

GRAPHILOR®

POLYTUBE®

shell and tube heat exchangers

www.serviceprocess.net

Service Process Equipment, Inc.

PO Box 850908

Mobile AL 36685-0908

251.342.1313 Fax 251.342.1377

Email msellers@serviceprocess.net



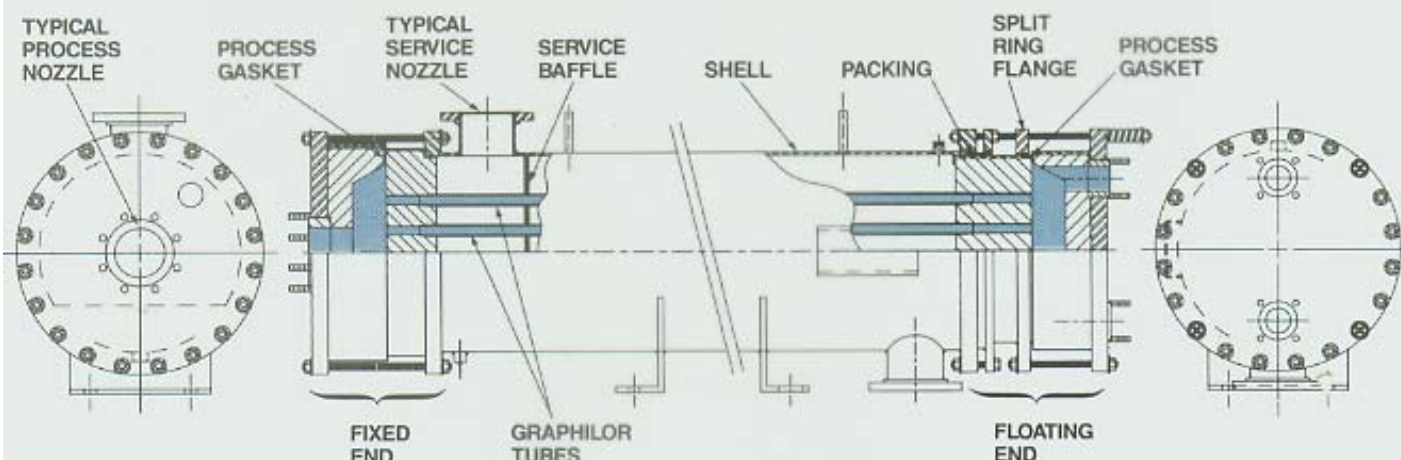
CARBONE OF AMERICA BECOMES MERSEN

mersen

540 Branch Drive, Salem VA 24153



CARBONE OF AMERICA



All surfaces in contact with process fluids in POLYTUBE heat exchangers are constructed of GRAPHILOR, a high density, high quality grade of impervious graphite. Shells and armored heads are designed in accordance with the ASME code and can be furnished with a "U" stamp, if specified. Shells can be supplied in a wide variety of materials, including low temperature steel, stainless steel, and fiberglass.

Service baffles and tie rods are also available in stainless, fiberglass and polypropylene.

The result is "POLYTUBE", a premium quality line of heat exchangers that combines optimum thermal efficiency, mechanical durability and chemical inertness.

CLOSE PITCH DESIGN

1.547" TRIANGULAR TUBE LAYOUT 1 1/4" O.D. x 7/8" I.D. GRAPHILOR TUBES

MODEL	SHELL DIAMETER	NUMBER OF TUBES	OUTSIDE SURFACE — HEAT TRANSFER AREA — SQ. FT.				
			TUBE LENGTHS				
			6'-0"	9'-0"	12'-0"	14'-0"	16'-0"
6	6"	9	17	27	35	41	47
8	8"	19	37	58	74	87	100
10	10"	31	60	91	121	142	162
14	14"	42	81	124	164	192	220
16	16"	64	124	188	250	293	335
18	18"	85	165	250	331	389	445
20	20"	109	211	321	425	499	571
22	22"	130	252	382	507	595	681
24	24"	163	315	480	636	747	854
26	26"	195	378	574	760	893	1021
28	28"	222	430	654	866	1017	1162
30	30"	268	519	789	1045	1228	1403
34	34"	349	675	1028	1361	1599	1827
38	38"	439	850	1293	1712	2011	2299
42	42"	579	1121	1705	2257	2652	3031

Maximum Operating Pressure — 50 psig. steam

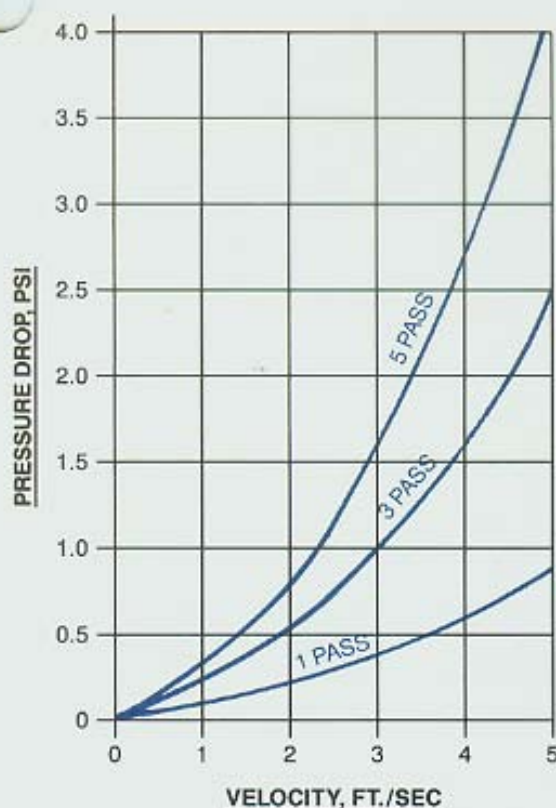
Maximum Operating Pressure — 75 psig. hydraulic

Maximum Operating Temperature — 360°F

Thermal conductivity of GRAPHILOR — 85 BTU/hr./sq. ft./°F/ft.

