第5編　水力學

5—1 各種溫度水之比重及密度表

溫度（華氏）	比重	密度（磅/立方呎）	密度值之對數	溫度（華氏）	比重	密度（磅/立方呎）	密度值之對數
15	0.99831	——	——	80	0.99669	62.217	1.79391
20	0.99898	——	——	85	0.99592	62.169	1.79357
25	0.99947	——	——	90	0.99510	62.118	1.79322
30	0.99979	——	——	95	0.99418	62.061	1.79282
32	0.99987	62.416	1.79529	100	0.99318	62.998	1.79238
35	0.99996	62.421	1.79533	110	0.99105	61.865	1.79144
39.3	1.00000	62.424	1.79535	120	0.98870	61.719	1.79042
40	0.99999	62.423	1.79534	130	0.98608	61.555	1.78926
45	0.99992	62.419	1.79532	140	0.98338	61.386	1.78807
50	0.99975	62.408	1.79524	150	0.98043	61.203	1.78673
55	0.99946	62.390	1.79511	160	0.97729	61.006	1.78537
60	0.99907	62.366	1.79495	170	0.97397	60.799	1.78390
65	0.99859	62.336	1.79474	180	0.97056	60.586	1.78237
70	0.99802	62.300	1.79449	200	0.96333	60.135	1.77913
75	0.99739	62.261	1.79422	212	0.95865	59.843	1.77701

5—2 各種高度之氣壓水柱與水銀柱表

海平面上高度（呎）	大氣压力（磅/平方吋）	水柱高度（呎）	水銀柱高度（吋）	海平面上高度（呎）	大氣压力（磅/平方吋）	水柱高度（呎）	水銀柱高度（吋）
0	14.70	33.9	29.9	3500	12.92	29.8	26.3
250	14.57	33.6	29.6	4000	12.69	29.3	25.8
500	14.44	33.3	29.3	4500	12.46	28.8	25.4
750	14.31	33.0	29.1	5000	12.23	28.2	24.9
1000	14.18	32.7	28.8	5500	12.01	27.7	24.5
1250	14.05	32.4	28.6	6000	11.80	27.2	24.0
1500	13.92	32.1	28.3	6500	11.60	26.7	23.6
1750	13.79	31.8	28.1	7000	11.40	26.3	23.2
2000	13.66	31.5	27.8	7500	11.21	25.9	22.8
2250	13.53	31.2	27.5	8000	11.03	25.5	22.5
2500	13.41	30.9	27.3	8500	10.85	25.1	22.1
3000	13.16	30.4	26.8	10000	10.3	23.7	20.9

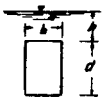
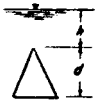
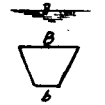
5—3 流體之粘度與密度表

溫度		粘度 $\mu = \frac{dyne \times sec}{sq.\ cm.}$			密度 $\rho = \frac{grams}{cu.\ cm.}$		
西度表	華氏表	水	水銀	空氣	水	水銀	空氣
°Cent.	°Fahr.						
−20	−4		0.0186			13.644459	0.00139.55
−15	5					.63257	.13684
−10	14	0.0260				.62017	.13423
− 5	23	0.0214				.60780	.13172
0	32	0.017938	0.0169	0.0001709	0.999868	.59545	.12931
1	33.8	0.017320			0.999927	13.59298	0.00128.83
2	35.6	16740			968	.59051	12836
3	37.4	16193			992	.58804	12790
4	39.2	15676			1.000000	.58558	12743
5	41.0	15188			0.999992	.58311	12698
6	42.8	0.014726			0.999968	13.58065	0.0012652
7	44.6	14288			929	.57818	12607
8	46.4	13872			876	.57572	12562
9	48.2	13476			808	.57326	12517
10	50.0	13097		0.0001739	727	.57079	12473
11	51.8	0.012735			0.999632	13.56833	0.0012429
12	53.6	12390			525	.56587	12385
13	55.4	12051			404	.56341	12342
14	57.2	11748			271	.56095	12299
15	59.0	11477			126	.55849	12256
16	60.8	0.011156			0.998970	13.55604	0.0012213
17	62.6	10875			801	.55358	12171
18	64.4	10603			622	.55113	12129
19	66.2	10340			432	.54867	12088
20	68.0	10087	0.0156	0.0001808	230	.54622	12046
21	69.8	0.009843			0.998019	13.54376	0.0012005
22	71.6	9608			0.997797	.54131	0.0011965
23	73.4	9380			565	.53886	11924
24	75.2	9161			323	.53641	11884
25	77.0	8949			071	.53396	11844
26	78.8	0.008746			0.996810	13.53151	0.0011804
27	80.6	8551			539	.52906	11765
28	82.4	8363			259	.52661	11726
29	84.2	8181			0.995.971	.52416	11687
30	86.0	8004		0.0001856	673	.52171	11648
31	87.8	0.007834			0.995367	13.51927	0.0011610
32	89.6	7670			052	.51682	11572
33	91.4	7511			0.994729	.51437	11534
34	93.2	7357			398	.51193	11496
35	95.0	7208			058	.50949	11459
36	96.8	0.007064			0.993712	13.50704	
37	98.6	6925			356	.50460	
38	100.4	6791			0.992994	.50216	
39	102.2	6661			623	.49972	
40	104.0	6536		0.0001904	246	.49728	
41	105.8	0.006415			0.991186	13.49484	
42	107.6	6298			147	.49240	
43	109.4	6184			107	.48996	
44	111.2	6075			066	.48752	
45	113.0	5.970			024	.48508	

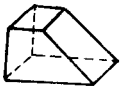
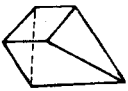
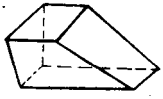
5—3 流體之粘度與密度表

