The Home Inspector's Companion to...

OILHEAT

OILHEAT
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Clearburn Science

NORA
NATIONAL OILHEAT RESEARCH ALLIANCE

BUILD YOUR KNOWLEDGE ABOUT OILHEAT

As a home inspector, you're under pressure to provide accurate information to your clients, a task made more difficult by the wide variety of equipment you evaluate.

The National Oilheat Research Alliance (NORA) respects the critical role you play in advising home buyers. That's why we've put together this guide to help you answer your clients' questions about their heating equipment and about oilheat in general.

Oil dealers also understand and respect how hard you work to support your clients. Please look to oilheat dealers in your market area as a resource for information and assistance.

We hope the information in this brochure makes your job a little easier. Knowing the facts and having the answers to questions about oilheat will make you more valuable to your clients and, ultimately, help you stand out from your competitors.

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Advances in oilheat

When most of the heating systems you look at are 20–40 years old, it's easy to conclude that oilheat is dirty, inefficient and prone to breakdowns. What was cutting-edge 40 years ago is not today. There have been some amazing advances in technology that make current oilheat options substantially more attractive.

Today's oilheat systems are so compact they take up as little as five square feet of space.

These advances have emerged thanks to the impact of Clearburn Science, which has produced dramatic improvements in oilheat technology. Examples include innovations such as high-pressure flame retention head burners, advanced solid-state and microprocessor-based electronic controls, and cleaner burning fuel. This guide explains some of the advances in technology that make today's oilheat clean, safe and efficient.

Heating oil

Heating oil is produced, transported and priced differently from other fuels.

How heating oil is made

Heating oil is refined from crude oil, a complex mix of hydrocarbons plus oxygen, nitrogen and sulfur. The refining process separates crude oil into different "fractions."

The lighter fractions eventually become propane, butane and petrochemicals; heavier fractions are used to produce gasoline, kerosene, jet fuel, diesel fuel and No. 2 home heating oil. Even heavier fractions become No. 4 and No. 6 heating oils, used for commercial and industrial buildings, hospitals and schools.

After refining, No. 2 heating oil is the color of champagne. For tax purposes, regulations require that heating fuel be dyed red before it is sold so it cannot be confused with on-road diesel fuel. The dye has no effect on the fuel and how it burns.

How heating oil gets around

After it is refined, heating oil is transported via ship, barge, truck and/or pipeline to major fuel terminals. It is distributed from the terminals to local heating oil companies. Many of these companies have their own storage facilities (such as the facility pictured below), which can hold thousands of gallons of oil. These company storage facilities ensure that an adequate supply of fuel is on hand.

How heating oil is priced

The price a customer pays for fuel oil is usually determined by the level of service provided by the oil supplier. Companies with service plans, 24-hour emergency service, monthly payment plans and equipment financing typically command a higher price than companies that only deliver oil. Oil companies usually offer several pricing options, allowing customers to choose the services that best meet their needs.

Heating oil companies and service

Your client will find a wide range of prices and services offered by different companies. Fortunately, oilheat companies aren't large monopolies.

Most oil companies are locally owned and operated and have established deep roots in their communities. They place a high value on the quality of the products and services they provide. In a recent national survey, oilheat customers gave their oil suppliers an average rating of 94% for friendly, fast service.

Common misconception:

Heating oil is a volatile fuel.

Truth: *Heating oil is safe. If you dropped a burning match into a barrel of oil, the match would go out, just as if you had dropped it in water. Oil must be vaporized before it will ignite or burn.*

Furnaces

Oil furnaces provide homeowners with many options for increased comfort. In addition to heat, the ductwork that connects with the furnace can deliver other kinds of conditioned air. For example, homeowners can use the same ductwork to:

- stay cool with a central air system.
- eliminate dry air by attaching a whole-house humidifier.
- filter out household dust and pollen that can cause allergic reactions by adding an air cleaner.

Types of furnaces you may see

The oldest kind of oil furnace you are likely to encounter will probably be connected to a gravity, warm air system that was designed to burn coal and has been converted to oil. Although few of these systems are still in use, they have contributed to the negative impression some people have about oilheat.

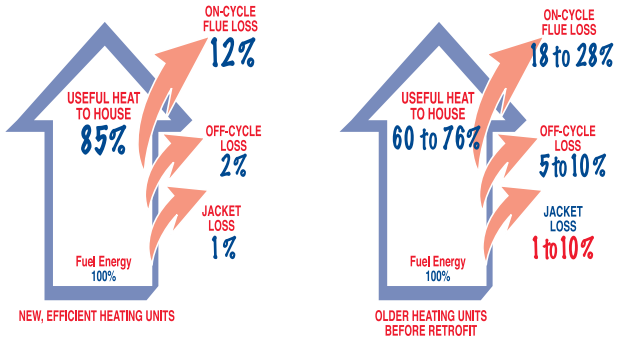
The owner of this 1916 furnace, which had been converted from coal to oil, recently replaced it with a high-efficiency oil furnace.

Efficiency levels

In many cases, a coal-to-oil converted system is extremely inefficient by today's standards.

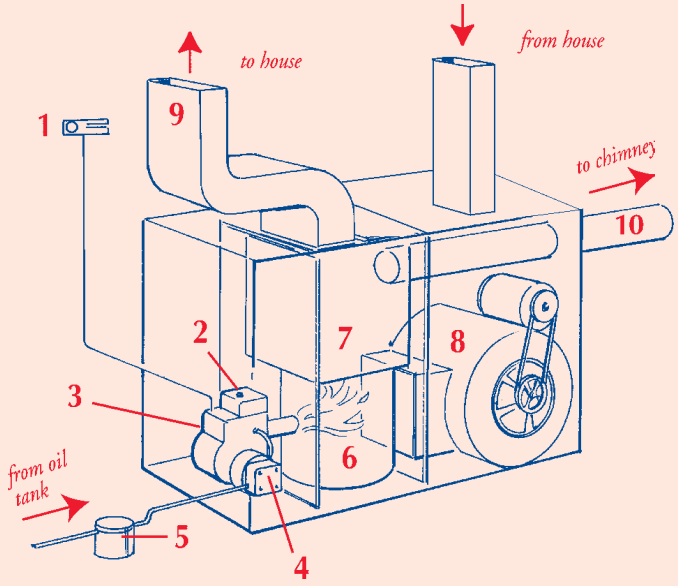
A typical oil furnace of this kind operates at 50%–60% efficiency, well below the efficiency levels of modern oil furnaces. The low efficiency of older furnaces is due to design flaws, which result in a great deal of heat loss.

A second factor is the burner found in older oilheat systems. It cannot cleanly convert the fuel into heat and thus does not perform as efficiently as a modern oil burner.