Design information

POLYTUBE HEAT EXCHANGERS TUBE SIDE FLUID PRESSURE DROP VS. VELOCITY BASED UPON WATER AT 70°F



MODEL	NO. OF TUBES	CSA
6	9	0.038
8	19	0.079
10	31	0.129
14	42	0.175
16	64	0.267
18	85	0.355
20	109	0.455
22	130	0.542
24	163	0.686
26	195	0.813
28	222	0.926
30	268	1.07
34	349	1.45
38	439	1.83
42	579	2.41

Calculation of Pressure Drop.

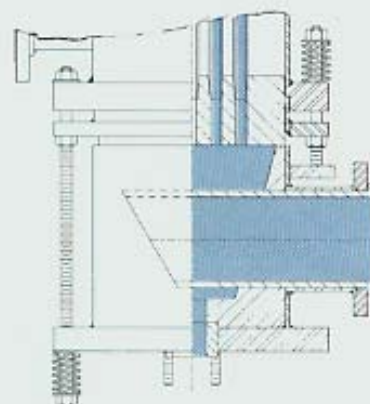
$$\text{Velocity} = \frac{\text{Flow Rate (gallons/sec)} \times \text{No. of Passes}}{7.48 \times \text{CSA (from table on left)}}$$

Read Pressure Drop (ΔP) from curve (on left) for appropriate pass arrangement. Multiply ΔP by correction factor (below) for required tube length.

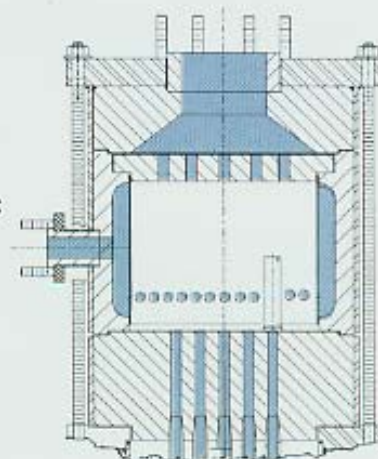
CSA — Cross Sectional Area in square feet.

Tube Length	Correction Factors
6'-0"	0.75
9'-0"	1.00
12'-0"	1.24
14'-0"	1.40
16'-0"	1.56

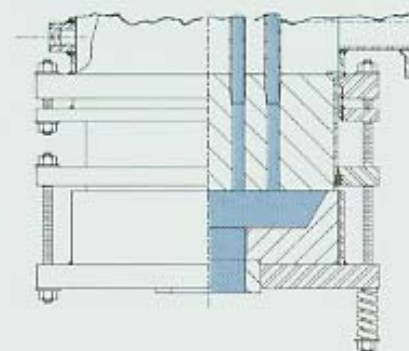
Typical head designs



RADIAL
VAPOR
AND
AXIAL
CONDENSATE
OUTLETS



HYDROCHLORIC
ACID
ABSORBER
INLET



ARMORED
FLOATING
HEAD

APPROXIMATE OVERALL HEAT TRANSFER COEFFICIENTS ⁽¹⁾		
HOT FLUID	COLD FLUID	OVERALL "U" ⁽²⁾
HEATERS		
Steam	Water	400-600
Steam	Aqueous Solutions	200-500
Steam	Organics	50-250
COOLERS		
Water	Water	300-500
Aqueous Solutions	Water	250-500
Organics	Water	50-200
Aqueous Solutions	Brine	200-250
Organics -	Brine	50-120
INTERCHANGERS		
Aqueous Solutions	Aqueous Solutions	250-500
Organics	Organics	25-100
EVAPORATORS		
Steam	Aqueous Solutions	400-600
Steam	Concentrated Solutions	150-250
Steam	Organics	100-200
CONDENSERS		
Water	Water	300-400
Light Organics	Water	150-200
Heavy Organics	Water	75-150

(1) Add appropriate fouling factors as indicated by specific operating conditions.

(2) CSA = 144 in² = 1 ft².

