

**Table 1.** Flow rates that limit velocities to 5 fps for Class 160 PVC and aluminum irrigation pipe.

Nominal Diameter (Inches)	Class 160 PVC		Aluminum Irr. Pipe	
	Inside Diameter (Inches)	Flow Rate (gpm)	Inside Diameter (Inches)	Flow Rate (gpm)
2	2.193	59	1.900	44
2.5	2.655	86	N/A <sup>1</sup>	N/A
3	3.230	128	2.914	104
4	4.154	211	3.906	187
5	N/A	N/A	4.896	294
6	6.115	458	5.884	424
7	N/A	N/A	6.872	579
8	7.961	777	7.856	756
10	9.924	1207	9.818	1181
12	11.770	1698	11.872	1727

<sup>1</sup>N/A: Not available in this size.

flow to 5 fps. The small surge pressures that can occur at this velocity will not cause damage if the working pressure in the pipeline is limited to 72 percent of the pressure rating stamped on the pipe. This limits the working pressure of Class 160 PVC pipe to 115 psi (0.72 x 160 psi = 115 psi).

**Temperature Effects**

Pressure ratings of PVC pipe are determined at the standard temperature of 73.4°F (23°C). A temperature increase above 73.4°F reduces the strength of PVC pipes, a factor that must be considered when PVC pipes are selected. For Class 160 PVC pipe, the amount of reduction is approximately 20 psi for each 10°F elevation in temperature. The actual reductions are shown in Table 2.

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**Water Hammer**

Water hammer pressures are the pressure surges that occur because of sudden stoppage or reduction in flow, or because of a change in direction of flow. These pressure surges occur when valves close quickly, when air is suddenly released from a pipeline or when water changes direction at a tee, elbow or other pipe fitting. Although water hammer pressure surges last for only a brief moment, they can be large enough to burst pipelines. Damage from water hammer typically occurs at fittings, particularly if the fittings are not properly installed.

In irrigation pipes, the actual water hammer pressure depends on pipe material, wall thickness, velocity of flow and other factors, such as how quickly a valve closes or how abruptly the water changes direction. A detailed surge pressure analysis must be made to estimate the amount of surge pressure that will be developed in a specific pipeline. Procedures for conducting a detailed surge analysis are given in IFAS Extension Circular 828, *Water Hammer in Irrigation Systems*.

ASAE (1991a) and FIS (1991) irrigation design standards state that water hammer in irrigation pipelines can be minimized by limiting the velocity of

When water is pumped from an underground aquifer, its temperature is normally in the range of 70°F to 75°F; such temperatures will have little effect on the pressure rating of the pipe. Water pumped from ponds is considerably warmer during summer months. Summertime pond water temperatures may reach 90°F or more. When this is the case, the pipe pressure rating will be reduced, as shown in Table 2. For example, the pressure rating of Class 160 PVC pipe will be 141 psi when the water temperature is 80°F. The rating will be only 120 psi when the water temperature is 90°F.

**Table 2.** Temperature effects on PVC pipe pressure ratings.

Temperature Degrees F	PVC Pipe De-Rating Factor (multiplier)	Class 160 PVC Pipe Pressure Rating (psi)
73.4	1.00	160
80	0.88	141
90	0.75	120
100	0.62	99
110	0.50	80
120	0.40	64

**PIPE SIZE SELECTION EXAMPLE**

A mainline pipe diameter is selected on the basis of both the maximum allowable velocity of 5 fps and a pressure rating adequate for the normal operating pressure plus surge pressures, after the pressure