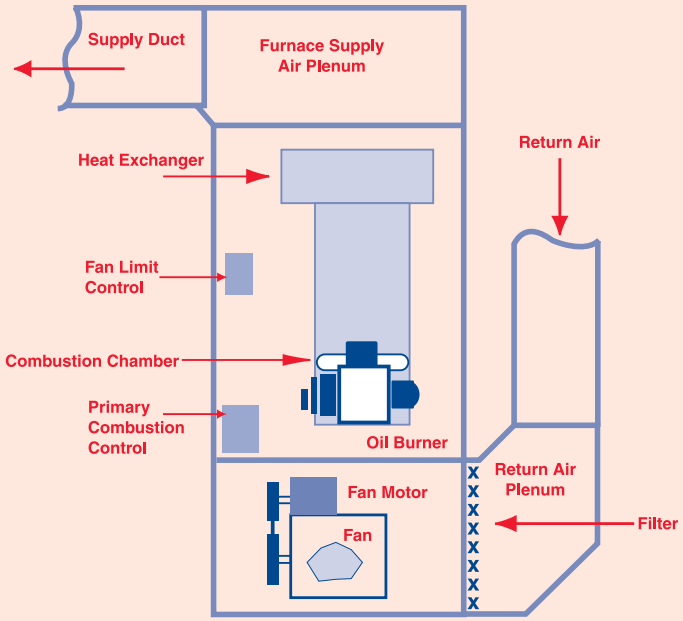


Older heating systems have poor insulation qualities, resulting in a great deal of heat loss. This diagram shows the difference in efficiencies between a new and an old system.

How an oil furnace works



The thermostat (1) sends a signal to the controls (2) on the burner (3). The fuel pump (4) draws oil through a filter (5) to the burner. The burner turns the oil into a fine spray, mixes it with air and ignites it in the combustion chamber (6), causing the chamber to become very hot. Air absorbs heat in the heat exchanger (7). A blower (8) sends this air through ducts (9) to heat the home. The air eventually circulates back to the heat exchanger and the cycle continues. Combustion emissions are vented out the flue (10).



Conversion of these coal systems, which started around the 1940s, involved removal of coal grates and installation of a combustion chamber and oil burner. The system may also have been retrofitted with a blower assembly and turned into a forced air system.

The coal-to-oil conversion also included the addition of three basic controls: a thermostat, a high limit control and a stack switch, also known as a primary control or stack relay.

Recommendation: Replacing one of these inefficient systems with a modern oilheat system can reduce heating bills by approximately 40%. At a minimum, the conventional burner could be replaced with a new flame retention head burner, saving the homeowner as much as 15% on annual fuel bills. (See p. 9 for more about burners.)

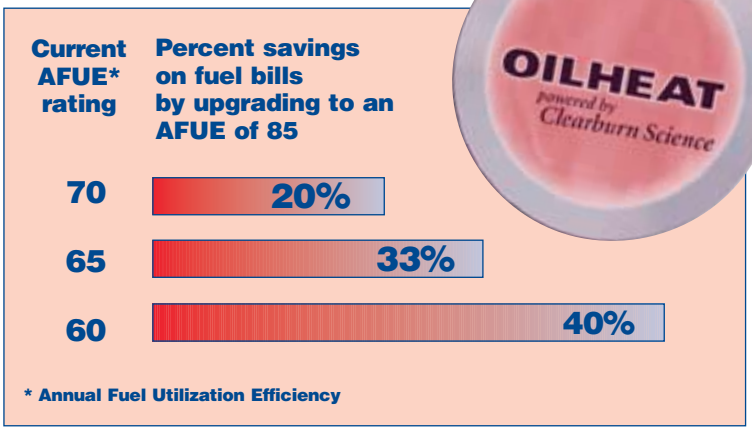
Today's oil furnaces

Modern oil furnaces range in efficiency from 81% to 95%. Some of the innovations found in today's oil furnaces include:

- low-mass combustion chambers and sophisticated heat exchangers, which together improve heat transfer.
- solid-state or microprocessor-based controls, which result in more reliable operation.
- high-pressure flame retention burners, which result in clean, efficient comfort.

Note: These technological advances also apply to modern oilheat boilers.

Upgrading to a new oilheat system pays



Savings can be even greater for oilheat systems that are less than 60% efficient. These systems were manufactured before the advent of AFUE ratings.

The condensing furnace

One of the newer technologies in oilheat is the condensing, oil-fired warm air furnace, which features two heat exchangers. Efficiency ratings of 95% have been achieved, so operating costs can be much lower. The ultra-high efficiency of the condensing furnace is achieved by lowering the stack temperature to the point where the steam in the flue gases turns back into water.

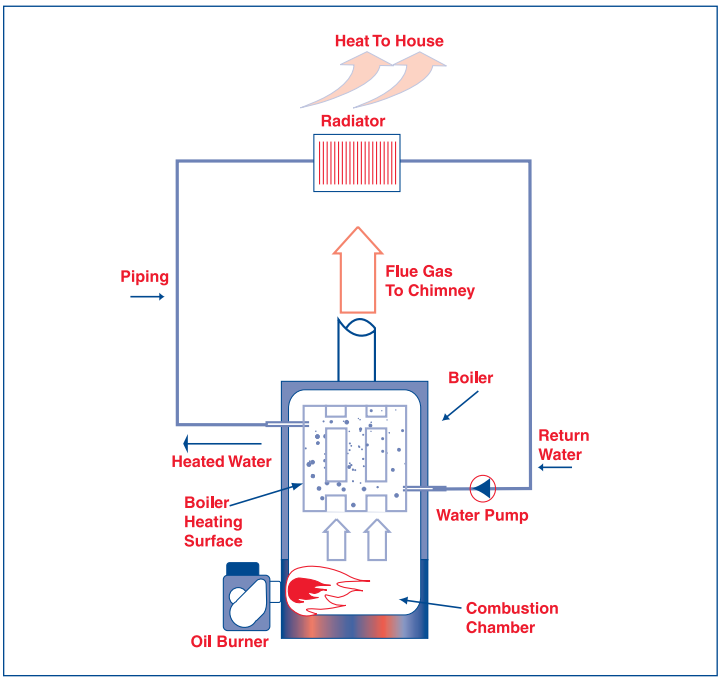
At far left is a typical furnace "jacket." Pictured at near left is a direct-drive blower, used in some oil furnaces. A direct-drive blower can be set to automatically deliver the correct amount of air flow for both heating and cooling a home.

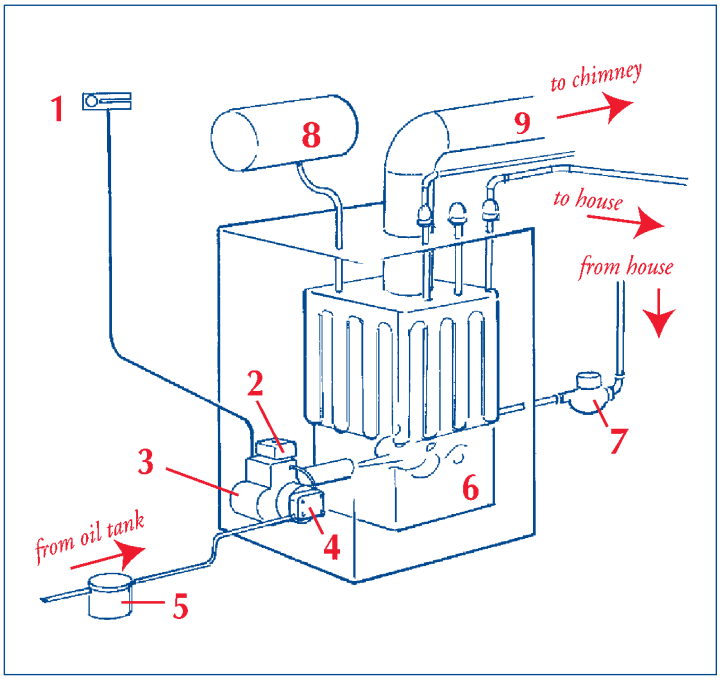
Tip for your client:

Explain to your client the importance of changing/cleaning the furnace filter. Since indoor air continues to circulate whenever the blower runs, household dust, pollen, animal hair and lint will get trapped in the filter. If the filter becomes clogged, the furnace will overheat and the limit control will shut the system down.