TUBE SIZE 7/8" ID x 1 1/4" OD

SHELL DIA.	NO. OF TUBES	DIMENSIONS (IN.)			SURFACE (sq.ft.) LENGTH (ft.) WEIGHT (lbs.)	TUBE LENGTH (L)								
						6'	9'	12'	14'	16'	18'	20'	24'	30'
		C	D	S										
8"	19	12 ⁵ / ₈	16 ⁵ / ₈	12 ⁵ / ₈	Surface	36	54	73	85	98	110	123	147	185
					Overall Length	7-9	10-10	13-9	15-9	17-9	19-9	21-9	25-9	31-9
					Empty Wt.	420	530	640	700	770	840	930	1060	1280
					Full Wt. (H ₂ O)	530	690	850	950	1050	1150	1270	1470	1520
					Surface	58	88	119	139	159	180	200	241	301
10"	31	13 ⁵ / ₈	17 ³ / ₄	14 ⁵ / ₈	Overall Length	7-11	10-10	13-11	15-11	17-11	19-11	21-11	25-11	31-11
					Empty Wt.	600	730	880	970	1080	1170	1260	1460	1740
					Op.Wt.	770	980	1210	1360	1530	1660	1800	2120	2560
					Surface	79	119	161	188	216	243	271	326	409
					Overall Length	8-1	11-1	14-1	16-1	18-1	20-1	22-1	26-1	32-1
12"	42	13 ³ / ₄	18	16 ¹ / ₂	Empty Wt.	790	990	1170	1300	1410	1540	1650	1920	2200
					Op.Wt.	1040	1350	1650	1870	2050	2270	2450	2890	3400
					Surface	103	157	208	247	283	318	355	427	535
					Overall Length	8-3	11-3	14-3	16-3	18-3	20-3	22-3	26-3	32-3
					Empty Wt.	950	1200	1450	1550	1700	1900	2050	2450	2900
14"	55	13 ¹ / ₂	18 ¹ / ₂	18 ³ / ₈	Op.Wt.	1300	1650	2000	2250	2500	2750	3000	3600	4300
					Surface	129	197	265	310	355	400	445	530	671
					Overall Length	8-5	11-5	14-5	16-5	18-5	20-5	22-5	26-5	32-5
					Empty Wt.	1300	1550	1850	2050	2200	2450	2650	3100	3550
					Op.Wt.	1650	2120	2600	2900	3200	3550	3900	4550	5400
16"	69	13 ³ / ₄	19 ¹ / ₂	20 ¹ / ₈	Surface	180	274	368	431	494	556	620	746	934
					Overall Length	8-8	11-8	14-8	16-8	18-8	20-8	22-8	26-8	32-8
					Empty Wt.	1700	2100	2450	2650	2900	3300	3550	4000	4850
					Op.Wt.	2200	2850	3400	3800	4200	4800	5200	5950	7300
					Surface	227	345	464	543	623	701	781	939	1173
18"	96	15 ¹ / ₄	20 ³ / ₈	22 ¹ / ₈	Overall Length	8-10	11-10	14-10	16-10	18-10	20-10	22-10	26-10	33-0
					Empty Wt.	2050	2450	2900	3300	3550	3750	4200	4650	5500
					Op.Wt.	2700	3400	4100	4750	5150	5550	6200	7000	8500
					Surface	283	431	579	678	777	876	975	1173	1474
					Overall Length	9-0	12-0	15-0	17-0	19-0	21-0	23	27	33-2
22"	151	17 ¹ / ₂	22	27 ¹ / ₈	Empty Wt.	2650	3100	3550	4000	4200	4650	5100	5750	6850
					Op.Wt.	3450	4200	5050	5700	6150	6800	7500	8600	10300
					Surface	351	534	718	840	962	1087	1205	1452	1818
					Overall Length	9-3	12-3	15-3	17-3	19-3	21-3	23-3	27-3	33-2
					Empty Wt.	3100	3750	4200	4650	5100	5500	6400	6850	7950
24"	187	18 ³ / ₈	23 ³ / ₄	29 ¹ / ₄	Op.Wt.	4100	5150	6050	6750	7500	8200	8900	10900	12400

						TUBE LENGTH (L)									
SHELL DIA.	NO. OF TUBES	DIMENSIONS (IN.)			SURFACE (sq.ft.) LENGTH (ft.) WEIGHT (lbs.)	6'	9'	12"	14"	16"	18"	20"	22"	24"	30"
		C	D	S											
26"	217	19 3/8	24 3/4	31 1/4	Surface	407	622	833	975	1119	1259	1399	1538	1689	2109
					Overall Length	9-5	12-5	15-5	17-5	19-5	21-5	23-5	25-5	27-5	33-5
					Empty Wt.	3550	4200	4850	5300	5750	6400	6850	7300	7700	9010
					Op. Wt.	4750	5850	7050	7800	8600	9600	10400	11100	11900	14200
28"	253	20	24 1/4	33 1/4	Surface	474	722	970	1140	1302	1463	1635	1797	1969	2464
					Overall Length	9-7	12-7	15-7	17-7	19-7	21-7	23-7	25-7	27-7	33-7
					Empty Wt.	4000	4850	5750	6200	6600	7300	7700	8400	8800	10400
					Op.Wt.	5300	6800	8200	9000	9850	10900	11700	12700	13500	16300
30"	288	22	25	35 7/8	Surface	540	822	1108	1251	1485	1668	1861	2044	2238	2797
					Overall Length	9-10	12-10	15-10	17-10	19-10	21-10	23-10	25-10	27-10	33-10
					Empty Wt.	4650	5500	6400	6850	7500	7950	8600	9050	9700	11500
					Op.Wt.	6200	7750	9250	10200	11200	12210	13300	14000	15300	18100
32"	332	23 1/2	26 1/2	38 1/4	Surface	622	948	1269	1495	1711	1926	2141	2356	2582	3228
					Overall Length	10-1	13-1	16-1	18-1	20-0	22-0	24-0	26-0	28-0	34-1
					Empty Wt.	5500	6400	7500	8200	8800	9500	10200	11000	11500	13500
					Op. Wt.	7900	9000	10900	12000	13200	14300	15500	16800	17900	21200
34"	376	24 1/2	29 3/4	39 1/4	Surface	705	1074	1442	1689	1937	2184	2432	2668	2916	3658
					Overall Length	10-3	13-3	16-3	18-3	20-3	22-3	24-3	26-3	28-3	34-2
					Empty Wt.	6200	7300	8400	9300	9900	10800	11500	12400	13000	15200
					Op.Wt.	8300	10200	12100	13500	14800	16300	17200	19000	20300	24000
36"	421	25 1/4	30 3/4	42 1/8	Surface	789	1205	1614	1893	2162	2442	2722	2991	3271	4099
					Overall Length	10-5	13-5	16-5	18-5	20-5	22-5	24-5	26-5	28-5	34-5
					Empty Wt.	7000	8200	9500	10400	11100	11900	12800	13400	14300	16800
					Op.Wt.	9400	11400	13800	15300	16300	17900	19400	20800	22300	26500
38"	472	26 3/8	30 3/8	44 1/2	Surface	885	1345	1808	2120	2430	2734	3046	3358	3670	4596
					Overall Length	10-8	13-8	16-8	18-8	20-8	22-8	24-8	26-8	28-8	34-9
					Empty Wt.	8400	9900	11500	12300	13500	14300	15400	16300	17400	20500
					Op.Wt.	11000	13600	16200	17900	19600	21200	22900	24500	26200	31300
40"	522	28	33 3/8	46 1/8	Surface	918	1496	2002	2347	2691	3025	3369	3714	4058	5081
					Overall Length	10-10	13-10	16-10	18-10	20-10	22-10	24-10	26-10	28-10	34-10
					Empty Wt.	9200	11000	12600	13700	15000	16100	17200	18300	19400	22000
					Op.Wt.	12200	15100	17900	19800	21800	23600	25600	27600	29300	34400
42"	583	29	34 1/2	48 1/2	Surface	1099	1688	2239	2616	3003	3380	3767	4144	4532	5673
					Overall Length	11-0	14-0	17-0	19-0	21-0	23-0	25-0	27-0	29-0	35-1
					Empty Wt.	10400	12100	13900	15200	16300	17700	18700	20100	21200	24300
					Op.Wt.	13700	16800	19600	22000	23800	26000	28000	30000	31200	37500

