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TECHNICAL BULLETIN

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SUPPORT SPACING FOR SUSPENDED WATER, SEWER, AND DRAIN PVC PIPES

Occasions arise in which it may be necessary to suspend PVC pipes from hangers above ground. In these cases, it is important that the pipe be properly supported to prevent excessive stress concentration due to point loading and/or pipe bending due to sag.

The Uni-Bell Handbook of PVC Pipe states:

"In common practice, a support is secured to the PVC pipe on both sides of pipe joints with interval between support and joint not exceeding two feet. Pipe supports should provide a smooth bearing surface conforming closely to the bottom half of the pipe. Bearing surface in contact with the pipe should be at least two inches wide.

"Supports should permit longitudinal pipe movement in expansion and contraction without abrasion, cutting, or restriction. Supports should be mounted rigidly to prevent lateral or vertical pipe movement perpendicular to the longitudinal axis in response to thrust from internal pressure. Changes in pipe line size and direction should be adequately anchored."

Common industry practice is to limit vertical sag of a suspended pipe to 0.2% of the span length. This usually results in conservative design in terms of bending stress. However, bending stress should be checked since it governs for some combinations of large pipes and high temperatures.

SUPPORT SPACING CALCULATIONS BASED ON DEFLECTION (SAG)

To determine maximum support (i.e. hanger) spacing for PVC pipes filled with water, use the following equation:

Equation 1: Maximum Support Spacing

$$L = \left[\frac{0.154\ EI}{W} \right]^{1/3}$$

Where:

L = Support Spacing (inches)
E = Modulus of Elasticity for PVC Pipe Material (lbs/in^2)
I = Pipe Moment of Inertia (in^4)
W = Weight of Pipe Filled With Water (lbs/in)

At 73° F, **E** has the following values:

PVC Cell Class 12454: 400,000 (lbs/in^2)
PVC Cell Class 12364: 440,000 (lbs/in^2)

As temperature increases, **E** decreases. Therefore, to determine the value of **E** for higher temperatures, multiply the value at 73° F by the correction factors in Table 1.

Table 1

TEMPERATURE CORRECTIONS FOR E		
At 90° F	Multiply by	0.93
At 100° F	Multiply by	0.88
At 110° F	Multiply by	0.84
At 120° F	Multiply by	0.79
At 130° F	Multiply by	0.75
At 140° F	Multiply by	0.70

Pipe Moment of Inertia (in^4):

*** I** = $0.0491\ (D_o^4 - D_i^4)$

Where:

D_o = Pipe Average Outside Diameter (inches)

D_I = Pipe Average Inside Diameter (inches)

Weight of the Pipe Filled With Water (lbs/in):

*** W** = $0.0113\ [(3.5D_o^2) - D_i^2]$

*** Note:** The equations for **I** and **W** are applicable to solid wall pipes only.

Example 1: Support Spacing Calculations

This example calculates support spacing for 8" AWWA C900 DR18 Pipe with a PVC cell class of 12454 and a temperature of 100° F.

For cell class 12454 and temperature of 73° F.

E = 400,000 lbs/in^2

Using Table 1, with a temperature or 100° F:

E = 400,000 lbs/in^2 x 0.88

= 352,000 lbs/in^2

For 8" C900 DR 18 Pipe:

D_o = 9.05 inches

D_I = 7.97 inches

Thus:

I = $0.0491\ [(9.05\ in)^4 - (7.97\ in)^4]$

= 131 in^4

W = $0.0113\ [3.5 \times (9.05\ in)^2 - (7.97\ in)^2]$

= 2.52 lbs/in

To determine maximum recommended support spacing, insert the above values into Equation 1.

$$L = \left[\frac{(0.154)(352{,}000\ \text{lbs/in}^2)\ (131\ \text{in}^4)}{2.52\ \text{lbs/in}}\right]^{1/3}$$

L = 141 inches or 11.8 feet

PIPE SAG CALCULATIONS

To calculate maximum vertical sag in suspended PVC pipes filled with water given a support spacing, use the following equation (calculations for **E** and **W** are the same as above).

Equation 2: Maximum Vertical Sag

Where:

$$Y = \frac{0.013\ WL^4}{E\ I}$$

Y = Maximum Vertical Sag of Pipe (inches)

This equation provides a conservative result in that it assumes there are two supports per singlespan of pipe.