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## **TECHNOLOGIES AND MODERN HOMES ARTICLES**

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# Air Duct Systems

Virtually all of the nation's manufactured homes use forced air systems for heating and cooling distribution. Recent studies suggest that the duct systems in these homes have relatively high leakage rates, contributing to high energy costs, moisture problems, and homeowner discomfort. A recent study revealed that the system losses in an average duct system accounts for 40% of an average home's total heating energy use and 15% of total cooling energy use. These large numbers represent a readily available opportunity for making cost-effective improvements in the design and installation of duct systems. Prior efforts have demonstrated that duct system heating losses can be cut to a reasonable limit of 5% and cooling to 3%. Such




reductions, applied to the average manufactured home, would reduce energy bills by an astounding 23%.

In a continuing endeavor to assist manufacturers in improving the performance of their duct systems, MHRA is sending building scientists to plants across the nation, evaluating their current practices, identifying methods to improve performance and then retesting the systems. The effort is made possible partly with funding from the US Departments of Energy and HUD. Plants interested in the duct system evaluation, should contact MHRA.

As a first step, MHRA Project Coordinator, Francis Conlin visited two plants evaluating their duct system practices. Here is a sampling of his initial findings.

## Plant #1

This plant uses a metal trunk duct, predominantly with perimeter supplies and metal tape used for sealing. The trunk is mostly constructed offline except for the in-line registers.

	Problem	Solution
	<ul style="list-style-type: none"> <li>• Metal crossover duct splitter box is not mechanically secured to furnace connector boot in three of four homes—critical connection held together with one layer of foil tape. This can lead to disconnections of the crossover duct splitter boxes.</li> </ul>	<ul style="list-style-type: none"> <li>• The crossover duct splitter box and furnace connector boot were pre-assembled off-line and should have been secured with 4 screws. Install screws offline when duct pieces are first assembled.</li> </ul>
	<ul style="list-style-type: none"> <li>• Connector for in-line supply register riser has very narrow profile (less than 3”), making installation through subfloor time-consuming.</li> </ul>	<ul style="list-style-type: none"> <li>• Install wider (4”) in-line boots or convert the in-line boots to short perimeter type flex duct connections.</li> </ul>
	<ul style="list-style-type: none"> <li>• Furnace connection box and rectangular-to-round flex duct takeoffs have numerous tabs that are bent over to mechanically fasten these joints. This is time-consuming and involves many sharp edges and unnecessary leakage sites.</li> </ul>	<ul style="list-style-type: none"> <li>• Redesign box without tabs or use a single bendable flange instead of hard-to-seal tabs; redesign takeoffs with wider or single flaps.</li> </ul>
	<ul style="list-style-type: none"> <li>• Uninsulated supply ducts in the floor system are prone to moisture condensation during air conditioning.</li> </ul>	<ul style="list-style-type: none"> <li>• Insulate all supply trunk ducts; add a 4 to 6” insulation wrap on the exterior of the crossover collars and in-line boots.</li> </ul>

## Plant #2

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This plant uses a metal trunk duct with predominantly in-line supplies, occasional metal branch sections and metal tape for sealing.

### Problem

### Solution



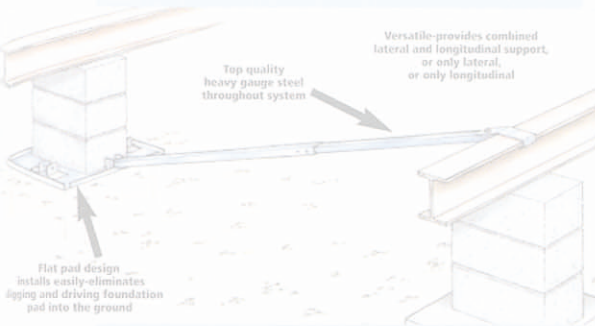
- Metal “cross-over collar” is being deformed into an oval shape to accommodate a larger 12” cross-over duct. This can cause significant leakage after setup.
- Section box and holes in trunk for supply risers are cut “blindly” with a hand held knife—hole will not be as accurate. Hand held knives are more prone to slipping and cutting through side wall of trunk.
- Metal tape is used to seal the furnace-to-trunk connector. This area has the highest pressure and temperature, and is the most important connection in the entire system. Metal tape performs poorly when used under the heating coil to seal this connection.

- Use a tensioning tool to connect duct to collar (collar will go back to round shape); use at least 4 screws through tabs into trunk and tape along collar seam to secure connection.
- Use zip spiral saw or similar tool, combined with a template to cut a more accurate hole that is easier to seal.
- Use superior mastic fiberglass tape instead of metal tape to seal connection.



