

CHAPTER 14 - MEASUREMENTS IN PRESSURE CONDUITS

13. Trajectory Methods

Basically, trajectory methods consist of measuring the horizontal and vertical coordinates of a point in the jet issuing from the end of a pipe (Stock, 1955). The pipe may be oriented either vertically or horizontally. The principal difficulty with this method is in measuring the coordinates of the flowing stream accurately.

(a) Vertical Pipes

Lawrence and Braunworth (1906) noted that two kinds of flow occur from the end of vertical pipes. With a small rise of water (up to $0.37d$) above the end of the pipe, the flow acts like a circular weir. When the water rises more than $1.4d$, jet flow occurs. When the rise is between these values, the mode of flow is in transition. Lawrence and Braunworth (1906) determined that when the height of the jet exceeded $1.4d$, as determined by sighting over the jet to obtain the maximum rise, the discharge is given by:

$$Q = 5.01d^{1.99}h^{0.53}$$

where:

Q = rate of flow, gal/min

d = inside diameter of the pipe, in

h = height of jet, in

When the rise of water above the end of the pipe is less than $0.37d$, discharge is given by:

$$Q = 6.17d^{1.25}h^{1.35}$$

For jet heights between $0.37d$ and $1.4d$, the flow is considerably less than that given by either of these equations. Figure 14-12, prepared using data from Stock (1955) gives flow rates in gallons per minute for standard pipes 2 to 12 in in diameter and jet heights from 12 to 60 in. Bos (1989) assigns to this method an accuracy of +/-10 percent for the jet flow range to +/-15 percent for the weir flow range.

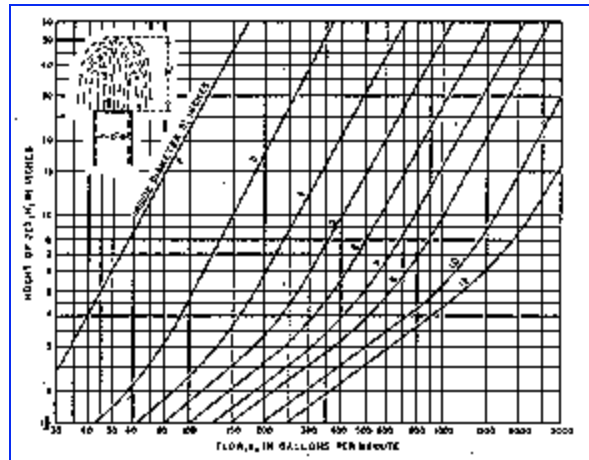


Figure 14-12 -- Discharge curves for measurement of flow from vertical standard pipes. The curves are based on data from experiments of Lawrence and Braunworth, American Society of Civil Engineers, Transactions, Vol. 57, 1906 (courtesy of Utah State University)..

For irrigation convenience, the Natural Resources Conservation Service produced a table from curves for vertical pipes in Stock (1955) for the NRCS *National Engineering Handbook* (1962a). This table is reproduced here as table 14-1. The table gives discharges

