

Badger Meter flow sensors, like all paddlewheel, impeller, and turbine meters, depend upon momentum interchange between the flow stream and a rotateable member, and upon interaction with the viscous friction of the flowing fluid. The result is an equilibrium rotational velocity of the rotating member related to the fluid property of viscosity and to the physical phenomenon of local average fluid stream velocity in the neighborhood of the impeller.

Most sensors produced by Badger Meter are rated for specific linear velocities of flow from 1 ft/sec to 30 ft/sec. At some rate

above 30 ft/sec, cavitation occurs, and the relationship between the stream velocity and impeller rotation is lost. Somewhere below 0.5 ft/sec there is not enough energy in the stream velocity to overcome friction and inertia and rotate the impeller.

To ensure adequate operation at low volumetric flow ranges (GPM), it is essential that pipe be sized small enough to ensure that the linear (ft/sec) flow rate equals or exceeds the 1 ft/sec minimum specified.

The associated minimum flow rates recommended for various pipe sizes are shown in the table below:

Sched 40 Pipe Size	1½"	2"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"
GPM	3	5	12	20	31	45	78	128	175	210	275	350

**Minimum Recommended Volumetric Flow  
For Various Pipe Sizes**

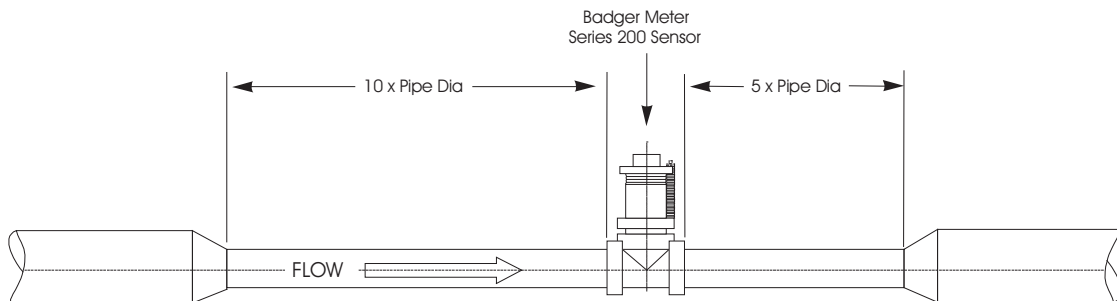
These typical minimum flows are valid for most pipe schedules and classes. For other pipe sizes, the rates can be calculated from:

$$q = \text{volumetric flow rate, gallons per minute}$$

$$D = \text{pipe inside diameter, inches}$$

$$q = 2.45 \times D \times D$$

When installing a Badger Meter flow sensor in an existing line with a known flow, or when designing a relatively large diameter piping system, the flow rate should be checked against the minimum values tabulated. If the system flow rate is lower than the minimum value listed for the appropriate application, a "meter run" or section of smaller pipe should be cut into the line. The accompanying illustration indicates the recommended method.



**DTB-039-01**

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