溫度		粘度 $\mu=\frac{dyne\times sec}{sq.\ cm.}$			密度 $\rho=\frac{grams}{cu.\ cm.}$		
百度表	華氏表						
°Cent.	°Fahr.	水	水銀	空氣	水	水銀	空氣
46	114.8	0.005358			0.989982	13.545265	
47	116.6	5770			940	48021	
48	118.4	5675			896	47779	
49	120.2	5582			852	47534	
50	122.0	5492	0.0141	0.0001951	807	47290	
51	123.8	0.005405			0.98762	13.547047	
52	125.6	5320			715	46804	
53	127.4	5236			669	46561	
54	129.2	5153			621	46317	
55	131.0	5072			573	46074	
56	132.8	0.004994			0.985525	13.545831	
57	134.6	4918			475	45588	
58	136.4	4843			425	45345	
59	138.2	4770			375	45102	
60	140.0	4699		0.0001997	324	44859	
61	141.8	0.004629			0.98272	13.544616	
62	143.6	4561			220	44373	
63	145.4	4495			167	44131	
64	147.2	4431			113	43888	
65	149.0	4368			059	43646	
66	150.8	0.004306			0.98005	13.543403	
67	152.6	4245			0.97950	43160	
68	154.4	4186			894	42918	
69	156.2	4128			838	42675	
70	158.0	4071		0.0002043	781	42433	
71	159.8	0.004016			0.97723	13.542191	
72	161.6	3962			666	41949	
73	163.4	3909			607	41706	
74	165.2	3857			548	41464	
75	167.0	3806			489	41222	
76	168.8	0.003756			0.97429	13.540980	
77	170.6	3708			368	40738	
78	172.4	3661			307	40496	
79	174.2	3615			245	40254	
80	176.0	3570		0.0002088	183	40012	
81	177.8	0.003526			0.97121	13.539770	
82	179.6	3483			057	39528	
83	181.4	3440			0.96994	39287	
84	183.2	3396			930	39045	
85	185.0	3357			865	38803	
90	194.0	0.003166		0.0002132	0.96534	13.537595	0.0009730
95	203.0	2994			192	36389	9588
100	212.0	2839	0.0122	0.0002175	0.95838	35183	9459
150	302.0	184		0.0002385		2330	8340
200	392.0		0.0101	0.0002582		1148	7457
250	482.0			0.0002770		12.9975	
300	572.0		0.0093	0.0002946		8806	
350	662.0			0.0003113		7638	
400	752.0			0.0003277			
500	932.0			0.0003583			

5—4 各式水門

直立水門式樣		重心与門之最高点距離	轉動慣量 $\bar{I}_x$	門之最高点 總壓力 p
長方		$\frac{d}{2}$	$\frac{1}{12}bd^3$	$wbd\left(h+\frac{d}{2}\right)$
三角		$\frac{2d}{3}$	$\frac{1}{36}bd^3$	$\frac{w}{2}bd\left(h+\frac{2d}{3}\right)$
倒三角		$\frac{d}{3}$	$\frac{1}{36}bd^3$	$\frac{w}{2}bd\left(h+\frac{d}{3}\right)$
圓形		$\frac{d}{2}$	$\frac{1}{64}\pi d^4$	$\frac{w}{4}\pi d^2\left(h+\frac{d}{2}\right)$
梯形		$\frac{d}{3}\,\frac{B+2b}{B+b}$	$\frac{d^3}{36}\,\frac{[(B+d)^2+2Bb]}{(B+b)}$	$\frac{w}{2}d\left\{h(B+b)+\frac{d}{3}(B+2b)\right\}$
半圓		$\frac{4d}{3\pi}$	$\left(\frac{\pi}{8}-\frac{8}{9\pi}\right)d^4$	$\frac{w}{2}\pi d^2\left(h+\frac{4d}{3\pi}\right)$
拋物線		$\frac{2}{5}d$	$\frac{8}{175}bd^3$	$\frac{2w}{3}bd\left(h+\frac{2d}{5}\right)$

上之總壓力圖表

距水面為 h 時		h = 0 時	
偏距 e	壓容 (pressure volume)	總壓力 P	偏距 e
$\frac{d^2}{12\left(h+\frac{d}{2}\right)}$		$\frac{w}{2}bd^2$	$\frac{d}{6}$
$\frac{d^2}{48\left(h+\frac{2d}{3}\right)}$		$\frac{w}{3}bd^2$	$\frac{d}{12}$
$\frac{d^2}{18\left(h+\frac{d}{3}\right)}$		$\frac{w}{6}bd^2$	$\frac{d}{6}$
$\frac{d^2}{16\left(h+\frac{d}{2}\right)}$		$\frac{w}{8}\pi d^3$	$\frac{d}{8}$
$\frac{d^2[(B+b)^2+2Bb]}{18(B+b)^2\left[h+\frac{d(B+2b)}{3(B+b)}\right]}$		$\frac{wd^2}{6}(B+2b)$	$\frac{d[(B+b)^2+2Bb]}{6(B+b)(B+2b)}$
$\frac{(9\pi^2-64)d^2}{12\pi(3\pi h+4d)}$		$\frac{2w}{3}\pi d^3$	$\frac{(9\pi^2-64)d}{8\pi}$
$\frac{12d^2}{35(5h+2d)}$		$\frac{4w}{15}bd^2$	$\frac{6d}{35}$

