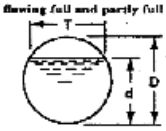
Appendix 8F-5 Geometric Properties and Critical Flow Factors for Circular Conduits Flowing Full and Partly Full

Table 4. – Geometric properties and critical flow factors for circular conduits flowing full and partly full

d = Depth of flow
d_c = Critical depth
d_m = Mean depth
D = Diameter of pipe
A = Area of flow
R = Hydraulic radius
T = Top width of flow
Q_c = Discharge at a critical flow condition
H_c = Specific head at critical flow
$H_c = d_c + (\alpha V_c^2)/(2g)$ (iterations with α)
V_c = Critical velocity
α = Kinetic energy correction factor
g = Acceleration due to gravity = 32.16 ft./sec./sec.



$\frac{d}{D}$ or $\frac{d_c}{D}$	$\frac{A}{D^2}$	$\frac{R}{D}$	$\frac{T}{D}$	$\frac{d_m}{D}$	$\frac{Q_c}{D^2\sqrt{gD}}$ $\alpha = 1.00$	$\alpha = 1.04$	$\alpha = 1.12$	$\frac{\alpha V_c^2}{2gD}$ all α	$\frac{H_c}{D}$ all α
1.00	0.7854	0.2500	—	—	—	—	—	—	—
0.99	.7841	.2666	0.1990	—	—	—	—	—	—
98	.7817	.2735	.2800	—	—	—	—	—	—
97	.7785	.2787	.3412	2.2817	6.6695	6.5490	6.3021	1.1410	2.1110
96	.7749	.2829	.3919	1.9773	6.1785	6.0585	5.8381	0.9883	1.9683
95	.7707	.2865	.4359	1.7681	5.8119	5.6991	5.4917	.8840	1.8540
94	.7662	.2895	.4750	1.6131	5.5182	5.4111	5.2142	.8063	1.7463
93	.7612	.2921	.5103	1.4917	5.2757	5.1703	4.9822	.7459	1.6759
92	.7560	.2944	.5426	1.3933	5.0602	4.9620	4.7814	.6965	1.6165
91	.7504	.2963	.5724	1.3110	4.8724	4.7770	4.6040	.6555	1.5655
.90	.7445	.2980	.6000	1.2408	4.7063	4.6120	4.4442	.6205	1.5205
.89	.7384	.2995	.6258	1.1799	4.5586	4.4681	4.3080	.5899	1.4799
.88	.7320	.3007	.6499	1.1263	4.4057	4.3202	4.1680	.5633	1.4433
.87	.7254	.3016	.6726	1.0785	4.2722	4.1893	4.0369	.5393	1.4093
.86	.7186	.3026	.6940	1.0354	4.1466	4.0661	3.9182	.5177	1.3777
.85	.7115	.3033	.7142	0.9962	4.0276	3.9494	3.8057	.4982	1.3482
.84	.7043	.3038	.7332	.9606	3.9144	3.8384	3.6988	.4802	1.3202
.83	.6969	.3041	.7513	.9276	3.8062	3.7323	3.5965	.4637	1.2937
.82	.6893	.3043	.7684	.8971	3.7021	3.6302	3.4982	.4484	1.2684
.81	.6815	.3043	.7846	.8686	3.6020	3.5321	3.4036	.4343	1.2443
.80	.6736	.3042	.8000	.8420	3.5051	3.4370	3.3120	.4209	1.2209
.79	.6655	.3039	.8146	.8170	3.4111	3.3449	3.2232	.4084	1.1984
.78	.6573	.3036	.8285	.7934	3.3200	3.2555	3.1371	.3966	1.1766
.77	.6489	.3031	.8417	.7709	3.2314	3.1687	3.0534	.3855	1.1555
.76	.6405	.3024	.8542	.7498	3.1450	3.0839	2.9717	.3749	1.1349
0.75	0.6319	0.3017	0.8660	0.7297	3.0606	3.0012	2.8920	0.3648	1.1148
.74	.6231	.3008	.8773	.7102	2.9783	2.9205	2.8142	.3552	1.0952
.73	.6143	.2998	.8879	.6919	2.8977	2.8414	2.7381	.3459	1.0759
.72	.6054	.2987	.8980	.6742	2.8188	2.7641	2.6635	.3371	1.0571
.71	.5964	.2975	.9075	.6572	2.7416	2.6884	2.5906	.3285	1.0385
.70	.5872	.2962	.9165	.6407	2.6656	2.6138	2.5188	.3204	1.0204
.69	.5780	.2948	.9250	.6249	2.5912	2.5409	2.4485	.3125	1.0025
.68	.5687	.2933	.9330	.6095	2.5182	2.4693	2.3795	.3048	0.9848
.67	.5594	.2917	.9404	.5949	2.4466	2.3990	2.3117	.2974	.9674
.66	.5499	.2900	.9474	.5804	2.3760	2.3299	2.2451	.2902	.9502
.65	.5404	.2882	.9539	.5665	2.3068	2.2620	2.1797	.2833	.9333
.64	.5308	.2862	.9600	.5529	2.2386	2.1951	2.1153	.2765	.9165