TUBE SIZE 7/8" ID x 1 1/4" OD

SHELL DIA.	NO. OF TUBES	DIMENSIONS (IN.)			SURFACE (sq. ft.) LENGTH (ft.) WEIGHT (lbs.)	TUBE LENGTH (L)								
		C	D	S		6'	9'	12'	14'	16'	18'	20'	24'	30'
44"	649	30 3/4	35 1/4	50 1/4	Surface Overall Length Empty Wt. Op. Wt.	1216 11-2 11700 15400	1851 14-2 13700 19000	2486 17-2 15900 22500	2917 19-2 17200 24700	3337 21-2 18500 26900	3767 23-2 20000 29300	4187 25-2 21400 31700	5038 29-2 24300 36400	6318 35-2 28700 43400
46"	700	31 1/4	36 1/2	52 1/4	Surface Overall Length Empty Wt. Op. Wt.	1313 11-5 13000 17000	2002 14-5 15200 21000	2691 17-5 17500 24700	3143 19-5 19800 27100	3606 21-5 20300 29300	4058 23-5 22000 32300	4521 25-5 23400 35000	5436 29-5 26500 39500	6814 35-5 31000 47000
48"	764	32 1/2	37 1/2	55 1/4	Surface Overall Length Empty Wt. Op. Wt.	1432 11-7 15200 19700	2185 14-7 18000 24000	2928 17-7 20500 28500	3433 19-7 22000 31000	3929 21-7 24300 34000	4435 23-7 26500 37700	4930 25-7 28700 41000	5931 29-7 33000 47400	7438 35-7 37500 55300
50"	847	33 3/4	38 1/2	57 1/4	Surface Overall Length Empty Wt. Op. Wt.	1593 11-9 16500 21500	2422 14-9 19600 24500	3251 17-9 22000 30600	3810 19-9 24200 34200	4359 21-9 26500 37500	4919 23-9 28700 40800	5468 25-9 31000 44300	6577 29-9 35300 51100	8245 35-9 39700 59000
52"	913	35	38 3/4	59	Surface Overall Length Empty Wt. Op. Wt.	1711 11-11 18300 24000	2605 14-11 21600 29000	3509 17-11 24300 33500	4101 19-11 26500 36800	4704 21-11 28700 40600	5296 23-11 30900 44100	5899 25-11 33100 47400	7095 29-11 37500 54500	8880 35-11 41900 62600
54"	977	36	40 1/2	60 1/4	Surface Overall Length Empty Wt. Op. Wt.	1830 12-1 19100 25000	2788 15-1 22300 30500	3746 18-1 25400 35500	4392 20-1 27600 39300	5027 22-1 29800 42800	5673 24-1 32000 46300	6307 26-1 34200 49900	7589 30-1 38600 57100	9505 36-1 44100 66800
56"	1050	37 1/4	41 1/2	62 1/4	Surface Overall Length Empty Wt. Op. Wt.	1970 12-3 20200 26600	3003 15-3 23600 32200	4026 18-3 27600 36400	4715 20-3 29800 42100	5403 22-3 32000 45900	6092 24-3 34200 49600	6781 26-3 36400 53400	8159 30-3 40800 60900	10215 36-3 46300 70800
58"	1123	38	42 1/2	64 1/4	Surface Overall Length Empty Wt. Op. Wt.	2110 12-5 21400 28200	3208 15-5 24300 33500	4316 18-5 28700 40600	5048 20-5 30900 44300	5780 22-5 33100 47800	6512 24-5 35300 51800	7255 26-5 37500 55600	8719 30-5 41900 63300	10979 36-5 48500 74500
60"	1203	39 1/4	43 1/4	66 1/4	Surface Overall Length Empty Wt. Op. Wt.	2260 12-8 22000 29500	3434 15-8 26500 36600	4618 18-8 30900 43400	5404 20-8 33100 47400	6189 22-8 35300 51400	6975 24-8 37500 55300	7772 26-8 39700 58600	9343 30-8 44100 67000	11733 36-8 50700 78500

