

BEATING THE BIG CHILL

In cold weather, portable heaters are a convenient way to heat temporary shelters for framing and siding crews working on unheated buildings. More important, portable heaters help control temperatures during crucial construction phases. Freshly placed concrete, for example, must be protected when average air temperatures drop below 40°F for more than three consecutive days (see “Cold-Weather Concreting,” 1/95). In moderate cold, insulating blankets and temporary shelters will usually provide enough cold-weather protection; but in severe cold, using portable heaters is often the best way to maintain proper temperatures.

Combustion heaters. Fuel-fired, or combustion, heaters are popular on construction sites because they are economical and feature a wide variety of options. Typical fuels include liquefied petroleum gas (LPG), natural gas, and liquid fuels such as kerosene and No. 1 fuel oil.

There are two types of combustion heaters — direct-fired and indirect-fired. Like a furnace, indirect heaters are vented to the outside to carry away carbon monoxide, carbon dioxide, and other byproducts of combustion (see photo). Most portable heaters, however, are unvented direct-fired heaters, so products

of combustion are emitted together with the heated air. To avoid a dangerous buildup of carbon monoxide in an enclosure, use indirect-combustion heaters whenever possible. When using direct-combustion heaters in an enclosed space, be sure to supply plenty of fresh air.

Combustion gases can cause problems, however, even when an enclosure is unoccupied and worker safety is not an

In cold weather, portable heaters keep workers comfortable and protect cold-sensitive materials like fresh concrete

BY MOIRA HARDING

issue. For example, carbon dioxide from direct-combustion heaters interferes with cement hydration, resulting in a soft, chalky concrete surface. When heating air over concreting operations, the Portland Cement Association recommends using vented heaters for at least the first 24 hours.

Electric heaters. While electric heaters are not as common as fuel-fired

types, they have the advantage of not relying on combustion to produce heat. Consequently, the heated air is free from combustion byproducts.

Electric heaters produce heat in one of two ways — using resistance elements or infrared radiation. Infrared heaters transfer heat directly to nearby people or objects. Resistance heaters heat the air in the immediate vicinity of the heater; as with combustion heaters, the warmed air is then distributed either by natural convection currents or by means of a fan mounted on the heater.

Choosing. Both combustion and electric heaters come in a range of sizes to meet different job-site conditions. To determine the best type of heater for your needs, evaluate these five criteria:

- Heating capacity
- Efficiency
- Fuel availability and storage
- Portability
- Safety features

Heating Capacity

Before selecting a heater, gauge the size of the area to be heated and estimate how much the temperature needs to rise (see “Calculating Heater Capacity”). In general, raising the temperature of 10,000 cubic feet of air 20°F requires



While indirect-fired heaters are larger than required for most residential sites, their advantage is that they vent combustion gases to the outside, delivering clean heated air to the work area.

26,000 Btu per hour. (Wind and drafts will decrease heating efficiency.)

Manufacturers' Btu ratings (expressed in Btu per hour) measure heat output, which varies considerably between electric and fuel-fired heaters. Typically, a high rating for electric heaters is just over 100,000 Btu per hour, but Btu ratings for fuel-fired heaters can reach as high as 7 million Btu per hour.

Efficiency

Btu ratings for combustion heaters vary with the type of fuel consumed (see "Fuel Heat Values"). No. 1 fuel oil, for example, with a heat value of 135,000 Btu per gallon, contains more stored energy than gasoline, which has a heat

value of 128,000 Btu per hour.

Btu ratings reveal not only how efficiently a fuel burns, but also how efficiently the heater operates. Provided heaters consume the same type of fuel at the same rate, heaters with high Btu ratings are more efficient, though they consume more fuel. Within a single line of oil-fired heaters, for example, a 50,000-Btu model may burn 4 gallons of fuel in 11 hours, a 100,000-Btu model may burn 9 gallons in 12 hours, and a 150,000-Btu model may burn more than 13 gallons in 12 hours. Which heater you should choose depends on the size of the area you need to heat, the number of degrees you need to raise the temperature, and the length of time you need to keep the area heated.

Despite lower Btu ratings, electric heaters may be more energy-efficient than fuel-fired heaters. Because electric units use heating elements that resist the flow of electric currents, they create heat with negligible energy loss. On job sites, however, the type and amount of electricity available often limits the size of the electric heater and its heat output. Many electric heaters, for instance, require three-phase power or voltages other than 120 or 240. And depending on electric utility rates, electric heaters can be expensive to use. Compared with a 50,000-Btu combustion heater, for instance, which burns about \$7 worth of fuel (at \$1.50 per gallon) in 11 hours, a similarly sized electric resistance heater will cost almost twice as much to run for the same length of time (at 10¢ per kilowatt).

Fuel Heat Values

Fuel	Btu
No. 1 Fuel Oil	135,000 /gal.
Kerosene	134,000 /gal.
Gasoline	128,000 /gal.
Liquid Propane Gas	91,000 /gal.
Natural Gas	1,000 /cu. ft.

