

b. The furnace combustion efficiency should be checked with scientific instruments by your heating contractor or burner dealer. The three important indicators of good combustion are chimney draft, stack temperature in degrees Fahrenheit, and percentage of carbon dioxide in the flue gas. A poor operating oil burner unit may have a stack temperature as high as 800 F with the carbon dioxide around 5 per cent. A good operating oil burner should have a stack temperature of approximately 450 F with a carbon dioxide content of 10 per cent.

10. RECONDITION HEATING PLANT

a. Many home owners are unknowingly wasting fuel in their heating plants at the present time and for that reason a competent heating contractor should be obtained to survey and test the installation. Frequently an inefficient apparatus can be repaired or adjusted at a small charge with resulting fuel savings that will more than compensate for the expenditure within a short time.

b. The thermostatic control equipment including the room thermostat, limit controls, water temperature regulator, safety devices, low water cut-out, etc., should be carefully inspected and adjusted for efficient operation.

c. If there are cracks or pieces of insulation loose on the boiler or piping, they should be repaired or replaced. Have the radiator air valves either cleaned, repaired or replaced, as the contractor recommends. It is also a good idea to have all of the steam radiator traps checked for efficient operation and the radiator valves packed in case it is necessary. Some radiators become air bound from operation and these should have the air purged from them.

d. In a warm air furnace system it is important to have the air filter in the proper condition, as a dirty unit will increase the air resistance. To alleviate this condition the filter should be removed and inspected. In some cases a vacuum cleaner may be used to remove the superfluous dirt from the outside surface of the filter. Make sure that all of the air supply and return grilles are open and unobstructed, so that the air will be circulated to all of the intended portions of the house. In case there is an outside air intake, it should be closed off for the duration.

Combustion and Fuels

To supplement the *Ten Ways to Save Fuel and Improve Heating Plant Efficiency*, the A.S.H.V.E. War Service Committee also outlined several suggestions for the hand firing of coal in those residential heating plants which could be converted from automatically fired oil or gas:

1. The furnace grate area and the depth to which the coal is fired are the two governing factors

in the selection of size of coal. Consult the directions provided by the manufacturer of the boiler or furnace, or your coal dealer for the proper size and kind of fuel to be used. Do not wet the coal before burning it. Garbage or rubbish should not be burned in the heating system.

2. Leave from two to three inches of ashes on the grate at all times for protection against excessive heat and to prevent unburned coal falling through. Coal should be heaped as much as possible against the rear or side walls of the firebox so that a portion of the glowing fuel is always left exposed to ignite the gases. Keep the firebox filled to a level with the bottom of the firing door. Avoid poking or punching holes in the fire.

3. After fire is started the turn damper in the smoke pipe should be nearly shut at all times. Control the fire with the check damper in the smoke pipe and the ash-pit damper. For moderate heating requirements, open check damper wide and close ash-pit damper. As additional heat is required close check damper partially or fully and open ash-pit damper similarly. The damper in the fire door should be slightly open at all times. Do not leave fire door open as this wastes coal. The ash-pit doors and draft slide should fit tightly.

4. Do not shake the fire unnecessarily. Stop shaking when the first red glow appears in the ash-pit. Wet ashes thoroughly and remove just before next shaking. Do not allow ashes to accumulate excessively in the ash-pit, as this shuts off the draft and may burn out the grates.

Automatic Fuel Burning Equipment

1. No automatic coal stokers having a capacity of 60 lb or less can be manufactured during the emergency. Larger stokers have been made available for converting big users of fuel oil to coal, when approved by the War Production Board.

2. The shortage of fuel oil has restricted the manufacture of oil burners, except on government preference order. It is possible to replace an existing oil burner in a residence, in case the need arises, providing the installation cannot be converted to coal.

3. The manufacture of automatic gas heating equipment has been restricted for the emergency. In case there is a need to replace an existing unit, the new installation may be the equivalent, but not a substantial improvement over the old installation.

Heating Boilers

1. Boilers of 10,000 sq ft of equivalent steam radiation and less have been con-

structed of cast-iron to conserve on critical materials, and above this capacity steel has been permitted.

2. Due to the advent of the airplane, it has been found necessary to shorten the boiler stacks nearer the roof line, and use axial flow propeller type induced draft fans. These induced draft fans have been inter-connected to the automatic fuel burning control equipment.

3. Induced draft has been used more frequently on boilers to eliminate steel stacks and radial brick chimneys.

4. Smoke breechings of masonry have been used wherever possible instead of steel.

5. Some previous central boiler plants have been designed with units generating steam at 100 lb per square inch. Steam at this pressure has been distributed to the several buildings on the system, with reducing pressure valves located at each building to take care of individual requirements. Instead of this design, it has been the practice in some cases, to use relatively low pressure cast-iron boilers for heating in the central plant and two or more 50 lb boilers for providing the necessary sterilizing and process steam supply. This latter arrangement has necessitated a duplicate distribution system of piping with a consequent increase in poundage of metal for the whole installation, but an important saving has been made in critical boiler plate and reducing valves.

Radiators and Convectors

1. Cast-iron convectors or steel fin type radiation, instead of non-ferrous units, have been used.

2. Radiator and convector cabinets and enclosures of substitute materials, such as wood, plastic and rigid fiberboard have been fabricated.

3. Large-tube cast-iron radiators are not available during the emergency, and the manufacturers have limited the production of small-tube cast-iron radiators to the ten sizes listed:

NO. OF TUBES PER SECTION	CATALOG RATING PER SECTION SQ FT EDR	HEIGHT INCHES
3 or equal.....	1.6	25
4 or equal.....	1.6 1.8 2.0	19 22 25
5 or equal.....	2.1 2.4	22 25
6 or equal.....	1.6 2.3 3.0 3.7	14 19 25 32

Steam Heating Systems

1. Radiator valve and trap bodies have been made of cast-iron instead of brass.

2. Plastic floor and ceiling plates have been used instead of metal plates.

Piping for Steam Heating Systems

1. Whereas steam supply mains for vacuum systems have been previously designed on the basis of a pressure loss of $\frac{1}{4}$ lb per 100 ft of equivalent run and an initial pressure of 1 lb or less, some designers have used a pressure drop of 1 lb per 100 ft and an initial pressure of 5 lb per square inch.

Pipe, Fittings, Welding

1. All valves 2 in. and larger have been made of iron throughout, without bronze seats, seat rings and spindles.

2. Uncoated wrought iron or steel pipe has been used in lieu of brass or galvanized iron wherever practicable.

3. Expansion loops have been used in distribution systems instead of expansion joints.

Gravity Warm Air Furnace Systems

1. Standardization of the sizes and shapes of ducts, boots, stackheads, registers, and return air grilles has been voluntarily effected by the manufacturers in which about 75 to 80 per cent of former listed