

B.6 LIMITATION OF VELOCITY

B.6.1 Consideration of Velocity in Design

Velocity of flow through water supply piping during periods of peak demand is an important factor that must be considered in the design of building water supply systems. Limitation of water velocity should be observed in order to avoid objectionable noise effects in systems, shock damage to piping, equipment, tanks, coils, and joints, and accelerated deterioration and eventual failure of piping from corrosion. (Also see Section 10.14.1)

B.6.2 Good Engineering Practice

In accordance with good engineering practice, it is recommended generally that maximum velocity at maximum probable demand in supply piping be limited to 8 fps. This is deemed essential in order to avoid such objectionable effects as the production of whistling line noise, the occurrence of cavitation, and associated excessive noise in fittings and valves.

Note that this velocity is too great for systems where the flow is continuous, as in the case of recirculated hot water piping. The continuous flow rate for hot water with modest chemical content should be limited to not more than 2 fps for such continuous systems. That is, verify that the flow rate in the system as a result of the circulation pump only does not exceed 2 fps at any point.

It is also recommended that maximum velocity be limited to 4 fps in water supply piping that supply a quick-closing device, such as a solenoid valve, pneumatic valve, or a quick-closing valve or faucet of the self-closing, push-pull, push-button, or other similar type. This limitation is necessary in order to avoid excessive and damaging shock pressures in the piping and equipment when flow is suddenly shut off. Plumbing equipment and systems are not designed to withstand the very high shock pressures that may occur as the result of sudden cessation of high velocity flow in piping. (Also see Section 10.14.1)

B.6.3 Manufacturers' Recommendations for Avoiding Erosion/Corrosion

Velocity limits recommended by pipe manufacturers to avoid accelerated deterioration of their piping materials due to erosion/corrosion should be observed. Recent research studies have shown that turbulence accompanying even relatively low flow velocities is an important factor in causing erosion/corrosion, and that this is especially likely to occur where the water supply has a high carbon dioxide content (i.e., in excess of 10 ppm), and where it has been softened to zero hardness. Another important factor is elevated water temperature (i.e., in excess of 110°F).

To control erosion/corrosion effects in copper water tube, and copper and brass pipe, pipe manufacturers' recommendations are as follows:

- (1) Where the water supply has a pH value higher than 6.9 and a positive scale-forming tendency, such as may be shown by a positive Langelier Index, peak velocity should be limited to 8 fps;
- (2) Where the water supply has a pH value lower than 6.9 and may be classified as aggressively corrosive, or where the water supply has been softened to zero hardness by passage through a water softener, peak velocity should be limited to 4 fps; and
- (3) The velocity in copper tube conveying hot water at up to 140°F should be limited to 5 fps because of the accelerated corrosion rate with hot water. Velocities should be limited to 2 - 3 fps for temperatures above 140°F.

Note that the above values apply to velocities at maximum probable demand. For continuous flow circulating systems, do not exceed 2 fps flow rate for the flow produced by the circulator.