Boilers

How a hydronic boiler system works





The thermostat (1) sends a signal to the controls (2) on the burner (3). The fuel pump (4) draws oil through a filter (5) to the burner. The burner turns the oil into a fine spray, mixes it with air and ignites it in the combustion chamber (6), causing the chamber to get very hot. Water circulates around the combustion chamber. A circulator (7) pumps the heated water through radiators or baseboards to heat the home. An expansion tank (8) adjusts to varying pressures. Eventually, the water returns to the heating unit to begin the cycle again. Combustion emissions are vented out the flue (9).

While furnaces heat and distribute air, boilers heat and distribute water. One of the advantages of an oil-fired boiler is that it can heat a home's domestic hot water as well as heat the home. A separate water heating unit is not needed. Another advantage of a boiler is that it heats a home very evenly.

What's more, because of new technology, such as small, flexible air ducts, homeowners with boilers can now install a central air conditioning system more easily than in the past.

Additionally, boilers can be used in homes that have duct systems by means of a hydro-air system. In a hydro-air system, heated water is sent to an air handler to warm the house. The concept is much like that of a central cooling system where refrigerant is sent to an air handler to cool the house. The hot water in the hydro-air system warms the air in the air handler and the heated air blows through the ducts to warm the home.

Over the years many different models and designs of oil boilers have been manufactured and installed in homes. In most cases, however, these statements about boilers are true.

- Oil-fired boilers are generally heavier and smaller than oil furnaces. On average, efficiency ratings for conventional boilers 30 years old or older, without Clearburn Science technology, are in the mid-60% range.

- Often, the same boiler block can be used to produce either hot water or steam, but this also depends on the particular electrical and mechanical components that are present.

Tip for your client:

Today's oilheat equipment is so compact, homeowners can open up a great deal of space in a basement, garage or utility room by installing a new oilheat system. Some models take up as little as five square feet. (See photo on p. 2.)

Hot water boilers

In radiant heating, the boiler circulates heated water through flexible tubing, which can be installed under floors and behind walls. It can even be installed outside—under walkways, patios and driveways to melt snow and ice.

In a hot water (hydronic) boiler system, heated water from the boiler is pumped by a circulator through radiators, radiant tubing or baseboards. With hot water heating, zoning—or dividing the system into separate heating areas of the home—is easily accomplished. Zoning provides efficient, comfortable, inexpensive heating.

Radiant heating, one of the oldest forms of hot water heating, has made a comeback in recent years due to its warmth and efficiency. Advances in technology have made radiant piping more durable and affordable.

Hydronic boiler systems can distribute hot water through:

- radiators
- baseboards
- convectors
- vents (hydro-air systems)

Boiler designs

A New York heating oil company recently replaced this original boiler from a home built in 1891.

Some older oil boilers you may see have been converted from coal. Due to antiquated designs, these systems are plagued by high draft loss and poor heat transfer.

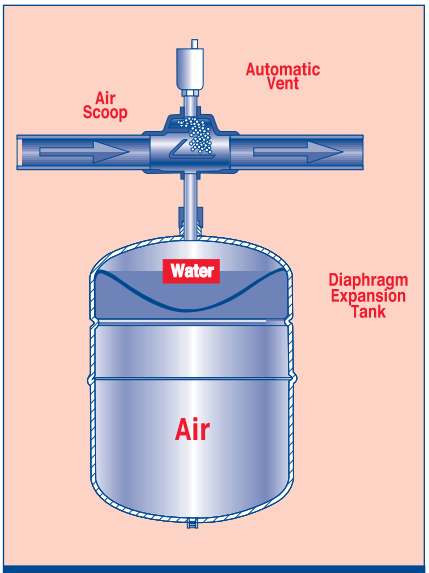
Newer oil-fired boilers are more efficient, in part because of low-mass construction and reduced water storage. This results in less heat loss.

You are most likely to find either a steel or cast-iron boiler in homes you inspect. The most common design for steel boilers uses fire tubes. Combustion gases flow into these long tubes, which are surrounded by water. The oil burner fires into the combustion chamber, which has a dry base design. A dry base design means there is no water surrounding the firebox. All the water is contained in the upper section of the boiler.

Other steel boilers have a wet base design in which water surrounds the combustion chamber. This design is more efficient because the hot gases pass through the fire tubes twice before they are vented. The wet base design is also called a two-pass system.

Like steel boilers, cast-iron boilers also have dry base and wet base designs. In a cast-iron boiler, the hot gases rising out of the firebox pass over the outside of each of the boiler's cast sections through flue channels. (Flue channels are located between the cast sections.) The gases are then vented through the flue pipe to the chimney.

All boilers have internal passages for the combustion gases. If the passages are too wide, the heat transfer rate will be low. (Combustion gas passages that are too wide are often a problem in boilers converted from coal to oil.)



All hot water systems use expansion tanks. Older boilers typically have a steel expansion tank, which must be recharged with air periodically. Newer boilers have a pressurized tank with a diaphragm, a design that requires less maintenance.

Efficiency ratings

Cast-iron and steel boilers are tested to verify their heating capacity and efficiency. Boiler ratings are published by The Hydronics Institute. Rating indicators for each boiler model include hot water output in Btu's per hour and the Annual Fuel Utilization Efficiency (AFUE) ratio.

AFUE is determined by a testing procedure specified by the U.S. Department of Energy. All heating equipment manufactured after 1980 is required to have a label indicating its AFUE. The AFUE ratio is a measurement of a heating system's seasonal efficiency, taking into account how well the system performs over an entire season of starts and stops.

AFUE should not be confused with combustion efficiency, which indicates how well the burner converts oil into heat. In many oil-heated homes, there are tags attached to the equipment that may indicate combustion efficiency.

If the combustion efficiency is below 78, you may want to encourage your client to consult with an oilheat professional. While the unit doesn't have to be replaced if its combustion

efficiency is less than 78, a careful analysis may indicate that the homeowner could save energy and money by upgrading the burner, furnace or boiler. Such an assessment would require a review of the household's heating oil bills, and the cost of new equipment, including installation, to determine if upgrading to new equipment is justified.

Determining age and life expectancies

It's impossible to determine the exact age of all systems, but it's safe to say that this one is at retirement age.

"How old is it and how long do you think it will last?"

You've probably heard this question hundreds of times after evaluating the heating system in a home. As you know, it can be difficult to determine equipment age, especially if you're dealing with a furnace or boiler that's a real old-timer. And unless you practice astrology too, you don't want to start predicting the future of any equipment you've inspected.

