

usually apply primarily to installation and the Underwriters' Laboratories label of approval is sufficient to cover acceptance of the unit.

Testing and Rating

Commercial Standard CS101-43 is intended to provide a uniform standard method for ascertaining the maximum practical heat output in Btu per hour of flue-connected oil-burning space heaters under approximately normal service conditions. This method is based upon the following equations:

$$H_r = A - B \quad (5)$$

and

$$E = H_r / A \quad (6)$$

where

A = total heat of fuel used

B = heat lost in flue gases

H_r = net heat delivered to the room

E = unit efficiency

The following minimum performance requirements are stipulated:

1. Adequate provision for ease of lighting and insurance against loss of ignition prior to heating of burner.
2. Ease of operation of controls.
3. Proper operation of burner without excessive carbonization with grades of oil recommended by the manufacturer.
4. The heater shall be capable of passing the 6 per cent ICHAM smoke test.
5. The heater shall be capable of operating with an overall efficiency of not less than 70 per cent under conditions of test, or at a lower stack draft recommended by the manufacturer.

Design Considerations

Some factors important in the design of oil-burning heaters are:

- (1) Proper pitch of oil lines from the sump to the burner, thus preventing vapor and air lock.
- (2) Proper positioning of the oil sump to maintain the proper oil level in the burners if factory assembled.
- (3) Tight construction, not only of oil lines, but of oil tank, sump, and burner to prevent a hazardous condition due to oil leakage.
- (4) Provision for leveling and aligning the entire stove for maintenance of proper operation.
- (5) Provision of a draft regulator to prevent abnormal draft fluctuations.
- (6) Proper shielding of an attached fuel oil supply tank to prevent excessive oil temperatures.
- (7) All metal parts subjected to the corrosive action of the oil shall be made of non-corrodible metal or of metal suitably coated to resist corrosion.
- (8) The heater should have suitable baffling or insulation to prevent overheating of floors and walls.
- (9) Strength in assembly to prevent transportation and use damage.

GAS HEATERS

Vented gas heaters are defined as those capable of removing 90 per cent of the flue gases through a single flue outlet. All heaters having a gas input rating in excess of 50,000 Btu per hour must be of the vented type in order to meet ASA Approval Requirements for Gas Space Heaters¹¹.

Space heaters may be classified by burner type as follows:

1. *Injection Burner* type which employs the energy of a jet of gas to inject air for combustion into the burner and mix it with the gas.
2. *Yellow Flame Burner* type in which secondary air only is depended on for the combustion of the gas.
3. *Power Burner* type in which either gas or air or both are supplied at pressures exceeding, for gas, the line pressure; and for air, atmospheric pressure, this added pressure being applied at the burner.
4. *Pressure Burner* type in which an air-gas mixture is supplied under pressure.

Materials and Construction

Standards covering materials and accessories used in the construction of gas heaters are described in ASA Approval Requirements for Gas Space Heaters¹¹ and in applicable Listing Requirements¹².

Efficiency Requirement

Vented space heaters having input ratings in excess of 20,000 Btu per hour are required to have a heating efficiency of not less than 70 per cent¹¹, based on the total heating value of the gas. Vented space heaters having input ratings of 20,000 Btu per hour or less are required to have a heating efficiency of not less than 65 per cent¹¹. These efficiencies are based upon the following equation:

$$e_t = 100 - \frac{H_t}{q} \times 100$$

where

q = hourly gas heat input, Btu per hour

H_t = heat above room temperature carried away by the flue products, Btu per hour.

e_t = heating efficiency, per cent

Radiant heaters are required to have a radiant efficiency of not less than 28 per cent.

Design Considerations

Some factors important in the design of gas heaters are:

1. Proper design of the burner head, port sizes and locations so that the flame will not lift, float, or flash back, and be excessively noisy in operation.
2. Proper venting of combustion chamber for relief of forces resulting from ignition of an explosive mixture of gas and air.
3. Protection of valve handles to prevent excessive temperature rise during operation.
4. Insulation and baffling of heater to prevent over-heating of walls and floor.

SPECIAL FEATURES

Some special design features found on all types of space heaters are:

- (1) Circulating heaters can be equipped with small electric fans for increased room air circulation.
- (2) Water evaporation pans are provided on some heaters, located in air which has been heated by contact with the heating surfaces.
- (3) Thermostatic control of primary air admission; and oil or gas flow, dependent upon type of fuel used.