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- Engineering Report -
Evaluation of 90° Long Turn Dryer Elbow

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Reference: Report by Mr. Julius A. Ballanco, P.E., JB Engineering and Code Consulting, P.C., 1661 Cardinal Drive, Munster, IN 46321, (219) 922-6171, Evaluation of Large Radius Dryer Elbow, April 26, 2006.

Scope: Section 104.11, Alternative materials, design and methods of construction and equipment, of the 2004 Florida Building Code, Building, permits alternate construction material and methods provided "that sufficient evidence or proof be submitted to substantiate any claim regarding the alternative". The In-O-Vate Technologies 90° Long Turn Dryer Elbow was evaluated for the equivalent length of dryer exhaust duct as an alternative to the standard three section 90° elbow commonly used. The evaluation was performed in accordance with ASHRAE and SMACNA guidelines.

Product

Description: The In-O-Vate Technologies 90° Long Turn Dryer Elbow is a smooth interior metallic elbow that has a 10-inch bend radius. There are no sections that allow movement to the elbow.

Engineering

Evaluations: The pressure loss due to friction in a round duct is calculated using the following equation:

$$PL = L/100 * FL_d$$

Where: PL = Pressure Loss in Duct in Inches of Water Column (WC)
L = Length of Duct in Feet
FL = Friction Loss per 100 feet of Duct at Specified Velocity of Flow

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The pressure loss through a duct fitting is calculated using the following equation:

$$TP = C * V_p$$

Where: TP = Total Pressure Loss in Inches of WC
C = Fitting Coefficient
V_p = Velocity Pressure at Upstream Connection in Inches of WC

The pressure loss through a fitting is often calculated by establishing the equivalent length of duct for each fitting. By using this method of calculating duct pressure loss, the equivalent length of each fitting is added to the total duct length to establish the pressure loss through the duct system.

To establish the equivalent length for a given fitting, the fitting equation is set as being equal to the duct length equation. Solving for "L" establishes the equivalent duct length for a specific fitting with a given velocity of flow through the duct. The equation becomes:

$$L = 100/FL_d * C * V_p$$

A standard three section, 4 inch dryer exhaust duct 90° elbow with a 4 inch bend radius has been established as having an equivalent length of 5 feet per Section 504.6, Domestic clothes dryer ducts, of the 2004 Florida Building Code, Mechanical.

The coefficient for a standard 4 inch, three section 90° elbow per SMACNA Duct Design Handbook is 0.42. The coefficient for a 4 inch smooth 90° elbow with a 10 inch bend radius is 0.12.

To establish the equivalent length of dryer exhaust duct for the 4 inch smooth 90° elbow with a 10 inch bend radius, the equivalent factors are cancelled leaving the following equation:

$$L_{10} = L_4 * C_{10}/C_4$$

Where: L₁₀ = Equivalent length for the 10 inch radius smooth elbow
L₄ = Equivalent length for the 4 inch radius, three section elbow
C₁₀ = Coefficient for the 10 inch radius smooth elbow
C₄ = Coefficient for the 4 inch radius, three section elbow

Solving the equation results in:

$$L_{10} = L_4 * C_{10}/C_4 = 5 \text{ feet} * 0.12/0.42 = 1.43 \text{ feet equivalent length}$$

Rounding up, the 4 inch smooth 90° elbow with a 10 inch bend radius would have an equivalent length of dryer vent of 1-1/2 feet.

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Conclusions: The In-O-Vate Technologies 90° Long Turn Dryer Elbow has an equivalent length of 1-1/2 feet of duct when calculating the allowable length for a dryer exhaust duct.

Certification: This report was prepared by Marcus Standrod, P.E., Standrod Engineering, P.A., State of Florida Professional Engineer, license number PE0051519.

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Respectfully submitted,



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President

