

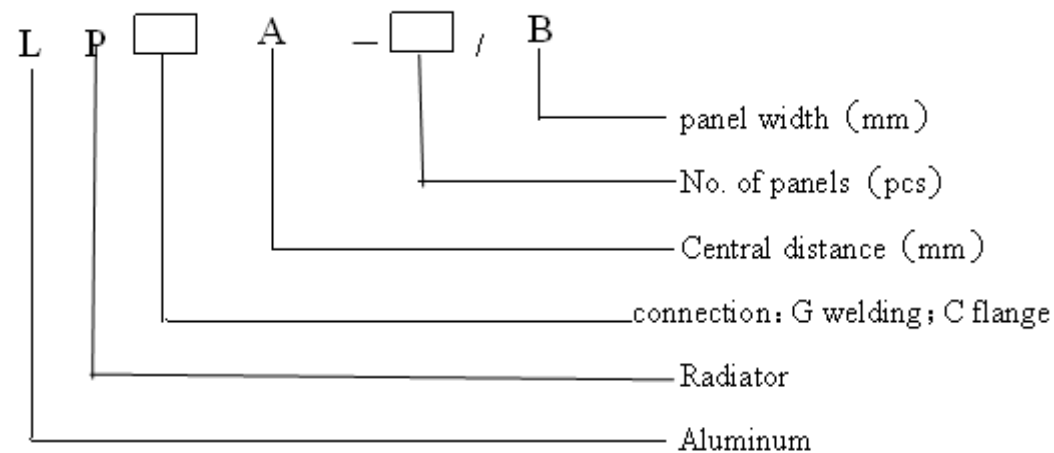
Introduction of Aluminum radiator for transformers



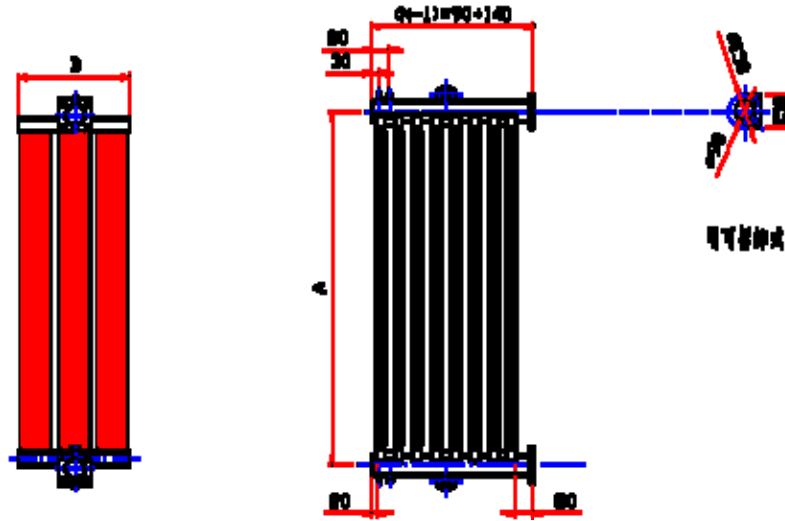
Product properties

- 1) The thermal conductivity of carbon steel is 80w/mk. But AL alloy is 237w/mk. Al radiators absolutely perform much better thermal conduction than ordinary steel radiators.
- 2) The panel structures of Al radiators are designed against the thermodynamic principles to achieve the best effects effects not only on heat conduction, but convection and radiations.
- 3) The weight of Al radiators is only 20-30% of steel radiators and size of Al radiators is also much smaller than steel radiators.
- 4) The anti-corrosion properties of Al radiators are much better than steel radiators.

Models Instructions



Composition of Al Radiators



Panel and elements: Each panel of Al radiator is composed by 2-3 elements. The width of single element is 140mm. For example, 520mm panel is composed with 3 elements, and 320mm panel is composed with 2 elements.

Material of Elements, pipe and flange: AL6030

Finish:

Internal: Refined polyurethane insulation vanish, color in white or brick red

External: Painted or galvanized. Refined polyurethane or epoxy paint, color customized.