SHELL DIA.	NO. OF TUBES	DIMENSIONS (IN.)			SURFACE (sq. ft.) LENGTH (ft.) WEIGHT (lbs.)	TUBE LENGTH (L)								
		C	D	S		6'	9'	12'	14'	16'	18'	20'	24'	30'
62"	1300	40 3/4	44 3/4	68 1/2	Surface Overall Length Empty Wt. Op. Wt.	2433 12-10 24300 32400	3714 15-10 28700 39400	4994 18-10 33100 46700	5845 20-10 35300 50700	6695 22-10 37500 54700	7546 24-10 39700 58900	8396 26-10 41900 62800	10097 30-10 46300 70800	12700 36-10 55100 85100
64"	1369	41 3/4	46 1/4	70 1/2	Surface Overall Length Empty Wt. Op. Wt.	2573 13-0 26500 35000	3907 16-0 30900 42500	5253 19-0 35300 49800	6148 21-0 37500 54000	7050 23-0 39700 58000	7944 25-0 41900 62200	8837 27-0 44100 66600	10635 31-0 50700 76900	13347 37-0 57300 89500
66"	1483	42 3/4	47 1/4	72 1/2	Surface Overall Length Empty Wt. Op. Wt.	2777 13-3 28700 38100	4241 16-3 33100 45600	5694 19-3 37500 53100	6663 21-3 39700 57300	7632 23-2 41900 61700	8600 25-3 46300 68100	9580 27-3 48500 72300	11517 31-3 52900 80900	14424 37-3 61700 95900
68"	1554	44	48 3/4	74 3/4	Surface Overall Length Empty Wt. Op. Wt.	2917 13-5 30900 41000	4435 16-5 35300 48700	5963 19-5 39700 56200	6986 21-5 44000 62800	7998 23-5 46300 67500	9020 25-5 48500 71700	10032 27-5 52900 78300	12056 31-5 59500 89300	15077 37-5 68300 104700
70"	1654	45	49 3/4	77 1/4	Surface Overall Length Empty Wt. Op. Wt.	3100 13-7 33000 43900	4725 16-7 37500 51600	6351 19-7 44100 61700	7427 21-7 46300 66400	8514 23-7 48500 71000	9601 25-7 52900 77600	10678 27-7 55100 82200	12810 31-7 61700 93300	16100 37-7 72800 111300
72"	1759	46 1/4	50 3/4	79 3/4	Surface Overall Length Empty Wt. Op. Wt.	3293 13-9 35300 46700	5027 16-9 41900 57100	6749 19-9 46300 65000	7901 21-9 48500 69900	9053 23-9 52900 76900	10204 25-9 55100 81600	11410 27-9 59500 88400	13670 31-9 66100 99900	17115 37-9 77200 117100
74"	1846	47 1/4	51 3/4	81 3/4	Surface Overall Length Empty Wt. Op. Wt.	3466 13-11 37500 49900	5274 16-11 44100 60400	7083 19-11 48500 68600	8300 21-11 52900 75800	9505 23-11 55100 80500	10710 25-11 59500 87500	11948 27-11 61700 92100	14316 31-11 70500 106300	17976 37-11 79400 122600

TUBE SIZE 1 1/2" ID x 2" OD

SHELL DIA.	NO. OF TUBES	DIMENSIONS (IN.)			SURFACE (sq.ft.) LENGTH (ft.) WEIGHT (lbs.)	TUBE LENGTH (L)								
						6'	9'	12'	14'	16'	18'	20'	24'	30'
		C	D	S										
8"	7	12 ³ / ₄	16 ¹ / ₄	12 ³ / ₄	Surface	22	32	43	51	58	65	72	87	109
					Overall Length	7-9	10-9	13-9	15-9	17-9	19-9	21-9	25-9	31-9
					Empty Wt.	420	510	620	680	750	820	880	1010	1210
					Op.Wt.	530	680	840	940	1050	1140	1260	1460	1760
10"	10	13 ¹ / ₂	17 ¹ / ₄	14 ¹ / ₂	Surface	30	45	61	72	83	93	103	124	156
					Overall Length	7-11	10-11	13-11	15-11	17-11	19-11	21-11	25-11	31-11
					Empty Wt.	570	710	840	930	1050	1100	1200	1370	1630
					Op.Wt.	760	980	1210	1360	1500	1650	1800	2100	2540
12"	19	13 ³ / ₄	18 ¹ / ₄	18 ³ / ₄	Surface	57	87	116	137	156	177	196	236	296
					Overall Length	8-1	11-1	14-1	16-1	18-1	20-1	22-1	26-1	32-1
					Empty Wt.	800	970	1170	1280	1410	1520	1650	1900	2200
					Op.Wt.	1050	1350	1650	1850	2070	2250	2450	2870	3420
14"	22	13 ¹ / ₂	18 ¹ / ₄	18 ³ / ₄	Surface	66	100	136	157	181	205	227	273	343
					Overall Length	8-3	11-3	14-3	16-3	18-3	20-3	22-3	26-3	32-3
					Empty Wt.	950	1150	1350	1500	1650	1800	1900	2200	2650
					Op.Wt.	1260	1600	2000	2200	2450	2700	2900	3400	4100
16"	31	13 ³ / ₄	19 ¹ / ₄	20 ¹ / ₄	Surface	93	142	191	223	255	288	321	385	482
					Overall Length	8-5	11-5	14-5	16-5	18-5	20-5	22-5	26-5	32-5
					Empty Wt.	1250	1550	1850	2050	2200	2400	2650	3100	3550
					Op.Wt.	1650	2150	2600	2950	3200	3600	3900	4600	5400
18"	38	15 ¹ / ₄	20 ³ / ₄	22 ³ / ₄	Surface	114	173	234	273	313	353	393	473	592
					Overall Length	8-8	11-8	14-8	16-8	18-8	20-8	22-8	26-8	32-8
					Empty Wt.	1600	2000	2400	2650	2950	3100	3300	3550	4400
					Op.Wt.	2200	2800	3500	3900	4250	4650	5050	5400	7000
20"	55	16 ¹ / ₂	20 ³ / ₄	25 ³ / ₄	Surface	165	252	338	395	453	510	568	684	8563
					Overall Length	8-10	11-10	14-10	16-10	18-10	20-10	22-10	26-10	33-10
					Empty Wt.	2100	2650	3100	3300	3550	4000	4200	4850	5750
					Op.Wt.	2750	3600	4300	4750	5150	5800	6200	7250	8750
22"	61	17 ¹ / ₂	22	25 ³ / ₄	Surface	183	279	375	438	503	566	630	758	949
					Overall Length	9-0	12-0	15-0	17-0	19-0	21-0	23-0	27-0	33-0
					Empty Wt.	2400	3100	3500	3750	4200	4400	4850	5500	6400
					Op.Wt.	3200	4300	5100	5550	6250	6700	7400	8550	10100
24"	76	18 ³ / ₄	23 ³ / ₄	29 ³ / ₄	Surface	228	348	467	547	625	705	785	944	1184
					Overall Length	9-3	12-3	15-3	17-3	19-3	21-3	23-3	27-3	33-3
					Empty Wt.	3100	3500	4200	4600	5100	5300	5700	6600	7700
					Op.Wt.	4100	5000	6100	6900	7600	8100	8900	10300	12300