Table 14-1 -- Flow from vertical pipes¹

Pipe height inches	Diameter of pipe (inches)							
	2	3	4	5	6	8	10	12
	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0
2	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0
2 1/2	2.1	3.2	4.3	5.4	6.5	8.6	10.7	12.8
3	2.2	3.3	4.4	5.5	6.6	8.7	10.8	12.9
3 1/2	2.3	3.4	4.5	5.6	6.7	8.8	10.9	13.0
4	2.4	3.5	4.6	5.7	6.8	8.9	11.0	13.1
4 1/2	2.5	3.6	4.7	5.8	6.9	9.0	11.1	13.2
5	2.6	3.7	4.8	5.9	7.0	9.1	11.2	13.3
5 1/2	2.7	3.8	4.9	6.0	7.1	9.2	11.3	13.4
6	2.8	3.9	5.0	6.1	7.2	9.3	11.4	13.5
6 1/2	2.9	4.0	5.1	6.2	7.3	9.4	11.5	13.6
7	3.0	4.1	5.2	6.3	7.4	9.5	11.6	13.7
7 1/2	3.1	4.2	5.3	6.4	7.5	9.6	11.7	13.8
8	3.2	4.3	5.4	6.5	7.6	9.7	11.8	13.9
8 1/2	3.3	4.4	5.5	6.6	7.7	9.8	11.9	14.0
9	3.4	4.5	5.6	6.7	7.8	9.9	12.0	14.1
9 1/2	3.5	4.6	5.7	6.8	7.9	10.0	12.1	14.2
10	3.6	4.7	5.8	6.9	8.0	10.1	12.2	14.3
10 1/2	3.7	4.8	5.9	7.0	8.1	10.2	12.3	14.4
11	3.8	4.9	6.0	7.1	8.2	10.3	12.4	14.5
11 1/2	3.9	5.0	6.1	7.2	8.3	10.4	12.5	14.6
12	4.0	5.1	6.2	7.3	8.4	10.5	12.6	14.7
12 1/2	4.1	5.2	6.3	7.4	8.5	10.6	12.7	14.8
13	4.2	5.3	6.4	7.5	8.6	10.7	12.8	14.9
13 1/2	4.3	5.4	6.5	7.6	8.7	10.8	12.9	15.0
14	4.4	5.5	6.6	7.7	8.8	10.9	13.0	15.1
14 1/2	4.5	5.6	6.7	7.8	8.9	11.0	13.1	15.2
15	4.6	5.7	6.8	7.9	9.0	11.1	13.2	15.3
15 1/2	4.7	5.8	6.9	8.0	9.1	11.2	13.3	15.4
16	4.8	5.9	7.0	8.1	9.2	11.3	13.4	15.5
16 1/2	4.9	6.0	7.1	8.2	9.3	11.4	13.5	15.6
17	5.0	6.1	7.2	8.3	9.4	11.5	13.6	15.7
17 1/2	5.1	6.2	7.3	8.4	9.5	11.6	13.7	15.8
18	5.2	6.3	7.4	8.5	9.6	11.7	13.8	15.9
18 1/2	5.3	6.4	7.5	8.6	9.7	11.8	13.9	16.0
19	5.4	6.5	7.6	8.7	9.8	11.9	14.0	16.1
19 1/2	5.5	6.6	7.7	8.8	9.9	12.0	14.1	16.2
20	5.6	6.7	7.8	8.9	10.0	12.1	14.2	16.3
20 1/2	5.7	6.8	7.9	9.0	10.1	12.2	14.3	16.4
21	5.8	6.9	8.0	9.1	10.2	12.3	14.4	16.5
21 1/2	5.9	7.0	8.1	9.2	10.3	12.4	14.5	16.6
22	6.0	7.1	8.2	9.3	10.4	12.5	14.6	16.7
22 1/2	6.1	7.2	8.3	9.4	10.5	12.6	14.7	16.8
23	6.2	7.3	8.4	9.5	10.6	12.7	14.8	16.9
23 1/2	6.3	7.4	8.5	9.6	10.7	12.8	14.9	17.0
24	6.4	7.5	8.6	9.7	10.8	12.9	15.0	17.1
24 1/2	6.5	7.6	8.7	9.8	10.9	13.0	15.1	17.2
25	6.6	7.7	8.8	9.9	11.0	13.1	15.2	17.3
25 1/2	6.7	7.8	8.9	10.0	11.1	13.2	15.3	17.4
26	6.8	7.9	9.0	10.1	11.2	13.3	15.4	17.5
26 1/2	6.9	8.0	9.1	10.2	11.3	13.4	15.5	17.6
27	7.0	8.1	9.2	10.3	11.4	13.5	15.6	17.7
27 1/2	7.1	8.2	9.3	10.4	11.5	13.6	15.7	17.8
28	7.2	8.3	9.4	10.5	11.6	13.7	15.8	17.9
28 1/2	7.3	8.4	9.5	10.6	11.7	13.8	15.9	18.0
29	7.4	8.5	9.6	10.7	11.8	13.9	16.0	18.1
29 1/2	7.5	8.6	9.7	10.8	11.9	14.0	16.1	18.2
30	7.6	8.7	9.8	10.9	12.0	14.1	16.2	18.3
30 1/2	7.7	8.8	9.9	11.0	12.1	14.2	16.3	18.4
31	7.8	8.9	10.0	11.1	12.2	14.3	16.4	18.5
31 1/2	7.9	9.0	10.1	11.2	12.3	14.4	16.5	18.6
32	8.0	9.1	10.2	11.3	12.4	14.5	16.6	18.7
32 1/2	8.1	9.2	10.3	11.4	12.5	14.6	16.7	18.8
33	8.2	9.3	10.4	11.5	12.6	14.7	16.8	18.9
33 1/2	8.3	9.4	10.5	11.6	12.7	14.8	16.9	19.0
34	8.4	9.5	10.6	11.7	12.8	14.9	17.0	19.1
34 1/2	8.5	9.6	10.7	11.8	12.9	15.0	17.1	19.2
35	8.6	9.7	10.8	11.9	13.0	15.1	17.2	19.3
35 1/2	8.7	9.8	10.9	12.0	13.1	15.2	17.3	19.4
36	8.8	9.9	11.0	12.1	13.2	15.3	17.4	19.5
36 1/2	8.9	10.0	11.1	12.2	13.3	15.4	17.5	19.6
37	9.0	10.1	11.2	12.3	13.4	15.5	17.6	19.7
37 1/2	9.1	10.2	11.3	12.4	13.5	15.6	17.7	19.8
38	9.2	10.3	11.4	12.5	13.6	15.7	17.8	19.9
38 1/2	9.3	10.4	11.5	12.6	13.7	15.8	17.9	20.0
39	9.4	10.5	11.6	12.7	13.8	15.9	18.0	20.1
39 1/2	9.5	10.6	11.7	12.8	13.9	16.0	18.1	20.2
40	9.6	10.7	11.8	12.9	14.0	16.1	18.2	20.3