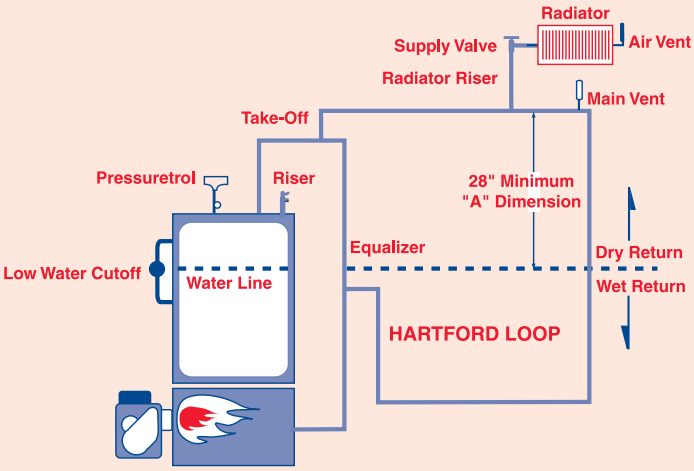
Here are some guidelines, however, that may help you give a partial answer to your clients' questions, one that will put them more at ease.

One way to determine a system's age is by checking the serial number; the date of manufacture is sometimes "hidden" within the serial number. Look for labels and tags too. The date of manufacture may be on a label, and it's possible that the installer tagged the system with the date of installation.

As far as longevity is concerned, oil-fired boilers and furnaces can last for decades, unlike most major appliances that typically wear out in 10–15 years. The life span of heating equipment also depends on the quality of the maintenance and service it has received.

Steam boilers

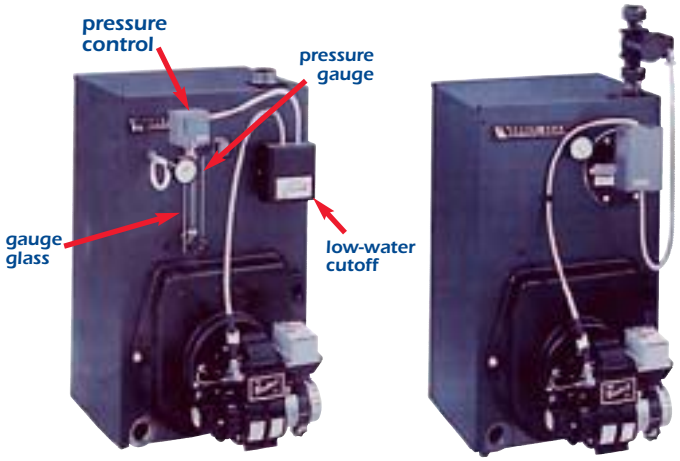
In a steam system, water heated in the boiler turns to steam, and the steam rises to radiators to heat the home. For the most part, steam boilers have not been installed in new homes since the 1940s, when forced hot water heating systems were introduced. While there are many similarities between a steam boiler and a hot water boiler, there are a few differences, including devices found in a steam boiler system that may be unfamiliar to you.



A typical configuration for a one-pipe steam heating system.

Steam valves. Located on the radiators, these valves vent the air in the pipes to make room for the steam. If you notice white calcium buildup around a steam valve, it means steam is escaping.

Gauge glass. This shows the water level in the boiler. The normal level is usually in the center of the glass. The water level in the glass will fluctuate slightly when the burner runs.



Examples of oil boilers: A steam boiler is on the left, a hydronic/hot water boiler on the right.

Low-water cutoff. Required by code, this device shuts off the burner if the water level in the boiler falls too low.

Automatic water feeder. This optional device, which is sometimes found on steam systems, automatically adds water to the boiler if the level gets too low. Even if a system has an automatic water feed, the homeowner should still check the boiler's water level on a regular basis.

Pressure relief valve. The pressure relief valve is a safety device to prevent the system from over-pressurizing.

Steam limit control. Sometimes called a pressuretrol, the steam limit control turns off the burner when sufficient steam pressure is achieved.

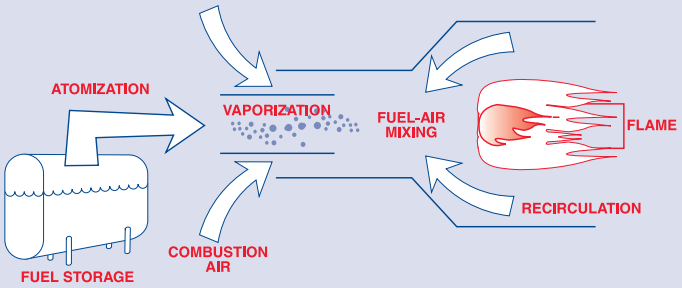
Tip for your client:

The external low-water cutoff on a steam boiler should be drained once or twice a month to flush sediment out of the system. This helps expel mineral deposits that form after the water turns to steam.

Burners

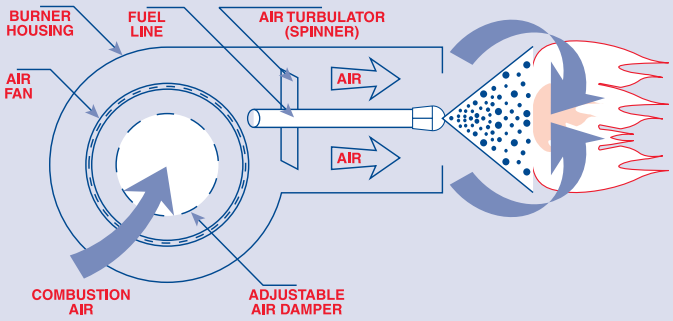
How an oil burner works

SIMPLIFIED SCHEMATIC OF COMBUSTION PROCESS



Heating oil in liquid form must be turned into vapor and mixed with air before it can burn. When the oil from the storage tank reaches the burner's nozzle, it's broken into small droplets. This process is called atomizing. These droplets are mixed with air and then ignited by the burner.

DRAWING OF OIL BURNER OPERATION

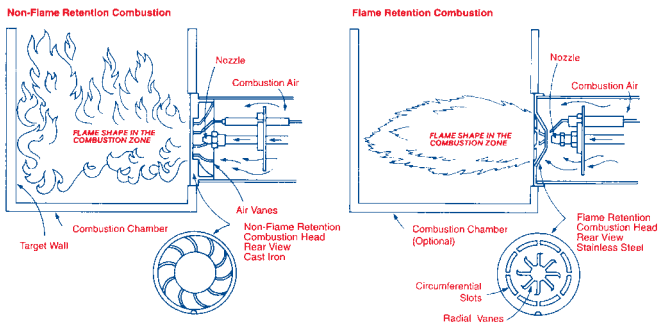


The efficiency of the oil-air mix achieved by a burner depends on its design. The biggest difference between old burners and modern ones is the air handling step of the process.

Flame retention burner introduced

In the late 1960s, the manufacturers of oilheat equipment introduced the flame retention burner, which produced a smaller, more compact flame. Since its advent, the high-efficiency flame retention burner has saved homeowners billions of dollars in fuel costs. More than six billion gallons of fuel have been conserved. The flame retention burner has also helped reduce emission levels of oil-fired heating systems to almost zero. Compared with older burners, the flame retention burner:

- burns cleaner.
- has an efficiency level that's 5%–15% higher.
- produces a hotter flame.
- maintains an airflow pattern that results in a more complete mixing of fuel and air.



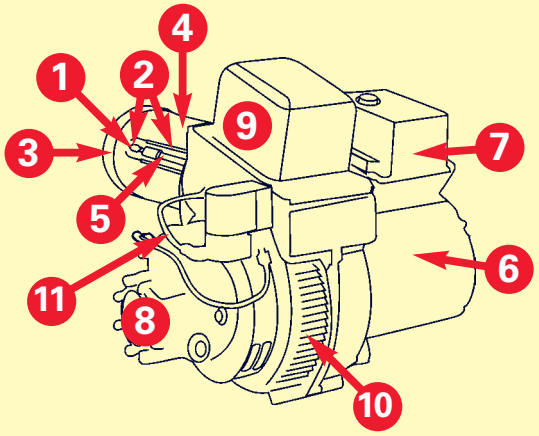
The flame retention burner gets its name from the compact flame it produces as illustrated in the diagram at right. Older burners produce a less controlled, less efficient flame as shown in the diagram at left.