Leakage test: 100% radiators tested under air pressure not exceed of 0.123Mpa.

Package: Strong steel pallets for sea shipments.

Testing:

All radiators are pressure tested individually in water under air pressure 120KPa for 20 min.

The radiators are leak proof against transformer oil at 105 C pressure being 1.0 kg/cm².

Mounting:

Before mounting, remove the caps and tight the oil discharging valve.

The distance between radiator groups should keep more than 50mm.

To keep a suitable distance from lower tube to the earth for smoothing air flow.

For the mounting of type PG, drill holes on the oil tank according to the diameter and the center of the tubes and weld them together.

To mounting of type PC.

1)Select the suitable flange on oil tank with reference of selected center distance. Group distance and the size of flange on radiators.

2)Select the suitable rubber seals,bolts and washer with reference of the center hole of flange and the size of bolts.

3)Choose connection punits,nuts, bolts and washer according to the distance of groups and dimensions

4)Connect and fasten the radiators to tank's flanges(or valves), and connect the neighbouring groups with connective units

Important Notes:

If air tightness testing needed before installation. The testing pressure(inside)should not exceed 0.12Mpa.

If tightness testing need for elastic type of radiator. Then the position limiting need to be made. When charging the transformer oil. Semivacuum or full vacuum needed.

Always be careful during installation to prevent from knocking.,Squeezing, pushing and falling down.

When mounting, connect the radiator to transformer first and leave the bolts loosening. Adjust the distance radiators then fasten the connection bolts and fasten bolts of radiator flange at last.

Al radiator with 520mm

center distance(mm)		500			600					700				
No.of Panels		4. 00	5. 00	6. 00	2. 00	3. 00	4. 00	5. 00	6. 00	2. 00	3. 00	4. 00	5. 00	6. 00
cooling surface	Selfcooling m ²	2. 05	2. 56	3. 07	1. 32	1. 94	2. 63	3. 29	3. 95	1. 61	2. 41	3. 21	4. 02	4. 82
Available m ²	Aircooling m ²	2. 66	3. 33	3. 99	1. 71	2. 56	3. 42	4. 27	5. 13	2. 09	3. 13	4. 18	5. 22	6. 27
Weight/R Empty(kg)		19. 69	24. 61	29. 53	11. 16	16. 74	22. 32	27. 90	33. 47	12. 47	18. 71	24. 95	31. 19	37. 42
Oil Weight/Radiator(kg)		4. 92	6. 16	7. 39	3. 17	4. 75	6. 33	7. 92	9. 50	3. 87	5. 81	7. 74	9. 68	11. 61
Geometric Surface(m ²)		4. 09	5. 12	6. 14	2. 63	3. 95	5. 26	6. 58	7. 89	3. 21	4. 82	6. 43	8. 04	9. 64
Dissipation (W)		818	1023	1228	526	789	1052	1315	1578	625	964	1286	1607	1928

center distance(mm)		800				900					1000			
No.of Panels		2.00	3.00	4.00	5.00	2.00	3.00	4.00	5.00	6.00	4.00	5.00	6.00	7.00
cooling surface	Selfcooling m ²	1.90	2.85	3.80	4.75	2.19	3.68	4.91	6.14	7.37	4.97	6.21	7.45	8.69
Available m ²	Aircooling m ²	2.47	3.70	4.94	6.17	2.85	4.27	5.70	7.12	8.55	6.46	8.04	9.69	11.30
Weight/R Empty(kg)		13.79	20.68	27.58	34.47	15.10	22.66	30.21	37.76	45.31	32.84	41.05	49.26	57.47
Oil Weight/Radiator(kg)		4.57	6.86	9.14	11.43	5.28	7.91	10.55	13.19	15.83	11.96	14.95	17.94	20.93
Geometric Surface(m ²)		3.80	5.70	7.60	9.50	4.38	6.58	8.77	10.96	13.15	9.94	12.42	14.90	17.39
Dissipation (W)		760	1139	1519	1899	877	1315	1754	2192	2630	1987	2484	2981	3478