					TUBE LENGTH (L)									
SHELL DIA.	NO. OF TUBES	DIMENSIONS (IN.)			SURFACE (sq.ft.) LENGTH (ft.) WEIGHT (lbs.)	6'	9'	12'	14'	16'	18'	20'	24'	30'
		C	D	S										
26"	92	20	24 3/4	31 3/4	Surface	276	421	565	661	758	854	950	1141	1432
					Overall Length	9-5	12-5	15-5	17-5	19-5	21-5	23-5	27-5	33-5
					Empty Wt.	3500	4200	4800	5300	5700	6200	6800	7300	9000
					Op.Wt.	4800	6000	7100	7900	8700	9500	10500	11200	14500
28"	109	20 3/4	25 1/2	33 1/4	Surface	327	498	670	784	898	1012	1130	1356	1701
					Overall Length	9-7	12-7	15-7	17-7	19-7	21-7	23-7	27-7	33-7
					Empty Wt.	4000	4800	5500	6200	6600	7100	7700	8200	10400
					Op.Wt.	5400	6800	8100	9100	9400	10800	11800	12700	16500
30"	126	22 3/4	25 3/4	35 3/8	Surface	378	576	774	905	1038	1173	1302	1561	1959
					Overall Length	9-10	12-10	15-10	17-10	19-10	21-10	23-10	27-10	33-10
					Empty Wt.	4600	5500	6600	7100	7700	8400	9000	9500	12000
					Op.Wt.	6300	7900	9700	10600	11700	12900	12900	15000	19200
32"	141	23 3/4	28 3/4	38 3/4	Surface	423	645	865	1014	1163	1313	1453	1754	2196
					Overall Length	10-1	13-1	16-1	18-1	20-1	22-1	24-1	28-1	34-1
					Empty Wt.	5300	6400	7300	7900	8600	9300	9900	11300	13000
					Op.Wt.	7300	9200	11000	12000	13200	14600	15700	18000	21400
34"	162	25 3/4	29 3/4	39 3/4	Surface	485	741	995	1163	1335	1507	1679	2013	2519
					Overall Length	10-3	13-3	16-3	18-3	20-3	22-3	24-3	28-3	34-3
					Empty Wt.	5700	6800	7700	8400	9000	9700	10600	12000	13900
					Op.Wt.	8000	10000	11700	13000	14100	15400	16800	19600	23200
36"	187	26	30 3/4	42 3/4	Surface	561	855	1152	1346	1539	1733	1938	2325	2906
					Overall Length	10-5	13-5	16-5	18-5	20-5	22-5	24-5	28-5	34-5
					Empty Wt.	6800	7900	9000	9900	10800	11500	12300	13900	16300
					Op.Wt.	9300	11400	13600	15000	16500	17900	19400	22300	26700
38"	201	27 3/4	32 3/4	44 1/2	Surface	602	918	1238	1442	1658	1862	2077	2497	3132
					Overall Length	10-8	13-8	16-8	18-8	20-8	22-8	24-8	28-8	34-8
					Empty Wt.	7900	9500	10800	11700	12600	13500	14600	16300	19000
					Op.Wt.	10800	13500	15900	17400	19000	20800	22500	25800	30600
40"	230	28 3/4	33 3/8	46 3/8	Surface	690	1052	1410	1658	1894	2131	2379	2863	3584
					Overall Length	10-10	13-10	16-10	18-10	20-10	22-10	24-10	28-10	34-10
					Empty Wt.	8800	10400	12000	13000	14100	15200	16100	18300	21400
					Op.Wt.	12000	14800	17500	19400	21200	23200	25100	28900	34400
42"	253	29 3/4	34 1/2	48 1/2	Surface	759	1152	1550	1819	2088	2347	2616	3143	3940
					Overall Length	11-0	14-0	17-0	19-0	21-0	23-0	25-0	29-0	35-0
					Empty Wt.	9700	11500	13000	14100	15200	16300	17400	19600	22000
					Op.Wt.	13200	16300	19200	21400	23200	25100	27200	31100	36400

