Metering Flow... Naturally!

- Documented and Certified Installation Performance
- Time Tested and Proven

The accuracy of a differential pressure producing flow meter is dependent on the basic accuracy of the device and its discharge coefficient (C_D). The basic accuracy is the tolerance band in which the actual C_D of a particular meter is expected to fall, based on the published C_D for the type of meter specified. The basic accuracy statement assumes a normal flow pattern; that is, one that is not skewed by up-stream pipe fittings or obstructions. If a flow pattern is skewed by an upstream pipe fitting, then the velocity profile is not constant across the cross-sectional area. This introduces additional error to the measurement. Thus, a differential pressure producing flow meter becomes an accurate meter only if it is installed properly.

The installed accuracy of a flow meter takes into account the piping configuration in which the flow meter is installed, and the basic C_D value. The only way to determine the effects of upstream and downstream pipe fittings is by flow tests at a hydraulics laboratory. Various pipe fittings are installed upstream and downstream of the flow-meter at different distances. The C_D value is determined at the various locations. The "Change in C_D %" is plotted vs. distance Z (pipe diameters). Z is the distance between the fitting and flow meter. The distance between fittings and the flow meter should be changed until the tests show no change in C_D.

In order for the data to be valid, the tests must be hydraulically and geometrically similar.

BIF has done extensive testing to determine upstream and downstream piping effects on the Universal Venturi Tube (UVT). Figures 1 through 3 show the effect on C_D for some of the most common upstream fittings. The tests show that the effect on C_D is dependent on the pressure tap type, static (Model 20181) or corner (Model 20182), beta ratio and the fitting upstream. A generalization about the distance upstream is not possible. The data in Figures 1 through 3 show that smaller beta ratios are less effected, and static tap flow meters require less upstream piping than corner tap flow meters.

Our testing also shows that downstream fittings have no effect on the C_D values. The recovery section on the UVT is of sufficient length to make it insensitive to these fittings.

It is not recommended to use any valve or fitting upstream that protrudes into the flow stream. These devices should be located downstream of the flow meter. The use of straighteners should be reviewed carefully. If used improperly, they can preserve the bad flow pattern rather than correct it. Flow straighteners are useful to stop flow rotation/swirl which can occur after two elbows in different planes. Contact BIF or your BIF products representative if installation meets these conditions.

