Nominal Bore mm		100		150		200		225		300		375		400	
Hydraulic Gradient	1 in	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s
.0010	1000.0	0.23	1.84	0.31	5.46	0.37	11.74	0.40	16.06	0.49	34.45	0.66	62.19	0.69	73.75
.0011	909.1	0.25	1.93	0.32	5.73	0.39	12.33	0.42	16.87	0.51	36.18	0.69	65.29	0.62	77.43
.0012	833.3	0.26	2.02	0.34	5.99	0.41	12.90	0.44	17.64	0.54	37.83	0.62	68.26	0.64	80.95
.0013	769.2	0.27	2.11	0.35	6.24	0.43	13.44	0.46	18.38	0.56	39.41	0.64	71.11	0.67	84.32
.0014	714.3	0.28	2.19	0.37	6.49	0.44	13.96	0.48	19.09	0.58	40.93	0.67	73.84	0.70	87.57
.0015	666.7	0.29	2.27	0.38	6.72	0.46	14.46	0.50	19.78	0.60	42.40	0.69	76.48	0.72	90.70
.0016	625.0	0.30	2.35	0.39	6.95	0.48	14.95	0.51	20.44	0.62	43.82	0.72	79.04	0.75	93.73
.0017	588.2	0.31	2.43	0.41	7.17	0.49	15.42	0.53	21.09	0.64	45.20	0.74	81.52	0.77	96.66
.0018	555.6	0.32	2.50	0.42	7.39	0.51	15.88	0.55	21.71	0.66	46.53	0.76	83.93	0.79	99.51
.0019	526.3	0.33	2.57	0.43	7.59	0.52	16.33	0.56	22.32	0.68	47.83	0.78	86.27	0.81	102.29
.0020	500.0	0.34	2.64	0.44	7.80	0.53	16.76	0.58	22.92	0.69	49.10	0.80	88.56	0.84	104.99
.0022	454.5	0.35	2.77	0.46	8.19	0.56	17.60	0.61	24.06	0.73	51.54	0.84	92.94	0.88	110.19
.0024	416.7	0.37	2.90	0.48	8.56	0.59	18.40	0.63	25.15	0.76	53.88	0.88	97.14	0.92	115.17
.0026	384.6	0.38	3.02	0.50	8.92	0.61	19.17	0.66	26.20	0.79	56.12	0.92	101.17	0.96	119.94
.0028	357.1	0.40	3.14	0.52	9.27	0.63	19.91	0.68	27.21	0.82	58.27	0.95	105.04	0.99	124.53
.0030	333.3	0.41	3.25	0.54	9.60	0.66	20.62	0.71	28.18	0.85	60.35	0.98	108.78	1.03	128.97
.0032	312.5	0.43	3.36	0.56	9.92	0.68	21.31	0.73	29.13	0.88	62.36	1.02	112.40	1.06	133.25
.0034	294.1	0.44	3.47	0.58	10.24	0.70	21.98	0.76	30.04	0.91	64.31	1.05	115.91	1.09	137.41
.0036	277.8	0.45	3.57	0.60	10.54	0.72	22.63	0.78	30.92	0.94	66.20	1.08	119.31	1.13	141.44
.0038	263.2	0.47	3.67	0.61	10.83	0.74	23.26	0.80	31.79	0.96	68.04	1.11	122.62	1.16	145.36
.0040	250.0	0.48	3.77	0.63	11.12	0.76	23.88	0.82	32.63	0.99	69.83	1.14	125.85	1.19	149.19
.0042	238.1	0.49	3.87	0.65	11.40	0.79	24.48	0.84	33.44	1.01	71.58	1.17	128.99	1.22	152.91
.0044	227.3	0.50	3.96	0.66	11.68	0.80	25.06	0.86	34.24	1.04	73.29	1.20	132.06	1.25	156.55
.0046	217.4	0.52	4.05	0.68	11.94	0.82	25.64	0.88	35.03	1.06	74.96	1.22	135.07	1.27	160.11