TUBE SIZE 1 1/2" ID x 2" OD

SHELL DIA.	NO. OF TUBES	DIMENSIONS (IN.)			SURFACE (sq.ft.) LENGTH (ft.) WEIGHT (lbs.)	TUBE LENGTH (L)								
		C	D	S		6'	9'	12'	14'	16'	18'	20'	24'	30'
44"	283	30 1/4	35 1/4	50 1/4	Surface	849	1292	1744	2034	2336	2626	2928	3520	4402
					Overall Length	11-2	14-2	17-2	19-2	21-2	23-2	25-2	29-2	35-2
					Empty Wt.	10800	12400	14100	15200	16300	17400	18300	20700	24300
					Op.Wt.	14800	17900	21200	23100	25400	27400	29500	33700	40100
46"	304	31 1/4	36 1/4	52 1/4	Surface	912	1389	1862	2185	2508	2820	3143	3778	4736
					Overall Length	11-5	14-5	17-5	19-5	21-5	23-5	25-5	29-5	35-5
					Empty Wt.	11900	13700	15400	16500	17900	19000	20300	22000	26500
					Op.Wt.	16300	19600	23000	25400	27800	30000	32200	36200	43700
48"	336	33 1/4	37 1/4	55 1/4	Surface	1008	1539	2067	2411	2766	3122	3477	4176	5231
					Overall Length	11-7	14-7	17-7	19-7	21-7	23-7	25-7	29-7	35-7
					Empty Wt.	13500	15500	17600	19000	20300	21600	22000	26500	30900
					Op.Wt.	18200	22000	25800	28500	30900	33300	35000	42000	49600
50"	364	34 1/2	38 1/2	57 1/4	Surface	1087	1668	2239	2616	3003	3380	3757	4521	5662
					Overall Length	11-9	14-9	17-9	19-9	21-9	23-9	25-9	29-9	35-9
					Empty Wt.	14800	17000	19200	20500	22000	24300	26500	28100	33100
					Op.Wt.	20100	24300	28400	30900	33700	37300	40800	45400	53600
52"	392	36 3/4	39 3/4	59	Surface	1173	1798	2411	2820	3229	3638	4047	4876	6103
					Overall Length	11-11	14-11	17-11	19-11	21-11	23-11	25-11	29-11	35-11
					Empty Wt.	16300	18500	21000	22000	24300	26500	28700	30900	35300
					Op.Wt.	22000	26500	30900	33300	36800	40600	43900	49000	57500
54"	433	37 3/4	40 3/4	60 1/4	Surface	1302	1981	2659	3111	3563	4015	4521	5382	6738
					Overall Length	12-1	15-1	18-1	20-1	22-1	24-1	26-1	30-1	36-1
					Empty Wt.	17200	19900	22000	24300	26500	28700	30900	33100	37500
					Op.Wt.	23300	28200	32400	36200	39700	43200	47000	52000	60600
56"	461	38 1/2	41 3/4	62 3/4	Surface	1388	2110	2831	3315	3800	4284	4758	5726	7180
					Overall Length	12-3	15-3	18-3	20-3	22-3	24-3	26-3	30-3	36-3
					Empty Wt.	18500	21400	24300	26500	28700	31000	33000	37000	42000
					Op.Wt.	25400	30400	35700	39500	43200	46700	50500	57700	67000
58"	499	39 3/4	42 3/4	64 3/4	Surface	1496	2282	3068	3584	4111	4629	5156	6200	7772
					Overall Length	12-5	15-5	18-5	20-5	22-5	24-5	26-5	30-5	36-5
					Empty Wt.	20700	24300	26500	28700	30900	33000	37500	39700	46300
					Op.Wt.	28000	34000	38600	42500	46300	50300	57500	61500	73000
60"	526	41	44 1/4	66 1/2	Surface	1582	2400	3229	3778	4338	4887	5436	6534	8191
					Overall Length	12-8	15-8	18-8	20-8	22-8	24-8	26-8	30-8	36-8
					Empty Wt.	22000	26500	28700	30900	33100	37500	39700	42000	48500
					Op.Wt.	30000	37100	41700	45700	49900	55800	59800	65500	77400