¹ Table prepared from discharge curves in Utah Engineering Experimental Station, Bulletin 5, "Measurement of Irrigation Water," June 1955.

² Standard pipe.

³ Outside diameter of well casing.

for different heads up to 40 in for standard nominal pipe diameters from 2 to 12 in and for outside diameters of well casings from 4 to 12 in. As mentioned before, accuracies better than 15 and 10 per-cent should not be expected, depending on whether the flow is acting as a weir or jet-type flow.

(b) Horizontal Pipes

When brink depths are greater than $0.5D$, the more general Purdue pipe method developed by Greve (1928) should be used, rather than the California pipe method. The Purdue method applies equally well to both partially and completely filled pipes. The Purdue method consists of measuring coordinates of the upper surface of the jet as shown on figure 14-13. If the water in the pipe is flowing at a depth of less than $0.8D$ at the outlet, the vertical distance, Y , can be measured at the end of the pipe where $X = 0$. For higher rates of flow, Y may be measured at horizontal distances, X , from the pipe exit of 6, 12, or 18 in. Flow values in gallons per minute for 2- to 6-in-diameter standard pipes are shown in graphs on figure 14-14 (Stock, 1955).

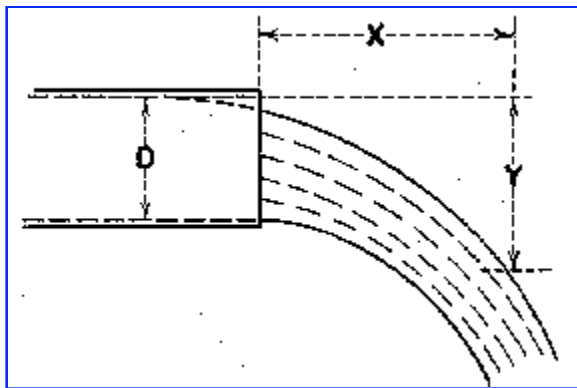


Figure 14-13 -- Purdue method of measuring flow from a horizontal pipe (courtesy of Utah State University)..

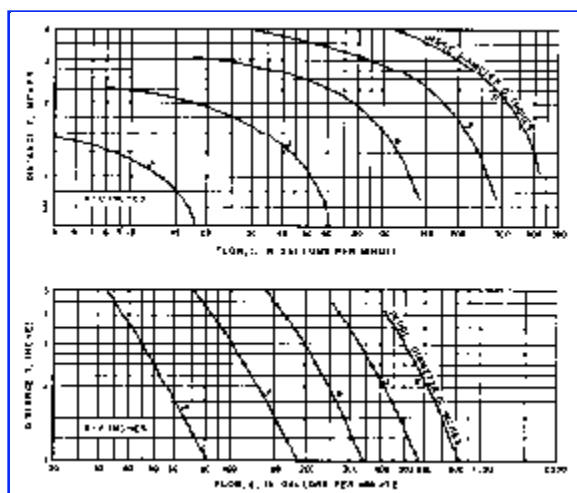


Figure 14-14 -- Flow from horizontal standard pipes by Purdue coordinate method (courtesy of Utah State University) (sheet 1 of 2)..

