HOW TO IMPROVE THE EFFICIENCY OF YOUR

Oil-Fired Furnace

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
U.S. DEPARTMENT OF ENERGY
U.S. ENVIRONMENTAL PROTECTION AGENCY

This pamphlet is to help you, the homeowner, save money and reduce pollution by having your oil-fired heating system serviced regularly. Annual maintenance check-ups will keep your furnace operating at top efficiency and thereby save fuel costs. In this pamphlet you will be shown how your annual fuel cost can be further reduced by having your service technician adjust the firing rate of your burner or by replacing it.

Is it really possible for me to save money by improving the efficiency of my heating system?

Yes. Recent field tests revealed that almost all of the oil burners examined were oversized. Oversizing means that the furnace burns oil at a faster rate than necessary to maintain a comfortable house temperature. These field tests showed that reducing the nozzle size and modifying air handling parts can save 14% in seasonal operating costs. A 30% savings is possible by replacing inefficient burners with new, high-efficiency burners that have a reduced firing rate. Consult your service technician for advice on the most appropriate modifications and potential fuel savings for your system.

How much money can I expect to save by improving the efficiency of my system?

The cost of most modifications suggested in this pamphlet will pay for themselves in fuel savings over relatively short periods of time. The following table shows the dollar savings per $100 of annual fuel costs that can be achieved by increasing the efficiency of your furnace. Remember, as fuel prices increase, your payback period is shortened.

Dollar Savings Per $100 of Annual Fuel Cost

From Original Efficiency of	To An Increased Efficiency Of					
	55%	60%	65%	70%	75%	80%
50%	$9.10	$16.70	$23.10	$28.60	$33.00	$37.50
55%		8.30	15.40	21.50	26.70	31.20
60%			7.70	14.30	20.00	25.00
65%				7.10	13.30	18.80
70%					6.70	12.50
75%						6.30

How can I find out what modifications are applicable to my heating system?

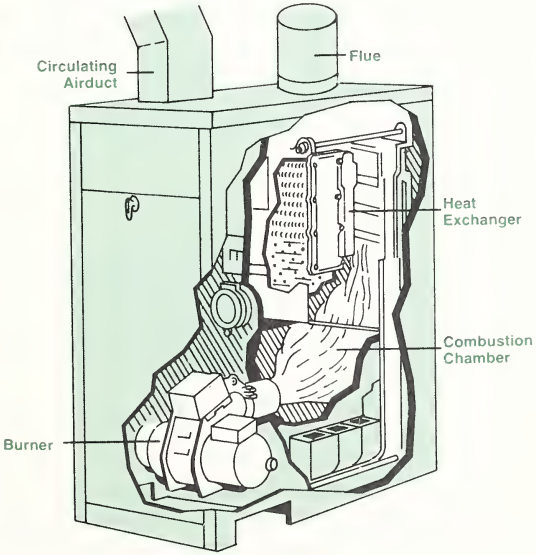
Read through this pamphlet to get a general understanding of how your heating system works, efficiency tests that a service technician can perform, and the efficiency you can expect from an oil burner heating system. This will enable you to do some things yourself. It will also give you enough information to talk knowledgeably to a qualified

service technician and make decisions on his recommendations.

Isn't my heating system a complex piece of equipment?

Yes, but its basic operation is quite simple. Your heating system consists of four principal parts: the burner, the furnace or boiler, the heat distribution system, and the chimney.

The burner generates heat by burning fuel oil. Part of the heat produced by the burning of the fuel is absorbed by the furnace or boiler and transferred to air or water, which is then distributed throughout the home by air ducts or hot water pipes and radiators. The heat that is not absorbed by the furnace or boiler is lost up the chimney in the process of disposing of smoke and gases. The overall heating system efficiency depends on the performance of each of these parts.



How can I find out if my burner is working efficiently?

Call your local oil burner service technician. Have him measure the carbon dioxide level in your flue. This measurement gives you an indication of the combustion efficiency of the system. Oil must be thoroughly mixed with air to burn completely. This usually requires more air than is actually needed to convert the carbon and hydrogen in the fuel to carbon dioxide and water, which are the products of complete combustion. The amount of this excess air can be determined by measuring the amount of carbon dioxide in the flue.

Generally, the higher the carbon dioxide level, the less excess air used and the more efficient the combustion process. Too little air, however, causes smoking, increases pollution, and reduces efficiency. A carbon dioxide level of 9% is considered good. Levels over 11% are excellent. If, after tune up and adjustment, your service technician cannot obtain a carbon dioxide reading of at least 9%, without smoking, it may be that:

- The furnace is leaking air into the combustion chamber and needs to be properly sealed;
- There is too little or too much draft up the chimney; or
- The air and oil are not thoroughly mixing for combustion.