5—5 水壓力表

$\eta = 1000H$ 公斤/方公尺　　$P = 500H^2$ 公斤/公尺

$= 204.82H$ 磅/方英尺　　$= 335.87H^2$ 磅/英尺

H = 水深（公尺）　η = 單位压力　P = 立面揽压力

H		η		P		H		η		P	
公尺	英尺	公斤/方公尺	磅/方英尺	公斤/公尺	磅/英尺	公尺	英尺	公斤/方公尺	磅/方英尺	公斤/公尺	磅/英尺
0.0	.00	0	0.0	0	0	4.0	13.12	4000	819.3	8000	5375
.1	.33	100	20.5	5	3	.1	13.45	4100	839.7	8405	5648
.2	.66	200	41.0	20	13	.2	13.78	4200	860.2	8820	5927
.3	.98	300	61.5	45	30	.3	14.11	4300	880.7	9245	6213
.4	1.31	400	81.9	80	54	.4	14.44	4400	901.2	9680	6505
.5	1.64	500	102.4	125	84	.5	14.76	4500	921.7	10125	6804
.6	1.97	600	122.9	180	121	.6	15.09	4600	942.2	10580	7110
.7	2.30	700	143.4	245	165	.7	15.42	4700	962.6	11045	7422
.8	2.63	800	163.9	320	215	.8	15.75	4800	983.1	11520	7742
.9	2.95	900	184.3	405	272	.9	16.08	4900	1003.6	12005	8068
1.0	3.28	1000	204.8	500	336	5.0	16.40	5000	1024.1	12500	8400
.1	3.61	1100	225.3	605	407	.1	16.73	5100	1044.6	13005	8739
.2	3.94	1200	245.8	720	484	.2	17.06	5200	1065.0	13520	9085
.3	4.27	1300	266.3	845	567	.3	17.39	5300	1085.5	14045	9438
.4	4.59	1400	286.7	980	659	.4	17.72	5400	1106.0	14580	9798
.5	4.92	1500	307.2	1125	756	.5	18.05	5500	1126.5	15125	10164
.6	5.25	1600	327.7	1280	860	.6	18.37	5600	1147.0	15580	10537
.7	5.58	1700	348.2	1445	971	.7	18.70	5700	1167.5	16245	10917
.8	5.91	1800	368.7	1620	1089	.8	19.03	5800	1187.9	16820	11303
.9	6.25	1900	389.2	1805	1213	.9	19.36	5900	1208.4	17405	11696
2.0	6.56	2000	409.6	2000	1344	6.0	19.69	6000	1228.9	18000	12096
.1	6.89	2100	430.1	2205	1482	.1	20.01	6100	1249.4	18605	12502
.2	7.22	2200	450.6	2470	1626	.2	20.34	6200	1269.9	19220	12915
.3	7.55	2300	471.1	2645	1778	.3	20.67	6300	1290.3	19845	13335
.4	7.87	2400	491.1	2880	1936	.4	21.00	6400	1310.8	20480	13762
.5	8.20	2500	512.0	3125	2100	.5	21.33	6500	1331.3	21125	14195
.6	8.53	2600	532.5	3380	2272	.6	21.65	6600	1351.8	21780	14636
.7	8.86	2700	553.0	3645	2450	.7	21.98	6700	1372.3	22445	15082
.8	9.19	2800	573.5	3920	2634	.8	22.31	6800	1392.6	23120	15536
.9	9.51	2900	594.0	4205	2826	.9	22.64	6900	1413.2	23805	15996
3.0	9.84	3000	614.5	4500	3024	7.0	22.97	7000	1433.7	24500	16463
.1	10.17	3100	634.9	4805	3229	.1	23.22	7100	1454.2	25205	16937
.2	10.50	3200	655.4	5120	3441	.2	23.62	7200	1474.7	25920	17417
.3	10.83	3300	675.9	5445	3659	.3	23.95	7300	1495.2	26645	17904
.4	11.16	3400	696.4	5780	3884	.4	24.28	7400	1515.6	27380	18398
.5	11.48	3500	716.9	6125	4116	.5	24.61	7500	1536.1	28125	18899
.6	11.81	3600	737.3	6480	4355	.6	24.93	7600	1556.6	28880	19406
.7	12.14	3700	757.8	6845	4600	.7	25.26	7700	1577.1	29645	19920
.8	12.47	3800	778.3	7220	4852	.8	2559	7800	1597.6	30420	20441
.9	12.80	3900	798.8	7605	5110	.9	25.92	7900	1618.1	31205	20968
4.0	13.12	4000	819.8	8000	5375	8.0	26.25	8000	1638.5	32000	21503