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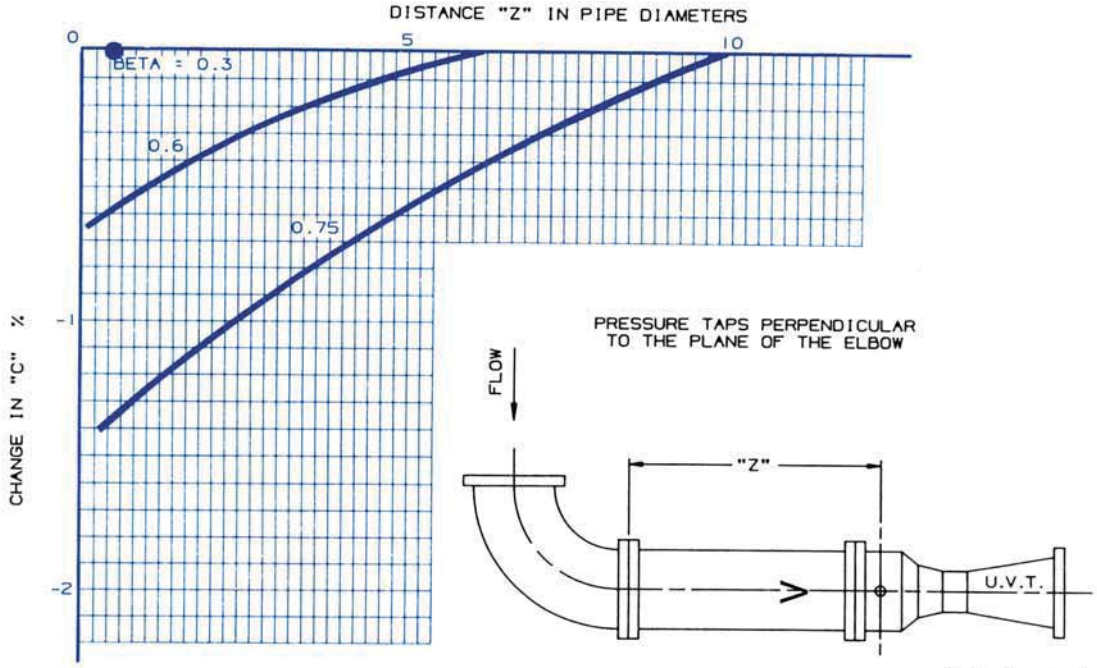
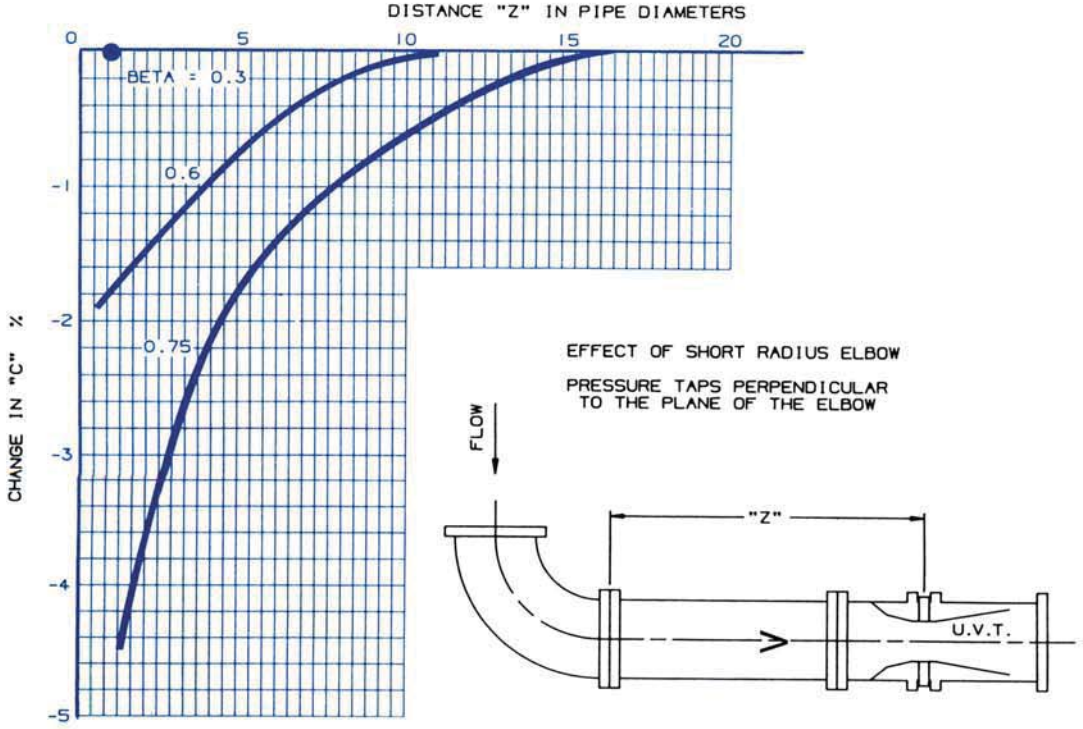
Universal Venturi Tube