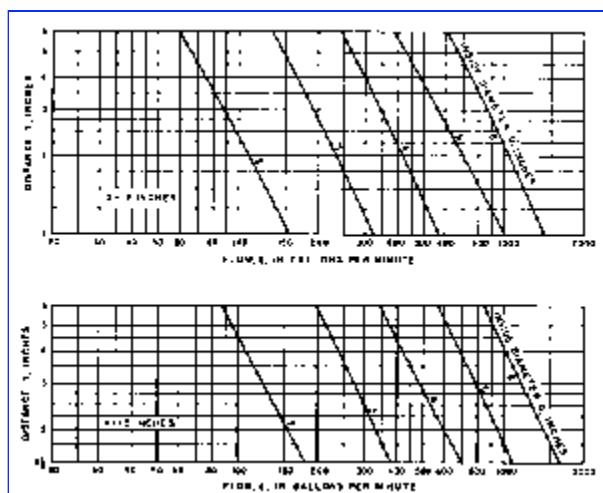


Figure 14-14 -- Flow from horizontal standard pipes by
Purdue coordinate method (courtesy of Utah State University)
(sheet 2 of 2)..

The most accurate results will be obtained when the pipe is truly horizontal. If it slopes upward, the indicated discharge will be too high. If it slopes downward, the indicated discharge will be too low.

Difficulty occurs in making the vertical measurement, Y , because the top of the jet will usually not be smooth and well defined.

The NRCS produced table 14-2 for horizontal pipe discharge for X of 0, 6, 12 and 18 in and Y up to about 8 in for pipe diameters from 2 to 6 in. As mentioned previously, accuracies better than 10 percent should not be expected.

Table 14-2 Flow from horizontal pipes¹

Y (inches)	WHEN X=0 Size of pipe (nominal diameter)				
	2-inch	3-inch	4-inch	5-inch	6-inch
0.20	0.17	0.27	0.37	0.47	0.57
.30	0.18	0.29	0.39	0.49	0.59
.40	0.19	0.30	0.40	0.50	0.60
.50	0.20	0.31	0.41	0.51	0.61
.60	0.21	0.32	0.42	0.52	0.62
.70	0.22	0.33	0.43	0.53	0.63
.80	0.23	0.34	0.44	0.54	0.64
.90	0.24	0.35	0.45	0.55	0.65
1.00	0.25	0.36	0.46	0.56	0.66
1.20	0.27	0.38	0.48	0.58	0.68
1.40	0.29	0.40	0.50	0.60	0.70
1.60	0.31	0.42	0.52	0.62	0.72
1.80	0.33	0.44	0.54	0.64	0.74
2.00	0.35	0.46	0.56	0.66	0.76
2.20	0.37	0.48	0.58	0.68	0.78
2.40	0.39	0.50	0.60	0.70	0.80
2.60	0.41	0.52	0.62	0.72	0.82
2.80	0.43	0.54	0.64	0.74	0.84
3.00	0.45	0.56	0.66	0.76	0.86
3.20	0.47	0.58	0.68	0.78	0.88
3.40	0.49	0.60	0.70	0.80	0.90
3.60	0.51	0.62	0.72	0.82	0.92
3.80	0.53	0.64	0.74	0.84	0.94
4.00	0.55	0.66	0.76	0.86	0.96
4.20	0.57	0.68	0.78	0.88	0.98
4.40	0.59	0.70	0.80	0.90	1.00
4.60	0.61	0.72	0.82	0.92	1.02
4.80	0.63	0.74	0.84	0.94	1.04
5.00	0.65	0.76	0.86	0.96	1.06
5.20	0.67	0.78	0.88	0.98	1.08
5.40	0.69	0.80	0.90	1.00	1.10
5.60	0.71	0.82	0.92	1.02	1.12
5.80	0.73	0.84	0.94	1.04	1.14
6.00	0.75	0.86	0.96	1.06	1.16
6.20	0.77	0.88	0.98	1.08	1.18
6.40	0.79	0.90	1.00	1.10	1.20
6.60	0.81	0.92	1.02	1.12	1.22
6.80	0.83	0.94	1.04	1.14	1.24
7.00	0.85	0.96	1.06	1.16	1.26
7.20	0.87	0.98	1.08	1.18	1.28
7.40	0.89	1.00	1.10	1.20	1.30
7.60	0.91	1.02	1.12	1.22	1.32
7.80	0.93	1.04	1.14	1.24	1.34
8.00	0.95	1.06	1.16	1.26	1.36