Increasing efficiency. Fuel-fired heaters can be equipped with options that increase heat productivity. Thermostatic control, which is standard on many models and available as an option on almost all heaters, is a good way to better control heat output and fuel consumption. Also, some heaters run on more than one fuel; most oil-fired heaters will burn either kerosene or No. 1 fuel oil, and some gas heaters can switch between propane and natural gas. This enables contractors to choose a fuel based on price as well as heat output.

Some gas-fired heaters also have an optional vaporizing coil that takes liquid propane from the tank, vaporizes it, and delivers the vapor to the burner. This feature makes it easier to use liquid propane fuel in very cold weather.

An adjustable thermostat is available on electric heaters, as is a thermal cut-out switch, which prevents overload and increases the life of the heating element. Some of these switches also have an automatic reset option. And some electric infrared heaters feature a replaceable heating element that has an average rated life of 5,000 hours.

Calculating Heater Capacity

Step 1: Determine size of space in cubic feet

Step 2: Multiply by degrees of desired temperature rise

Step 3: Multiply result by .133

For example, to raise the temperature 60°F in a 24x24-foot room with a 10-foot ceiling:

$$\begin{array}{r}
 5,760 \text{ cu. ft. (24x24x10)} \\
 \times 60 \text{ degree temperature rise} \\
 \hline
 345,600 \text{ subtotal} \\
 \times .133 \\
 \hline
 45,965 \text{ Btu per hour}
 \end{array}$$

In this case, choose a heater with a Btu rating of 50,000. Remember, however, that drafts (from frequent opening and closing of enclosure doors, for instance) will decrease heater efficiency.

Fuel Availability and Storage

Although efficient to use, fuels are often difficult to transport and store. Natural gas, for example, requires its own pipeline to the job site, while propane is commonly supplied in bulky 100-pound cylinders. Safety standards require that the tanks be stored in accordance with ANSI/NFPA 58 and that this storage conform to local guidelines. Liquid fuels must also be stored in bulk outside the structure, with no more than one day's supply stored inside the building. (Gas suppliers, local fire departments, and state government agencies are all good sources for information about storage of fuels and use of temporary heaters on site.)



Direct-fired convection heaters, such as Grainger's 200,000-Btu Dayton model 4E237 (left), rely on natural currents to circulate heated air. Electric infrared heaters, like this model from Fostoria (middle), use radiation to heat people and objects directly. Fostoria's Sun Mite electric resistance heater (right) uses a fan to distribute warm air. While electric portable heaters may be more expensive to run than combustion heaters, they produce clean heat.

Electricity is often unavailable on job sites, especially while the concrete work is still going on, and typical job-site generators can't provide enough power to run heaters. And although small electric heaters require only a single-phase hookup, large ones typically need three-phase power. Remember also that some electric heaters must have enough power to run both the fan and the heater.

If electricity is available and an electric heater appears suitable for the job at hand, match the unit's power requirements to your needs. Depending upon the brand, power requirements may vary from 1.8 to 30 kilowatts, 6.1 to 65 amps, single- or three-phase hookup, and voltages of 120, 208, 240, 480, and 600.

Portability

The biggest factor affecting portability is weight, which varies considerably from heater to heater. Smaller units — weighing from 4 to 70 pounds — are light enough for one person to move. Larger heaters, however, typically weigh several hundred pounds, and some trailer-mounted heater-generator units weigh as much as 3,500 pounds.

Fortunately, various options are available on both large and small heaters to make them easier to move. The simplest feature, found on smaller units, is a carrying handle. Another option is a built-in stand or base, with attached wheels to transport the heater. Some heaters have a one- or two-handled cart equipped with wheels so the heater can be easily transported. This arrangement is often built in to the unit, but is sometimes available as an

accessory. Larger heaters often have a two-wheel undercarriage.

Safety Features

Important safety features required by ANSI include:

- Permanent safety data plates displaying information on clearances, ventilation, fuel type, fuel pressure, lighting, extinguishing, relighting, electrical power supply characteristics, and change of location.
- Grounding continuity to all parts of the heater, including connection to a

grounded power supply.

- A warning label advising that heaters manufactured or modified for thermostatic control or intermittent operation may start at any time.
- An automatic flame-loss device to stop the flow of fuel if the flame is extinguished. ■

Moira Harding is associate editor of Concrete Construction magazine. This article was adapted with permission from Concrete Construction, published by The Aberdeen Group in Addison, Ill.

Sources of Supply

DESA International
2701 Industrial Dr.
Bowling Green, KY 42102
502/781-9600

Detroit Radiant Products Co.
21400 Hoover Rd.
Warren, MI 48089
800/222-1100

Fostoria Industries
1200 N. Main St.
Fostoria, OH 44830
419/435-9201

Grainger
333 Knightsbridge Pkwy.
Lincolnshire, IL 60069
708/913-7028

Heatwagon
P.O. Box 90
Valpariso, IN 46383
800/362-6951

Homelite
P.O. Box 7047
Charlotte, NC 28241
704/588-3200

Scheu Products
297 E. Stowell
Upland, CA 91785
800/325-7057

Tioga
850 Florida Ave. South
Minneapolis, MN 55426
800/218-4642

Reader Service numbers are included in this product directory to assist readers in obtaining information. They are not sponsored or paid for by the manufacturer.