center distance(mm)		1200				1400					1600			
No.of Panels		5	6	7	8	4	5	6	7	8	4	5	6	7
cooling surface	Selfcooling m ²	7.67	9.20	10.74	12.27	7.31	9.13	10.96	12.79	14.61	8.48	10.59	12.71	14.83
Available m ²	Aircooling m ²	9.97	11.97	13.96	15.95	9.50	11.87	14.27	16.62	19.00	11.02	13.77	16.52	19.28
Weight/R Empty(kg)		47.63	57.15	66.68	76.20	43.36	54.20	65.04	75.88	86.72	48.62	60.78	72.93	85.09
Oil Weight/Radiator(kg)		18.47	22.16	25.85	29.54	17.59	21.99	26.38	30.78	35.18	20.40	25.50	30.60	35.70
Geometric Surface(m ²)		15.34	18.41	21.48	24.54	14.61	18.27	21.92	25.57	29.22	16.95	21.19	25.42	29.66
Dissipation (W)		3068	3682	4295	4909	2922	3653	4384	5114	5845	3390	4237	5084	5932

center distance(mm)		1600	1800				2000				2200			
No.of Panels		8.00	6	7	8	9	10	7	8	9	10	11	6	7
cooling surface	Selfcooling m ²	16.95	14.46	16.88	19.28	21.70	24.11	18.92	21.60	24.33	27.03	29.73	17.97	20.97
Available m ²	Aircooling m ²	22.03	18.80	21.94	25.07	28.20	31.34	24.58	28.11	31.63	35.14	38.65	23.36	27.26
Weight/R Empty(kg)		97.24	80.82	94.29	107.76	121.23	134.70	103.50	118.29	133.07	147.86	162.65	96.61	112.71
Oil Weight/Radiator(kg)		40.80	34.84	40.63	46.43	52.24	58.04	45.55	52.06	58.56	65.07	71.58	43.27	50.48
Geometric Surface(m ²)		33.90	28.93	33.75	38.57	43.39	48.21	37.84	43.25	48.65	54.06	59.47	35.94	41.93
Dissipation (W)		6779	5785	6749	7714	8678	9642	7568	8650	9731	10812	11893	7188	8386

center distance(mm)		2200					2400					2600		
No.of Panels		8	9	10	11	12	8	9	10	11	12	8	9	10
cooling surface	Selfcooling m ²	23. 96	26. 96	29. 950	32. 945	35. 940	26. 30	29. 59	32. 88	36. 16	39. 45	28. 64	32. 22	35. 80
Available m ²	Aircooling m ²	31. 15	35. 04	38. 935	42. 892	46. 722	34. 19	38. 46	42. 74	47. 01	51. 29	37. 23	41. 88	46. 53
Weight/R Empty(kg)		128. 81	144. 91	161. 01	177. 11	193. 21	139. 33	156. 74	174. 16	191. 58	208. 99	139. 33	156. 74	174. 16
Oil Weight/Radiator(kg)		57. 69	64. 90	72. 110	79. 321	86. 530	63. 31	71. 23	79. 14	87. 05	94. 97	68. 94	77. 56	86. 18
Geometric Surface(m ²)		47. 92	53. 91	59. 900	65. 890	71. 880	52. 60	59. 18	65. 75	72. 33	78. 90	57. 27	64. 43	71. 59
Dissipation (W)		9584	10782	11980	13178	14376	10520	11835	13150	14465	15780	11454	12886	14318

