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Air-Conditioning, Heating, and Refrigeration Institute

December 2, 2011

Ms. Abigail Daken
ENERGY STAR Water Heater Program Manager
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Dear Abigail:

Based on the information and discussions that occurred at the November 10, 2011 Stakeholder meeting, we have the following comments on the Draft 2 Version 2.0 Water Heaters Specification.

Qualification Criteria

The added requirement that heat pump water heaters provide an audible alert when the compressor turns off due to a blocked condensate drain is unnecessarily restrictive. A visual indicator should be adequate to convey to the consumer that the compressor has shut down. Although, saving energy is important, it is not a life-safety issue. The requirement for an audible alert conveys a sense of urgency that is not warranted. One of the reasons provided for adding this requirement is consumer complaints regarding prolonged operation in the electric resistance mode due to condensate drain malfunction. There likely will be clear indicators that the heat pump water heater is operating off the electric resistance element, such as running out of heated water. Accordingly, an indicator that can be seen by the consumer when he or she goes to check the unit is adequate to indicate a compressor "shutdown" problem.

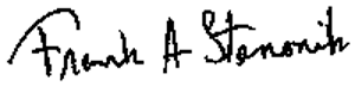
EPA has raised some question on the value of the Energy Star label for point of use water heaters. We believe that a factor contributing to these questions is the confusion created by using a test procedure designed for whole-home models on products not designed to provide heated water to the entire home. The EF description does not account for the system benefits of POU units. Also, it appears that this issue is being overanalyzed. Consumers will consider POU units only for those cases where such units make sense, whether it is distant fixture which would otherwise often fill a long pipe run with unused, heated water or an added load from a new point of use that could otherwise require changes to the whole home water heater. In such cases, the Energy Star Label identifies a viable, energy saving option. It does not inherently drive the consumer to an incorrect or inefficient option. EPA should not disqualify point-of-use water

heaters because of the short-comings of the current DOE efficiency test procedure. Also, we urge EPA to consider the detailed cost/benefit analysis information for POU units being submitted by the manufacturers of electric tankless water heaters.

The comments that we submitted on September 9, 2011, included recommended criteria for small storage point of use water heaters. As mentioned in those comments, attached is a suggested procedure for measuring the standby loss of small volume (i.e. 2 gallons up to 20 gallons) electric point of use water heaters.

We appreciate the opportunity to comment on this draft specification document. If you have any questions, please do not hesitate to call me.

Respectively Submitted,



Frank A. Stanonik
Chief Technical Advisor

Attachment

Standby Loss Test for Small (Point of Use) Storage Electric Water Heaters

The test method for Point of Use electric water heaters is as follows:

(A) Storage Tank Volume

Determine the storage capacity of the water heater, in gallons, by subtracting the weight of the empty water heater from the weight of the water heater when completely filled with water (with all air eliminated and line pressure applied) and dividing the resulting net weight by the density of water at the measured temperature.

$$V = \frac{Wf - Wt}{\rho}$$

Where:

V = the storage capacity in gallons
Wf = the weight of the water heater when full (lb)
Wt = the weight of the empty water heater (lb)
ρ= the density of the water (lb/gal)

(B) Test Set-Up

1. Insulate the water piping, including heat traps, if provided by the manufacturer. Ensure that the insulation does not contact any water heater surface except at the location where the pipe connections penetrate the appliance jacket. Water piping should be similar to Figures 1, 2, or 3 below (Reference is figures 4, 5 and 6 of DOE 10 CFR Pt 430 Subpt B.)