5---5 水壓力表

$\pi = 1000\,H$ 公斤/方公尺　　$P = 500\,H^2$ 公斤/公尺

$= 204.82\,H$ 磅/方英尺　　$= 335.87\,H^2$ 磅/英尺

H＝水深（公尺）　π＝單位壓力　P＝立面總壓力

H		π		P		H		π		P	
公尺	英尺	公斤/方公尺	磅/方英尺	公斤/公尺	磅/英尺	公尺	英尺	公斤/方公尺	磅/方英尺	公斤/公尺	磅/英尺
8.0	26.25	8000	1638.5	32000	21503	12.0	39.37	12000	2457.8	72000	48382
.1	26.38	8100	1659.0	32805	22044	.1	39.70	12100	2478.3	73205	49175
.2	26.98	8200	1679.5	33620	22532	.2	40.03	12200	2498.8	74420	49991
.3	27.23	8300	17000	34445	23146	.3	40.33	12300	2519.2	75645	50814
.4	27.56	8400	1720.5	35280	23707	.4	40.68	12400	2539.7	76880	51643
.5	27.89	8500	1740.9	36125	24275	.5	41.01	12500	2560.2	78125	52480
.6	28.22	8600	1761.4	36980	24850	.6	41.34	12600	2580.7	79380	53323
.7	28.54	8700	1781.9	37845	25431	.7	41.67	12700	2601.2	80645	54172
.8	28.87	8800	1802.4	38720	26019	.8	42.00	12800	2621.7	81920	55029
.9	29.20	8900	1822.9	39805	26614	.9	42.32	12900	2642.1	83205	55892
9.0	29.53	9000	1843.4	40500	27315	13.0	42.65	13000	2662.6	84500	56763
.1	29.86	9100	1863.8	41405	27825	.1	42.98	13100	2683.1	85805	57639
.2	30.18	9200	1884.3	42380	28438	.2	43.31	13200	2703.6	87120	58522
.3	30.51	9300	1904.8	43245	29059	.3	43.64	13300	2724.1	88445	59412
.4	30.84	9400	1925.3	44180	29688	.4	43.96	13400	2744.5	89780	60309
.5	31.17	9500	1945.8	45125	30323	.5	44.29	13500	2765.0	91125	61212
.6	31.50	9600	1966.2	46080	30964	.6	44.62	13600	2785.5	92480	62123
.7	31.82	9700	1986.7	47045	31613	.7	44.95	13700	2806.0	93845	63039
.8	32.15	9800	2007.2	48020	32268	.8	45.28	13800	2826.5	95220	63963
9	32.48	9900	2027.7	49005	32930	.9	45.60	13900	2847.0	96605	64893
10.0	32.81	10000	2048.2	50000	33599	14.0	45.93	14000	2867.4	98000	65832
.1	33.14	10100	2068.7	51005	34274	.1	46.26	14100	2887.9	99405	66774
.2	33.46	10200	2089.2	52020	34956	.2	46.59	14200	2908.4	100820	67725
.3	33.79	10300	2109.6	53045	35643	.3	46.92	14300	2928.9	102245	68682
.4	34.12	10400	2130.1	54080	36340	.4	47.24	14400	2949.4	103680	69646
.5	34.45	10500	2050.6	55125	37043	.5	47.57	14500	2969.9	105125	70617
.6	34.78	10600	2171.1	56180	37752	.6	47.90	14600	2990.8	106580	71594
.7	35.10	10700	2191.6	57245	38467	.7	48.23	14700	3010.8	108045	72578
.8	35.43	10800	2212.0	58320	39190	.8	48.56	14800	3031.3	109520	73569
.9	35.76	10900	2232.5	59405	39918	.9	48.88	14900	3051.8	111005	74566
11.0	36.09	11000	2253.0	60500	40654	15.0	49.21	15000	3072.3	112500	75572
.1	36.42	11100	2273.5	61605	41397	.1	49.54	15100	3092.7	114005	76582
.2	36.75	11200	2294.0	62720	42146	.2	49.87	15200	9113.2	115520	77599
.3	37.07	11300	2314.4	63845	42902	.3	50.20	15300	3133.7	117045	78624
4	37.40	11400	2334.9	64980	43665	.4	50.53	15400	3154.2	118580	79655
.5	37.73	11500	2355.4	66125	44434	.5	50.85	15500	3174.7	120125	80693
.6	38.06	11600	2375.9	67280	45210	.6	51.19	15600	3195.2	121680	81737
.7	38.39	11700	2396.4	68445	45993	.7	51.51	15700	3215.6	123245	82789
.8	38.71	11800	2416.8	69620	46782	.8	51.84	15800	9236.1	124820	83847
.9	39.04	11900	2437.3	70805	47578	.9	52.17	15900	3256.6	126405	84911
12.0	39.37	12000	2457.8	72000	48382	16.0	52.49	16000	3277.1	128000	85984

5—6 理論流速表

公式：$V=\sqrt{2gH}$

V＝流速（秒/公尺）　H＝水頭（公尺）　g＝9.81（公尺/秒/秒）

H	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	H
0.00	0.000	0.443	0.626	0.768	0.886	0.990	1.085	1.172	1.253	1.329	0.00
.10	1.401	1.469	1.534	1.597	1.657	1.715	1.771	1.826	1.879	1.939	.10
.20	1.981	2.030	2.078	2.124	2.170	2.215	2.259	2.302	2.344	2.385	.20
.30	2.426	2.466	2.506	2.545	2.583	2.620	2.658	2.694	2.730	2.766	.30
.40	2.801	2.836	2.871	2.906	2.938	2.971	3.004	3.037	3.069	3.101	.40
.50	3.132	3.163	3.194	3.225	3.255	3.285	3.315	3.344	3.373	3.402	.50
.60	3.431	3.459	3.488	3.516	3.543	3.571	3.598	3.625	3.652	3.679	.60
.70	3.705	3.732	3.758	3.784	3.810	3.856	3.861	3.887	3.912	3.937	.70
.80	3.962	3.986	4.011	4.035	4.060	4.084	4.108	4.131	4.155	4.179	.80
.90	4.202	4.225	4.248	4.271	4.294	4.317	4.340	4.362	4.385	4.407	.90
1.00	4.430	4.452	4.473	4.495	4.517	4.539	4.560	4.582	4.603	4.624	1.00
.10	4.645	4.667	4.688	4.708	4.729	4.750	4.770	4.791	4.811	4.832	.10
.20	4.852	4.872	4.892	4.912	4.932	4.952	4.972	4.992	5.011	5.031	.20
.30	5.050	5.070	5.089	5.108	5.127	5.146	5.165	5.184	5.205	5.222	.30
.40	5.241	5.259	5.278	5.297	5.315	5.333	5.352	5.370	5.388	5.406	.40
.50	5.425	5.448	5.461	5.479	5.496	5.514	5.532	5.550	5.568	5.585	.50
.60	5.563	5.620	5.637	5.655	5.672	5.689	5.707	5.724	5.741	5.758	.60
.70	5.775	5.792	5.809	5.826	5.843	5.859	5.876	5.893	5.909	5.926	.70
.80	5.942	5.959	5.975	5.992	6.008	6.024	6.040	6.057	6.073	6.089	.80
.90	6.105	6.121	6.137	6.153	6.169	6.185	6.201	6.217	6.233	6.248	.90
2.00	6.264	6.279	6.295	6.311	6.326	6.341	6.357	6.372	6.388	6.403	2.00
.10	6.418	6.434	6.449	6.464	6.479	6.495	6.510	6.525	6.540	6.555	.10
.20	6.570	6.585	6.600	6.614	6.629	6.644	6.659	6.674	6.688	6.703	.20
.30	6.717	6.732	6.746	6.761	6.776	6.790	6.804	6.819	6.833	6.847	.30
.40	6.863	6.876	6.890	6.904	6.919	6.933	6.947	6.961	6.975	6.989	.40
.50	7.003	7.017	7.031	7.045	7.059	7.073	7.086	7.100	7.114	7.128	.50
.60	7.142	7.156	7.169	7.183	7.197	7.210	7.224	7.238	7.251	7.264	.60
.70	7.278	7.292	7.305	7.318	7.332	7.345	7.358	7.372	7.385	7.398	.70
.80	7.412	7.425	7.438	7.451	7.464	7.478	7.491	7.504	7.517	7.530	.80
.90	7.543	7.556	7.569	7.582	7.594	7.608	7.620	7.633	7.646	7.659	.90
3.00	7.672	7.684	7.697	7.710	7.723	7.736	7.748	7.761	7.773	7.786	3.00
.10	7.799	7.811	7.824	7.836	7.849	7.861	7.874	7.886	7.899	7.911	.10
.20	7.923	7.936	7.948	7.960	7.972	7.985	7.999	8.010	8.022	8.034	.20
.30	8.046	8.058	8.070	8.083	8.095	8.107	8.119	8.131	8.143	8.155	.30
.40	8.168	8.179	8.191	8.203	8.215	8.227	8.239	8.251	8.263	8.275	.40
.50	8.287	8.299	8.310	8.322	8.334	8.346	8.358	8.369	8.381	8.395	.50
.60	8.405	8.416	8.428	8.459	8.451	8.462	8.474	8.485	8.497	8.508	.60
.70	8.520	8.532	8.543	8.555	8.566	8.578	8.589	8.600	8.612	8.623	.70
.80	8.634	8.646	8.658	8.669	8.680	8.691	8.702	8.714	8.725	8.736	.80
.90	8.748	8.759	8.770	8.781	8.792	8.803	8.814	8.826	8.837	8.848	.90
4.00	8.859	8.870	8.881	8.892	8.905	8.914	8.925	8.936	8.947	8.958	4.00
H	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	H