Diagram courtesy of the Beckett Corp.

An oil burner has these key characteristics:

- An electric motor drives the fan and fuel pump.
- The fan pushes air to the burner's air tube to support combustion.
- The pump draws oil from the tank and delivers it to the nozzle.
- The regulating valve, located in the pump housing, produces the right amount of pressure to atomize the oil.
- The ignition/transformer produces a high-voltage spark that provides enough heat to vaporize the atomized oil from the nozzle and achieve ignition.
- The drawer assembly holds the nozzle and electrodes.

Oil burner components

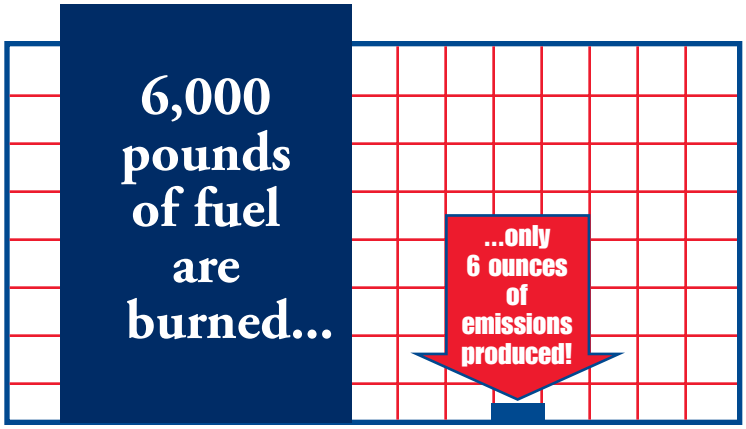


1 *nozzle* 2 *electrodes and porcelain insulators*
3 *end cone* 4 *blast tube* 5 *firing assembly*
6 *burner motor* 7 *cad cell relay*
8 *fuel pump* 9 *ignition transformer*
10 *burner fan and coupling* 11 *nozzle line*

Clean burning

The newest burners for oilheat systems make home heating with oil cleaner and more environmentally friendly than ever before.

- Modern oil burners use electronic pre-purge and post-purge controls that ensure ultra-clean starts and stops. The high static air pressure produced by the burner helps prevent particle buildup.
- An oilheat system with one of today's modern burners is capable of burning 99.9% clean.
- The oil burners of today are so clean that they produce on average *six ounces* of particulate emissions (or soot) a year. To put that in context, consider that the six ounces of emissions comes from burning *three tons* of heating oil.



Tip for your client:

If a heating system appears to be in good shape but the burner is out of date, a flame retention burner should be considered. A new burner often pays for itself in just a few years as a result of lower fuel costs. Less fuel will be used because a flame retention burner burns cleaner and operates more efficiently.

Oil-powered hot water

Homeowners with oil-fired water heaters have discovered they have low-cost access to virtually unlimited amounts of hot water. Oilheat's ability to produce a reliable, inexpensive supply of domestic hot water is one of its strongest features. Although an oil-fired water heater may cost a little more to install up front, its efficiency in heating water means extremely low operating costs over the life of the unit.

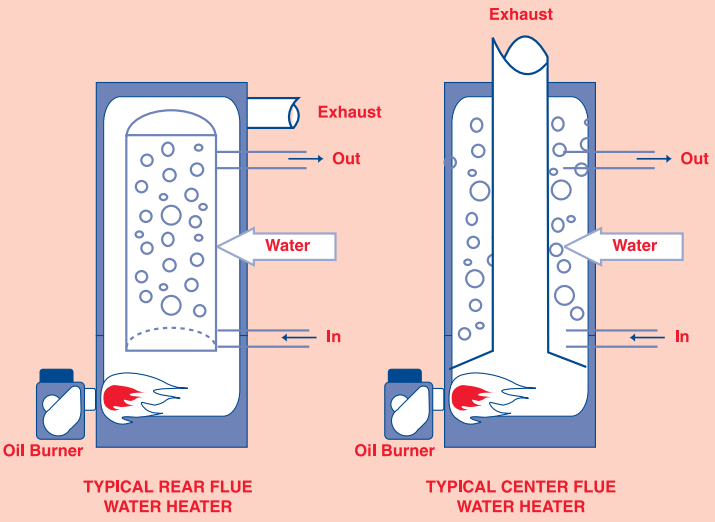
Oil-fired water heaters have *high recovery rates,* which means they can heat large amounts of water quickly. A water heater's recovery rate is the amount of water whose temperature the unit can raise by 100° in one hour. For example, if it can increase the temperature of 40 gallons of water by 100° in an hour, the unit has a 40-gallon recovery rate. Oil-fired water heaters have recovery rates as high as 120 gallons per hour.

Homeowners can contact an oil dealer to find out which water heating option is best for their home and family. The oil company can work with them to make sure the water heater they choose has a sufficient recovery rate for their needs. Two adults, for instance, may never need more than 30 gallons of hot water an hour, but a family of six may need 70 gallons.

An oil dealer can help homeowners with another choice too, because oil-fired water heating systems come in two categories: direct and indirect.

Direct-fired water heaters

In a direct-fired water heater, the water is heated directly by the heat of the oil flame. You'll usually find a direct-fired water heater in a home with a warm air furnace. The oil is burned in a combustion chamber under the water storage tank, and hot flue gases heat the water in the tank. (See illustration below.)



There are two direct system designs: a rear flue heater (left) in which flue gases are vented out the back, and a center flue heater (right) in which gases are vented through the top of the water heater.

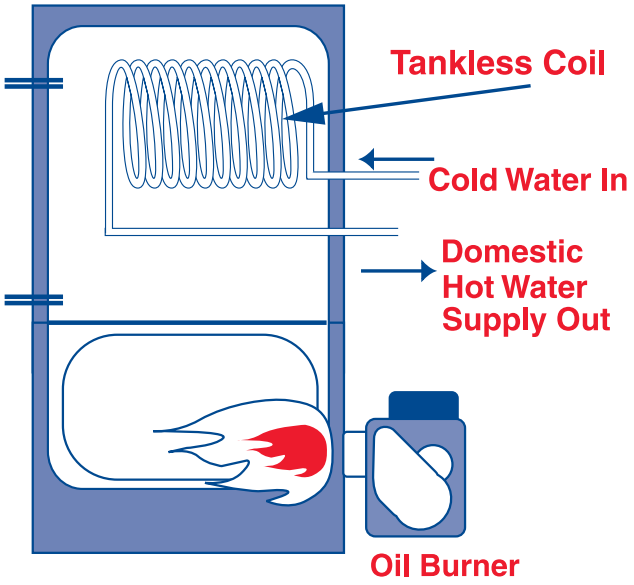
Indirect-fired water heaters

In an indirect-fired water heating system, the domestic water is heated by hot water from the boiler. In many oil-heated homes, you may find an indirect-fired system that is also tankless. A tankless, indirect-fired water heating system can work in conjunction with either a hot water boiler or a steam boiler.