Effect of Short Radius Elbow



Static Inlet Tap

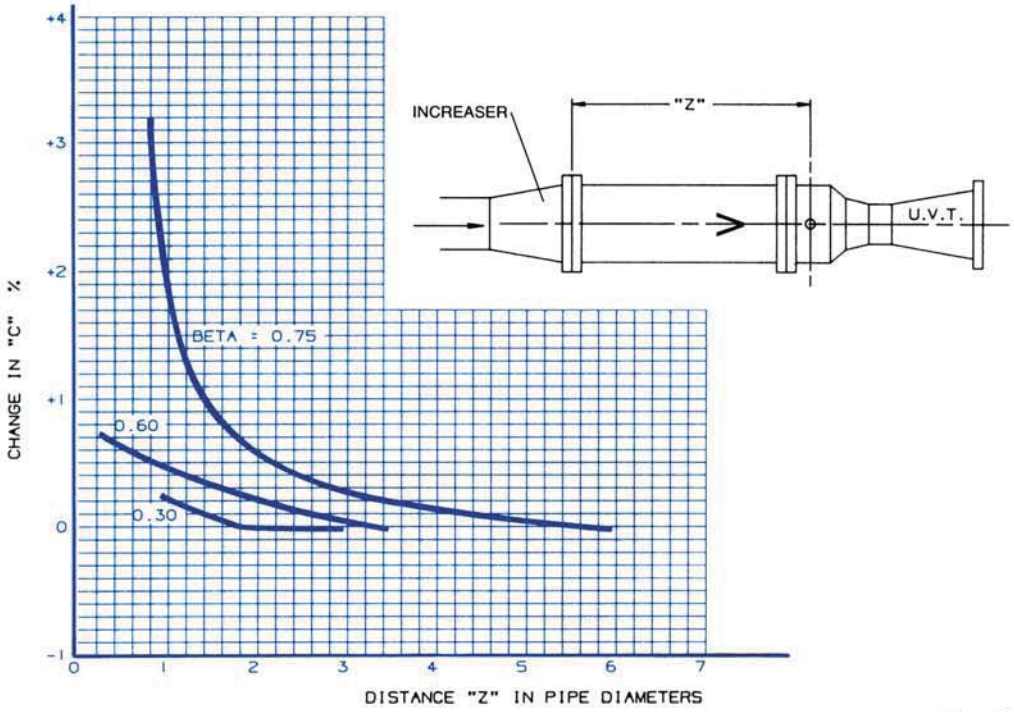
(Figure 1)



Corner Inlet Tap

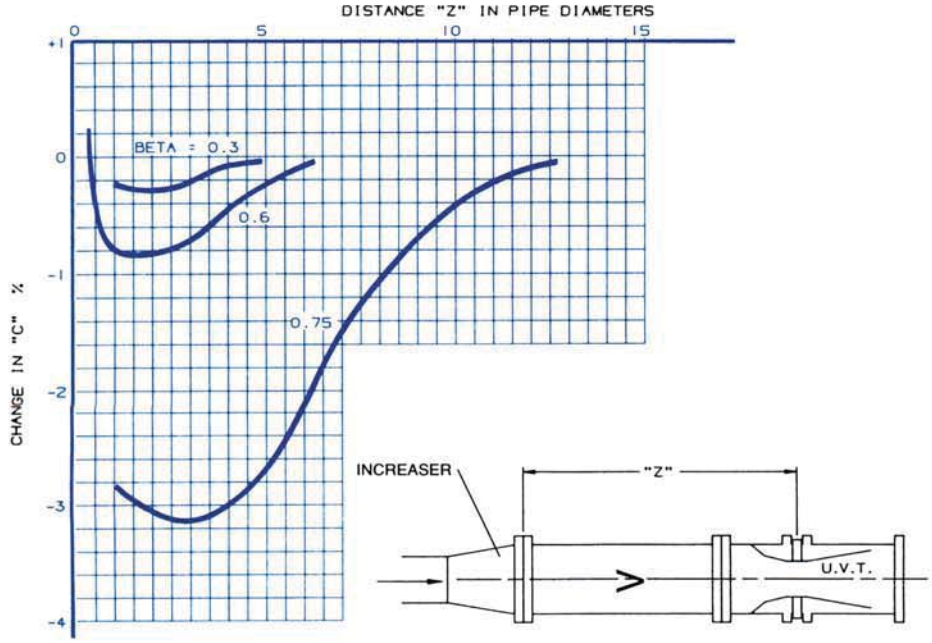
Universal Venturi Tube

Effect of Increaser



Static Inlet Tap

(Figure 2)