Table 14-2 Flow from horizontal pipes¹ (continued)

D inches	WHEN X IS INCHES Size of pipe nominal diameter				
	2-inch	3-inch	4-inch	5-inch	6-inch
0.60	5.60	6.00	6.40	6.80	7.20
0.65	5.75	6.15	6.55	6.95	7.35
0.70	5.90	6.30	6.70	7.10	7.50
0.75	6.05	6.45	6.85	7.25	7.65
0.80	6.20	6.60	7.00	7.40	7.80
0.85	6.35	6.75	7.15	7.55	7.95
0.90	6.50	6.90	7.30	7.70	8.10
0.95	6.65	7.05	7.45	7.85	8.25
1.00	6.80	7.20	7.60	8.00	8.40
1.05	6.95	7.35	7.75	8.15	8.55
1.10	7.10	7.50	7.90	8.30	8.70
1.15	7.25	7.65	8.05	8.45	8.85
1.20	7.40	7.80	8.20	8.60	9.00
1.25	7.55	7.95	8.35	8.75	9.15
1.30	7.70	8.10	8.50	8.90	9.30
1.35	7.85	8.25	8.65	9.05	9.45
1.40	8.00	8.40	8.80	9.20	9.60
1.45	8.15	8.55	8.95	9.35	9.75
1.50	8.30	8.70	9.10	9.50	9.90
1.55	8.45	8.85	9.25	9.65	10.05
1.60	8.60	9.00	9.40	9.80	10.20
1.65	8.75	9.15	9.55	9.95	10.35
1.70	8.90	9.30	9.70	10.10	10.50
1.75	9.05	9.45	9.85	10.25	10.65
1.80	9.20	9.60	10.00	10.40	10.80
1.85	9.35	9.75	10.15	10.55	10.95
1.90	9.50	9.90	10.30	10.70	11.10
1.95	9.65	10.05	10.45	10.85	11.25
2.00	9.80	10.20	10.60	11.00	11.40
2.05	9.95	10.35	10.75	11.15	11.55
2.10	10.10	10.50	10.90	11.30	11.70
2.15	10.25	10.65	11.05	11.45	11.85
2.20	10.40	10.80	11.20	11.60	12.00
2.25	10.55	10.95	11.35	11.75	12.15
2.30	10.70	11.10	11.50	11.90	12.30
2.35	10.85	11.25	11.65	12.05	12.45
2.40	11.00	11.40	11.80	12.20	12.60
2.45	11.15	11.55	11.95	12.35	12.75
2.50	11.30	11.70	12.10	12.50	12.90
2.55	11.45	11.85	12.25	12.65	13.05
2.60	11.60	12.00	12.40	12.80	13.20
2.65	11.75	12.15	12.55	12.95	13.35
2.70	11.90	12.30	12.70	13.10	13.50
2.75	12.05	12.45	12.85	13.25	13.65
2.80	12.20	12.60	13.00	13.40	13.80
2.85	12.35	12.75	13.15	13.55	13.95
2.90	12.50	12.90	13.30	13.70	14.10
2.95	12.65	13.05	13.45	13.85	14.25
3.00	12.80	13.20	13.60	14.00	14.40
3.05	12.95	13.35	13.75	14.15	14.55
3.10	13.10	13.50	13.90	14.30	14.70
3.15	13.25	13.65	14.05	14.45	14.85
3.20	13.40	13.80	14.20	14.60	15.00
3.25	13.55	13.95	14.35	14.75	15.15
3.30	13.70	14.10	14.50	14.90	15.30
3.35	13.85	14.25	14.65	15.05	15.45
3.40	14.00	14.40	14.80	15.20	15.60
3.45	14.15	14.55	14.95	15.35	15.75
3.50	14.30	14.70	15.10	15.50	15.90
3.55	14.45	14.85	15.25	15.65	16.05
3.60	14.60	15.00	15.40	15.80	16.20
3.65	14.75	15.15	15.55	15.95	16.35
3.70	14.90	15.30	15.70	16.10	16.50
3.75	15.05	15.45	15.85	16.25	16.65
3.80	15.20	15.60	16.00	16.40	16.80
3.85	15.35	15.75	16.15	16.55	16.95
3.90	15.50	15.90	16.30	16.70	17.10