There are three variations: internal tankless coil, external tankless coil and tankless coil with storage tank.

An indirect-fired water heater derives its heat from the boiler water that circulates through the water heater's internal coil, as shown here.

Boiler



Internal tankless coil. In this type of indirect tankless water heating system, the coil containing the domestic water supply is located in the water jacket of the boiler.

One drawback to this design is the absence of hot water storage; another is the need to maintain the temperature of the boiler water at a high level, high enough to heat the domestic water as it passes through the coil.

External tankless coil. This indirect-fired water heater has a separate storage tank that contains an internal coil. The unit connects to the sides of the boiler.

A newer version of the external tankless coil water heater is the plate heat exchanger (shown at right). It contains a series of wafers or plates with internal porting; plates alternate between boiler water and domestic water.

Tankless coil with storage tank. Better known as an **aqua booster,** this indirect water heating system was introduced to boost water heating capacity. After water has been heated by going through the indirect system's coil, it is stored in a vertical storage tank. The temperature of the hot water in the tank is usually maintained by means of a recirculating loop; it allows water to be reheated by going back to the coil, either by gravity or forced circulation.

NOTE: Some local codes require an anti-scald control, also called a tempering valve, for tankless coil indirect water heating units. (See following section on water heating controls.)

Boiler and hot water heating controls

- Regardless of design, any water heating system that stores hot water should have a **pressure relief valve;** it's installed to protect the system from high pressure.
- With tankless coil designs (where no water is stored in a tank), a **pressure-only relief valve** may be used; it protects the coil and piping from excessive pressure.
- A **vacuum relief valve** vents the system if a vacuum occurs inside the tank.
- A **back flow preventer** prevents boiler water from flowing into potable water systems.
- A direct-fired water heater needs an **aquastat** to control operation and temperature; it also needs a **primary control** and **heat detector** for safe operation of the oil burner.
- The new indirect-fired units typically have a **triple aquastat,** which controls high and low temperatures. This device communicates with the oil burner via a built-in cad cell relay. The aquastat can also control zone valves and the circulator.
- Because water inside a tankless coil can be extremely hot, all tankless coil systems should have an anti-scald device known as a **tempering valve** or **mixing valve.** When necessary, it automatically mixes in an appropriate amount of cold water to lower the temperature of the water to the chosen temperature setting.

Common misconception:

When you see a tankless coil system, don't assume the hot water capacity is inadequate. When you test the hot water output, always do it under normal circumstances. For example, if a homeowner were filling a bathtub, he would open both the hot and cold water valves. Do the same. Keep in mind that the hot water unit may also be deficient due to a lack of maintenance. In hard water areas, calcium deposits in the coil must be cleaned out regularly.

Comparing water heating options

UNIT	WHAT IT IS	HOW IT WORKS	PROS	CONS
INDIRECT-FIRED	a storage tank with coiled pipes inside	hot water from the boiler passes through the coil, which heats up the domestic water surrounding it	– never runs out of hot water – lasts for 30 years or more with minimal service – extremely fuel efficient	– only used in conjunction with a boiler
DIRECT-FIRED	a storage tank with its own oil burner	burner heats domestic water in tank	– never runs out of hot water – perfect for big families	– higher service costs due to separate burner – medium life span
AQUA BOOSTER	a storage tank hooked to a tankless coil	stores hot domestic water made by tankless coil	– improves hot water response and efficiency of tankless coils – long lasting	– depends on efficiency of tankless coil in boiler
TANKLESS COIL	a coiled pipe inside the boiler	domestic water passes through the coil, which is heated up by the boiler water around it	– inexpensive to purchase with new heating unit – very efficient in winter	– expensive to service – during summer, can't meet big load requirements (more showers, laundry, etc.)

Oil heating controls

The proven reliability of modern oil heating controls has been an important factor in making today's oil a remarkably safe and efficient fuel for heating people's homes.

A wide range of limit controls, thermostats and switching relays are used in oil heating systems. They have become more accurate and sophisticated with the introduction of more technologically advanced equipment.

Here's a brief overview of some of these controls to help you better understand how an oilheat system works.

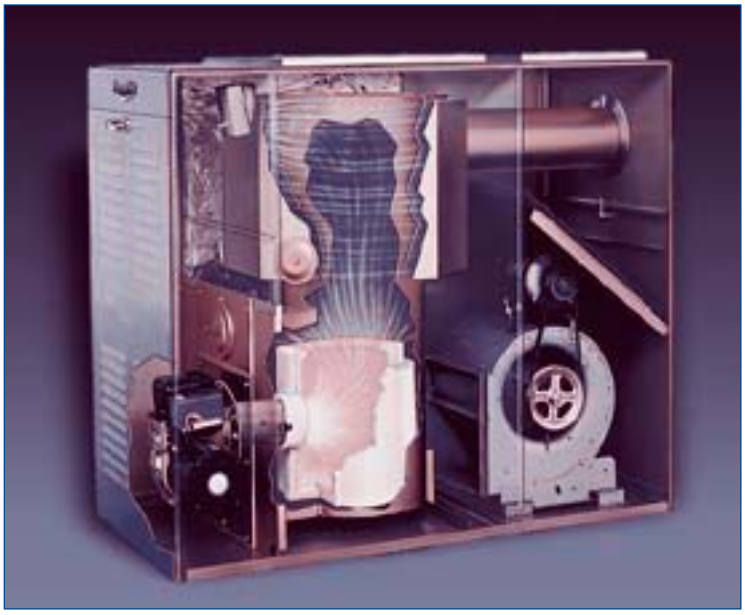
Thermostats

When heat is needed, the thermostat starts the burner through the primary control (described on next page) and an electrical circuit. The thermostat is the control that gets all of the other controls on an oilheat system going. When the thermostat sends a signal for heat, it triggers a series of subsidiary controls.

Tip for your client:

Ideally, a thermostat should be mounted on an inside wall about five feet from the floor. It won't communicate proper heating needs if it's near a heat source, like a lamp or television, or if it's in an area prone to drafts, such as near a door or window.

Limit controls



Today's oilheat systems use sophisticated controls to ensure proper operation and safety.

Limit controls regulate warm air, water temperature and pressure. There are two categories: high limit/safety controls and low limit/operating controls.

High limit/safety controls. These controls act as safeguards to prevent overheating. They turn off the burner if temperatures become too high in the furnace or boiler, or if the pressure in a steam boiler rises to an unsafe level.

Low limit/operating controls. These controls start and stop the burner on a signal from the thermostat or aquastat.

Primary controls

Primary controls monitor the flame of the oil burner.

Three kinds of primary controls are in use today. The oldest are thermal-mechanical controls. Solid-state and advanced microprocessor-based controls are newer and more accurate.

Cad cell controls

Additional protection circuits, such as the cad cell (cadmium sulfide photocell sensors), were added to oilheat systems in the early 1970s.

A cad cell, which is usually mounted on the burner, uses its photocell "eye" to send a shutdown message to the primary control board if it cannot "see" the burner's flame in about 45 seconds.

Many cad cells made today feature 15-second safety timers.

Burner power switches

There are usually two switches for cutting off electric power to the burner.

