# Recirculating Direct Fired Heaters vs. Unit Heater Systems

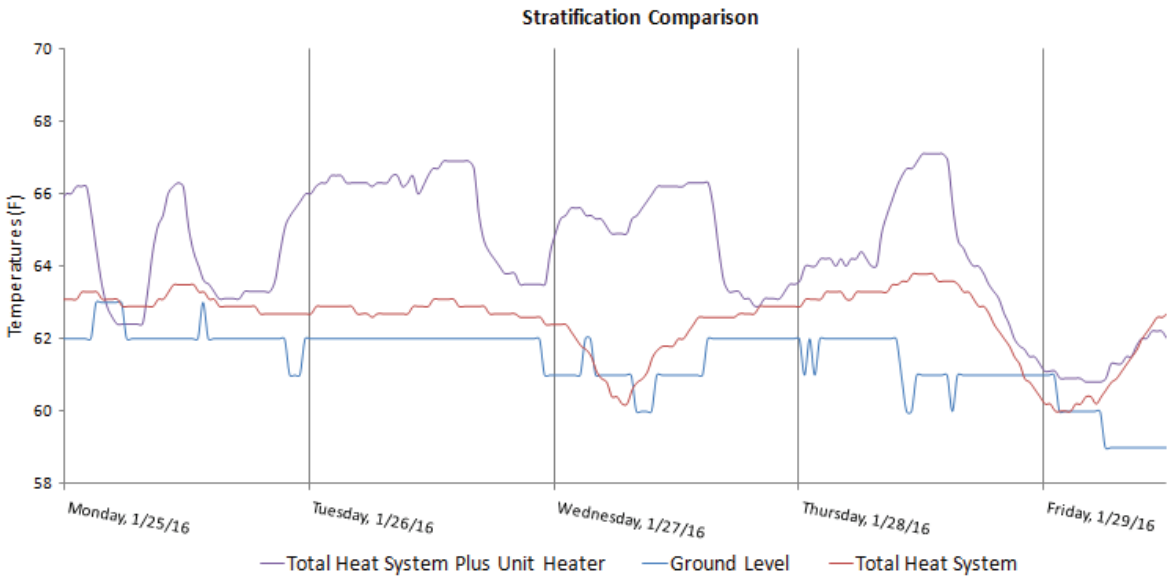
December 17, 2024

## CaptiveAire's Direct Fired Recirculating Heaters:

CaptiveAire's direct fired recirculating heaters are the most efficient way to heat and ventilate a wide variety of applications. From big box warehouse and manufacturing facilities to service garages, recirculating direct fired heaters are a comprehensive approach to thermal comfort. A system including CaptiveAire's direct fired recirculating heaters can be designed to include three major products and technologies:

1. Pressure controlled recirculating direct fired heaters
2. Gravity vents
3. HVLS fans

Each of these components offers a distinct advantage over competing heating systems. First, direct fired burners offer nearly 100% efficiency, transferring all the heat released from the fuel into the space. The use of recirculating direct fired heaters further increases seasonal efficiency by continuously recirculating up to 80% of indoor air. Capturing naturally stratified air near the ceiling allows the heater to recover internal heat gains and use them to temper the incoming outdoor air, saving fuel. Unit heaters, on the other hand, are typically non-condensing indirect fired furnaces. This limits their efficiency to around 80-85%; meaning 15% of energy in the fuel is simply exhausted out the flue. Furthermore, unit heaters do nothing to control stratification, resulting in most of the heat rising to the ceiling. A warehouse snapshot demonstrating this behavior is shown below.




Here the floor level temperatures are compared to the ceiling temperatures at locations with and without a unit heater. While the floor level temperatures at the two locations did not differ, the unit heater's stratification represents an annual cost increase of over $4,000 for a 600,000 square foot warehouse with R30 ceilings. These losses are further magnified once infiltration, efficiency, and other losses are taken into account. Note that the unit heater in this study benefited from recirculating direct fired heaters operating in the background. In buildings solely heated by unit heaters, a 15 to 20 degree temperature differential is not uncommon. This would increase costs to $20,000 due to stratification alone, in addition to the added cost associated with meeting the building's heat load less efficiently. While unit heaters are individually inexpensive, a large number of them are required to heat a building in its entirety. Increased installation, maintenance, and operational costs often make unit heaters a less attractive long term heating solution.



© 2024. CaptiveAire, Inc. All Rights Reserved 

# Recirculating Direct Fired Heaters vs. Unit Heater Systems

## CaptiveAire's Direct Fired Recirculating Heaters cont.:

CaptiveAire's direct fired recirculating heaters simultaneously modulate indoor and outdoor air dampers to maintain a slight positive pressure in the space. Positive pressurization ensures that infiltration and cold drafts are minimized, aids in preventing condensation at the building envelope[1], and ensures the system continuously introduces fresh air as per ASHRAE 62.1 ventilation codes. During normal operation, recirculating direct fired heaters recirculate the designed percentage of air. When a dock door opens, or an intermittent exhaust load occurs, the heater temporarily increases the amount of outside air used in order to make up lost pressure. The recirculating direct fired heaters fully modulating direct fired burner constantly meets the precise heating requirements of the space. While unit heaters also respond to colder temperatures by increasing firing rate, lack of pressure control and intermittent operation results in lower efficiency as well as cold drafts. Unit heaters require supplemental equipment in order to satisfy ASHRAE 62.1 minimum ventilation requirements.

Gravity vents offer a variety of benefits to the building environment. These vents aid in directing air movement as well as provide pressure relief. As unit heaters do not create a pressure gradient in the space, air movement is not controlled outside of natural air movement, usually occurring in the form of undesirable infiltration and thermal stratification.

HVLS, or high volume low speed fans, are an efficient and high performance solution to many challenges found in big box applications. These fans further increase occupant comfort during the heating season, circulate air throughout the space, reduce surface condensation, and offer cost effective evaporative cooling in the summer. HVLS fan's unique design moves more air for less energy, increasing building efficiency.



1. The Precast Concrete Institute. Designers Notebook: Mold



© 2024. CaptiveAire, Inc. All Rights Reserved 