5—6 理論流速表

公式：$V=\sqrt{2gH}$

V＝流速（秒/公尺） H＝水頭（公尺） g＝9.81（公尺/秒/秒）

H	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
4	8.86	8.97	9.08	9.19	9.29	9.40	9.50	9.60	9.70	9.80	4
5	9.90	10.00	10.10	10.20	10.29	10.39	10.48	10.58	10.67	10.76	5
6	10.85	10.94	11.03	11.12	11.21	11.27	11.38	11.47	11.55	11.63	6
7	11.72	11.80	11.88	11.97	12.05	12.13	12.21	12.29	12.37	12.54	7
8	12.53	12.61	12.68	12.76	12.84	12.91	12.99	13.07	13.14	13.21	8
9	13.29	13.36	13.44	13.51	13.58	13.65	13.72	13.80	13.87	13.94	9
10	14.01	14.08	14.15	14.22	14.28	14.35	14.42	14.49	14.56	14.62	10
1	14.69	14.76	14.82	14.89	14.95	15.02	15.09	15.15	15.22	15.28	1
2	15.34	15.41	15.47	15.53	15.60	15.66	15.72	15.78	15.85	15.92	2
3	15.97	16.03	16.09	16.15	16.21	16.27	16.33	16.39	16.45	16.51	3
4	16.57	16.63	16.69	16.75	16.81	16.87	16.92	16.98	17.04	17.10	4
5	17.15	17.21	17.27	17.33	17.38	17.44	17.49	17.55	17.61	17.66	5
6	17.72	17.77	17.83	17.88	17.94	17.99	18.05	18.10	18.15	18.21	6
7	18.26	18.31	18.37	18.42	18.48	18.53	18.58	18.63	18.69	18.74	7
8	18.79	18.84	18.90	18.95	19.00	19.05	19.10	19.15	19.20	19.26	8
9	19.31	19.36	19.41	19.46	19.51	19.56	19.61	19.66	19.71	19.76	9
20	19.81	19.86	19.91	19.96	20.01	20.06	20.10	20.15	20.20	20.25	20
1	20.30	20.35	20.39	20.44	20.49	20.54	20.59	20.63	20.68	20.73	1
2	20.78	20.82	20.87	20.92	20.96	21.01	21.06	21.10	21.15	21.20	2
3	21.24	21.29	21.35	21.38	21.43	21.47	21.52	21.56	21.61	21.65	3
4	21.70	21.74	21.79	21.83	21.88	21.92	21.97	22.01	22.06	22.10	4
5	22.15	22.19	22.23	22.28	22.32	22.37	22.41	22.45	22.50	22.54	5
6	22.59	22.63	22.67	22.72	22.76	22.80	22.84	22.89	22.93	22.97	6
7	23.02	23.06	23.10	23.14	23.18	23.23	23.27	23.31	23.35	23.40	7
8	23.44	23.48	23.52	23.56	23.60	23.65	23.69	23.73	23.77	23.81	8
9	23.85	23.90	23.94	23.98	24.02	24.06	24.10	24.14	24.18	24.22	9
30	24.26	24.30	24.34	24.38	24.42	24.46	24.50	24.54	24.58	24.62	30
1	24.66	24.70	24.74	24.78	24.82	24.86	24.90	24.94	24.98	25.02	1
2	25.06	25.10	25.13	25.17	25.21	25.25	25.29	25.33	25.37	25.41	2
3	25.45	25.48	25.52	25.56	25.60	25.64	25.68	25.71	25.75	25.79	3
4	25.83	25.86	25.90	25.94	25.98	26.02	26.05	26.09	26.13	26.17	4
5	26.20	26.24	26.28	26.32	26.35	26.39	26.43	26.47	26.50	26.54	5
6	26.58	26.61	26.65	26.69	26.72	26.76	26.80	26.83	26.87	26.91	6
7	26.94	26.98	27.02	27.05	27.09	27.13	27.16	27.20	27.23	27.27	7
8	27.30	27.34	27.38	27.41	27.45	27.48	27.52	27.56	27.59	27.63	8
9	27.66	27.70	27.73	27.77	27.80	27.84	27.88	27.91	27.94	27.98	9
H	0	1	2	3	4	5	6	7	8	9	H
40	28.01	28.05	28.08	28.12	28.15	28.19	28.22	28.26	28.29	28.33	40
50	31.32	31.35	31.38	31.41	31.45	31.48	31.51	31.54	31.57	31.60	50
60	34.31	34.34	34.37	34.40	34.42	34.45	34.48	34.51	34.54	34.57	60
70	37.06	37.09	37.11	37.14	37.16	37.19	37.22	37.24	37.27	37.30	70
80	39.62	39.64	39.67	39.69	39.72	39.74	39.76	39.79	39.81	39.84	80
90	42.02	42.04	42.07	42.09	42.11	42.14	42.16	42.18	42.21	42.23	90