2. If the manufacturer has not provided a temperature and pressure relief valve, one shall be installed and insulated.

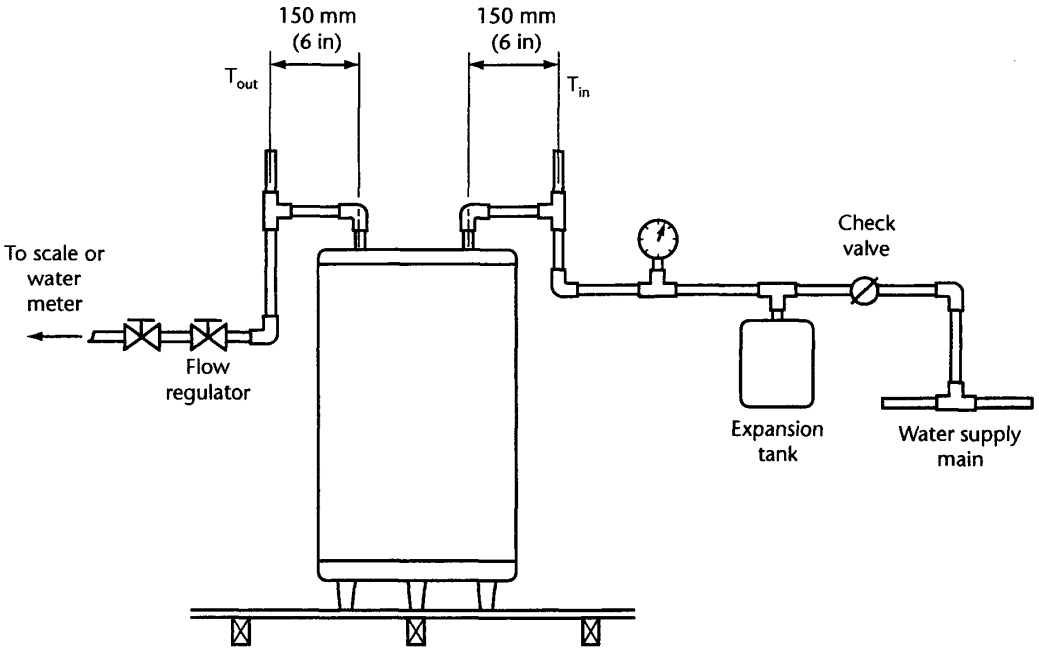


Figure 1

Piping Arrangement for Point of Use Water Heaters Top Inlet and Outlet

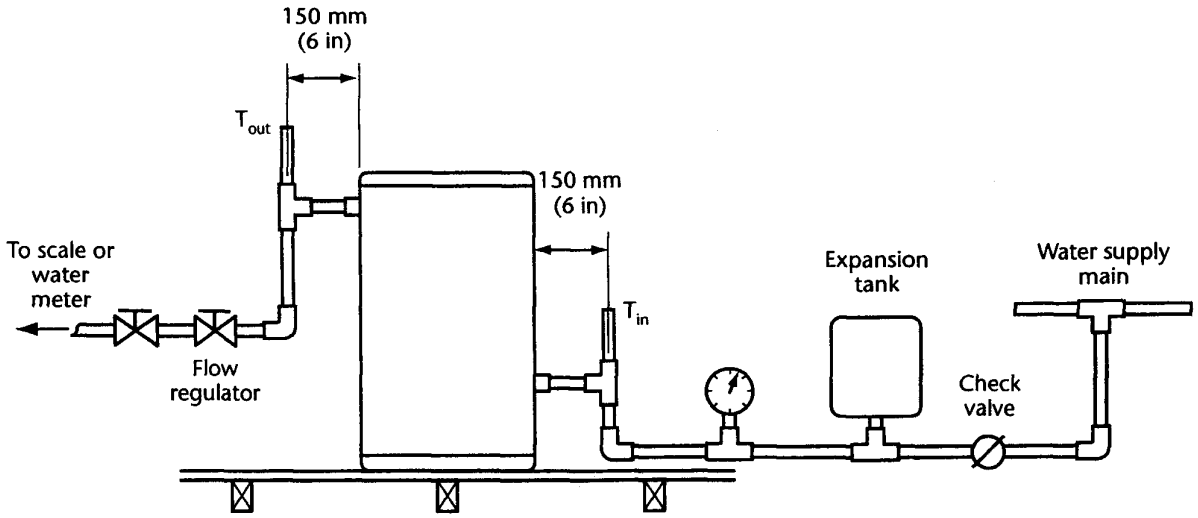
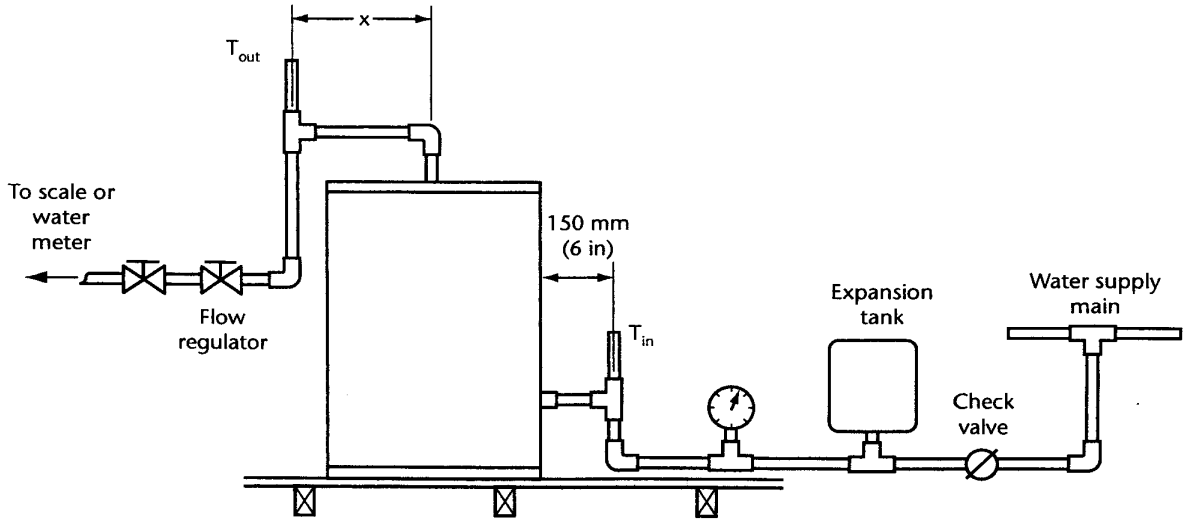