center distance(mm)		2600			2800						3000			
No.of Panels		11	12	13	8	9	10	11	12	13	8	9	10	11
cooling surface	Selfcooling m²	39. 38	42. 95	46. 53	30. 97	34. 84	38. 72	42. 587	46. 458	50. 330	33. 31	37. 48	41. 64	45. 80
Available m²	Aircooling m²	51. 19	55. 84	60. 49	40. 26	45. 30	50. 33	55. 362	60. 395	65. 428	43. 31	48. 72	54. 13	59. 55
Weight/R Empty(kg)		191. 58	208. 99	226. 41	160. 37	180. 41	200. 46	220. 51	240. 55	260. 60	170. 90	192. 26	213. 62	234. 98
Oil Weight/Radiator(kg)		94. 80	103. 42	112. 03	74. 57	83. 90	93. 21	102. 53	111. 85	121. 17	80. 82	90. 23	100. 25	110. 28
Geometric Surface(m²)		78. 75	85. 91	93. 07	61. 94	69. 69	77. 43	85. 17	92. 92	100. 66	66. 62	74. 95	83. 28	91. 61
Dissipation (W)		15750	17182	18613	12389	13937	15486	17035	18583	20132	13325	14990	16656	18322

center distance(mm)		3000	3200						3400					
No.of Panels		12	8	9	10	11	12	13	8	9	10	11	12	13
cooling surface	Selfcooling m²	49. 97	35. 65	40. 10	44. 56	49. 02	53. 47	57. 93	37. 99	42. 74	47. 79	52. 234	56. 982	61. 731
Available m²	Aircooling m²	64. 96	46. 34	52. 14	57. 93	63. 72	69. 51	75. 31	49. 38	55. 56	61. 73	67. 904	74. 077	80. 250
Weight/R Empty(kg)		256. 34	181. 42	204. 09	226. 77	249. 45	272. 12	294. 80	191. 94	215. 93	139. 92	263. 91	287. 90	311. 90
Oil Weight/Radiator(kg)		120. 30	85. 82	96. 55	107. 28	118. 01	128. 74	139. 46	91. 46	102. 89	114. 32	125. 75	137. 18	148. 62
Geometric Surface(m²)		99. 94	71. 30	80. 21	89. 12	98. 03	106. 94	115. 86	75. 98	85. 47	94. 97	104. 47	113. 96	123. 46
Dissipation (W)		19987	14259	16042	17824	19606	21389	13171	15195	17095	18994	20893	22793	24692

center distance(mm)		3600					3800					
No.of Panels		11	12	13	14	15	9	10	11	12	13	14
cooling surface	Selfcooling m²	55. 45	65. 53	65. 53	70. 57	75. 61	47. 99	58. 33	58. 66	63. 99	69. 32	74. 66
Available m²	Aircooling m²	72. 08	85. 18	85. 18	91. 73	98. 29	62. 39	69. 33	76. 26	83. 19	90. 12	97. 05
Weight/R Empty(kg)		278. 38	328. 99	328. 99	354. 30	376. 61	239. 60	266. 22	292. 84	319. 46	346. 09	372. 71
Oil Weight/Radiator(kg)		133. 49	157. 76	157. 76	169. 89	182. 03	115. 55	128. 39	141. 23	154. 07	166. 91	179. 75
Geometric Surface(m²)		110. 89	131. 05	131. 05	141. 13	151. 22	95. 99	106. 65	117. 32	127. 98	138. 65	149. 31
Dissipation (W)		26697	31551	31551	33978	36405	23110	25678	28246	30814	33381	35949

center distance(mm)		4000					
No.of Panels		12	13	14	15	16	17
cooling surface	Selfcooling m²	67. 50	73. 13	78. 75	84. 375	90. 000	95. 625
Available m²	Aircooling m²	87. 75	95. 06	102. 38	109. 69	117. 00	124. 31
Weight/R Empty(kg)		335. 26	363. 19	391. 13	419. 07	447. 01	474. 95
Oil Weight/Radiator(kg)		162. 50	176. 05	189. 59	203. 13	216. 67	230. 21
Geometric Surface(m²)		135. 00	146. 25	157. 50	168. 75	180. 00	191. 25
Dissipation (W)		32501	35209	37918	40626	43334	46043