.0048	208.3	0.53	4.14	0.68	12.20	0.83	26.20	0.90	35.79	1.08	76.59	1.25	138.00	1.30	163.59
.0050	200.0	0.54	4.23	0.71	12.46	0.85	26.75	0.92	36.54	1.11	78.19	1.28	140.88	1.33	167.00
.0055	181.8	0.57	4.44	0.74	13.08	0.89	28.07	0.96	38.35	1.16	82.06	1.34	147.83	1.39	175.24
.0060	166.7	0.59	4.64	0.77	13.67	0.93	29.34	1.01	40.09	1.21	85.75	1.40	154.48	1.46	183.11
.0065	153.8	0.62	4.84	0.81	14.24	0.97	30.56	1.05	41.74	1.26	89.29	1.46	160.85	1.52	190.66
.0070	142.9	0.64	5.02	0.84	14.79	1.01	31.73	1.09	43.34	1.31	92.70	1.51	166.98	1.58	197.93
.0075	133.3	0.66	5.20	0.87	15.32	1.05	32.86	1.13	44.88	1.36	95.99	1.57	172.90	1.63	204.94
.0080	125.0	0.69	5.38	0.90	15.83	1.08	33.95	1.17	46.37	1.40	99.17	1.62	178.62	1.68	211.72
.0085	117.6	0.71	5.55	0.92	16.32	1.11	35.00	1.20	47.81	1.45	102.25	1.67	184.16	1.74	218.29
.0090	111.1	0.73	5.71	0.95	16.80	1.15	36.03	1.24	49.21	1.49	105.25	1.72	189.55	1.79	224.67
.0095	105.3	0.75	5.87	0.98	17.27	1.18	37.03	1.27	50.58	1.53	108.16	1.76	194.79	1.84	230.88
.0100	100.0	0.77	6.02	1.00	17.72	1.21	38.00	1.31	51.91	1.57	110.99	1.81	199.89	1.89	236.92
.0110	90.9	0.81	6.32	1.05	18.60	1.27	39.88	1.37	54.47	1.65	116.46	1.90	209.72	1.98	248.57
.0120	83.3	0.84	6.61	1.10	19.44	1.33	41.67	1.43	56.91	1.72	121.69	1.98	219.12	2.07	259.71
.0130	76.9	0.88	6.88	1.15	20.24	1.38	43.39	1.49	59.26	1.79	126.69	2.07	228.13	2.15	270.39
.0140	71.4	0.91	7.15	1.19	21.02	1.43	45.05	1.55	61.52	1.86	131.51	2.14	236.80	2.23	280.66
.0150	66.7	0.94	7.40	1.23	21.76	1.48	46.65	1.60	63.70	1.93	136.17	2.22	245.17	2.31	290.56
.0160	62.5	0.97	7.65	1.27	22.48	1.53	48.19	1.66	65.81	1.99	140.67	2.29	253.27	2.39	300.17
.0170	58.8	1.00	7.89	1.31	23.18	1.58	49.69	1.71	67.85	2.05	145.03	2.36	261.11	2.46	309.46
.0180	55.6	1.03	8.12	1.35	23.86	1.63	51.14	1.76	69.83	2.11	149.26	2.43	268.73	2.53	318.49
.0190	52.6	1.06	8.34	1.39	24.52	1.67	52.56	1.80	71.76	2.17	153.38	2.50	276.13	2.60	327.25
.0200	50.0	1.09	8.56	1.42	25.17	1.72	53.93	1.85	73.64	2.23	157.39	2.57	283.35	2.67	335.81
.0220	45.5	1.14	8.99	1.49	26.41	1.80	56.59	1.94	77.26	2.34	165.12	2.69	297.26	2.80	352.29
.0240	41.7	1.20	9.39	1.56	27.59	1.88	59.12	2.03	80.73	2.44	172.51	2.81	310.55	2.93	368.04
.0260	38.5	1.25	9.78	1.62	28.73	1.96	61.56	2.11	84.05	2.54	179.60	2.93	323.30	3.05	383.15