SHELL DIA.	NO. OF TUBES	DIMENSIONS (IN.)			SURFACE (sq.ft.) LENGTH (ft.) WEIGHT (lbs.)	TUBE LENGTH (L)								
		C	D	S		6'	9'	12'	14'	16'	18'	20'	24'	30'
62"	571	42 ¹ / ₄	45 ¹ / ₂	68 ¹ / ₂	Surface	1711	2616	3509	4101	4704	5296	5899	7093	8891
					Overall Length	12-10	15-10	18-10	20-10	22-8	24-8	26-8	30-8	36-8
					Empty Wt.	24300	26500	30900	33100	35300	37500	39700	44100	53000
					Op.Wt.	32800	38000	45200	49200	53400	57300	61500	69500	83800
64"	604	43 ³ / ₈	46 ¹ / ₂	70 ¹ / ₂	Surface	1808	2766	3714	4338	4973	5608	6243	7503	9408
					Overall Length	13-0	16-0	19-0	21-0	23-0	25-0	27-0	31-0	37-0
					Empty Wt.	26500	28700	33100	35300	37500	41900	44100	48500	55100
					Op.Wt.	35800	40800	48300	52500	56700	63100	67300	75600	88200
66"	649	44 ¹ / ₂	47 ³ / ₈	72 ¹ / ₂	Surface	1948	2971	3983	4661	5350	6028	6706	8062	10107
					Overall Length	13-3	16-3	19-3	21-3	23-3	25-3	27-3	31-3	37-3
					Empty Wt.	28700	30900	35300	37500	41900	44100	46300	50700	59500
					Op.Wt.	38600	43900	51600	55800	62400	66600	71000	79800	94800
68"	682	46 ¹ / ₈	49 ¹ / ₂	74 ³ / ₄	Surface	2045	3122	4187	4908	5619	6329	7050	8471	10613
					Overall Length	13-5	16-5	19-5	21-5	23-5	25-5	27-5	31-5	37-5
					Empty Wt.	30900	35300	39700	41900	44100	48500	50700	57300	66100
					Op.Wt.	41700	49400	57100	61500	66000	72500	77200	88200	103600
70"	733	46 ³ / ₈	50 ¹ / ₄	77 ¹ / ₄	Surface	2196	3348	4500	5274	6039	6803	7578	9106	11410
					Overall Length	13-7	16-7	19-7	21-7	23-7	25-7	27-7	31-7	37-7
					Empty Wt.	33100	37500	41900	44100	48500	50700	55100	59500	70500
					Op.Wt.	44500	52500	60400	65000	71900	76300	83100	92200	110300
72"	771	48 ³ / ₈	51 ¹ / ₈	79 ¹ / ₄	Surface	2314	3520	4736	5544	6351	7158	7965	9580	12056
					Overall Length	13-9	16-9	19-9	21-9	23-9	25-9	27-9	31-9	37-9
					Empty Wt.	35300	39700	44100	48500	50700	55100	57300	64000	72700
					Op.Wt.	47400	55800	64000	71000	75600	82500	87300	98800	114600
74"	817	49	52 ¹ / ₂	81 ¹ / ₄	Surface	2454	3735	5016	5877	6728	7589	8439	10150	12702
					Overall Length	13-11	16-11	19-11	21-11	23-11	25-11	27-11	31-11	37-11
					Empty Wt.	37500	41900	42900	50700	52900	57300	59500	68300	72800
					Op.Wt.	50500	58900	67200	74500	79100	86400	91000	105400	118000

GRAPHILOR 3 HB Tube Specifications

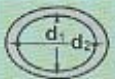
Mechanical Properties

Tensile strength**	PSI	≥4350
Bending strength**	PSI	5800 to 7200
Compressive strength**	PSI	10100 to 11600
Tensile strength of cemented joints	PSI	≥4350
Variation in tensile strength/10°C	0/00	0
Bursting strength at 20°C	PSI	870 to 1450, 1160 (on average)
Permeability to air: - initial t_0 - at t_{1000} (after 1000h in air at 150°C)	$\text{cm}^2.\text{s}^{-1}$	10^{-6} 10^{-6}
Maximum service temperature under continuous operation (t° in the graphite)	°F	365
Resilience**	mm.N.mm^{-2}	2 (on an average)
Young's modulus	N.mm^{-2}	$1.5.10^{10}$
Thermal conductivity radial direction (without resin film)	$\text{W.m}^{-1}.\text{°K}^{-1}$	35 to 64
	$\text{kcal.h}^{-1}.\text{m}^{-1}.\text{°C}^{-1}$	30 to 55
Total thermal resistance of the resin films	$\text{m}^2.\text{°K.W}^{-1}$	$7.6.10^{-5}$
	$\text{h.m}^{-1}.\text{°C.kcal}^{-1}$	$8.9.10^{-5}$
Coefficient of linear expansion (axial direction)	°K^{-1}	3.10^{-6}

*Tests carried out according to two methods: flash CEA (French Atomic Energy Office) and electrical test (Kohlrausch)

**Tests standardized and inspected by TÜV

Typical Dimensions

Nominal diameter	25 x 16 mm	1 1/4" x 7/8"	37 x 25 mm	50 x 37 mm	2" x 1 1/2"
Actual outside diameter** (mm)	25	31.75	37	50.80	50.80
Actual inside diameter** (mm)	16	20.60	24	35	38.10
Tolerance on diameter	±3%	±3%	±3%	±3%	±3%
Ovalization (mm) d_2-d_1 	≤ 0.45	≤ 0.50	≤ 0.55	≤ 0.75	≤ 0.75
Eccentricity (mm) e_2-e_1 	≤ 0.45	≤ 0.50	≤ 0.55	≤ 0.75	≤ 0.75
Average weight per foot length (lbs./ft.)	0.34	0.54	0.81	1.34	1.08

■ Maximum length without joint: 14'

■ Tolerance on length: -0 + 4"

■ Maximum number of cemented joints: 1 per 9' length

■ Maximum bend (tube vertical held at top): ≤ 7 0/00

Surface Finish

■ Outside: as impregnated (the tubes can also be supplied without the outer impregnant skin)

■ Ends: plain or machined

Tests on Finished Product

Systematic Tests (100%)

- Pressure test: 290 PSIG
- Tightness test: 130 PSIG, air under water
- Dimensional check on length

Statistical Control (10% of those made)

- Check on diameter
- Check on eccentricity
- Check on ovalization