5—7 理論流速水頭表

公式：$H=\frac{V^2}{2g}$

H＝水頭　　V＝流速（秒/公尺）　　g＝9.81（公尺/秒/秒）

V	00	.01	.02	.03	.04	.05	.06	.07	.08	.09	V
0.0	.0000	.0000	.0000	.0000	.0001	.0001	.0002	.0002	.0003	.0003	0.0
.1	.0004	.0005	.0007	.0009	.0010	.0011	.0013	.0015	.0017	.0019	.1
.2	.0020	.0022	.0025	.0027	.0029	.0032	.0034	.0037	.0040	.0043	.2
.3	.0046	.0049	.0052	.0055	.0059	.0062	.0066	.0070	.0073	.0077	.3
.4	.0082	.0086	.0090	.0094	.0099	.0103	.0108	.0112	.0117	.0122	.4
.5	.0127	.0133	.0138	.0143	.0149	.0154	.0160	.0165	.0171	.0177	.5
.6	.0183	.0190	.0196	.0202	.0209	.0215	.0222	.0229	.0236	.0243	.6
.7	.0250	.0257	.0264	.0272	.0279	.0287	.0274	.0302	.0310	.0318	.7
.8	.0326	.0334	.0349	.0351	.0360	.0373	.0377	.0386	.0395	.0404	.8
.9	.0419	.0422	.0431	.0441	.0450	.0460	.0470	.0480	.0490	.0500	.9
1.0	.0510	.0520	.0530	.0541	.0551	.0562	.0573	.0584	.0595	.0606	1.0
.1	.0617	.0628	.0639	.0651	.0662	.0674	.0686	.0698	.0710	.0722	.1
.2	.0734	.0746	.0759	.0771	.0784	.0796	.0809	.0822	.0835	.0848	.2
.3	.0861	.0874	.0888	.0902	.0919	.0929	.0948	.0957	.0971	.0985	.3
.4	.0999	.1019	.1028	.1042	.1057	.1072	.1886	.1101	.1116	.1132	.4
.5	.1147	.1162	.1178	.1193	.1209	.1225	.1240	.1256	.1273	.1289	.5
.6	.1305	.1321	.1338	.1354	.1371	.1388	.1405	.1422	.1439	.1456	.6
.7	.1473	.1490	.1508	.1526	.1543	.1561	.1579	.1597	.1615	.1638	.7
.8	.1652	.1670	.1688	.1707	.1726	.1745	.1764	.1783	.1802	.1821	.8
.9	.1840	.1860	.1879	.1899	.1919	.1938	.1958	.1978	.1998	.2010	.9
2.0	.2039	.2059	.2080	.2100	.2121	.2142	.2163	.2184	.2205	.2226	2.0
.1	.2242	.2269	.2291	.2312	.2334	.2356	.2378	.2400	.2422	.2444	.1
.2	.2467	.2489	.2512	.2533	.2558	.2580	.2603	.2626	.2649	.2673	.2
.3	.2696	.2720	.2743	.2767	.2791	.2815	.2839	.2863	.2887	.2911	.3
.4	.2936	.2960	.2985	.3010	.3035	.3059	.3084	.3109	.3135	.3160	.4
.5	.3186	.3211	.3237	.3262	.3288	.3314	.3340	.3360	.3398	.3419	.5
.6	.3445	.3472	.3499	.3525	.3552	.3579	.3606	.3634	.3661	.3688	.6
.7	.3716	.3748	.3771	.3799	.3827	.3854	.3883	.3911	.3939	.3967	.7
.8	.3996	.4025	.4054	.4082	.4111	.4140	.4169	.4198	.4228	.4257	.8
.9	.4287	.4316	.4346	.4375	.4405	.4435	.4466	.4496	.4526	.4557	.9
3.0	.4587	.4618	.4648	.4679	.4710	.4741	.4772	.4884	.4835	.4867	3.0
.1	.4898	.4930	.4962	.4994	.5026	.5058	.5090	.5122	.5154	.5186	.10
.2	.5219	.5252	.5284	.5318	.5351	.5384	.5417	.5450	.5494	.5517	.2
.3	.5550	.5584	.5618	.5652	.5686	.5720	.5754	.5789	.5823	.5858	.3
.4	.5892	.5926	.5962	.5996	.6032	.6067	.6102	.6137	.6172	.6208	.4
.5	.6244	.6280	.6315	.6351	.6387	.6424	.6460	.6496	.6532	.6569	.5
.6	.6606	.6642	.6679	.6716	.6754	.6790	.6828	.6866	.6903	.6940	.6
.7	.6978	.7015	.7053	.7092	.7130	.7168	.7206	.7244	.7283	.7322	.7
.8	.7360	.7399	.7438	.7477	.7516	.7555	.7595	.7634	.7674	.7713	.8
.9	.7753	.7799	.7832	.7872	.7912	.7952	.7992	.8033	.8074	.8114	.9
4.0	.8155	.8196	.8237	.8278	.8319	.8360	.8401	.8442	.8484	.8526	4.0
V	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	V

