

USING PORTABLE HEAT PUMPS/OTHER PORTABLE HEATING DEVICES

Knowing when and where to use the different types of portable heating devices available will save time, money and headaches.

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⚡ Contractors and technicians can suggest several types of portable heating sources to supplement a building's heating system, such as the large, electric heater shown here, which provides clean, dry air with no emissions.

There are a number of portable heating options available to contractors today for non-residential applications, but they are not as well understood as their portable air-conditioning counterparts, and are therefore sometimes underutilized. As colder weather approaches, a quick refresher course on this topic is appropriate. This article will focus on portable heat pumps and will review other technologies available for emergency, temporary or supplemental heating applications.

The key types of equipment used for portable heating are as follows:

Direct-fired heaters—also known as construction heaters—blow air across a natural-gas or propane flame and into the area to be heated. This is a cost effective heating option at an open construction site. However, there is an open flame that has some level of toxic emissions, so safety issues are of concern. For temporary use in well-ventilated, open areas, direct-fired heaters are a viable choice and can help speed construction processes such as ground thawing, concrete and drywall curing, etc. These units typically feature very large capacities of 80,000–7,000,000 Btuh.

Electric heaters, whether large or small, use resistive heat, which is very effective in cold environments but is the most expensive form of heat available. Large electric heaters with capacities of 34,000–512,000 Btuh are quite popular. They use a forced-air fan to blow or duct fresh, warm air to the area to be heated, delivering clean, dry air with no emissions. Electric power, however, may be an issue. These large heaters usually require three-phase 220-V or 460-V high-voltage wiring, which may not be available—sometimes requiring the use of a generator or an electrician.

Much smaller electric space heaters also are used for spot heating, but due to the well-known safety issues—the potential for nearby drapes or furnishings to catch fire, or for office workers to singe a hand or foot on the exposed coils—these units are often prohibited for use in commercial buildings.

Indirect-fired heaters have been gaining in popularity due to the combined benefits of enhanced fire safety, no harmful emissions, and the ability to heat outdoor or indoor areas that include construction sites, manufacturing/industrial areas and tents. These powerhouses generate a high amount of heat—100,000–1,000,000 Btuh—and are user-friendly. They are used in a wide range of applications, from keeping professional football players warm on the bench to keeping congregations comfortable in drafty churches when the central heating system needs a boost because outdoor temperatures are frigid.

Indirect-fired heaters incorporate a heat exchanger with a natural-gas line or propane or kerosene tank that heats the air. Fresh air is heated and then blown or ducted into a building or other area, without open flames or toxic emissions. Indirect heaters also offer advantages over electric heating units. They are easier to operate, self-contained and convenient; and they operate with low power consumption, so generator power is not required.



« A 700,000-Btuh, indirect-fired portable heater is shown here being used to heat a construction site. Return air is recirculated through the heater to form a closed loop.

Portable heat pumps are the newest technology available, having come into use over the past 10 years or so. They look identical to the spot coolers that are so widely accepted for a host of applications, but with the addition of a heating function that is safer and more efficient than resistive electric heating. Unlike the other portable devices described so far, portable heat pumps are unique in their ability to provide two-in-one cooling and heating functions—and at an incremental cost of around 20%–30% higher than a same-size unit with only cooling capability. Because of their versatility, and the fact that so many regions of the country have seasonal needs for *both* cooling and heating, portable heat pumps are beneficial in these areas.

Applications include localized temperature control—spot-heating/-cooling—for spaces ranging from office environments and shop floors to industrial processes. Portable heat pumps can address “cold spots,” and individual preferences for more cooling or heating than the general environment provides. Corner rooms, areas that receive less sunlight, or spaces that need extra heat due to lack of balance in the central system are other common applications.

Understanding how portable heat pumps work and the types of units available will help with selection and installation.

Understanding heat-pump technology

The most common type of portable heat pump today uses *air-cooled* technology. A reverse-cycle refrigeration system directs

cooled/dehumidified or warmed air to a conditioned space. In the cooling mode, a direct-expansion device allows the refrigerant to evaporate and cool a heat exchanger, which cools and dehumidifies an air stream flowing through the heat exchanger and then to the conditioned space. The heat absorbed from the air stream is rejected to the environment by means of another air stream flowing through a condensing heat exchanger. In the heating mode, the functions of the heat exchangers and air streams described above are reversed. Heat is absorbed from the environment and rejected into the conditioned space.

Heat pumps provide much more heat—about three times more—than electric resistance heat of the same kilowatt consumption. And because they are constructed of all mechanical parts, they eliminate the fire hazards encountered with electric space heaters.