Al radiator with 330mm

center distance(mm)		500			625			750			875			
No.of Panels		2	3	4	2	3	4	2	3	4	2	3	4	5
cooling surface	Selfcooling m²	1. 023	1. 535	2. 046	0. 925	1. 388	1. 850	1. 169	1. 754	2. 338	1. 412	2. 118	2. 824	3. 530
Available m²	Aircooling m²	1. 330	1. 995	2. 660	1. 203	1. 804	2. 405	1. 520	2. 280	3. 039	1. 836	2. 753	3. 671	4. 589
Weight/R Empty(kg)		9. 844	14. 766	19. 688	11. 158	16. 737	22. 316	8. 486	12. 729	16. 972	9. 582	14. 373	19. 164	23. 955
Oil Weight/Radiator(kg)		2. 462	3. 693	4. 924	3. 166	4. 749	6. 332	2. 814	4. 221	5. 628	3. 400	5. 100	6. 800	8. 500
Geometric Surface(m²)		1. 364	2. 046	2. 782	1. 850	2. 775	3. 700	2. 338	3. 507	4. 676	2. 824	4. 236	5. 648	7. 060
Dissipation (W)		272. 8	409. 2	545. 6	370. 0	555. 0	740. 0	467. 6	701. 4	935. 2	564. 8	847. 2	1129. 6	1412. 0

center distance(mm)		1000				1250				1500				
No.of Panels		3	4	5	6	3	4	5	6	3	4	5	6	7
cooling surface	Selfcooling m ²	2. 484	3. 312	4. 140	4. 968	3. 215	4. 286	5. 358	6. 429	3. 945	5. 260	6. 575	7. 890	9. 205
Available m ²	Aircooling m ²	3. 229	4. 306	5. 382	6. 458	4. 179	5. 572	6. 965	8. 358	5. 129	6. 838	8. 548	10. 257	11. 967
Weight/R Empty(kg)		16. 017	21. 356	26. 695	32. 034	28. 575	38. 100	47. 625	57. 150	22. 593	30. 124	37. 655	45. 186	52. 717
Oil Weight/Radiator(kg)		5. 979	7. 972	9. 965	11. 958	7. 740	10. 320	12. 900	15. 480	9. 498	12. 664	15. 830	18. 996	22. 162
Geometric Surface(m ²)		4. 968	6. 624	8. 280	9. 936	6. 429	8. 572	10. 715	12. 858	7. 890	10. 520	13. 150	15. 780	18. 410
Dissipation (W)		993. 6	1324. 8	1656. 0	1987. 2	1285. 5	1714. 4	2143. 0	2571. 6	1578. 0	2104. 0	2630. 0	3156. 0	3682. 0

center distance(mm)		1750				2000				2250				
No.of Panels		4	5	6	7	5	6	7	8	5	6	7	8	9
cooling surface	Selfcooling m ²	6. 234	7. 793	9. 351	10. 910	9. 010	10. 812	12. 614	14. 416	10. 228	12. 273	14. 319	16. 364	18. 410
Available m ²	Aircooling m ²	8. 104	10. 130	12. 156	14. 182	11. 713	14. 056	16. 398	18. 741	13. 296	15. 955	18. 614	21. 273	23. 932
Weight/R Empty(kg)		34. 508	43. 135	51. 762	60. 389	48. 615	58. 338	68. 061	77. 784	54. 095	64. 914	75. 733	86. 552	97. 371
Oil Weight/Radiator(kg)		15. 008	18. 760	22. 512	26. 264	21. 650	26. 028	30. 366	34. 704	24. 625	29. 550	34. 475	39. 400	44. 325
Geometric Surface(m ²)		12. 468	15. 585	18. 702	21. 819	18. 020	21. 624	25. 228	28. 832	20. 455	24. 546	28. 637	32. 728	36. 819
Dissipation (W)		2493. 6	3117. 0	3740. 4	4363. 8	3604. 0	4324. 8	5045. 6	5766. 4	4091. 0	4909. 2	5727. 4	6545. 6	7363. 8