.63	.5212	.2842	.9656	.5398	2.1717	2.1295	2.0521	.2699	.8999
.62	.5115	.2821	.9708	.5269	2.1058	2.0649	1.9898	.2635	.8835
.61	.5018	.2799	.9755	.5144	2.0410	2.0014	1.9286	.2572	.8672
.60	.4920	.2776	.9798	.5021	1.9773	1.9389	1.8684	.2513	.8511
.59	.4822	.2753	.9837	.4902	1.9147	1.8775	1.8092	.2451	.8351
.58	.4724	.2728	.9871	.4786	1.8531	1.8171	1.7510	.2393	.8193
.57	.4625	.2703	.9902	.4671	1.7924	1.7576	1.6937	.2335	.8035
.56	.4526	.2676	.9928	.4559	1.7328	1.6999	1.6373	.2279	.7879
.55	.4426	.2649	.9950	.4448	1.6741	1.6416	1.5819	.2224	.7724
.54	.4327	.2621	.9968	.4339	1.6166	1.5852	1.5276	.2170	.7570
.53	.4227	.2592	.9982	.4235	1.5598	1.5295	1.4739	.2117	.7417
.52	.4127	.2562	.9992	.4130	1.5041	1.4749	1.4212	.2065	.7266
.51	.4027	.2531	.9998	.4028	1.4494	1.4213	1.3696	.2014	.7114
.50	.3927	.2500	1.0000	.3927	1.3956	1.3685	1.3187	.1964	.6964
.49	.3827	.2468	.9998	.3828	1.3427	1.3166	1.2687	.1914	.6814
.48	.3727	.2435	.9992	.3730	1.2906	1.2657	1.2197	.1865	.6665
.47	.3627	.2401	.9982	.3634	1.2400	1.2159	1.1717	.1817	.6517
.46	.3527	.2366	.9968	.3538	1.1900	1.1669	1.1244	.1770	.6370
.45	.3428	.2331	.9950	.3445	1.1410	1.1188	1.0781	.1722	.6222
.44	.3328	.2295	.9928	.3352	1.0929	1.0717	1.0327	.1577	.6077
.43	.3229	.2258	.9902	.3261	1.0459	1.0256	0.9883	.1631	.5931
.42	.3130	.2220	.9871	.3171	0.9997	0.9803	.9446	.1586	.5786
.41	.3032	.2182	.9837	.3082	.9546	.9361	.9020	.1541	.5641
.40	.2934	.2142	.9798	.2994	.9104	.8927	.8602	.1497	.5497
.39	.2836	.2102	.9755	.2907	.8672	.8504	.8194	.1454	.5354
.38	.2739	.2062	.9708	.2821	.8249	.8089	.7795	.1410	.5210
.37	.2642	.2020	.9656	.2736	.7836	.7684	.7404	.1368	.5068
.36	.2546	.1978	.9600	.2652	.7433	.7289	.7024	.1325	.4925
.35	.2450	.1935	.9539	.2568	.7040	.6903	.6652	.1284	.4784
.34	.2355	.1891	.9474	.2486	.6657	.6528	.6290	.1242	.4642
.33	.2260	.1847	.9404	.2403	.6284	.6162	.5938	.1202	.4502
.32	.2167	.1802	.9330	.2323	.5921	.5806	.5595	.1161	.4361
.31	.2074	.1756	.9250	.2242	.5569	.5461	.5262	.1121	.4221
.30	.1982	.1709	.9165	.2163	.5226	.5125	.4938	.1083	.4081
.29	.1890	.1662	.9075	.2083	.4893	.4798	.4623	.1042	.3942
.28	.1800	.1614	.8980	.2004	.4571	.4482	.4319	.1003	.3803
.27	.1711	.1566	.8879	.1927	.4259	.4175	.4024	.0963	.3668
.26	.1623	.1516	.8773	.1850	.3957	.3880	.3739	.0924	.3524
.25	.1535	.1466	.8660	.1773	.3667	.3596	.3465	.0887	.3387
.24	.1449	.1416	.8542	.1696	.3386	.3320	.3199	.0849	.3249
.23	.1365	.1364	.8417	.1622	.3116	.3055	.2944	.0810	.3110
.22	.1281	.1312	.8285	.1546	.2857	.2802	.2700	.0773	.2973
.21	.1199	.1259	.8145	.1472	.2609	.2558	.2465	.0736	.2826
0.20	0.1118	0.1206	0.8000	0.1397	0.2371	0.2325	0.2240	0.0699	0.2699
.19	.1039	.1153	.7846	.1324	.2144	.2102	.2026	.0662	.2562
.18	.0961	.1097	.7684	.1251	.1928	.1891	.1822	.0626	.2426
.17	.0885	.1042	.7513	.1178	.1724	.1691	.1629	.0590	.2290
.16	.0811	.0985	.7332	.1106	.1530	.1500	.1446	.0553	.2153
.15	.0739	.0929	.7142	.1035	.1347	.1321	.1272	.0516	.2016
.14	.0668	.0871	.6940	.0963	.1176	.1153	.1111	.0482	.1882
.13	.0600	.0813	.6726	.0892	.1016	.0996	.0960	.0446	.1746
.12	.0534	.0755	.6499	.0822	.0868	.0851	.0820	.0411	.1611
.11	.0470	.0695	.6258	.0751	.0731	.0717	.0691	.0378	.1476

Source: