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BASICS OF PORTABLE HEAT PUMPS & OTHER PORTABLE HEATERS

As cold weather approaches, the time is right to review the technologies available to building owners, operators and maintenance supervisors for emergency, temporary and supplemental heating applications. There are a number of good portable heating options on the market for non-residential applications; but they are not as well understood as their portable air conditioning counterparts, and are therefore sometimes underutilized.

The main categories of equipment used for portable heating are as follows:

DIRECT-FIRED HEATERS (also known as construction heaters) - With direct-fired units, air is blown across a natural gas or propane flame and into the area to be heated. On an open construction site, nothing works more cost-effectively - however, there is an open flame that has some level of toxic emissions, so safety precautions need to be taken. For temporary use in well-ventilated open areas, it is 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 to 7,000,000 BTU/hour.

ELECTRIC HEATERS whether large or small, use resistive heat which is very effective in cold environments. Large electric heaters with capacities of 34,000 to 512,000 BTU/hour 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. Larger electric heaters usually require 3-phase 220 volt or 460 volt high voltage wiring and sometimes require the boost of a generator. Much smaller electric space heaters are also used for spot heating and require less electric power.

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 and indoor areas including construction sites, manufacturing/ industrial areas and tents. These powerhouses generate a high amount of heat (ranging from about 100,000 to 1,000,000 BTU/hour capacity) and are user-friendly. They are used in a wide range of applications - from keeping NFL players warm on the bench, to making congregations more comfortable in drafty churches when the central heating system needs a boost due to frigid temperatures outdoors.

Indirect-fired heaters are safe for indoor and outdoor use.

Indirect-fired heaters incorporate a heat exchanger with a natural gas line or propane or kerosene tank that heats up the air. Fresh air is heated and then blown or ducted into a building or other area,

with no worries about open flames or toxic emissions. Indirect heaters offer distinct advantages: they are easier to operate, are self-contained and convenient, and operate with low power consumption, so generator power is not required.

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 devises described so far, portable heat pumps are unique in their ability to provide “two-in-one” cooling and heating function. 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 regarded as having strong growth potential.

Applications range from spot heating and cooling of spaces ranging from office environments to shop floors to industrial processes. The portability of the units permits localized temperature control and also the ability to roll out the units at the end of the rental or lease period. Portable heat pumps can address “cold spots” as well as personal preference for more cooling or heating than the general environment. 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.

We will take a closer look at how portable heat pumps work, the types of units available, and the selection and installation guidelines.

UNDERSTANDING HEAT PUMP TECHNOLOGY

The most common type of portable heat pump today uses air-cooled technology. A reverse-cycle refrigeration system directs cooled and dehumidified air 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 air stream flowing through the heat exchanger and then 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 kW consumption. And because they are constructed of all mechanical parts, they eliminate any fire hazards encountered with electric space heaters.

5-ton portable heat pump shifts automatically from heating to cooling.

One potential drawback to portable heat pumps involves their operating temperature limitations while in heating mode. Although a portable heat pump in the cooling mode offers cooling relief in the most sizzling summer heat wave, the same portable unit in the heating mode cannot always be used as the primary heat source, since you can only extract so much heat 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, and many more.

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 AND 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 - 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 the 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 need no extra wiring. The units simply plug into the wall, with no outside access needed through windows, making them safe and secure.

Portable heat pumps typically range from 1 to 5 tons (or up to about 60,000 BTU/hour) in capacity, 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-volt circuit, but larger capacity units will require higher voltages to operate.

Some units have the capacity to perform to ambient temperatures of 40 degrees 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 degrees 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 environmentally friendly R-410A refrigerant.

SIZING 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 in which you are located, insulation factors, and desired temperature to be delivered to the space may increase or decrease your heating demand. You will also have to allow for the impact of other heating sources in the building (e.g., the central heating system) and heat loss that may be generated by windows, lack of insulation, etc. Taking these factors into account, along with the available power supply, you should be able to arrive at a fairly accurate estimate of the size and/or number of portables needed for the application.

INSTALLATION

If you have ever installed a spot cooler, then you are already familiar with the basic installation principles, which are fast and easy. The most effective approach is to use a return 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 you are trying to heat. This will help to increase the net heating effect, but not as efficiently as a plenum.

In the majority of applications, you will want to locate the unit within the space to be warmed. If this is not possible due to space constraints or noise concerns, the portable may be located outside the room and warm air ducted into the space to be heated. Keep in mind 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 are also 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 of cold ambient air. They are an excellent choice in the right conditions, but they are limited to use in areas where the municipal water supply is plentiful and economical, or in

buildings with closed-looped cooling towers. The most common applications include emergency or supplemental heating in retail stores, restaurants, offices and other commercial spaces.

SELECTING A PORTABLE EQUIPMENT SUPPLIER

A reputable distributor of portable equipment should be able to guide you through the above steps and provide sizing, technical and installation assistance. When selecting a supplier, ask:

What kinds of equipment are offered? Look for a supplier who carries both portable heating and cooling equipment from multiple manufacturing sources, so you can get unbiased advice on the best unit for your application as well as year-round assistance. Ask what accessories are available and whether they are included in the basic rental price.

Does the supplier have a national accounts program? If you manage multiple facilities, look for a supplier who offers a program tailored to national account customers. You may be able to save time and money with an integrated program that includes single point of contact within the portable equipment supplier organization for all your service needs, a customized emergency response plan, and the ability to accommodate your company's ordering system.

What other support and/or certifications are available? Ask what kind of technical support is available from the supplier. If you manage a government facility, determine if the distributor is U.S. General Services Administration (GSA) certified. Ask if they follow green initiatives such as the use of environmentally-friendly refrigerants, etc. Also, make sure the supplier has a large inventory of locally stocked equipment and a proven track record in emergency response.

Sunbelt Rentals, Climate Control Services is a leading provider of temporary, portable, supplemental and emergency heating, cooling and dehumidification equipment. The company provides climate control equipment as well as engineered solutions for a wide array of applications including server rooms, hospitals, commercial, industrial and event entertainment sites. Sunbelt Rentals offers 24/7 emergency service and support from fully stocked locations nationwide. For further information, call 800-892-8677, or visit www.sunbeltrentals.com/climatecontrol.