center distance(mm)		2500				2750				3000				
No.of Panels		5	6	7	8	6	7	8	9	6	7	8	9	10
cooling surface	Selfcooling m ²	11. 445	13. 734	16. 023	18. 312	16. 815	19. 618	22. 420	25. 223	16. 656	19. 432	22. 208	24. 984	27. 760
Available m ²	Aircooling m ²	14. 879	17. 854	20. 830	23. 806	21. 860	25. 503	29. 146	32. 789	21. 635	25. 263	28. 870	32. 479	36. 088
Weight/R Empty(kg)		59. 6	71. 5	83. 4	95. 3	78. 1	91. 1	104. 1	117. 1	84. 6	98. 7	112. 9	127. 0	141. 1
Oil Weight/Radiator(kg)		27. 555	33. 066	38. 577	44. 088	36. 582	42. 679	48. 776	54. 873	40. 098	46. 781	53. 464	60. 147	66. 830
Geometric Surface(m ²)		22. 890	27. 468	32. 046	36. 624	33. 630	39. 235	44. 840	50. 445	33. 312	38. 864	44. 416	49. 968	55. 520
Dissipation (W)		4578	5494	6409	7325	6726	7847	8968	10089	6662	7773	8883	9994	11104



中国原子能科学研究院

反应堆工程研究设计所

报告编号: RG-PS1003

2. 检测结果

➤ 自然循环条件下的自、风冷散热性能

冷却方式	进口油温 $t_1(^{\circ}\text{C})$	出口油温 $t_2(^{\circ}\text{C})$	环境温度 $t_0(^{\circ}\text{C})$	加热总功率 $P_1(\text{kW})$	油箱本体散热功率 $P_2(\text{kW})$	平均油温升系数 C
自冷	61.01	42.00	10.95	19.5	1.3	0.278*
风冷	60.80	29.94	10.63	46.0	1.1	0.264**

$$* C = \frac{\frac{t_1 + t_2}{2} - t_0}{\left(\frac{P_1 - P_2}{S_z} \right)^{0.8}}$$

S_z —自冷有效散热面积 (m^2)

$$** C = \frac{\frac{t_1 + t_2}{2} - t_0}{\left(\frac{P_1 - P_2}{S_f} \right)^{0.8}}$$

S_f —风冷有效散热面积 (m^2)

➤ 真空强度

测试仪表: ZDZ-2K 型低真空计;

绝对压强: 低于 133Pa;

持续时间: 大于 10min;

测试结果: 无永久变形。

以下空白

编制:

校核:

审核:

批准:



China institute of Atomic Enemy

Test report

Report No. RG-PS1003

Test sample: Aluminum radiator, used for transformers

Test Result:

A) Dissipation under normal condistion of self-cooling and air-coolings

cooling	Oil temp. at entrance $t_1(^{\circ}\text{C})$	Oil. Temp. at exit $t_2(^{\circ}\text{C})$	ambient temp. $t_0(^{\circ}\text{C})$	Total heating power $P_1(\text{kW})$	Dissipation of transformer tank $P_2(\text{kW})$	Coefficient of average temp. rise C
Self-cooling	61.01	42.00	10.95	19.5	1,30	0.278 *
Air-cooling	60.80	29.94	10.63	46.00	1.10	0,264 **

$$* C = \frac{\frac{t_1 + t_2}{2} - t_0}{\left(\frac{P_1 - P_2}{S_z} \right)^{0.8}}$$

$$** C = \frac{\frac{t_1 + t_2}{2} - t_0}{\left(\frac{P_1 - P_2}{S_f} \right)^{0.8}}$$

S_z — self-cooling surface available (m^2)

S_f —Air-cooling surface available (m^2)

B) Mechanical strength in Vacuum condition

Meter: Vacuum meter model ZDZ-2K

Absolute pressure: Not exceed of 133Pa

Duration: more than 10 Min.

Test result: No permanent deformation











