

Space Heaters

Space heaters are designed to provide heat to specific areas or objects. There are many different types, ranging from small portable heaters that use varying methods of heat distribution to permanently installed heaters that are surface-mounted to a ceiling or wall. Depending on their design, space heaters can operate on electricity, natural gas, wood, or liquid fuel, though they most often use either electricity or natural gas.

Space heaters won't be the right choice for every application, but they can save energy and money in some cases, such as:

- When using only part of a facility that has a central heating system that cannot isolate the area in use
- When only a small fraction of a large facility is occupied, such as a shipping desk in an unheated warehouse
- When specific tasks of limited duration must be performed in an otherwise unheated space

Typically, portable electric heaters are used in residential applications, leaving the permanently installed ceiling- or wall-mounted heaters for commercial and industrial applications. There are of course exceptions to this, with surface-mounted radiant heating panels sometimes used in residential applications and portable electric heaters sometimes used in commercial or industrial spaces.

The efficiency of a specific space heater is not necessarily important; what matters is its intended use—what type of heating the consumer wants from it. Using a space heater in a manner for which it was not intended can drive up energy costs and fail to provide occupant comfort. But in the right applications, space heaters can maintain comfort and lower overall energy costs.

WHAT ARE THE OPTIONS?

Space heaters are typically used either to supplement an inadequate existing heating system or to save energy and defray energy costs in one of the situations described above. In either of these cases, look for a heater that has a design and safety features that match your needs.

Heater Types

To pick a design that works well in a certain situation, it is important to understand the different types of space heaters that are available.

Radiant heaters. This type of heater provides warmth in the same way that the sun's rays or a warm fireplace does: by emitting radiated heat in a specific direction. They can be powered either by electricity or by a fuel (typically propane, natural gas, or kerosene). Electric radiant heaters use a variety of heating elements, including quartz tubes, carbon tubes, metal coils, and halogen lamps (**Figure 1**). Some radiant heaters use reflectors to focus the heat; others simply allow the heat to dissipate in the direction the heater is facing. Radiant heaters are better suited to heating objects (usually people) than entire spaces, and they work best in areas with open architecture (not many doors or other obstructions). Objects must be within the heater's line of sight to feel the heat. Over time, radiant heaters will increase air temperature as the people and objects that absorb the radiant heat directly transfer some of it to the air. Fuel-fired heaters typically require some degree of fresh makeup air for the space to avoid buildup of combustion pollutants.

Figure 1: Radiant heater

A typical radiant heater, utilizing a reflector to direct heat outward.



Courtesy: Honeywell International Inc.

If you plan on being in a room for only a short period, a radiant heater is the best option for space heating. They can be more efficient over a short period than other heater types because radiant heaters avoid the energy needed to heat the entire room by instead directly warming the occupant of the room and the occupant's immediate surroundings. Radiant heaters are sometimes referred to as quartz, infrared, parabolic, ceramic, halogen, and reflective heaters.

Convection heaters. The main difference between a convection heater and a radiant heater is air flow. Convection heaters rely on the the natural pattern of rising hot air to heat a room. They are designed to heat an entire room by heating the air, rather than focusing the heat on any particular object, and so they work best in rooms that can be sealed off (usually by closing a door). One example is a portable electric baseboard-style space heater. With a baseboard heater, air circulates through the room and enters the baseboard heater on the floor. The air is then warmed by passing across the electric element in the heater and rises through the room. The cold air in the room descends to enter the heater, and the cycle is repeated. The most efficient convection heaters are oil- and water-filled heaters (**Figure 2**). These employ a heating element in a bath of oil or water. The oil or water remains heated while the unit is on and heats the surrounding air by way of natural air movement through the unit, similar to an electric baseboard heater. These oil- or water-filled units look like a portable radiator. Fuel-fired convection heaters are also available. Like their radiant heater cousins, they require a fresh air supply. These are often used in semi-enclosed spaces, such as a patio or barn.

Figure 2: Convection heater

A typical convection heater, using air movement through the unit to heat the room.



Courtesy: DeLonghi

Combination heaters. Many space heaters employ both radiant and convection heating techniques. These combination heaters are sometimes regarded as having more flexible operating use requirements than conventional heaters. One example of this type of heater is a ceramic radiant heater that uses an internal fan to distribute the heat it generates (**Figure 3**). Combination heaters heat specific objects in addition to the air surrounding them, although they don't do either as well as a heater designed solely with either radiant or convection technology would. Combination heaters are also called heater fans.

Figure 3: Combination heater

A typical combination heater, with controls on top and an internal fan that circulates heat throughout the room.



Courtesy: Vornado Air Circulation Systems Inc.

Unit heaters. One type of space heater that dominates use in the commercial and industrial sectors is the unit heater, which is basically a forced-air furnace without ducts (**Figure 4**). It is a self-contained, permanently surface-mounted heater that can operate on either electricity or natural gas, though natural gas is the more common fuel used. As with all gas-fired combustion equipment, unit heaters must be vented to the outdoors to exhaust the combustion gas. These units require some installation work, but they can also provide a much greater amount of heating for a space than a typical portable space heater. Unit heaters are good for heating an add-on room, workshop, or garage without needing to add ductwork. They are most commonly used in warehouses, car dealerships, auto service bays, and other large open buildings. Even with their ability to create a large amount of heat for open areas, they are sometimes criticized for creating large temperature differences in a space, as well as for the noise they produce.

Figure 4: Unit heater

A typical gas-fired unit heater, with an exhaust pipe shown on the back side.



Courtesy: Sterling Gas Products

Utility heaters. These are used mainly at outdoor worksites and in other areas where spot heating is either helpful or necessary. They are generally oil- or propane-fueled, and they use a cylindrical shape to direct heating in a specific direction (**Figure 5**). They can be used in auto bays and other industrial areas that are often open to the elements. They are effective for outdoor worksite use where electrical outlets may not be convenient, although some units come fitted with an electric ignition that requires an outlet.

Figure 5: Utility heater

A typical oil-fired utility heater, with the fuel reservoir located in the base of the unit.



Courtesy: DESA LLC

Heater Efficiency

Because the efficiency of an electric space heater is essentially 100 percent, all of the electricity it consumes will be given off as heat. Though there are no federal minimum

efficiency standards for gas-fired space heaters, the Energy Policy Act of 2005 (EPAct 2005) included component requirements for unit heaters that went into effect on August 8, 2008. They must now be equipped with an intermittent ignition device and have power venting or an automatic flue damper.

However, ASHRAE (the American Society of Heating, Refrigerating, and Air-Conditioning Engineers) Standard 90.1, the Energy Standard for Buildings Except Low-Rise Residential Buildings, does specify minimum efficiency levels for gas- and oil-fired unit heaters. This is significant, because 90.1 is often adopted by local building codes, either directly or indirectly through local adoption of the International Energy Conservation Code, which includes many 90.1 specifications. According to 90.1-2007, both gas- and oil-fired unit heaters must have a minimum combustion efficiency of 80 percent. Combustion efficiency is defined as 100 percent efficiency minus flue losses.

COMMON FEATURES

Not all space heaters have all of the features listed here; this is a list of the most commonly found and most highly desired space heater characteristics.

- Adjustable heating element (providing multiple heat settings)
- Adjustable fan
- Carrying handle
- Cool-touch exterior
- Thermostatic control
- Digital thermostat
- Night light
- Occupancy sensor
- Oscillating unit
- Overheat safety shut-off
- Power indicator
- Remote control

- Silent operation
- Timer
- Tip-over safety alarm
- Tip-over safety shut-off
- Wheels

HOW TO MAKE THE BEST CHOICE

this section

Once you've decided that space heaters are right for your business, it is helpful to answer a few questions to help determine the proper type of space heater that will suit your needs.

For example:

- Do you have a preference on whether it uses electricity or natural gas? Are both available where the heat is needed?
- Is an adequate supply of fresh air available?
- Where do you plan to use the space heater? In what areas or rooms, specifically? What tasks will be performed there?
- In general, how often and for how long will the heater be in use—periodically or constantly?
- What features are important for your application?

Sporadic usage, spot heating. If you need help “filling the gap” or simply adding some extra warmth while performing a task at home or at work, a radiant heater will be the best match. They provide heat almost instantaneously but must be located fairly close to warm an occupant effectively. The main caveat with these types of heaters is that they can be a fire hazard, so safety precautions must be taken in order to prevent fires, burns, or other damage. Examples of where these heaters might be used are for a person working at a desk or sitting on a couch; these perform well when the object to be warmed is relatively stationary.

In some instances, it makes sense to use a radiant heating panel: These are varying-sized electric panels that are mounted to a surface (wall, ceiling, or floor) and radiate heat to an object directly in front of them. They operate completely silently, are cool to the touch, and typically consume less power than a traditional radiant heater; they also produce less heat, but can work well to provide some heat for a person sitting at a desk or other small enclosed area with a nearby mounting surface.

Constant operation, whole-room heating. If you plan to use the space heater for extended periods of time or to heat an entire room and a conventional central heating system is impractical, a convection heater will most likely be your best choice. Either an oil- or water-filled radiator heater or a portable baseboard-style heater will work. Unlike radiant heaters, convection heaters cannot provide instantaneous spot heating but instead gradually warm the air in the room. They provide an even, comfortable heat through natural convection of the room air. Most of these heaters are silent and cool to the touch.

Varied operation, versatile tasks. If the space heater will be used for a variety of tasks, a combination heater—employing both radiant and convection techniques—is best. These are currently the most commonly used space heaters. Any space heater with a heating element and an internal fan can be classified as a combination heater. These heaters can be used to warm up an entire room (although not as evenly as a true convection heater) and to heat a stationary person (again, not as efficiently as a true radiant heater). Many people enjoy the versatility of these portable types. These heaters can also be a fire hazard, so it is important to operate them in areas where they're unlikely to come into contact with flammable materials such as paper.

Large open commercial or industrial spaces. Larger spaces typically benefit the most from installing a unit heater. Their large Btu capacity and ductwork-free operation make them an

attractive option where a conventional forced-air system would be more costly.

Saving Energy and Money with Space Heaters

Some advertisements for radiant space heaters claim that they save large quantities of energy. That claim can be true, but only in very specific situations. To achieve energy savings with space heaters, you have to be willing to turn down the temperature setpoint for the central heating system considerably, and then use radiant space heaters to heat only those areas that are occupied by people. The radiant heat warms occupants and the objects surrounding them directly, so the indoor air temperature does not need to be set as high, which reduces the amount of energy consumed by the central heating system.

The cost-effectiveness of using one of the various space heater options will vary with several factors. The most important are how often the space heater will be used and the type of space it is used in—for example, an enclosed office versus a open-air loading dock. Also, the cost of fuel or electricity and the efficiency of the heater will also have an impact on net operating cost. In addition, if space heating is replacing some portion of a central heating system, the avoided cost of operating the system will somewhat offset the cost of the heater. To illustrate the cost of operating space heaters, we looked at three applications (**Table 1**). We assumed that each space heater would operate 8 hours a day, 5 days a week (22 days per month) at the fuel price given by the U.S. Energy Information Administration for 2008 national average retail commercial customers (\$11.44 per million Btu), or an electricity rate of \$0.10/kilowatt-hour.

Table 1: Typical space heater operating costs

We looked at the operating costs for three applications: using an electric space heater to supplement the heating of an office; using a gas-fired unit heater for a warehouse loading dock; and using an overhead gas-fired radiant heater for an outdoor patio, such as at a restaurant.

	Energy input	Heat output (Btu/h)	Efficiency (%)	Usage cost			
				Daily (US\$)	Monthly (US\$)	Daily (C\$)	Monthly (C\$)
Electric combination heater	1,500 W	5,120	100	1.04	22.89	1.24	27.22
Natural gas unit heater	200,000 Btu/h	160,000	80	17.79	391.42	21.16	465.46
Natural gas overhead radiant heater	100,000 Btu/h	80,000	80	8.90	195.71	10.58	232.73

Notes: Btu/h = Btu per hour; MMBtu = million Btu; mcf = thousand cubic feet;
W = watt.

Assumptions: Fuel prices: electricity, \$0.10/kilowatt-hour; gas \$11.44/MMBtu.
Heating value: natural gas, 1.019 MMBtu/mcf; U.S. to Canadian
exchange rate calculated at 1:1.18915.

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Before You Buy

Before you jump onto the space heater bandwagon, it will likely be beneficial to perform some easy and inexpensive energy-saving measures at your workplace. Any one of these could solve your heating problems without any additional heating equipment.

- Weatherize the building: Install caulking and weather stripping around doors and windows and add insulation.
- Clean or replace the furnace air filter regularly.
- Insulate heating ducts.
- Verify that heat registers are not blocked (by furniture or other objects) or clogged.
- Seal off registers in unused spaces.

These measures can be implemented in just a few hours, and any costs are usually recouped in savings over just a few months.

WHAT'S ON THE HORIZON?

this section

Space heater technology and features advance at a slow rate. Though EPA Act 2005 included new standards provisions for unit heaters, we don't expect any other major changes any time soon.

WHO ARE THE MANUFACTURERS?

this section

A useful online resource to compare general space heater features and performance are consumer opinion web sites such as www.epinions.com . Small portable space heaters are rated on these sites, but there are currently no ratings for unit heaters and radiant panels. You can also compare information on the web sites of space heater manufacturers, including these:

Electric space heaters

- [DeLonghi](#)
- [Holmes](#)
- [Patron](#)
- [Vornado](#)

Electric radiant panels

- [Econo-heat](#)

Fuel-fired radiant space heaters

- [Space-Ray](#)
- [Detroit Radiant Products Co.](#)
- [Patron](#)

Fuel-fired convection space heaters

- [Mr. Heater](#)
- [Patron](#)
- [R.E. Williams Contractor Inc.](#)

- Universal

Utility heaters

- Mr. Heater

Unit heaters

- Modine
- Reznor
- Sterling

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