.0280	35.7	1.29	10.15	1.68	29.83	2.03	63.90	2.19	87.24	2.64	186.42	3.04	335.56	3.16	397.68
.0300	33.3	1.34	10.51	1.75	30.89	2.11	66.16	2.27	90.32	2.73	193.00	3.15	347.40	3.28	411.70
.0320	31.2	1.38	10.86	1.81	31.90	2.18	68.34	2.35	93.30	2.82	199.36	3.25	358.84	3.38	425.27
.0340	29.4	1.43	11.20	1.86	32.89	2.24	70.46	2.42	96.19	2.91	205.53	3.35	369.94	3.49	438.41
.0360	27.8	1.47	11.53	1.92	33.85	2.31	72.51	2.49	99.00	2.99	211.52	3.45	380.71	3.59	451.17
.0380	26.3	1.51	11.85	1.97	34.79	2.37	74.51	2.56	101.73	3.07	217.34	3.54	391.18	3.69	463.59
.0400	25.0	1.55	12.16	2.02	35.70	2.43	76.45	2.63	104.39	3.15	223.01	3.63	401.39	3.79	475.68
.0420	23.8	1.59	12.46	2.07	36.59	2.49	78.36	2.69	106.98	3.23	228.55	3.72	411.36	3.88	487.47
.0440	22.7	1.62	12.76	2.12	37.45	2.55	80.22	2.75	109.51	3.31	233.95	3.81	421.06	3.97	498.99
.0460	21.7	1.66	13.05	2.17	38.30	2.61	82.03	2.82	111.98	3.38	239.23	3.90	430.56	4.06	510.25
.0480	20.8	1.70	13.33	2.21	39.13	2.67	83.80	2.88	114.40	3.46	244.40	3.98	439.86	4.15	521.26
.0500	20.0	1.73	13.61	2.26	39.94	2.72	85.54	2.94	116.78	3.53	249.46	4.06	448.96	4.23	532.05
.0550	18.2	1.82	14.28	2.37	41.90	2.86	89.74	3.08	122.50	3.70	261.69	4.26	470.96	4.44	558.11
.0600	16.7	1.90	14.92	2.48	43.78	2.98	93.75	3.22	127.98	3.87	273.37	4.45	491.97	4.64	583.01
.0650	15.4	1.98	15.53	2.58	45.58	3.11	97.60	3.35	133.23	4.03	284.58	4.64	512.13	4.83	606.89
.0700	14.3	2.05	16.12	2.68	47.31	3.22	101.30	3.48	138.28	4.18	295.36	4.81	531.52	5.01	629.87
.0750	13.3	2.13	16.69	2.77	48.98	3.34	104.87	3.60	143.15	4.33	305.76	4.98	550.24	5.19	652.05
.0800	12.5	2.20	17.24	2.86	50.59	3.45	108.32	3.72	147.87	4.47	315.82	5.15	568.34	5.36	673.49
.0850	11.8	2.26	17.76	2.95	52.16	3.55	111.67	3.83	152.44	4.61	325.58	5.30	585.88	5.52	694.28
.0900	11.1	2.33	18.30	3.04	53.68	3.66	114.92	3.95	156.87	4.74	335.05	5.46	602.91	5.68	714.46
.0950	10.5	2.39	18.80	3.12	55.15	3.76	118.09	4.05	161.19	4.87	344.26	5.61	619.48	5.84	734.09

TABLE B5 *(continued)*

PIPE FLOWING FULL $k_s = 0.6mm$

450mm to 1000mm Nominal Bore

Nominal Bore mm		450		500		600		700		800		900		1000	
Hydraulic Gradient	1 in	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s	velocity m/s	discharge l/s
.0010	1000.0	0.63	100.66	0.68	132.91	0.76	214.87	0.84	322.34	0.91	457.85	0.98	623.79	1.05	822.41
.0011	909.1	0.66	105.67	0.71	139.52	0.80	225.54	0.88	338.33	0.96	480.53	1.03	654.66	1.10	863.08
.0012	833.3	0.69	110.46	0.74	145.84	0.83	235.74	0.92	353.60	1.00	502.20	1.08	684.15	1.15	901.93
.0013	769.2	0.72	115.06	0.77	151.90	0.87	245.52	0.96	368.25	1.04	522.99	1.12	712.45	1.20	939.20
.0014	714.3	0.75	119.48	0.80	157.74	0.90	254.93	0.99	382.35	1.08	542.99	1.16	739.67	1.24	975.07
.0015	666.7	0.78	123.75	0.83	163.36	0.93	264.01	1.03	396.85	1.12	562.29	1.20	765.94	1.29	1009.67
.0016	625.0	0.80	127.88	0.86	168.81	0.96	272.79	1.06	409.11	1.16	580.95	1.24	791.35	1.33	1043.15
.0017	588.2	0.83	131.88	0.89	174.09	0.99	281.31	1.10	421.86	1.19	599.05	1.28	815.98	1.37	1075.59
.0018	555.6	0.85	135.77	0.91	179.21	1.02	289.58	1.13	434.25	1.23	616.62	1.32	839.89	1.41	1107.09
.0019	526.3	0.88	139.54	0.94	184.19	1.05	297.62	1.16	446.29	1.26	633.71	1.36	863.15	1.45	1137.73
.0020	500.0	0.90	143.23	0.96	189.05	1.08	305.45	1.19	458.03	1.29	650.35	1.39	885.80	1.49	1167.57
.0022	454.5	0.95	150.32	1.01	198.41	1.13	320.55	1.25	480.64	1.36	682.44	1.46	929.47	1.56	1225.10
.0024	416.7	0.99	157.10	1.06	207.35	1.18	334.98	1.31	502.25	1.42	713.10	1.53	971.20	1.63	1280.07
.0026	384.6	1.03	163.61	1.10	215.92	1.23	348.81	1.36	522.98	1.48	742.51	1.59	1011.23	1.70	1332.79
.0028	357.1	1.07	169.87	1.14	224.18	1.28	362.13	1.41	542.93	1.53	770.80	1.65	1049.74	1.76	1383.53
.0030	333.3	1.11	175.90	1.18	232.14	1.33	374.98	1.46	562.18	1.59	798.11	1.71	1086.90	1.82	1432.48
.0032	312.5	1.14	181.75	1.22	239.85	1.37	387.41	1.51	580.79	1.64	824.52	1.77	1122.85	1.88	1479.83
.0034	294.1	1.18	187.41	1.26	247.31	1.41	399.45	1.56	598.83	1.69	850.11	1.82	1157.68	1.94	1525.72
.0036	277.8	1.21	192.90	1.30	254.56	1.45	411.15	1.60	616.35	1.74	874.97	1.87	1191.51	2.00	1570.28
.0038	263.2	1.25	198.25	1.33	261.61	1.49	422.53	1.65	633.38	1.78	899.14	1.92	1224.41	2.05	1613.62
.0040	250.0	1.28	203.46	1.37	268.48	1.53	433.61	1.69	649.99	1.84	922.68	1.98	1256.46	2.11	1655.83
.0042	238.1	1.31	208.54	1.40	275.18	1.57	444.41	1.73	666.18	1.88	945.65	2.02	1287.71	2.16	1697.00
.0044	227.3	1.34	213.50	1.43	281.72	1.61	454.97	1.77	681.98	1.93	968.07	2.07	1318.23	2.21	1737.21
.0046	217.4	1.37	218.35	1.47	288.11	1.65	465.28	1.81	697.43	1.97	989.99	2.12	1348.06	2.26	1776.51
.0048	208.3	1.40	223.09	1.50	294.37	1.68	475.38	1.85	712.55	2.01	1011.44	2.16	1377.26	2.31	1814.96