Figure 2

Piping Arrangement for Point of Use Water Heaters Side Inlet and Outlet



Note: *x = distance from the centre of the outlet to the edge of the tank, plus* 50 mm (2 in)

Figure 3

Piping Arrangement for Point of Use Water Heaters, Side Inlet and Top Outlet

3. Maintain the temperature of the supply water at 70° F ± 2° F and the pressure of the water supply between 40 psi and the maximum pressure specified by the manufacturer. The accuracy of the pressure measuring devices shall be within ± 1.0 pound per square inch. The water heater shall be isolated by use of a shut-off valve in the supply line with an expansion tank installed in the supply line downstream of the shutoff valve. There shall be no shut-off means between the expansion tank and the appliance inlet.

4. Before starting the testing of the water heater, the setting of the thermostat shall be obtained by supplying water to the system at 70° F ± 2° F and then noting the maximum mean temperature of the water after the thermostat shuts off the electric supply to be 135° F ± 5° F.

5. For measuring the energy consumption, instrumentation shall be installed which measures within ± 2 percent. Voltage shall be within ± 10 percent of the rated voltage.

6. Three or more temperature sensing means shall be installed inside the storage tank on the vertical center of each of three or more non-overlapping sections of approximately equal volume from the top to the bottom of the tank. Each temperature sensing means is to be located as far as possible from any heat source or other irregularity, anodic protective device, or water tank or flue wall. The distance between successive sensors shall be at least 4 inches. The anodic protective device shall be removed in order to install the temperature sensing means and testing shall be carried out with the device removed. If the temperature sensing means cannot be installed as specified above, placement of the temperature sensing means shall be made at the discretion of the testing agency so that comparable water temperature measurements are obtained. A temperature sensing means, shielded against direct radiation and positioned at the vertical midpoint of a tank-type water heater at a perpendicular distance of approximately 24 inches from the surface of the jacket, shall be installed in the test room.

7. The ambient air temperature of the test room shall be maintained at 75° F ± 10°F. The ambient temperature shall not vary more than ± 7.0° F from the average during the test, temperature readings being taken at 15 minute intervals and averaged at the end of test.

(C) Standby Loss

Fill the water heater with water. Turn on the electric power to the water heater. After the first cut out, allow the water heater to remain in the standby mode until the next cut out. At this time, record the time, ambient temperature and begin measuring the electric consumption.

Record the maximum mean tank temperature that occurs after cut out. Record the mean tank temperature and the ambient air temperature at the end of the first 15 minute interval and at

the end of each subsequent 15 minute interval. The duration of this test shall be until the first cut out that occurs after 24 hours.

Immediately after the conclusion of the test, record the total electrical energy consumption, the final ambient air temperature, and the time duration of the standby loss test (t) in hours rounded to the nearest one hundredth of an hour and the maximum mean tank temperature that occurs after the final cut out. Calculate the average of the recorded values of the mean tank temperatures and of the ambient air temperatures taken at the end of each time interval, including the initial and final values. Determine the difference (ΔT3) between these two averages by subtracting the latter from the former, and the differences (ΔT4) between the final and initial mean tank temperatures by subtracting the latter from the former.

Determine the Standby Loss (% per hour) using the formula:

$$S = \left[\frac{E \times 3412}{(K)(V)(\Delta T3)(t)} - \frac{(\Delta T4)}{(\Delta T3)(t)(Er/100)}\right] \times 100$$

Where:

S = standby loss, percent per hour, expressed as a ratio of the heat loss per hour to the heat content of the stored water above room temperature
K = 8.25 Btu per gallon °F, the nominal specific heat of water
V = tank capacity expressed in gallons
3412 = conversion factor, 1 kWh = 3412 Btu
ΔT3 = difference between the mean tank temperature and the average ambient air temperature, °F
ΔT4 = difference between the final and initial mean tank temperature, °F t = duration of test, hrs.
E = electrical energy consumption in kWh
Er = recovery efficiency, assumed to be 98% for water heaters with immersed heating elements

Determine the Standby Loss (W) using the formula:

W = S x K x V (ΔT1) / (3412 Btu/kWh)

Where:

ΔT1 = 60° F, the nominal difference between mean tank temperature and the average ambient air temperature
S = standby loss, hr^{-1}
K = 8.25 Btu per gallon °F, the nominal specific heat of water
V = tank capacity expressed in gallons
3412 = conversion factor from kWh to Btu/hr

(D) Report the following values:

Measured Volume, V	= gallons
Rated electrical input, P	= kW
Size (overall dimensions)	= inches (h x w x d)
Standby Loss, S	= %/hr
Standby Loss	= watts