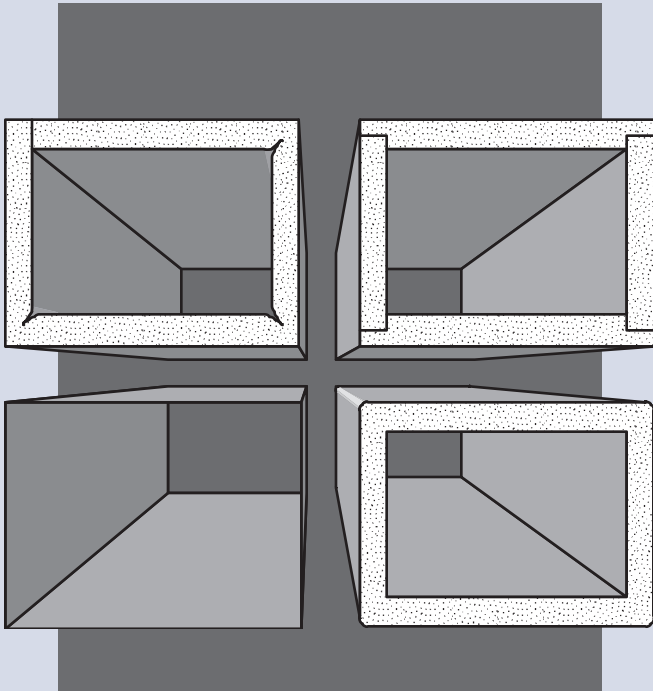


# A COMPARISON OF AIR DUCT SYSTEMS ENERGY SAVINGS AND ACOUSTICAL PERFORMANCE



## Research Shows Duct System Performance Has Significant Impact On Home Energy Costs

Several research studies have taken a close and practical look at duct systems in homes. The results are astounding. They show duct leakage and location of supply and return outlets have a much greater impact on overall home energy usage than previously thought.

The magnitude of the observed leakage from an uninsulated system when the air handling unit is turned on may double or triple the home infiltration rate and increase space conditioning costs by an estimated 10% to 12%.

With field data from well over 1000 houses in different regions of the country, these tests demonstrate that duct leakage is a major cause of energy loss. Pressure imbalances in the house produced by leakage, duct location and forced air distribution systems, can also cause secondary problems such as increased radon and moisture entry through foundations, plus possible back drafting of combustion appliances.

Other studies show that duct leakage can reduce the efficiency of a heat pump by more than 25%.

**Fig. 1 – Duct Noise Attenuation Loss (dB/L)**

| Description   | Octave Band Frequency (Hz.) |     |     |      |      |      |
|---|-----------------------------|-----|-----|------|------|------|
|   | 125                         | 250 | 500 | 1000 | 2000 | 4000 |
| <b>Bare Sheet Metal*</b><br>No perceived noise reduction  | .1                          | .1  | .1  | .1   | .1   | .1   |
| <b>Wrapped Sheet Metal*</b><br>No perceived noise reduction   | .2                          | .2  | .2  | .2   | .2   | .2   |
| <b>Lined Sheet Metal*</b><br>(1" thick)**<br>Significant perceived noise reduction  | .2                          | .5  | 1.4 | 3.0  | 2.4  | 1.9  |
| <b>Fiber Glass Air Duct</b><br>(1" thick)***<br>Very significant reduction.<br>Perceived noise reduced to less than 1/2 original level. | .4                          | 1.4 | 3.3 | 3.9  | 5.0  | 3.7  |

\* Ver. I.L., 1978 ASHRAE Transactions Vol 84. Part 1, p.122

\*\* ASHRAE HVAC Applications Handbook, 1999, Ch. 46

\*\*\* Noise Control Manual, O.C. 6th Edition, 1986

Unsealed metal ducts leak air at the joints where the duct sections are joined together and at the longitudinal joint. Studies show that as much as 30% of conditioned air can be lost at the unsealed joints. Uninsulated sheet metal leaks energy in other ways, too. Heat is lost by radiating through the uninsulated metal. And during cooling periods, the ducts can sweat and drip water. Metal duct joints must be sealed and the duct insulated. If not sealed, the leakage can be so great that it may make the insulation ineffective.

## The Solution

Fortunately, there is one solution to many of the problems reported with unsealed and uninsulated sheet metal – a rigid fiber glass duct system. A properly installed rigid fiber glass duct system has sealed joints. The system combines superior thermal performance and acoustical insulating properties in a single product with a damage-resistant surface.

Fiber glass duct systems are designed for use in indoor commercial and residential heating, ventilating, and air conditioning duct systems operating at air velocities to 2,400 FPM and at static pressures to 2" W.G. (Contact NAIMA member companies for specific limitations.) Fiber glass duct systems meet national and local codes recognized by most standards-making bodies. They are approved for use by key governmental agencies, and are

rated as Class 1 Air Ducts by Underwriters Laboratories. For a complete compliance list, refer to the back page.






For over 30 years, fiber glass duct systems have been handling air reliably and quietly in commercial and residential buildings throughout the country.