.0050	200.0	1.43	227.74	1.53	300.50	1.72	485.26	1.89	727.36	2.05	1032.45	2.21	1405.85	2.36	1852.62
.0055	181.8	1.50	238.96	1.61	315.30	1.80	509.15	1.98	763.13	2.15	1083.19	2.32	1474.91	2.47	1943.60
.0060	166.7	1.57	249.69	1.68	329.45	1.88	531.97	2.07	797.31	2.25	1131.68	2.42	1540.91	2.59	2030.53
.0065	153.8	1.63	259.98	1.75	343.01	1.96	553.85	2.16	830.10	2.34	1178.19	2.52	1604.21	2.69	2113.92
.0070	142.9	1.70	269.88	1.81	356.07	2.03	574.92	2.24	861.64	2.43	1222.94	2.62	1665.11	2.79	2194.15
.0075	133.3	1.76	279.43	1.88	368.66	2.11	595.24	2.32	892.08	2.52	1266.12	2.71	1723.88	2.89	2271.56
.0080	125.0	1.82	288.67	1.94	380.85	2.17	614.89	2.39	921.52	2.60	1307.89	2.80	1780.72	2.99	2346.44
.0085	117.6	1.87	297.63	2.00	392.66	2.24	633.94	2.47	950.05	2.68	1348.36	2.89	1835.82	3.08	2419.01
.0090	111.1	1.93	306.32	2.06	404.12	2.31	652.44	2.54	977.76	2.76	1387.67	2.97	1889.31	3.17	2489.47
.0095	105.3	1.98	314.78	2.11	415.27	2.37	670.43	2.61	1004.71	2.84	1425.90	3.05	1941.34	3.26	2558.01
.0100	100.0	2.03	323.01	2.17	426.14	2.43	687.96	2.68	1030.96	2.91	1463.13	3.13	1992.01	3.34	2624.76
.0110	90.9	2.13	338.89	2.28	447.07	2.55	721.74	2.81	1081.55	3.05	1534.90	3.28	2089.70	3.51	2753.44
.0120	83.3	2.23	354.06	2.38	467.08	2.67	754.01	2.94	1129.89	3.19	1603.48	3.43	2183.04	3.66	2876.39
.0130	76.9	2.32	368.62	2.48	486.27	2.78	784.97	3.06	1176.26	3.32	1669.26	3.57	2272.56	3.81	2994.32
.0140	71.4	2.41	382.62	2.57	504.73	2.88	814.76	3.17	1220.88	3.45	1732.56	3.71	2358.70	3.96	3107.79
.0150	66.7	2.49	396.13	2.66	522.55	2.98	843.50	3.28	1263.83	3.57	1793.63	3.84	2441.82	4.10	3217.28
.0160	62.5	2.57	409.20	2.75	539.78	3.08	871.30	3.39	1305.67	3.69	1852.69	3.96	2522.21	4.23	3323.17
.0170	58.8	2.66	421.86	2.83	556.48	3.18	898.25	3.50	1345.92	3.80	1909.94	4.09	2600.13	4.36	3425.81
.0180	55.6	2.73	434.16	2.92	572.70	3.27	924.41	3.60	1385.11	3.91	1966.53	4.21	2675.78	4.49	3525.46
.0190	52.6	2.81	446.12	3.00	588.47	3.36	949.85	3.70	1423.22	4.02	2019.59	4.32	2749.36	4.61	3622.39
.0200	50.0	2.88	457.77	3.08	603.84	3.45	974.64	3.79	1460.34	4.12	2072.25	4.43	2821.03	4.73	3716.88
.0220	45.5	3.02	480.23	3.23	633.45	3.62	1022.41	3.98	1531.90	4.32	2173.76	4.65	2959.19	4.96	3898.78
.0240	41.7	3.15	501.69	3.37	661.75	3.78	1068.06	4.16	1600.27	4.52	2270.75	4.88	3091.19	5.19	4072.67
.0260	38.5	3.28	522.27	3.51	688.89	3.93	1111.86	4.33	1665.85	4.70	2363.78	5.06	3217.80	5.40	4239.45
.0280	35.7	3.41	542.07	3.64	715.00	4.08	1153.98	4.49	1728.95	4.88	2453.30	5.25	3339.63	5.60	4399.93
.0300	33.3	3.53	561.18	3.77	740.20	4.23	1194.63	4.65	1789.83	5.05	2539.67	5.43	3457.18	5.80	4554.77
.0320	31.2	3.64	579.67	3.89	764.57	4.36	1233.94	4.80	1848.72	5.22	2623.20	5.61	3570.88	5.99	4704.53
.0340	29.4	3.76	597.58	4.01	788.19	4.50	1272.05	4.95	1905.79	5.38	2704.17	5.79	3681.07	6.17	4849.58
.0360	27.8	3.87	614.97	4.13	811.13	4.63	1309.05	5.10	1961.21	5.54	2782.78	5.95	3788.06	6.35	4990.63
.0380	26.3	3.97	631.89	4.24	833.43	4.76	1345.04	5.24	2015.11	5.69	2859.24	6.12	3892.13	6.53	5127.71
.0400	25.0	4.08	648.36	4.35	855.16	4.88	1380.09	5.37	2067.61	5.84	2933.72	6.28	3993.49	6.70	5261.22
.0420	23.8	4.18	664.43	4.46	876.35	5.00	1414.28	5.51	2118.81	5.98	3006.35	6.43	4092.34	6.88	5391.44
.0440	22.7	4.28	680.13	4.57	897.04	5.12	1447.66	5.64	2168.81	6.12	3077.28	6.58	4188.87	7.05	5518.59
.0460	21.7	4.37	695.47	4.67	917.27	5.24	1480.29	5.76	2217.68	6.26	3146.61	6.73	4283.23	7.18	5642.89
.0480	20.8	4.47	710.47	4.77	937.06	5.35	1512.22	5.89	2265.50	6.39	3214.45	6.88	4375.56	7.34	5764.51
.0500	20.0	4.56	725.17	4.87	956.45	5.46	1543.49	6.01	2312.34	6.53	3280.89	7.02	4465.98	7.49	5883.62
.0550	18.2	4.78	760.68	5.11	1003.27	5.73	1619.03	6.30	2425.48	6.85	3441.39	7.36	4684.43	7.86	6171.37
.0600	16.7	5.00	794.62	5.34	1048.01	5.98	1691.21	6.58	2533.59	7.15	3594.76	7.69	4893.16	8.21	6446.31
.0650	15.4	5.20	827.16	5.56	1090.93	6.23	1760.44	6.85	2637.28	7.44	3741.85	8.01	5093.35	8.54	6710.02
.0700	14.3	5.40	858.47	5.77	1132.22	6.46	1827.06	7.11	2737.06	7.73	3883.39	8.31	5285.98	8.87	6963.75
.0750	13.3	5.59	888.69	5.97	1172.06	6.69	1891.33	7.36	2833.33	8.00	4019.95	8.60	5471.88	9.18	7208.60
.0800	12.5	5.77	917.91	6.17	1210.60	6.91	1953.50	7.60	2926.44	8.26	4152.04	8.88	5651.61	9.48	7446.40
.0850	11.8	5.95	946.24	6.36	1247.95	7.12	2013.75	7.84	3016.68	8.51	4280.06	9.16	5825.65	9.77	7674.91
.0900	11.1	6.12	973.74	6.54	1284.21	7.33	2072.26	8.07	3104.31	8.76	4404.36	9.42	5995.03	10.06	7897.76
.0950	10.5	6.29	1000.49	6.72	1319.48	7.53	2129.16	8.29	3189.53	9.00	4525.26	9.68	6159.57	10.33	8114.50