5—7 理論流速水頭表

公式：$H=\frac{V^2}{2g}$

H＝水頭　　V＝流速（秒/公尺）　　g＝9.81（公尺/秒/秒）

V	.00	.01	.02	.03	.04	.05	.06	07	.08	.09	V
4.0	0.816	0.820	0.824	0.828	0.832	0.836	0.840	0.844	0.848	0.853	4.0
.1	0.857	0.861	0.865	0.869	0.874	0.878	0.882	0.886	0.890	0.895	.1
.2	0.899	0.903	0.908	0.912	0.916	0.921	0.925	0.929	0.934	0.938	.2
.3	0.942	0.947	0.951	0.956	0.960	0.964	0.969	0.973	0.978	0.982	.3
.4	0.987	0.990	0.996	1.000	1.005	1.009	1.014	1.018	1.025	1.028	.4
.5	1.032	1.037	1.041	1.046	1.050	1.055	1.060	1.065	1.069	1.074	.5
.6	1.079	1.083	1.088	1.093	1.097	1.102	1.107	1.112	1.116	1.121	.6
.7	1.126	1.131	1.135	1.140	1.145	1.150	1.155	1.160	1.165	1.170	.7
.8	1.174	1.179	1.184	1.189	1.194	1.199	1.204	1.209	1.214	1.219	.8
.9	1.224	1.229	1.234	1.239	1.244	1.249	1.254	1.259	1.264	1.269	.9
5.0	1.274	1.279	1.284	1.290	1.295	1.300	1.305	1.310	1.315	1.320	5.0
.1	1.326	1.331	1.336	1.341	1.347	1.352	1.357	1.362	1.368	1.373	.1
.2	1.378	1.384	1.390	1.394	1.400	1.405	1.410	1.416	1.421	1.426	.2
.3	1.432	1.437	1.443	1.448	1.454	1.459	1.464	1.470	1.475	1.481	.3
.4	1.486	1.492	1.497	1.503	1.508	1.514	1.519	1.525	1.531	1.536	.4
.5	1.542	1.547	1.553	1.599	1.564	1.564	1.570	1.576	1.581	1.587	.5
.6	1.598	1.604	1.610	1.616	1.622	1.627	1.633	1.639	1.640	1.650	.6
.7	1.656	1.662	1.668	1.672	1.679	1.685	1.691	1.697	1.703	1.709	.7
.8	1.715	1.721	1.727	1.732	1.738	1.744	1.750	1.756	1.762	1.768	.8
.9	1.774	1.780	1.786	1.792	1.798	1.804	1.810	1.817	1.823	1.829	.9
6.0	1.835	1.841	1.847	1.853	1.859	1.866	1.872	1.878	1.884	1.890	6.0
.1	1.897	1.903	1.909	1.915	1.922	1.928	1.934	1.940	1.947	1.953	.1
.2	1.959	1.966	1.972	1.978	1.985	1.991	1.997	2.004	2.010	2.017	.2
.3	2.025	2.030	2.036	2.042	2.049	2.055	2.062	2.068	2.075	2.081	.3
.4	2.088	2.094	2.101	2.107	2.114	2.120	2.127	2.134	2.140	2.147	.4
.5	2.153	2.160	2.167	2.173	2.180	2.187	2.193	2.200	2.207	2.213	.5
.6	2.220	2.227	2.234	2.240	2.247	2.254	2.261	2.268	2.274	2.281	.6
.7	2.288	2.295	2.302	2.309	2.315	2.322	2.329	2.336	2.345	2.350	.7
.8	2.357	2.364	2.371	2.378	2.385	2.392	2.399	2.406	2.413	2.420	.8
.9	2.427	2.434	2.441	2.448	2.455	2.462	2.469	2.476	2.483	2.490	.9
7.0	2.498	2.505	2.512	2.519	2.526	2.535	2.540	2.548	2.555	2.562	7.0
.1	2.570	2.577	2.584	2.591	2.599	2.606	2.613	2.620	2.628	2.635	.1
.2	2.642	2.649	2.657	2.664	2.672	2.679	2.686	2.694	2.701	2.709	.2
.3	2.716	2.724	2.731	2.739	2.746	2.753	2.761	2.768	2.776	2.783	.3
.4	2.791	2.798	2.806	2.813	2.821	2.829	2.836	2.844	2.852	2.860	.4
.5	2.867	2.875	2.882	2.890	2.898	2.906	2.913	2.921	2.929	2.936	.5
.6	2.944	2.952	2.959	2.967	2.975	2.983	2.991	2.998	3.006	3.014	.6
.7	3.022	3.030	3.038	3.046	3.054	3.061	3.069	3.077	3.083	3.093	.7
.8	3.101	3.109	3.117	3.125	3.133	3.141	3.149	3.157	3.165	3.173	.8
.9	3.181	3.189	3.197	3.205	3.213	3.221	3.229	3.238	3.246	3.254	.9
8.0	3.262	3.270	3.278	3.286	3.295	3.303	3.311	3.319	3.317	3.336	8.0
V	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	V

5—8 孔口洩水

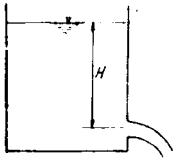
(一) 小孔口之流量 ($A=1$ 公分^2, $C=0.62$)

公式:—

$$Q=CA\sqrt{2gH}$$

A=孔口斷面積;

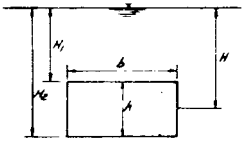
C=流量係數.



