

A Foot Is not Always a Foot: Disparities in Code Terminology

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When sizing piping for a plumbing system, engineers and designers trying to adhere to both the 2003 International Plumbing Code, published by the International Code Council, and the 2003 Uniform Plumbing Code, published by the International Association of Plumbing and Mechanical Officials, may run into difficulties. Why? The problem is that the two codes use a variety of terms to signify required pipe lengths, and it is unclear whether or not these terms indicate interchangeable measurements.

Confusing Code Terms

For example, consider the following excerpts from the codes. (Varying terms are indicated in *italic*.)

IPC Table 916.1 "Size and Developed Length of Stack Vents and Vent Stacks" lists *maximum developed vent lengths*. IPC Table 906.1 "Maximum Distance of Fixture Trap From Vent" specifies the *distance from trap*. IPC Table E201.1 "Minimum Size of Water Meters, Mains and Distribution Piping" specifies the *maximum developed length of water piping*.

In the UPC, Table 7-2 "Maximum Unit Loading and Maximum Length of Drainage and Vent Piping" lists *maximum vent lengths*, while Table 6-5 "Fixture Unit Table for Determining Water Pipe and Meter Sizes" specifies the *maximum allowable length of water piping*.

Just in these few examples, three different terms are used: maximum developed length, distance, and maximum allowable length. Are these three terms equivalent? Do they all mean the same thing? The quick answer is no.

But the Confusion Doesn't Stop There

Although both the IPC and the UPC define *developed length* as "the length along the center line of the pipe and fitting," text in the codes muddles the definition.

In IPC Appendix Section E201 "Selection of Pipe Size," procedure 3 states, "The maximum developed length for water piping is the actual length of piping between the source of supply and most remote fixture ... multiplied by a factor of 1.2 to compensate for

pressure loss through fittings." IPC Table 916.1 footnote A states, "the developed length shall be measured from the vent connection to the open air." IPC Table 916.5.1 footnote A states, "Developed length plus an appropriate allowance for entrance losses and friction due to fittings, changes in direction and diameter. Suggested allowances shall be obtained from NSB Monograph 31 or other approved sources. An allowance of 50 percent of the developed length shall be assumed if a more precise value is not available."

Step 4 of UPC Section 610.8 "Size of Meter and Building Supply Pipe Using Table 6-5" states, "Select the 'length' column which is equal to or longer than the required length." Paragraph 904.1 states, "The size of vent piping shall be determined from its length and the total number of fixture units connected thereto."

Both of the plumbing codes use the term *developed length*, but they use it differently. The UPC does not require the equivalent length of each valve or fitting to be included in determining the length of pipe in a plumbing system. The IPC permits an allowance for the pressure loss through valves and fittings to be included in the calculation of pressure drop through a plumbing system.

According to basic engineering principles, a pressure drop must occur for a fluid to flow through a piping system. All valves and fittings, in any piping system, have a pressure drop. The pressure drops of the valves and fittings in a piping system usually are specified as an equivalent length of straight pipe. No matter what type of system—one circulating air or one circulating water—a pressure drop must occur between the inlet and outlet for the fluid to flow. The pressure drop for valves and fittings must be included in pressure loss calculations. If the pressure losses through valves and fitting are not included, the piping might be undersized, and adequate pressure at the outlet will not be available for proper flow of the fluid at peak flow.

An Example

The measured length from where the water piping enters the building to the most remote outlet is 500 feet. Assuming a 50 percent factor for valves and fittings, the total equivalent length of piping would be 750 feet. Assuming a flow rate of 100 gallons per minute and a pipe size of 2 inches, the pressure drop for type L copper tubing would be 6.25 pounds per square inch per 100 feet. Thus, the total pressure drop for the piping would be 46.9 psi $[(750/100) \times 6.25]$. Using an equivalent length factor of only 40 percent, the total equivalent length of piping would be 700 feet, and the pressure drop in the piping system would be 43.8 psi $[(700/100) \times 6.25]$. This 3 psi difference may not seem big, but it could cause the system to operate improperly. It is better to overestimate the pressure drop in the piping system and have available pressure at the outlet than underestimate the pressure drop and not have sufficient pressure at the outlet.

When either of the plumbing codes lists a maximum length, you must assume that it is an equivalent length. You must use the total equivalent length of pipe when using any of the tables. The total equivalent length of pipe is the total developed length of straight pipe plus the equivalent length of all valves and fittings in the system. As stated in IPC Table 916.5.1 footnote A, an allowance of 50 percent of the developed length can be assumed if a more precise value is not available. ■



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