Corner Inlet Tap

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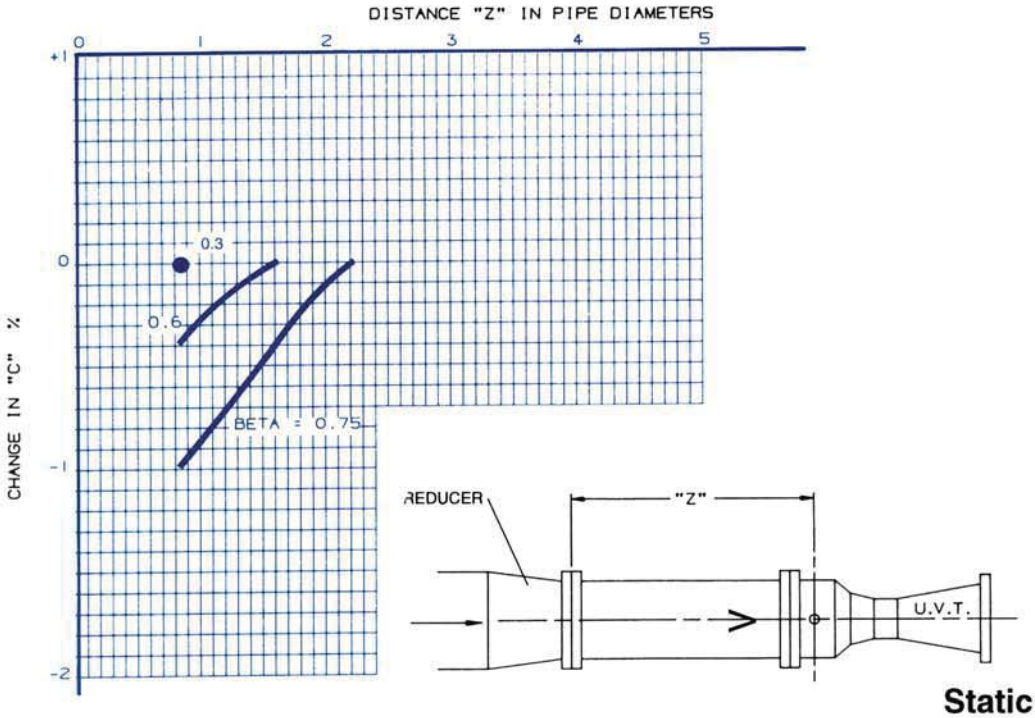
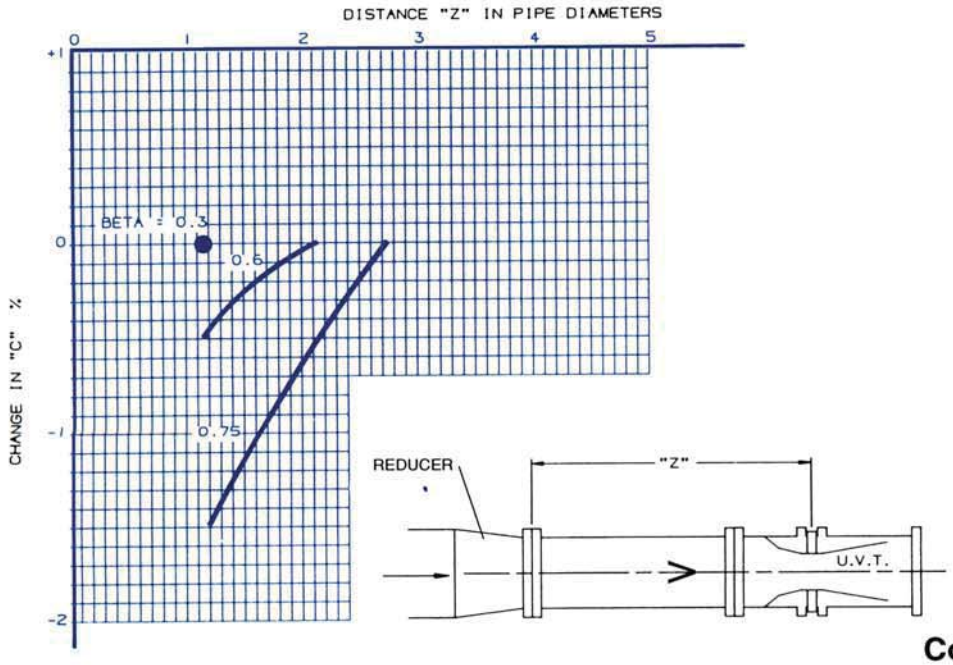
Universal Venturi Tube

Effect of Reducer



Static Inlet Tap

(Figure 3)



Corner Inlet Tap

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