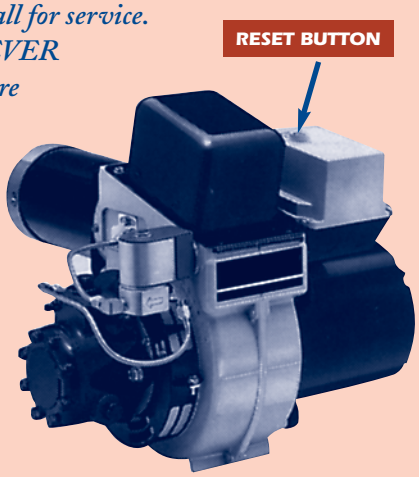
A *red emergency switch,* like the one pictured at left, is typically located at the top of the basement stairs. If the heating system is in a utility room, look for the emergency switch near the room's entrance.

A *second burner power switch* is often found on or near the heating system.

Tip for your client:

Primary controls have a reset button. This button allows the homeowner to restart the burner should a problem cause the unit to shut down. (For example, burners may need to be restarted after a power outage.)

Pushing the reset button should get the burner running, but if the safety switch shuts the burner down again, the homeowner should call for service. Homeowners should NEVER push the reset button more than once because it might cause excess oil to be pumped into the combustion chamber. This will result in a lengthy and costly repair.



Oil tanks

A heating oil storage tank offers an important advantage to a homeowner—the ability to safely store an adequate supply of heating oil that's ready for immediate use whenever cold weather arrives or a need to heat the home arises.

Because there are so many misunderstandings about oil tanks, you probably already know you have to be careful about what you say to the homeowner. To help you have more confidence in your recommendations, here are some facts about residential heating oil tanks.

Common misconception:

Tank leaks are common and lead to financial ruin.

Truth: *Every once in a while there will be a news story about a major oil leak that's reported in a way that tends to sensationalize the issue and negatively shape perceptions.*

Most leaks can be prevented if tanks are properly maintained and replaced when testing has shown they have reached the end of their life span.

In some states, there is a public fund for covering any cleanup costs that result from leaks. In other states, private insurance or a tank protection program may be useful to the homeowner.

Types of tanks

Oil storage tanks, either aboveground or underground tanks, can be found in three locations.

1. An aboveground tank may be inside the home, usually in the basement, utility room or garage. The most common tank is the inside 275-gallon basement tank.
2. Some aboveground tanks are located outside the home, either in the rear of or at the side of the house. (Like inside tanks, these tanks usually hold 275 gallons of oil.)
3. Underground tanks are found in various locations outside the home, buried in the yard. They are usually larger than aboveground tanks, holding 550 or 1,000 gallons of fuel.

Options for aboveground tanks

The term "aboveground tank" refers to any tank not buried in the ground.

Most oil tanks are now built of corrosion-resistant materials. The newest generation of aboveground tanks generally can be installed in small or unusually shaped spaces in basements or garages. Tanks can also be installed outdoors and hidden in a tank enclosure.

Many new heating oil tanks are also being installed below ground using new, innovative technologies.

Most tanks last for many decades without problems. Plus, proper installation and maintenance can increase the life span of the tank further.

Evaluating an underground tank

Although leaks do occur in residential oil tanks, they are extremely rare. A major national study showed that the chance of a leak from an underground heating oil tank is less than one-quarter of 1%.*

If a homeowner asks about the condition of an underground tank, you can suggest that they contact their oil dealer.

* Source: Environ Corp.: Analysis of the Potential Hazard Posed by No. 2 Fuel Oil Contained in Underground Storage Tanks.

Checking the vent and fill pipes

In addition to the tank, a heating oil storage system includes the fill pipe and the vent pipe. The oil driver connects the hose from the delivery truck to the fill pipe when making a delivery of fuel. The vent pipe releases air pressure from the tank as it's filled.

Generally, the terminus of the fill pipe and vent pipe are outdoors and near each other, as shown above. The National Fire Protection Association (NFPA) requires inside tanks to have an audible device (generally called a vent alarm) that indicates when, during a delivery, the tank reaches its fill point.

Tank regulations

Oil storage systems must comply with local fire ordinances; many municipalities have adopted NFPA standards in their building codes. For questions about a particular installation, call the local building department or a qualified heating contractor.

Inspection checklist for aboveground tanks

- ❑ Make sure the fill cap and vent cap are secured, and check that they are not clogged or restricted by ice, snow or insect nests.
- ❑ Look for leakage from tank fittings, filters, piping or the tank gauge. Also look for weeping (moisture) at tank seams.
- ❑ Inspect for signs of oil spills around the tank, fill pipe or vent lines.
- ❑ Check the condition of tank legs. The tank belly should not be touching the ground.
- ❑ Look for signs of corrosion. An aboveground tank can be painted to prevent external corrosion; it also improves the appearance of the tank. This is especially beneficial for outdoor tanks.

If any of these conditions exist, contact the heating oil company.

Aboveground tanks installed outdoors can be hidden inside an enclosure like the one shown here.

Tip for your client:

Many oil dealers offer the option of automatic delivery. By tracking the weather and each customer's fuel consumption, they can refill the tank before the fuel level gets too low. The homeowner never has to think about it.

Checklist: Identifying problem signs

- ❑ Operate the heating system using normal control devices to determine function.
  Tip: To run the system, make sure the thermostat setting is above room temperature.
- ❑ Examine the exterior of the furnace cabinet or the jacket of the boiler/water heater. Look for signs of rust, discoloration, burn marks and soot buildup.
  For more information, see section on common home heating problems at right.
- ❑ Check the aboveground tank and the condition, placement and size of the tank's vent pipe.
- ❑ Observe visible flue pipes, draft regulators and related components for safe operation.
- ❑ Observe the condition of ductwork and heat outlets, including vents, registers, baseboards and/or radiators. If you see marks that appear to be soot, be careful in making a conclusion about the cause. A homeowner often mistakes dark marks on walls for soot; they may actually be residue from cooking grease or candles. Marks on walls near registers and vents may also be "baked-on" dust.
  While these are possible explanations, there are others too, of course. Dark marks on walls could also indicate an inadequate draft, ignition problems or a cracked heat exchanger.

Common misconception: Soot is normal

If you see soot around registers or in vents in a home that's heated by a furnace, you should contact an oilheat professional to determine whether there is a crack in the heat exchanger.

In a house heated by a steam or hot water boiler, water leaking from the boiler may indicate a crack or leak. Contact an oilheat professional to assess the equipment.

Common home heating problems

In an effort to save energy, many homeowners have added insulation in their home, installed storm doors and double-pane windows, and followed other energy-conserving strategies. In some cases, these energy-saving changes can seal up a home so tightly that they prevent heating and cooling systems from having enough air to operate efficiently.

If you suspect this is a problem, encourage the homeowner to discuss the situation with a heating oil company. Poor air flow can also be caused by the following conditions.

- The furnace/boiler room is tightly sealed.
- A fireplace or exhaust fan may be operating at the same time as the burner. This can result in a smoky odor because a back draft is pulling flue gases through the exhaust system and into the home.
- A clothes dryer, workshop or a pet's living quarters are near the oil burner. Lint, sawdust or animal hair can be drawn into the air openings of the burner and clog it.
- If the burner flame looks weak and is orange in color, and if there are signs of soot, there is probably a lack of combustion air. To confirm this, open a door or window to bring air to the area around the heating system and watch the burner flame. If it turns a bright white, lack of combustion air is the problem.