Correcting these problems requires modification or replacement of the burner. If your service technician is unable to get an efficiency of 65% or better through tune-up and nozzle size adjustment,

it may pay to buy a new burner. A new burner should get at least 75% efficiency. You can figure the cost savings using the table on page 4. Even greater savings can often be achieved by installing a burner with a smaller firing rate if the existing heating system is oversized.

Have your service technician identify the problem and explain how it can be fixed and what the net savings to you will be.

Is it possible that my heating system is oversized?

Recent field tests have shown that furnaces and boilers are usually oversized for the heating requirement of the house. Even on the coldest day of the year many heating systems run less than 30% of the time. During these long off-periods, heat is lost up the chimney, greatly reducing the overall efficiency.

How can I find out if my system is oversized? What can be done?

Your service technician can determine if your system is oversized. He does this through a series of measurements and calculations that take into account the average daily temperatures in your region, the amount of oil used, and alternative nozzle sizes.

He may recommend that you have a smaller nozzle installed. With a smaller nozzle size, your system will run longer but burn less oil per unit

of time, and the amount of heat lost up the chimney will be reduced.

How can the efficiency of my furnace or boiler be improved?

Have your service technician measure the temperature of the flue gas leaving the furnace or boiler. Flue gas temperatures should be between 205 to 316 °C (400 to 600 °F) for an original furnace and 316 to 371 °C (600 to 700 °F) for conversion burners. Excessive temperature, measured after the burner nozzle has been properly adjusted, indicates that:

- The burner nozzle size is too large and that more heat is being generated than can be utilized in the heat exchanger; or
- The heat-exchanger surfaces are badly sooted. Have them brushed and vacuumed. Ask your service technician if your furnace has a fuel oil line solenoid valve. These electrically operated valves close off the fuel supply as soon as the fire has stopped. This prevents oil from dripping into the combustion chamber causing heavy smoke and soot deposits on the heat exchanger. If you don't have one, it may pay to have one installed.

How can I improve efficiency of heat distribution?

You can do several things to assure that the heat produced by the furnace or boiler efficiently reaches the areas of the home in which it is needed.

If you have a warm air furnace:

- See if you can feel air leaking out of duct joints when the fan is running. If so, seal the joints with ductwork tape. If ducts run through unheated spaces, wrap them with insulation. Vertical chases in walls, through which supply and return ducts pass, should be sealed off to prevent heat from being lost. Check to see that the chimney is sealed from the house structure both at the basement level and the attic. It should be sealed with non-combustible material to protect the combustible material of the house structure from the hot chimney.

- Clean or change air filters frequently during the heating season. Clothes dryers and home workshops create dust and lint. In houses where these are located near the oil burner, the filters will need to be changed more frequently.

- Have your service technician check and reset, if necessary,the on and off temperature settings of the furnace fan. To conserve fuel, the fan should shut off when the furnace temperature is about 32 °C (90 °F). It should not go on again until the burner comes on and raises the furnace temperature to about 43 °C (110 °F).

If you have a hot water boiler:

- Insulate the boiler, the hot water storage tank,and hot water piping in unheated spaces.
- Clean radiators or baseboards to make certain they are not blocking air circulation.

How can the performance of my chimney be improved?

Most chimneys or vents produce more draft than is necessary. It is the job of the draft control to prevent this. Ask your service technician to measure the draft at the flue collar of your furnace and over the fire and adjust the draft control if necessary. If you do not have a barometric draft damper, consider installing one to improve the seasonal efficiency of your system.

Does lowering my thermostat setting at night really save money?

Tests have shown that a 2.5-degree Celsius (5-degree Fahrenheit) reduction in setting for approximately 8 hours will save up to 10% in fuel costs. Greater reductions will lower fuel costs even more. Consider installing a clock thermostat that will automatically set the thermostat down at night and raise it before you get up in the morning.

Call your service technician today!

Tell him that you would like to have him tune up your furnace and clean it if necessary. He will be glad to discuss these money and fuel saving opportunities with you, show you how he takes burner and flue measurements, and explain the results. Call now—*EVERY DAY'S DELAY MAY BE COSTING YOU MONEY!*

Improved Efficiency Also Reduces Pollution

In a recent study, the U.S. Environmental Protection Agency found that burner tuning plus replacement of nontunable units reduced emission of pollutants on the average by the following amounts:

carbon monoxide	81%
hydrocarbons	90%
particulates	24%
smoke	59%

Further information can be obtained by ordering "Get the Most From Your Heating Oil Dollar," at no cost, from the Office of Public Affairs (MD 31), U.S. Environmental Protection Agency, Research Triangle Park, N.C. 27711.

Most of the data in this pamphlet is based on a field study conducted by the Walden Research Division of Abcor for the National Bureau of Standards under the sponsorship of the Federal Energy Administration.

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