With a rigid fiber glass duct system, air is delivered to the registers quietly at design temperatures. Equipment and fan noise is absorbed and there are no banging and popping sounds typically associated with the contraction and expansion of metal ducts. It also helps reduce noise that can be transmitted through the duct system from room to room. (See Figure 1.)

## Quality At A Lower Cost

Rigid fiber glass duct systems are more economical to install than insulated sheet metal – and they save more energy dollars.

Figure 2 below shows that a rigid fiber glass duct system can save up to four times more energy than bare sheet metal without sealed joints – 1.2 times more than sealed and lined sheet metal. The same chart shows that a 1" thick fiber glass duct system is thermally equivalent to sealed metal ducts wrapped with 1½" of duct wrap insulation (which is typically compressed 25% as it is installed).

| Fig. 2 – Air Duct Performance & Cost Comparison |  |  |  |  |  |
|---|---|---|--|---|---|
|   | (Uninsulated)   | (Uninsulated)   | (1", 1.5PCF. Duct Liner)   | (1.5", 0.75 PCF. Duct Wrap)   | (1" Thick EI 475)   |
| Leakage <sup>2</sup> (CFM)                      | 216   | 27  | 27   | 27  | 27  |
| Total Energy Loss <sup>3</sup> (BTU/Hr)         | 20,882  | 15,915  | 6,028  | 5,416   | 5,129   |
| Energy Cost <sup>4</sup> (\$/Sq. Ft)            | 4.70  | 3.59  | 1.36   | 1.22  | 1.16  |
| Installed Cost <sup>5</sup> (\$/Sq. Ft.)        | 4.42  | 5.08  | 7.57   | 7.59  | 4.12  |
| Payback Period (Days)                           | Baseline  | 339   | 555  | 533   | Initial cost less than baseline   |
| <b>Example Design Parameters</b>                |   |   |  |   |   |
| Design Pressure: 1.0 in WG                      | Design Duct Air Temp: 55°F  |   |  |   |   |
| Design Velocity: 1200 fpm                       | Ambient Air Temp: 80°F  |   |  |   |   |
| Duct Width: 36 inches                           | Duct Length: 50 feet  |   |  |   |   |
| Duct Height: 18 inches                          |   |   |  |   |   |

<sup>1</sup> Constructed per SMACNA: "HVAC Duct Construction Standards" and NAIMA Fibrous Glass Duct Construction Manual

<sup>2</sup> Per SMACNA: "HVAC Air Duct Leakage Test Manual"

<sup>3</sup> Per ASHRAE Fundamentals Duct Design Chapter

<sup>4</sup> Annualized Energy Cost Based on 5¢ / KWHr

<sup>5</sup> Based on Means Mechanical Cost Data, 2000

## Proven-In-Use

Since 1956, fiber glass duct systems have saved energy and power costs while delivering quiet comfort-conditioned air.

## Fiber Glass Air Handling Systems and the Indoor Environment

As interest in health and the environment has increased, so has American's interest in the issue of indoor air quality. When fiber glass air handling products are installed and maintained according to specifications, they can improve the overall quality of the indoor environment through the efficiency of their thermal and acoustical properties and their ability to reduce condensation.

When IAQ problems are traced to the air handling system, the typical culprit is poor or inadequate ventilation and system maintenance – and not the type of ducts in the system. HVAC system operation and maintenance is being given increased attention as the need to improve indoor air quality continues.

If cleaning of the HVAC air distribution ducts becomes necessary, NAIMA's publication entitled *Cleaning Fibrous Glass Insulated Air Duct Systems* may be consulted for guidance. The guide provides general, recommended practices for the inspection, opening, cleaning, and closing of air ducts using fiber glass insulation. The guide also includes pre-cleaning and post-cleaning system inspection lists along with information on performance criteria such as fire classifications, air velocity ratings, leakage prevention, temperature allowances and reinforcement recommendations.

## Air Erosion

Fiber glass duct board and duct liner products do not exhibit long term fiber erosion. Tests for erosion have been conducted in accordance with the industry recognized UL 181 Standard, "Factory-Made Air Ducts and Connectors."

Results of these tests, in addition to other independent studies, indicate that after initial start-up and blow down, levels of airborne glass fiber found in buildings with fiber glass duct systems were no greater than the amount of fiber glass found in the outside air.

### Fiber Glass Duct Systems Compliance with National Codes and Standards Making Bodies

- National Fire Prevention Assoc. (NFPA 90A & 90B)
- Building Officials Conference of America (BOCA)
- International Conference of Building Officials (ICBO)
- Southern Building Code Congress (SBCC)
- Federal Housing Authority  
"Minimum Property Standards"
- General Services Administration,  
Public Building Services, "Standard Air  
Conditioning Specifications"
- Corps of Engineers  
"Air Conditioning Guide Specifications"
- Department of Army Guide Specifications –  
Family Housing
- Department of Defense Guide Specifications –  
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- Department of Navy Guide Specifications –  
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