Probably the biggest drawback to portable heat pumps involves their operating temperature limitations in the heating mode. Although a portable heat pump in the *cooling* mode can offer cooling relief in the most sizzling summer heat wave, the same portable unit in the *heating* mode cannot be used as the primary heat source, since only so much heat can be extracted from cold air with a mechanical heat-pump system. The limitations for a heat-pump, in the heating mode, require the surrounding air temperature to be at a minimum of 40°F and in some cases 55°F, depending on the manufacturer of the equipment. As a result, the ambient climate must be temperate or another heating source must be available.

Within these limitations, portable heat pumps are an excellent option for:

- **Supplemental heating**—in chilly lobbies and public spaces, restaurants, offices, conference rooms, manufacturing areas, special events, nursing homes and hospitals.
- **Emergency heating in moderate climates**—Though portable heat pumps are not the answer for an unheated building in a very cold area, they can be effective during a cold snap in a usually temperate region.
- **Nighttime/weekend thermostat setbacks**—When a building's central system is shut down or set back to a lower temperature for a night, weekend or holiday closure, heat pumps can deliver spot heating targeted only to the areas that need it—at a much more efficient cost than the energy that would be required to heat the whole building.
- **Temporary heating during renovation or repair of the primary HVAC system**—In a high-rise tower or other large building, HVAC equipment repair or replacement is typically performed on a zoned basis, usually floor by floor. Portable heat pumps provide an ideal way for contractors to fill the gap and keep occupants comfortable during partial HVAC service or refurbishment. The portable units can be easily wheeled to different areas or floors as work progresses.
- **Spot heating in retail stores**—Portable heat pumps are convenient in retail locations because they do not need extra wiring. The units simply plug into the wall without requiring outside access through windows, making them safe and secure.

» This portable 5-ton heat pump automatically shifts from heating to cooling. Photo courtesy of OceanAire Inc.



⤴ An event tent is being heated by bringing in fresh outdoor air through the portable heater and ducting it inside.

Portable heat pumps typically range from 1–5 tons in capacity (or up to about 60,000 Btuh); are mounted on wheels; and are designed to fit through standard interior doors. Units at the lower end of this range can typically run on a standard 115-V circuit, but larger capacity units will require higher voltages to operate.

Some units have the capability to perform at ambient temperatures of 40°F, utilizing an expansion valve and an indoor/outdoor condenser, which provides for maximum efficiency through a balanced condenser air pressure. Some portables also have a built-in condenser plenum that draws warmer air from above the ceiling to increase heating output.

Other units use a cap-tube system that requires a minimum ambient temperature of 55°F to operate. Computerized controls that automatically switch from the cooling to heating function, or vice versa, are provided on some models, along with variable-speed evaporator fans that automatically cycle down as the temperature in the space approaches setpoint. Current-model heat pumps are updated to operate using R-410A refrigerant.

Sizing/installation guidelines

To determine the net heating effect that will be delivered, the simplest calculation is to take the cubic footage of the area to be heated and divide by 60. This will give you the general cfm requirement for the portable heater. The climate zone, insulation factors, and desired temperature to be delivered to the space may increase or decrease heating demand. The impact of other heating sources in the building—for



« Fresh outdoor air is heated and then ducted to multiple areas to warm this construction site.

example, the central heating system—and heat loss that may occur through windows, lack of insulation, or other such factors also need to be considered. Taking these things into account, along with the available power supply, should provide a fairly accurate estimate of the size and/or number of portables needed for the application.

The basic installation principles, are fast and easy. The most effective approach is to use a return-air plenum to draw heat from above the ceiling; the resulting heat-transfer effect will bring more warm air into the space. As noted above, some portables come equipped with built-in plenums as standard equipment. Other manufacturers offer it as an added-cost accessory.

If a return-air plenum cannot be utilized, an alternative is to draw negative pressure into the space being heated. This will help to increase the net heating effect, but not as efficiently as a plenum.

In the majority of applications, the unit will be located within the space to be warmed. If space constraint or noise concerns make this impossible, the portable may be located outside the room and warm-air ducted into the space to be heated. Keep in mind, though, that wherever the portable is located, the ambient temperature must be high enough for it to operate.

Finally, while the air-cooled heating and cooling portables described above dominate the market, water-cooled portable heat pumps also are worthy of mention. In these systems, water is used instead of air to remove heat from the refrigerant inside.

Water-cooled portables can perform in any temperature above freezing, offering greater operating range and much greater capacity than same-sized air-cooled counterparts, as it is possible to pull heat out of water more readily than out



⌘ 1.5-ton portable heat-pump/cooling unit operates in ambient temperatures of 40°F and above. Photo courtesy of KwiKool Portable Cooling Systems.

of cold ambient air. They are an excellent choice in the right conditions, but are limited to use in areas where the municipal water supply is plentiful and economical, or in buildings with closed-loop cooling towers. The most common applications include emergency or supplemental heating in retail stores, restaurants, offices and other commercial spaces. ☁

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800-972-6600
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