

Heat pump ready new manufactured homes

1



Most new manufactured homes ship from the factory with a ducted gas or electric furnace as the home's heating system. Local HVAC contractors have installed heat pumps in these homes for years, yet retailers and home buyers remain hesitant to promote or adopt heat pumps because they are not familiar with the technology and lack confidence in it. Home manufacturers are now exploring ways to increase the number of heat pumps installed in new homes—driven by financial incentives to install more heat pumps like the federal 45L energy efficient new home tax credit, which grants manufacturers a \$2,500 tax credit for building a home to ENERGY STAR requirements or \$5,000 for a home that is certified under the U.S. Department of Energy's Zero Energy Ready Home Program.

Local HVAC contractors typically install a furnace and a central air conditioner during the home setup process because they are familiar with this technology and approach. Many times, they ignore the factory recommended sizing specifications (or are not aware of them) leading to many systems being oversized, which contributes to customer complaints related to- comfort, issues with air distribution, and shorter equipment life.

Manufactured home heat pump installations commonly have mix-and-match systems with indoor and outdoor components from different HVAC manufacturers. Changes to Department of Energy heat pump efficiency requirements that went into effect in 2023, require heat pump installations to use "rated combinations." This means equipment components have been tested together. The new federal test standards require HVAC manufacturers to assume less efficient default air handler performance when a compressor and indoor coil are installed with an existing furnace.

As a result, HVAC contractors installing heat pumps in new manufactured homes must do one of the following:

1. Obtain the compressor and indoor coil from the original equipment manufacturer (OEM) furnace company. This often means purchasing outside of their preferred supply channels.
2. Install a compressor and coil combination that have an efficiency rating with a "default" air handler. This severely limits equipment choices.
3. Remove the OEM furnace and install equipment that is available through the contractor's normal distribution channels. This can require significant modification to the mechanical closet, which is often built right around the OEM furnace with minimal clearances.



These options result in either a minimum efficiency heat pump from the OEM furnace's equipment line or a challenging job that wrestles with space constraints and limited equipment options—likely resulting in an expensive installation. Additionally, all these installation approaches involve alterations to the home's floor system, which often results in compromising the building envelope to some degree. A different approach where part of the heat pump is installed at the factory and matching parts installed onsite could address these



challenges and deliver better outcomes to residents living in the homes. Home manufacturers can also prepare homes for heat pump installation by building a chaseway for refrigerant and condensate lines—reducing damage to the home’s belly when the heat pump is installed.

Exploring Partial Factory Installation

A heat pump could be partially installed in the factory—with the indoor coil installed into the electric furnace at the factory and matching outdoor compressor model information shipped with the home for local HVAC contractors to reference. The factory retains nearly the same HVAC performance risks as with a furnace and increase their profit because they are installing part of the heat pump in the factory. The performance risk may be reduced due to properly sized equipment installed on-site and by having a local contractor still involved with the heat pump system installation and servicing. Homeowners would benefit from good HVAC performance because the heat pump is properly sized. They would also benefit from a cost standpoint because the contractor can access the OEM compressor match for the furnace and indoor coil already in the home.

There are nearly 150 manufactured home factories around the country, collectively producing about 100,000 homes annually. There are an estimated 4,000 thousand home retailers involved with customers’ home purchase and setup decisions, and each retailer likely works with a couple of IHVAC contractors. There could be close to 10,000 HVAC contractors across the U.S. involved with installing heat pump and AC equipment into new manufactured homes. Home manufacturers are motivated to simplify the process and better guide the onsite HVAC installation work, which the partial installation of a heat pump is designed to do.

Heat Pumps

A U.S. Department of Energy Advanced Building Construction research team (Slipstream, Northwest Energy Works, and FSEC) identified a relatively new class of heat pump equipment that could prove to be a good fit for manufactured homes and can save residents more than 50% of their space conditioning energy usage when replacing electric resistance heating in cold climates. The equipment utilizes a variable speed compressor matched to a ducted central air handler with an electronically commutated motor (ECM) fan. The inverter-driven compressor is energy efficient and able to meet the heating load in cold weather. The air handler has a smaller footprint, which can be a good fit in the limited space available in a manufactured home furnace closet. Also, this class of equipment tends to come at a lower price point than comparable conventional unitary equipment.



This approach avoids the extra cost of performing a “site completion” inspection, a requirement for homes shipped without a complete heating system. We tested a Carrier heat pump with air handler that can be configured with electric strip heat and set to operate as an electric furnace independent from the compressor. This flexibility allows for partial heat pump installation in the manufactured home factory and for the home to ship with a functioning heating system, even before the heat pump’s installation on site. Our team was not able to fully test the partial install in the factory approach (due to HVAC supply chain issues and limited factory availability) for the following case study, but we believe it would be possible with this equipment. slipstreaminc.org/mhheatpump

Case Study

The heat pump was installed in a new Clayton manufactured home located in the heating-dominated region of Oregon, and it handled most of the heating load with very little need for back-up electric resistance heat (Figure 1). The system maintained supply air temperatures above 85°F (Figure 2), with higher temperatures observed during colder weather when the compressor would speed up to deliver more heat. The residents reported their home is comfortable in the heating season.

Figure 1. Heat pump energy usage

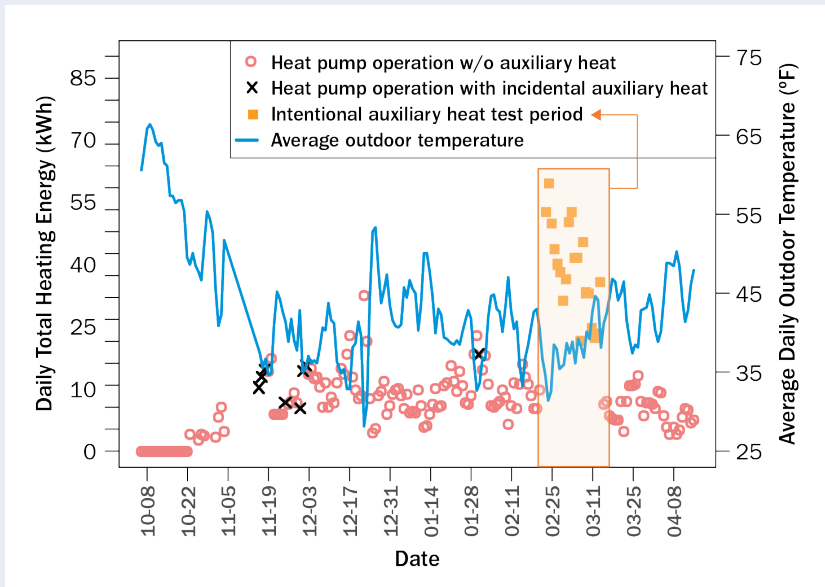


Figure 2. Heat pump comfort

Outdoor Air Temperature Bin	Average Supply Air Temperature	
	Heat Pump	Auxiliary Heating
(20°F–30°F)	94°F	85°F
(30°F–40°F)	88°F	89°F
(40°F–50°F)	85°F	89°F

Lessons Learned

- The heat pump met the comfort expectations for the home’s residents and used minimal auxiliary back-up heat.
- The heat pump used 63% less energy than a conventional electric resistance system during a heating season.
- Heat pump installers prefer factory heat pump preparation because it saves time and reduces damage to the home’s belly.
- Electrical preparation in the factory can save homeowners money by reducing the amount of work required by an onsite electrician during heat pump installation.

Looking Ahead

The project team is working with the manufactured home industry to explore the partial installation of a heat pump in the factory to support the industry’s adoption of heat pumps.