3.95	15.65	16.05	16.45	16.85	17.25
4.00	15.80	16.20	16.60	17.00	17.40
4.05	15.95	16.35	16.75	17.15	17.55
4.10	16.10	16.50	16.90	17.30	17.70
4.15	16.25	16.65	17.05	17.45	17.85
4.20	16.40	16.80	17.20	17.60	18.00
4.25	16.55	16.95	17.35	17.75	18.15
4.30	16.70	17.10	17.50	17.90	18.30
4.35	16.85	17.25	17.65	18.05	18.45
4.40	17.00	17.40	17.80	18.20	18.60
4.45	17.15	17.55	17.95	18.35	18.75
4.50	17.30	17.70	18.10	18.50	18.90
4.55	17.45	17.85	18.25	18.65	19.05
4.60	17.60	18.00	18.40	18.80	19.20
4.65	17.75	18.15	18.55	18.95	19.35
4.70	17.90	18.30	18.70	19.10	19.50
4.75	18.05	18.45	18.85	19.25	19.65
4.80	18.20	18.60	19.00	19.40	19.80
4.85	18.35	18.75	19.15	19.55	19.95
4.90	18.50	18.90	19.30	19.70	20.10
4.95	18.65	19.05	19.45	19.85	20.25
5.00	18.80	19.20	19.60	20.00	20.40
5.05	18.95	19.35	19.75	20.15	20.55
5.10	19.10	19.50	19.90	20.30	20.70
5.15	19.25	19.65	20.05	20.45	20.85
5.20	19.40	19.80	20.20	20.60	21.00
5.25	19.55	19.95	20.35	20.75	21.15
5.30	19.70	20.10	20.50	20.90	21.30
5.35	19.85	20.25	20.65	21.05	21.45
5.40	20.00	20.40	20.80	21.20	21.60
5.45	20.15	20.55	20.95	21.35	21.75
5.50	20.30	20.70	21.10	21.50	21.90
5.55	20.45	20.85	21.25	21.65	22.05
5.60	20.60	21.00	21.40	21.80	22.20
5.65	20.75	21.15	21.55	21.95	22.35
5.70	20.90	21.30	21.70	22.10	22.50
5.75	21.05	21.45	21.85	22.25	22.65
5.80	21.20	21.60	22.00	22.40	22.80
5.85	21.35	21.75	22.15	22.55	22.95
5.90	21.50	21.90	22.30	22.70	23.10
5.95	21.65	22.05	22.45	22.85	23.25
6.00	21.80	22.20	22.60	23.00	23.40
6.05	21.95	22.35	22.75	23.15	23.55
6.10	22.10	22.50	22.90	23.30	23.70
6.15	22.25	22.65	23.05	23.45	23.85
6.20	22.40	22.80	23.20	23.60	24.00
6.25	22.55	22.95	23.35	23.75	24.15
6.30	22.70	23.10	23.50	23.90	24.30
6.35	22.85	23.25	23.65	24.05	24.45
6.40	23.00	23.40	23.80	24.20	24.60
6.45	23.15	23.55	23.95	24.35	24.75
6.50	23.30	23.70	24.10	24.50	24.90
6.55	23.45	23.85	24.25	24.65	25.05
6.60	23.60	24.00	24.40	24.80	25.20
6.65	23.75	24.15	24.55	24.95	25.35
6.70	23.90	24.30	24.70	25.10	25.50
6.75	24.05	24.45	24.85	25.25	25.65
6.80	24.20	24.60	25.00	25.40	25.80
6.85	24.35	24.75	25.15	25.55	25.95
6.90	24.50	24.90	25.30	25.70	26.10
6.95	24.65	25.05	25.45	25.85	26.25
7.00	24.80	25.20	25.60	26.00	26.40
7.05	24.95	25.35	25.75	26.15	26.55
7.10	25.10	25.50	25.90	26.30	26.70
7.15	25.25	25.65	26.05	26.45	26.85
7.20	25.40	25.80	26.20	26.60	27.00
7.25	25.55	25.95	26.35	26.75	27.15