- Both folded and rolled up end cap systems are used; folded end cap is screwed shut, but large gaps are simply taped over. After a period of time, vibrations and poor adhesion can cause this seal to fail, resulting in significant leaks.
- Outdoor air ventilation duct is connected directly to top of furnace—ventilation air will not receive direct dehumidification. This has been associated with poor humidity control in humid climates.

- If adequately folded and fastened with screws, the “rolled up” end closure system may be a more durable, leak-proof seal; use seam sealing pliers to squeeze connection tight.
  - Ventilation air intake should be redirected to pass over the cooling and dehumidification coils when air conditioner is installed in the field.
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### MINUTE MAN ANCHORS DEVELOPS NEW FOUNDATION SYSTEM

Minute-Man Anchors Inc. has a new Longitudinal/Lateral Bracing System (LLBS) for anchoring manufactured homes. According to Minute-Man, this new foundation system exceeds design requirements for all HUD Code wind zones. Each installed LLBS has an ultimate load of 7,000 pounds. The LLBS can eliminate or reduce the spacing of most anchors and hardware, which can result in saving both time and money.

The foundation system consists of a flat pad design (footing pad) that installs quickly, eliminates any ground excavation and can be placed by driving the pad into the ground. This is accomplished by four steel extensions, one at each pad corner and connected to the bottom of the pad that is driven into the ground. To provide bracing requirements, an adjustable, heavy gauge steel tube connects the footing pad to the home's main I-beam. This foundation system is versatile in that it can provide combined lateral and longitudinal resistance to imposed loads. The LLBS also can be installed to provide only lateral or longitudinal support conditions.

For further information, contact Kelly Hogan or Frank Cockman of Minute-Man Anchors Inc. at 800-438-7277 or [minute-mananchors@hotmail.com](mailto:minute-mananchors@hotmail.com).

**Cutting Edge** is a forum for new products, services and ideas for manufactured housing. If you think your new product or service is a good candidate for **Cutting Edge**, forward materials (including publication-quality photos, slides or drawings) to Mark Nunn at MHI, 2101 Wilson Blvd., Ste. 610, Arlington, VA 22201 or [mark@mfghome.org](mailto:mark@mfghome.org). For questions call 703-558-0665.

### MHRA GUIDE CAN INCREASE ENERGY EFFICIENCY

Virtually all manufactured homes in the nation use forced air systems for heating and cooling distribution. While manufactured homes generally have more tightly sealed ducts than their site built counterparts, if not carefully installed and sealed they can become leaky, wasting a significant amount of energy. Recognizing that a few simple changes in the factory can translate to big savings on energy bills for homeowners, the Manufactured Housing Research Alliance (MHRA) embarked on a program, co-funded by the U.S. Department of Housing and Urban Development and manufacturers, to assess current duct system practices and improve efficiency.



MHRA sent building scientists into 16 plants nationwide to train production employees in the techniques and materials needed to build tightly sealed ducts. In most cases, these changes were simple to make and incurred no additional cost. The result is a more comfortable home, up to a 25 percent increase in energy savings to homeowners, eliminating a potential source of moisture problems, and in some cases enabling the Heating, Ventilation and Air Conditioning (HVAC) supplier to downsize cooling equipment.

With the growing interest in saving energy, this program is a major victory for the industry. The techniques to reduce duct leakage are low cost (in some cases less expensive than current practices) and add to customer satisfaction.

The techniques used to achieve these results are described in MHRA's publication *Manufactured Housing Duct Systems: Guide to Best Practices*, available from MHRA by calling 212-496-0900 or online at [www.mhrahome.org](http://www.mhrahome.org).

### NEW AIR CONDITIONERS AND HEAT PUMPS PROVIDE FLEXIBILITY

NORDYNE has introduced the Platinum Series line of Intertherm and Miller air conditioners and heat pumps to solve some of the most common design and comfort issues in the manufactured housing industry. The new line of air conditioners and heat pumps provide manufacturers with more flexibility in their floor plans.

The Platinum Series provides the ability to place the furnace anywhere in the floor plan by allowing the return air to be placed high on the wall in lieu of the grill in the door of the utility closet where the furnace resides. The electrical hook-up has also been pre-wired to reduce the installation labor cost to the retailer. Consumers can take advantage of improved air distribution to provide a balanced comfort level throughout the home, quiet operation and reduced noise levels, a two-year parts and labor warranty, and a five-year quality pledge on the Platinum air conditioner or heat pump, and a matching Intertherm or Miller furnace.

The Platinum Series products are sold through a network of independent distributors serving manufactured home retailers nationwide. For additional information, contact Carol Baker of NORDYNE at 636-561-7586, or Chris Horner of The Vandiver Group at 314-991-4641.

