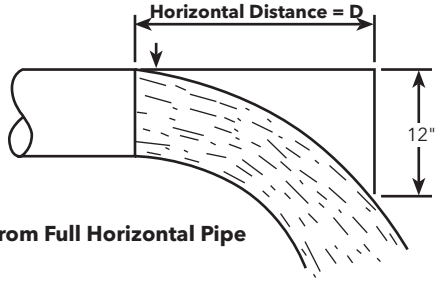
Measuring Flow - Full Pipe Method
200.E.09

FULL PIPE METHOD OF WATER

Where no instruments are available to accurately measure the flow of water from a pump, the following method will serve as an approximation.



Flow From Full Horizontal Pipe

Flow (GPM) = A x D x 1.105
Where: A = Area of pipe in square inches
D = Horizontal distance in inches
1.015 = Correction factor

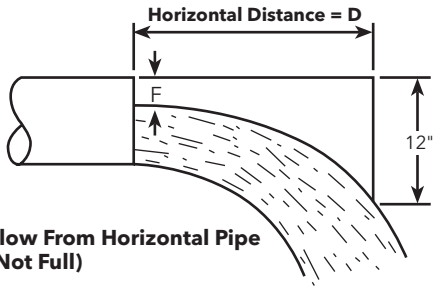
Using an ordinary rule or carpenters square, measure the horizontal distance from the end of the discharge pipe to a point exactly 12 inches above the falling stream of water. The discharge pipe must be level and running full of water when the reading is taken. Multiply this distance (in inches) by the cross sectional area of the pipe in square inches and the answer will be the approximate capacity in gallons per minute. For example, assume that the horizontal distance from the end of an 8" discharge pipe is 20". Multiplying 20" by the cross sectional area of an 8" pipe (approximately 50 sq. in.) we obtain a capacity of 1000 GPM.

By checking this method of estimation using accurate flow meters it has been found a correction factor of 1.015 should be applied. The table below gives the approximate rates of flow for various conditions after applying this correction factor.

APPROXIMATE FLOW IN GALLONS PER MINUTE WITH PIPE RUNNING FULL

Diameter of Pipe in Inches	Horizontal Distance D in Inches									
	12	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
4	150	181	207	232	258	284	310	336	361	387
6	352	410	470	528	587	645	705	762	821	880
8	610	712	813	915	1017	1119	1221	1322	1425	1527
10	960	1120	1280	1440	1600	1760	1920	2080	2240	2400
12	1378	1607	1835	2032	2286	2521	2760	2980	3210	3430

MEASURING FLOW AREA FACTOR METHOD (Pipe Not Running Full)



Flow From Horizontal Pipe (Not Full)

Flow (GPM) = A x D x 1.039 x F
A = Area of pipe in square inches
D = Horizontal distance in inches
F = Effective area factor shown below
Area of pipe equals inside Dia.^{2} x 0.7854

Ratio F/D = R %	Efficieny Area Factor F
5	0.981
10	0.948
15	0.905
20	0.858
25	0.805
30	0.747
35	0.688
40	0.627
45	0.564
50	0.500

Ratio F/D = R %	Efficieny Area Factor F
55	0.436
60	0.373
65	0.312
70	0.253
75	0.195
80	0.142
85	0.095
90	0.052
95	0.019
100	0.000

Example:
D = 20 inches – Pipe inside diameter = 10 inches –

F = 2½ inches

A = 10 x 10 x 0.7854 = 78.54 square inches

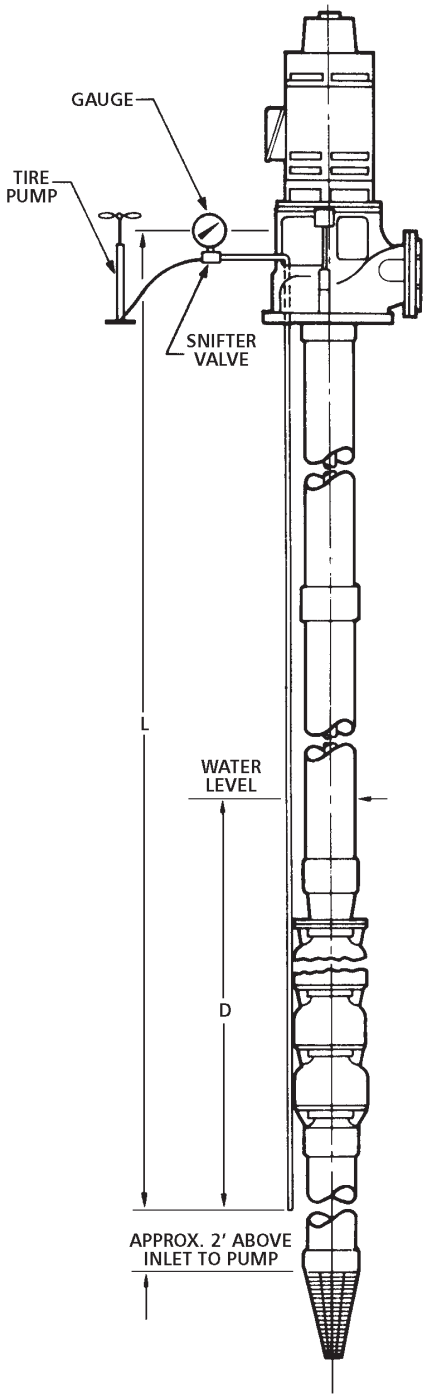
R = 2½/10 = 25%

F = 0.805

Flow = 78.54 x 20 x 1.039 x 0.805 = 1314 GPM

Water Level Testing

200.E.10



There are two commonly used methods to determine the water level in wells – airline and gauge, or an electric sounder.

AIRLINE METHOD:

The airline method can use a standard pressure gauge, indirect reading depth gauge, or direct reading depth gauge.

Installation: The airline is installed so that the lower end is near the bottom of the pump – for reliable readings the airline should extend 20' below low water level if possible. All airline joints must be air tight for proper operation. The upper end of the airline is connected to a gauge and snifter valve. Exact vertical length of the airline must be noted at time of installation. This length should be recorded on the face of the gauge.

Operation: A tire pump is used to expel all water from the airline, when this point is reached the gauge reading will remain constant. The maximum maintained pressure is equal to the height of water above the end of the airline (D).

Indirect Reading Depth Gauge (Fixed Dial): Pump up airline until maximum pressure (all water is expelled from airline) is reached, reading on gauge will be distance "D". Water level (below surface) is obtained by subtracting "D" from "L" (WL = L - D).

Direct Reading Depth Gauge (Movable Dial): Set the movable gauge dial so that the length of airline (L) is at the pin stop (gauge pointer position at 0 pressure). Pump airline to maximum pressure, gauge will read water level (L - D) direct.

Pressure Gauge: A pressure gauge can be used by converting PSI to feet of water as follows:

Feet of Water = PSI x 2.31

Operation would be identical to indirect reading gauge.

ELECTRIC SOUNDER METHOD

The electric sound consists essentially of a battery, a spool of well insulated waterproof wire and a millivolt meter. One terminal of the battery is connected to the pump head and the other through the potentiometer to one end of the spool of wire. The other end of the wire from the spool must be protected so that it will not close the circuit if it should bump against the pump in being lowered into the well, but at the same time so arranged that the circuit will be closed when the end of the wire contacts the water in the well. The wire from spool, then, is lowered into the well until the needle of the potentiometer deflects, indicating that the water level has been reached and the contact closed. The wire is then properly marked, pulled from the well and measured with a steel tape to determine the water level. (It is possible to calibrate the spool of wire so that it is direct reading.)

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