance (copper 100) 1280
 Magnetic susceptibility per g.
 18-330°C. -0.12 x 10⁶
 300-600°C. -0.08 x 10⁶
 Electrolytic solution pressure
 ions of Pb+ + 6.3 x 10⁻⁵ atm.
 ions of Pb+ + + 3.0 x 10⁻⁷ atm.

mechanical properties

Hardness, Moh's scale 1.5
 Brinell no., 1 cm. ball, 30 sec., 100 kg. load
 Common lead 3.2 to 4.5
 Chemical lead 4.5 to 6.0
 Influence of temperature on Brinell hardness (chemical lead)
 Temperature °C. 25 100 150
 Hardness 5.3 3.6 2.6
 Ultimate tensile strength
 Common lead 1400 to 1700 lb. per sq. in.
 Chemical lead 2300 to 2800 lb. per sq. in.

Effect of temperature on tensile properties (lead annealed at 100°C.)

Temperature		Tensile strength psi	Elongation percent	Reduction in area percent
°C	°F			
20	68	1920	31	100
82	180	1140	24	100
150	302	710	33	100
195	383	570	20	100
265	509	280	20	100

tensile strength and elongation

(laboratory rolled specimens, room temperature, pulling speed 1/4 in. per min. per in. of test section)

grade of lead	tensile strength psi	elongation percent
common (99.85 + 0.13 Bi)	1931	34.4
corroding (99.99 + 0.006 Bi)	1904	37.7
common (99.98 + no Bi)	2093	43.0
chemical (99.92 + 0.06 Cu)	2961	42.2
chemical (commercial sheet)	2454	47.0
chemical (extruded)	2200	48.0

creep (room temperature)

stress lb. per sq. in.	creep, percent per hour	
	common lead	chemical or copper lead
200	5 x 10 ⁻⁵	0.4 x 10 ⁻⁵
300	3.5 x 10 ⁻⁴	1.5 x 10 ⁻⁵
400	11 x 10 ⁻⁴	3 x 10 ⁻⁵

resistance to bending

(extruded strips under 200 lbs. per sq. in. stress subjected to alternate 90° reverse bends over 5-in. rolls, 11 cycles per min)

grade of lead	cycles to failure	elongation percent
common	72	49
chemical	103	52
corroding	54	35

fatigue

Fatigue limit (50,000,000 cycles extruded..... 215 lb. per sq. in.)

metal	endurance limit at 5 x 10 ⁷ cycles, lb. per sq. in.	endurance limit at 10 ⁷ cycles lb. per sq. in.
lead	215-400	407
lead + 0.026% calcium		1038
lead + 0.06% copper	600	725
lead + { 0.045% tellurium 0.06% copper		1000

Lead Joints

Approximate Weight
of Lead per Joint
2 in. Deep
Pounds

Size of Pipe	Approximate Weight of Lead per Joint 2 in. Deep Pounds
3	6.00
4	7.50
6	10.25
8	13.25
10	16.00
12	19.00
14	22.00
16	30.00
18	33.80
20	37.00
24	44.00
30	54.25
36	64.75
42	75.25
48	85.50
54	97.60
60	108.30
72	146.00
84	170.00

**ASTM B29 - 79 (REAPPROVED 1984)
STANDARD SPECIFICATION FOR PIG LEAD**

TABLE 1 Chemical Requirements^A

Type	Composition, weight %			
	Corroding Lead ^B	Common Lead ^B	Chemical Lead ^B	Copper-Bearing Lead ^B
Element				
Silver, max	0.0015	0.005	0.020	0.020
Silver, min	---	---	0.002	---
Copper, max	0.0015	0.0015	0.080	0.080
Copper, min	---	---	0.040	0.040
Silver and copper together, max	0.0025	---	---	---
Arsenic, antimony, and tin together, max	0.002	0.002	0.002	0.002
Zinc, max	0.001	0.001	0.001	0.001
Iron, max	0.002	0.002	0.002	0.002
Bismuth, max	0.050	0.050 ^C	0.005	0.025
Lead (by difference), min	99.94	99.94	99.90	99.90

^A The following applies to all specified limits in this table: For the purpose of determining conformance with this specification, an observed value obtained from analysis shall be rounded off "to the nearest unit" in the last right hand place of figures used in expressing the limiting value, in accordance with the rounding method of Practice E 29.

^B By agreement between the purchaser and the supplier, analyses may be required and limits established for elements or compounds not specified in Table 1.

^C By agreement between the purchaser and the supplier, bismuth levels of up to 0.150% may be allowed.

GRADES OF VIRGIN LEAD

Typical Chemical Analysis	Doe Run Copper Bearing	Doe Run Corroding
Silver %	0.0004	0.0004
Copper %	0.06	0.0001
Bismuth %	0.02	0.005
Zinc %	0.0001	0.0001
Iron %	0.0001	0.0001
Arsenic-Antimony-Tin Combined	0.0002	0.0001
Cadmium %	0.0002	0.0002
Cobalt and Nickel %	0.0046	0.0001
Lead by difference %	99.90+	99.99+

LEAD SHOT SIZES

NUMBER	DUST	12	11	10	9	8½	8	7½	7	6	5	4	2	AIR RIFLE
DIAM. IN INCHES		.04	.05	.06	.07	.085	.09	.095	.10	.11	.12	.13	.15	.175
APPROX. PELLETS IN 1 OZ.		4565	2385	1380	870	585	500	410	350	290	225	170	135	90

BUCK SHOT SIZES

4	3	1	0	00
DIAM. IN INCHES	.24	.25	.30	.32
APPROX. PELLETS IN 1 OZ.	340	300	175	145

**LEAD SHEET
Wt. vs Thickness**

Approx. Lb. Per Sq. Ft.	Thickness, In.	Approx. Lb. Per Sq. Ft.	Thickness, In.
3/4	1/80	8	1/8
1	1/64	10	5/32
1 1/2	3/128	12	3/16
2	1/32	14	7/32
2 1/2	5/128	16	1/4
3	3/64	20	1/3
3 1/2	7/128	24	2/5
4	1/16	30	1/2
5	5/64	40	3/3
6	3/32	60	1