

## HOW EFFICIENTLY IS YOUR HEATING SYSTEM OPERATING?

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Efficiency testing of a furnace or boiler involves a simple ten minute procedure and, if done on a regular basis, can indicate when problems are beginning to occur. Records of temperature and carbon dioxide ( $\text{CO}_2$ ) levels of the flue gases taken at weekly periods may indicate that carbon is building up on the heat transfer surfaces or air leaks are developing in the combustion chamber.

Efficiency may change from day to day with the weather. It is especially important to test after each fuel delivery.

Efficiency tests will also indicate when excess air is being supplied to the fire, robbing it of some of its expensive heat. Adjustment of the burner to obtain one to two percent greater efficiency can make a significant reduction in fuel usage over the heating season. For example, a 2% increase in efficiency in a 10 gallon per hour burner operating 3300 hours from September to May will result in about 650 gallons saved. This increase in efficiency is quite realistic based on tests of a number of greenhouses in Connecticut during the past year.

The equipment needed to conduct an efficiency test usually comes as a kit containing a stack thermometer that will read to  $1000^\circ\text{F}$ , a  $\text{CO}_2$  indicator with sampling tube and calculator, a smoke tester and scale and a draft gauge with remote tube. Manufacturers include Bacharach Instrument Company, Dwyer Instruments, Inc. and Lynn Products

Company. Prices for these kits start at \$125 and are available from some greenhouse equipment suppliers and heating equipment retailers. An instruction manual comes with each kit.

Before the heating season begins, the furnace or boiler should be cleaned and serviced. The burner blast tube, fan housing and blower wheel should be free of dirt and lint. Leaks into the combustion chamber, especially joints between cast iron boiler sections and around the fire door should be sealed. The oil filter should also be replaced. Manufacturer's recommendations should be followed in replacing the nozzle and in adjusting the ignition electrodes.

### Combustion Adjustment

1. Operate burner for a few minutes until operation has stabilized and furnace or boiler is warm.

2. Set draft. Check draft reading over the fire with the draft gauge through a 1/4 inch hole drilled in the fire or inspection door. Adjust barometric draft regulator on the flue to the draft recommended by the manufacturer. If no recommendations are available, a setting of 0.02 inches water column negative pressure is usually used. Where it is not possible to measure the draft at the fire box, a reading can be taken in the flue pipe near the furnace. An acceptable reading is 0.04-0.06 inches water column.

3. Smoke test. Make a smoke measurement in the flue following the smoke tester instructions. Compare the spot on the test paper to the smoke scale supplied with the kit. A reading of 1 or 2 is acceptable. Readings of 3 or 4 indicate sooting and will require cleaning more than once a year. Tests have shown that a 1/8 inch soot layer on heating surfaces will increase fuel consumption more than 8%.

4. Efficiency test. Measure stack temperatures and  $\text{CO}_2$  level following instructions with the test kit. Record these readings and the resulting combustion efficiency obtained from the chart or graph. Reduce the air gate opening on the burner blower slightly and repeat the efficiency test. This should increase efficiency. Check the smoke level to see if it is still acceptable. Repeat the test to obtain the highest efficiency while still maintaining an acceptable smoke level.

On older units the efficiency achieved should be greater than 75% for small burners and 80% for large burners. With heat retention burners, efficiencies of 80% or greater should be obtained. If the efficiency recorded is much below the above recommended levels, consideration should be given to replacing the burner or possibly the furnace or boiler. The increased efficiency of a new unit with the continual escalation of fuel prices may result in a relatively short pay-back period.