H (公分)	Q (公分^3/秒)	H (公分)	Q (公分^3/秒)
5	61	60	213
10	81	70	230
15	106	80	246
20	123	90	260
25	137	100	274
30	150	150	336
35	162	200	388
40	174	250	434
45	184	300	475
50	194	350	514

(二) 大孔口之流量

1. 矩形及正方形孔口



公式:—

$$Q=\frac{2}{3}cb\sqrt{2g}\left(H_2^{\frac{3}{2}}-H_1^{\frac{3}{2}}\right)$$

$$=cbh\sqrt{2gH}\left[1-\frac{1}{96}\left(\frac{h}{H}\right)^2-\frac{1}{2048}\left(\frac{h}{H}\right)^4-\cdots\right]$$

$$=cbh\sqrt{2gH}K_1$$

矩形孔口之 K_1 值

H/h	1.0	2.0	3.0	4.0~
K_1	0.989	0.997	0.999	1.000

在接近流速之處:

$$Q=\frac{2}{3}cb\sqrt{2g}\left[\left(H_2+h_a\right)^{\frac{3}{2}}-\left(H_1+h_a\right)^{\frac{3}{2}}\right]$$

$$h_a(\text{接近水頭})=\frac{V_a^2}{2g}$$

V_a=接近流速.

寬20公分矩形孔口之流量係數表

上緣之水深 H_1 (公分)	孔口高 h (公分)					
	1	2	3	5	10	20
5	0.680	0.658	0.640	0.625	0.605	0.585
10	0.667	0.655	0.637	0.630	0.611	0.592
20	0.655	0.649	0.634	0.631	0.615	0.598
40	0.646	0.642	0.631	0.629	0.617	0.602
60	0.641	0.638	0.630	0.627	0.617	0.604
80	0.635	0.635	0.628	0.626	0.616	0.605
100	0.629	0.632	0.627	0.625	0.615	0.605
150	0.617	0.620	0.621	0.619	0.611	0.602
200	0.613	0.615	0.613	0.613	0.607	0.601
300	0.609	0.603	0.607	0.606	0.603	0.601

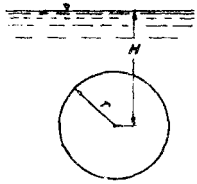
5--8 孔口洩水

正方形孔口之流量係數表

中心之水深 H (公分)	孔寬 b 及高 h (公分)					
	1	2	3	6	12	18
10	0.652	0.632	0.622	—	—	—
20	0.648	0.624	0.617	0.605	0.598	—
30	0.636	0.619	0.613	0.605	0.601	0.599
50	0.628	0.618	0.610	0.605	0.602	0.601
70	0.625	0.612	0.607	0.605	0.604	0.602
100	0.620	0.610	0.607	0.605	0.604	0.603
150	0.618	0.609	0.606	0.604	0.603	0.602
200	0.614	0.608	0.605	0.604	0.603	0.602
300	0.611	0.606	0.604	0.603	0.602	0.601

Ⅱ. 圓形孔口

公式:—



$$Q = c\pi r^2\sqrt{2gH}\left[1-\frac{1}{32}\left(\frac{r}{H}\right)^2-\frac{1}{1024}\left(\frac{r}{H}\right)^4-\cdots\right]$$

$$= c\pi r^2\sqrt{2gH}\ K_2$$

圓形孔口之 K_2 值

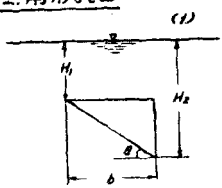
H/r	1.0	2.0	3.0	4.0	5.0	6.0 ~
K_2	0.960	0.992	0.997	0.998	0.999	1.000

○形孔口之流量係數表

中心之水深 H (公分)	半徑 r (公分)					
	1	2	3	6	18	30
10	0.642	0.626	0.619	—	—	—
20	0.639	0.619	0.613	0.601	0.593	—
30	0.634	0.613	0.608	0.600	0.595	0.591
50	0.626	0.609	0.605	0.600	0.596	0.593
70	0.620	0.607	0.603	0.599	0.598	0.596
100	0.619	0.605	0.602	0.599	0.598	0.596
150	0.614	0.604	0.601	0.598	0.597	0.597
200	0.611	0.603	0.600	0.597	0.596	0.596
300	0.607	0.600	0.598	0.597	0.596	0.595

5—8 孔口洩水

Ⅲ. 直角三角形孔口



公式:—

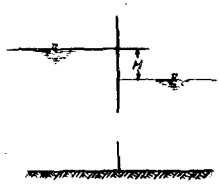
當(1)之孔口 $Q = C \cot\theta \sqrt{2g}\left[\frac{2}{3} H_2\left(H_2^{\frac{3}{2}} - H_1^{\frac{3}{2}}\right) - \frac{2}{5}\left(H_2^{\frac{5}{2}} - H_1^{\frac{5}{2}}\right)\right]$

當(2)之孔口 $Q = C \cot\theta \sqrt{2g}\left[\frac{2}{5}\left(H_2^{\frac{5}{2}} - H_1^{\frac{5}{2}}\right) - \frac{2}{3} H_1\left(H_2^{\frac{3}{2}} - H_1^{\frac{3}{2}}\right)\right]$

$C = 0.58 \sim 0.62$

(三) 潛孔口之流量

Ⅰ. 完全潛孔口



公式:—

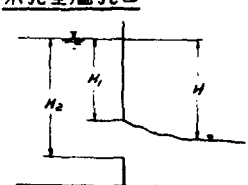
$Q = CA\sqrt{2gH}$

A = 孔口之斷面積.

完全潛孔口之流量係數表

形狀	尺寸	水位差 H (公尺)				
		0.09	0.15	0.30	0.60	1.20
圓形	直徑 1.5 公分	—	0.599	0.597	0.595	0.595
圓形	直徑 3.0 公分	0.600	0.600	0.600	0.599	0.598
方形	邊長 1.5 公分	—	0.600	0.607	0.605	0.604
方形	邊長 3.0 公分	0.607	0.605	0.604	0.603	0.602

Ⅱ. 不完全潛孔口



公式:—

$$Q = \frac{2}{3} C_1 b\sqrt{2g}\left(H^{\frac{3}{2}} - H_1^{\frac{3}{2}}\right) + C_2 (H_2 - H) b\sqrt{2gH}$$

b = 孔口之寬.

$C_1 = 0.62$ $C_2 = 0.53$