7.30	25.70	26.10	26.50	26.90	27.30
7.35	25.85	26.25	26.65	27.05	27.45
7.40	26.00	26.40	26.80	27.20	27.60
7.45	26.15	26.55	26.95	27.35	27.75
7.50	26.30	26.70	27.10	27.50	27.90
7.55	26.45	26.85	27.25	27.65	28.05
7.60	26.60	27.00	27.40	27.80	28.20
7.65	26.75	27.15	27.55	27.95	28.35
7.70	26.90	27.30	27.70	28.10	28.50
7.75	27.05	27.45	27.85	28.25	28.65
7.80	27.20	27.60	28.00	28.40	28.80
7.85	27.35	27.75	28.15	28.55	28.95
7.90	27.50	27.90	28.30	28.70	29.10
7.95	27.65	28.05	28.45	28.85	29.25
8.00	27.80	28.20	28.60	29.00	29.40
8.05	27.95	28.35	28.75	29.15	29.55
8.10	28.10	28.50	28.90	29.30	29.70
8.15	28.25	28.65	29.05	29.45	29.85
8.20	28.40	28.80	29.20	29.60	30.00
8.25	28.55	28.95	29.35	29.75	30.15
8.30	28.70	29.10	29.50	29.90	30.30
8.35	28.85	29.25	29.65	30.05	30.45
8.40	29.00	29.40	29.80	30.20	30.60
8.45	29.15	29.55	29.95	30.35	30.75
8.50	29.30	29.70	30.10	30.50	30.90
8.55	29.45	29.85	30.25	30.65	31.05
8.60	29.60	30.00	30.40	30.80	31.20
8.65	29.75	30.15	30.55	30.95	31.35
8.70	29.90	30.30	30.70	31.10	31.50
8.75	30.05	30.45	30.85	31.25	31.65
8.80	30.20	30.60	31.00	31.40	31.80
8.85	30.35	30.75	31.15	31.55	31.95
8.90	30.50	30.90	31.30	31.70	32.10
8.95	30.65	31.05	31.45	31.85	32.25
9.00	30.80	31.20	31.60	32.00	32.40
9.05	30.95	31.35	31.75	32.15	32.55
9.10	31.10	31.50	31.90	32.30	32.70
9.15	31.25	31.65	32.05	32.45	32.85
9.20	31.40	31.80	32.20	32.60	33.00
9.25	31.55	31.95	32.35	32.75	33.15
9.30	31.70	32.10	32.50	32.90	33.30
9.35	31.85	32.25	32.65	33.05	33.45
9.40	32.00	32.40	32.80	33.20	33.60
9.45	32.15	32.55	32.95	33.35	33.75
9.50	32.30	32.70	33.10	33.50	33.90
9.55	32.45	32.85	33.25	33.65	34.05
9.60	32.60	33.00	33.40	33.80	34.20
9.65	32.75	33.15	33.55	33.95	34.35
9.70	32.90	33.30	33.70	34.10	34.50
9.75	33.05	33.45	33.85	34.25	34.65
9.80	33.20	33.60	34.00	34.40	34.80
9.85	33.35	33.75	34.15	34.55	34.95
9.90	33.50	33.90	34.30	34.70	35.10
9.95	33.65	34.05	34.45	34.85	35.25
10.00	33.80	34.20	34.60	35.00	35.40

Table for standard steel pipe prepared from data resulting from actual experiments conducted at Purdue University Experimental Station, Bulletin 32, "Measurement of Pipe Flow by the Coordinate Method," August 1928.

¹ Table for standard steel pipe prepared from data resulting from actual experiments conducted at Purdue University Experimental Station, Bulletin 32, "Measurement of Pipe Flow by the Coordinate Method," August 1928.