



## JB ENGINEERING AND CODE CONSULTING, P.C.

1661 Cardinal Drive • Munster, IN 46321  
Phone: 219-922-6171 Fax: 219-922-6172  
E-Mail: JBEngineer@aol.com

JULIUS A. BALLANCO, P.E.  
President

April 26, 2006

Report Number: 06D0426E1

### - Engineering Report - Evaluation of Large Radius Dryer Elbow

**Client:** In-O-Vate Technologies  
810 Saturn Street  
Jupiter, FL 33477

**Contact:** Rick Harpenau, President  
(561) 743-8696  
(561) 745-9723 facsimile  
[www.dryerbox.com](http://www.dryerbox.com)

**Scope:** Section M1502.6 of the 2006 International Residential Code permits large radius elbows to be evaluated in accordance with ASHRAE Fundamentals Handbook for an equivalent length of clothes dryer duct. The In-O-Vate Technologies Large Radius 90° Dryer Elbow was evaluated for the equivalent length of dryer exhaust duct. The evaluation was performed in accordance with ASHRAE and SMACNA guidelines.

#### Product

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

#### Engineering

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

$$PL = \frac{L}{100} * FL_d$$

Where: PL = Pressure Loss in Duct in Inches of Water Column  
L = Length of Duct in Feet

FL = Friction Loss per 100 feet of Duct at Specified Velocity of Flow  
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<sub>p</sub> = 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:

$$L = \frac{100}{FL_d} * C * V_p$$

A standard three section, 4 inch dryer exhaust duct 90° elbow with a 4 inch radius has been established as having an equivalent length of 5 feet in Section 504.6.1 of the 2003 and 2006 ICC International Mechanical Code, Section M1501.3 of the 2003 ICC International Residential Code, and Section M1502.6 of the 2006 ICC International Residential Code. The coefficient for a three section elbow in SMACNA Duct Design Handbook is 0.42.

The coefficient for a 4 inch smooth 90° elbow with a 10 inch radius is 0.12. To establish the equivalent length of dryer exhaust duct for the 4 inch smooth 90° elbow with a 10 inch radius, you cancel out the equivalent factors and are left with the following equation:

$$L_{10} = L_4 * \frac{C_{10}}{C_4}$$

Where: L<sub>10</sub> = Equivalent length for the 10 inch radius smooth elbow  
L<sub>4</sub> = Equivalent length for the 4 inch radius, three section elbow  
C<sub>10</sub> = Coefficient for the 10 inch radius smooth elbow  
C<sub>4</sub> = Coefficient for the 4 inch radius, three section elbow

April 26, 2006

Report Number: 06D0426E1

Solving the equation results in:

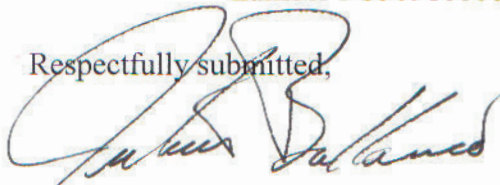
$$L_{10} = L_4 * \frac{C_{10}}{C_4} = (5) * \frac{0.12}{0.42} = 1.43 \text{ feet}$$

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

**Conclusions:** The In-O-Vate Technologies Large Radius 90° Dryer Elbow has an equivalent length of 1-1/2 feet of duct when calculating the allowable length for a dryer exhaust duct in accordance with the International Mechanical Code or International Residential Code.

**Certification:** This report was prepared by Julius Ballanco, P.E., President, JB Engineering and Code Consulting, P.C., registered as a Professional Engineer in the State of New Jersey, license number GE 26894. JB Engineering and Code Consulting, P.C. is a registered Engineering Professional Corporation in the State of Indiana, license number PC50910000.

Respectfully submitted,



Julius Ballanco, P.E.  
President

JB/jb