For safety's sake

- If power switch is off, determine why.
- **There should be no combustible materials near the heating source.**
- Don't turn on a heating system if circumstances are not conducive to safe operation or may damage the equipment.
- Do not turn on any valves. You may not be able to shut them off again.
- Don't touch the relief valve or change settings on any valves or controls.

Don't play taps

- Don't tap on the flue pipe to see if it's sound. (If you want to check the interior, shine a flashlight through the draft regulator.)
- Don't tap on a storage tank to try to determine how full it is. It doesn't work and you could damage the tank.

Preventive maintenance: The tune-up

Regular maintenance can extend the life of heating equipment.

This means that a homeowner who makes sure to have his system properly maintained may get several more years of satisfactory use from it.

What's more, approximately 75% of all emergency repairs can be prevented with regular maintenance.

How long does a tune-up take?

A complete professional tune-up generally takes from one to two hours. It typically includes a series of safety and operating tests to identify adjustments that need to be made to a system.

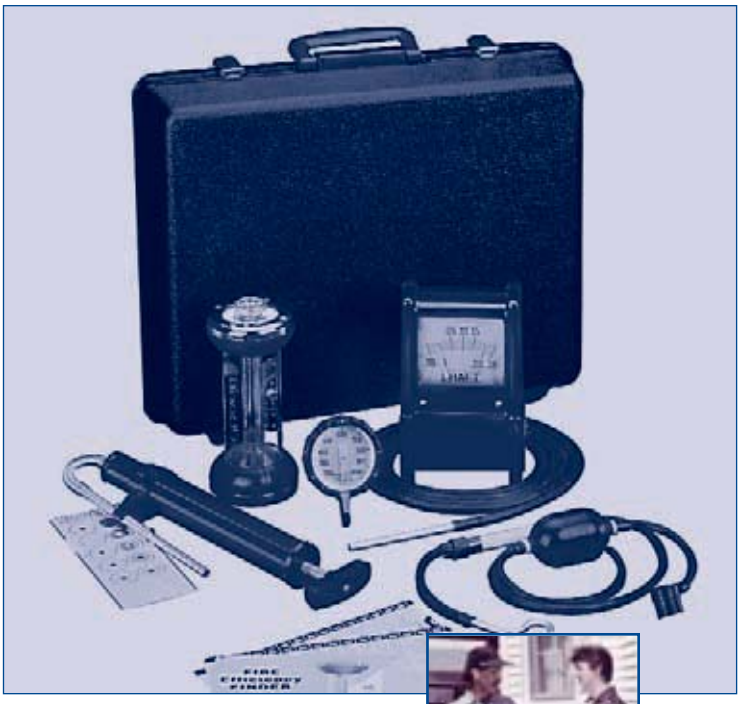
These include, among many others, testing the draft, the stack temperature, burner operation and system efficiency.

Tip for your client:

Recommend that the homeowner call in a qualified technician from a heating oil company to do a thorough inspection of the home's heating system. This is especially important if the system hasn't been serviced in the last couple of years.

Studies show that only 55% of U.S. homeowners have their heating equipment serviced regularly. Those that don't generally experience higher fuel bills.

Heating equipment that is maintained periodically uses less fuel than units not maintained, according to the U.S. Environmental Protection Agency.



Service technicians use diagnostic tools like the ones pictured above to test the operation of oil heating systems.

Conclusion

New advances in oilheat are constantly under development. As one example, the industry is moving toward wider use of cleaner-burning fuels. Tests show that low-sulfur heating oil reduces the need for equipment servicing.

The combination of high quality fuel and technologically advanced equipment makes oilheat a good choice for today's homeowner.

Some surprising facts

- Adjusted for inflation, heating oil prices today are virtually unchanged from 30 years ago.
- The average AFUE (Annual Fuel Utilization Efficiency) of a new oilheat system is in the low- to mid-80s. These efficiency levels were reached even before a federal mandate required that all heating systems have a minimum AFUE of 78%.
- The newest oil heating systems (condensing boilers and furnaces) have AFUE ratings that exceed 95%.
- Oil-heated homes warm up quickly and provide even, efficient heat. For every gallon of oil burned, a whopping 138,000 Btu's of heat is generated, and the flame temperature of oilheat systems reaches about 3,000°.
- There are about 10 million oil-heated homes in the United States; 350,000 of them were built in the past decade.
- Millions of homes in Europe rely on oilheat for comfort. Germany and Italy, along with the U.S., are leaders in the manufacture of oilheat equipment.

Compared to 25 years ago, homeowners now use, on average, 500 fewer gallons of oil to heat their homes each year.

Average annual fuel consumption in the 1970s

Average annual fuel consumption today

Oil-fired water heaters provide unlimited hot water at low cost

Not only does an oil water heater save huge amounts of money over its lifetime, it is also perfect for homes with a high demand for hot water, such as homes with growing families or homes with Jacuzzi bathtubs.

Resources

To help you learn more, here is a listing of oilheat associations that operate in the following states.

Connecticut
Independent Connecticut Petroleum Association
860-613-2041

Delaware
Mid-Atlantic Petroleum Distributors Association
410-349-0808

Idaho
Idaho Petroleum Marketers Association
208-336-1986

Indiana
Indiana Petroleum Marketers and Convenience Store Association
317-633-4662

Kentucky
Kentucky Petroleum Marketers Association
502-875-3738

Maine
Maine Oil Dealers Association
207-729-5298

Maryland
Mid-Atlantic Petroleum Distributors Association
410-349-0808

Massachusetts
Massachusetts Oilheat Council
800-722-0623 or 781-237-0730

Nevada
Nevada Petroleum Marketers & Convenience Store Association
775-348-1888

New Hampshire
Oil Heat Council of New Hampshire
603-895-3808

New Jersey
Fuel Merchants Association of New Jersey
973-467-1400

New York - York State
Empire State Petroleum Association
518-449-0702

New York - New York City
New York Oil Heating Association
212-695-1380

New York - Long Island
Oil Heat Institute of Long Island
631-360-0200

North Carolina
North Carolina Petroleum Marketers
919-782-4411

Ohio
Ohio Petroleum Marketers &
Convenience Store Association (OPMCA)
614-792-5212

Oregon
Oregon Petroleum Marketers Association
503-670-1777

Pennsylvania
Pennsylvania Petroleum Marketers &
Convenience Store Association
717-902-0210

Rhode Island
Oil Heat Institute of Rhode Island
401-464-8000

Vermont
Vermont Fuel Dealers Association
802-375-0000

Virginia
Virginia Petroleum Marketers & Convenience Store
Association Inc.
804-282-7534

Washington DC
Mid-Atlantic Petroleum Distributors Association
410-349-0808

Washington State
Pacific Northwest Oilheat Council
206-548-1500

Wisconsin
Petroleum Marketers Association of Wisconsin
608-256-7555

Regional
New England Fuel Institute
617-924-1000

National
National Oilheat Research Alliance (NORA)
703-519-4204
Oilheat Manufacturers Association
802-325-3437

NORA
NATIONAL OILHEAT RESEARCH ALLIANCE

The National Oilheat Research Alliance (NORA) works in conjunction with the U.S. Department of Energy on research to improve heating oil and oilheat equipment. Its core mission also includes consumer education and technical training for those in the industry. This guide is designed to provide you with an overview of a heating oil system. NORA provides many educational tools, including textbooks and videos, that you may want to access at www.noraed.org.