

RESIDENTIAL GAS AND ELECTRIC WATER HEATER SERVICE HANDBOOK

Definitions

Draw efficiency (draw down) is the quantity of hot water available to the consumer before the outlet water temperature decreases 25 degrees F. A 40 gallon water heater will typically provide 70% (28 gallons) of this “usable” hot water. The burner or elements are allowed to operate during this test. Incoming, cold water mixes the remaining stored water below this 25 degree limitation.

Energy Factor is an indicator of the combined thermal efficiency and standby efficiency of a water heater. The higher the energy factor, the more efficient the water heater will be.

Recovery rate is the amount of water that is heated to a set temperature, per hour. An example might be that a water heater has a recovery rate of 30 gallons of water per hour at 80 degree F. (Fahrenheit) temperature rise.

“R” Value is a measure of the resistance of a substance to heat flow.

Thermal efficiency is approximately the amount of generated BTU (British Thermal Units), which enters the water. A percentage of the total BTU passes out through the vent piping.

Temperature rise is the increase in the temperature from its coldest “inlet” water temperature to the desired hot (outlet) setting. Typically this is assumed to be 40 degrees entering water, 120 degrees desired stored water or 80 degrees “temperature rise.”

Standby efficiency – the water heater’s ability to contain heat in the tank. A minimum of tank water heat loss per hour is desired.

Sample: $\frac{\text{temperature change}}{\text{“R” value}} = \text{Btu/h loss/ square foot of tank surface}$

Water cannot (for all practical purposes) be compressed.

Water expands when it is heated.

Water Hammer – is a concussion of moving water against the sides of a containing pipe or vessel on a sudden stoppage of flow.

EX: 1/2 “copper pipe, 5GPM flow (7.2ft/sec.) – stop. Pressure rise of approximately 412 PSI.
3/4” copper pipe, 5GPM flow (3.3ft/sec) – stop. Pressure rise of approximately 188 PSI

Minerals and gases will separate from water as temperature increases.

Formulas:

BTU (British Thermal Unit) is the heat required to raise 1 pound of water 1 F
BTU divided by 3,413 = Kilowatts

To convert from Fahrenheit to Celsius: ($^{\circ}\text{F} - 32$) times 5/9, or .556, equals degrees C.

One gallon of 120 F (49 C), water weighs approximately 8.25 pounds.

Pounds X .45359 = Kilogram
Gallons X 3.7854 = Liters

% of Hot Water required to achieve a mixed water temperature
= (Mixed Temp. – Cold Temp.) divided by (Hot Temp. – Cold Temp.)

General Section – continued

% Thermal Efficiency = (GPH X 8.25 X Temp. Rise X 1.0) divided by BTU/H Input

BTU Output = GPH X 8.25 X Temp. Rise X 1.0

GPH= Gallons Per Hour Recovery

GPH = (BTU/H Input X % Eff.) divided by (Temp. Rise X 8.25)

One cubic foot of Natural Gas contains about 1000 BTU of heat.

One “therm” is equal to 100,000 BTU

One cubic foot of Propane Gas contains about 2500 BTU of heat.

One gallon of Propane gas contains about 91,250 BTU of heat.

One pound of Propane gas contains about 21,600 BTU of heat.

One pound of **gas pressure** is equal to 27.7 inches water column pressure
Inches of Water Column X .036091 = PSI
Inches of Water Column X .073483 = Inches of Mercury (Hg.)

Doubling the diameter of a pipe will increase its flow capacity (approximately) 5.3 times.

All water heaters will contain at least **one thermostat** (to operate the heater) and **one high limit** (to prevent water temperatures approaching the “steam” level).

