December 23, 2014

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Office, Mailstop EE-5B
1000 Independence Avenue SW
Washington, DC 20585

Re: AHRI Petition, Docket No. EERE-2011-BT-TP-0042

Dear Ms. Edwards:

As the author of the petition presented in the November 7, 2014 Federal Register, the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) reaffirms our contention that the certification and enforcement regulations for the rated volume of storage water heaters included in the July 11, 2014 final rule on water heater efficiency test procedures should be repealed. In further considering this matter we have identified additional information that should be considered by the Department of Energy (DOE). Therefore we are submitting these comments as a supplement to the issues noted in our original petition.

The action to establish certification and enforcement regulations for the rated volume of storage water heaters is contrary to both the policy established by Office of Management and Budget Circular No. A-119 (OMB A-119) and Executive Order 13563 "Improving Regulation and Regulatory Review," issued by the President in January 2011.

OMB A-119 establishes policies on the Federal use and development of voluntary consensus standards and on conformity assessment activities. It directs federal government agencies to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical. The creation of a DOE-unique regulation on rated volume is precisely the type of action OMB A-119 is directing agencies to avoid. As we have documented on several occasions, the allowable amount of difference between the rated and measured volume of residential storage water heaters is addressed by the national voluntary consensus standards applicable to gas and electric storage water heaters. The requirements on the rated volume in the voluntary consensus standards have been enforced for decades. Yet, the DOE final rule provided no indication that any consideration was given to using the existing requirement of the long standing voluntary consensus standards nor did it provide any explanation why the voluntary consensus standards were "inconsistent with the law or impractical." DOE has no documentation that the storage volume requirements of the voluntary consensus standards have been inadequate and have allowed manufacturers to avoid compliance with its water heater minimum efficiency standards in the 25 years those efficiency standards have existed.

OMB A-119 specifically directs that in the circumstance where the agency chooses to not use a voluntary consensus standard, it must submit a report describing the reason(s) for its use of government-unique

standards in lieu of voluntary consensus standards to the OMB through the National Institute of Standards and Technology (NIST). The comments we submitted on the NOPR for this rule included information on the voluntary consensus standards requirements addressing the regulation of rated volume values. This comment is acknowledged in the Federal Register notice for the final rule. Disregarding the directive of OMB A-119, DOE made no attempt to explain why it decided not to rely on the voluntary consensus standards. Rather, DOE noted that based on our information regarding the current water heater market, DOE's regulation should not cause any water heaters to be subject to different energy conservation standards. Our petition shows that statement to be false. This DOE response is off the point. Specifically, DOE must explain why the voluntary consensus standards are inadequate for its purposes.

In imposing this unique regulation, DOE has provided no data, no evidence, no compelling arguments that the voluntary consensus standards requirements for the rated volume of residential water heaters have failed to serve the agency's needs for the past 25 years; that they are infeasible or inadequate or ineffectual or less useful. This clearly does not comply with the directives of OMB A-119.

Executive Order 13563 is intended to ensure that federal regulations seek more affordable, less intrusive means to achieve policy goals and that agencies give careful consideration to the benefits and costs of those regulations. DOE's new regulation of rated storage volume is unquestionably intrusive, it adds costs to manufacturers and others in the water heater industry with no benefit. Furthermore, it has no direct relation to a goal of reducing energy consumption of water heaters. There is no indication that in developing this regulation, DOE considered low cost approaches that reduce burdens and maintain flexibility. If it had, the proper decision would have been to continue to rely on the existing requirement of the voluntary consensus standards, which adds no cost to either the industry or DOE. The Department has periodically issued notices seeking comments to assist it in implementing Executive Order 13563. A proper implementation of that order, of itself, should move DOE to grant out petition and repeal these regulations.

The statement that "The efficiency of a water heater is clearly related to the rated storage volume, and, therefore, within DOE's authority to regulate" misrepresents the relationship of the storage volume and efficiency. The determination of the minimum efficiency standard applicable to a particular water heater is related to the rated storage volume; the actual efficiency of the model is not.

Because all residential storage water heaters are tested with the same daily hot water usage, the energy factor (EF) measured by the test for a larger volume model will be lower than for a smaller volume model when both models have essentially the same efficiency characteristics. For larger volume models, the daily hot water usage in the test represents an underutilization of the model; it reduces the amount of time that the burner or heating element is "on" and increases the time during which the water heater is in standby. The more time a storage water heater is in standby during the test procedure, the lower its measured EF will be. Due to this peculiarity of the DOE efficiency test procedure, the rated storage volume is used as an adjustment factor in the equation to establish the minimum energy factor standard.

The following explains the origin of the efficiency standards for residential gas water heaters specified in the National Appliance Energy Conservation Act (NAECA) of 1987 and illustrates the role of rated volume in those standards.

In the original DOE residential water heater efficiency test procedures developed in the late 1970s the equations for determining the estimated daily energy consumption (C_x) and energy factor (EF) were:

$C_x = kU\Delta T_1 / E_r + (SkV\Delta T_2 (24 - (kU\Delta T_1 / E_r P))$ and $EF = kU\Delta T_1 / C_x$

The definition of these terms were:
k= 8.25 Btu/G degree
U = 64.3 gal/day
$\Delta T_1 = 90$ degrees
$\Delta T_2 = 90$ degrees
E_r - recovery efficiency in decimal form
S - standby loss, percent per hour as a decimal
V- measured volume in gallons
P - input rate in Btu/h

In the 1980s the efficiency requirements for residential gas storage water heaters in ASHRAE Standard 90.1 were a minimum recovery efficiency of 75% and a maximum percent standby loss of 2.3 + (67/V), where V was the rated volume. Using the constant values noted above and a recovery efficiency of 75% the C_x and EF equations simplify to:

$C_x = 63657 + (SV(742.5)(24 - 63657/ P))$ and $EF = 47743/ C_x$

The following table shows typical volume sizes that were available in the 1980s, the maximum input available for each volume size, the maximum percent standby loss per the ASHRAE 90.1 specification, the calculated C_x value and the EF, rounded to the nearest .01. The resulting EF values are the lowest possible EFs that a model in a given volume size could have if it complied with the ASHRAE 90.1 requirements.

V (Gal)	S	P (Btu)	Cx (Btu)	EF
20	0.056	32000	80997	0.58
30	0.045	40000	84948	0.55
40	0.04	53000	89345	0.53
50	0.036	65000	92847	0.51
75	0.032	75000	102805	0.46
100	0.03	75000	112592	0.42

A formula that describes a straight line which approximates the relationship of EF to volume size in this table is EF = .60 -.0019V, where V is the rated volume. The minimum efficiency standard for gas water heaters specified in NAECA, EF ≥ .62 -.0019V, was established by using this formula and adding 2 points to reflect an efficiency level a step better than the ASHRAE 90.1 minimum standards in effect at that time. (A similar process was followed to develop the NAECA minimums for residential electric and oil storage water heaters.)

The key thing to note is that the volume adjustment factor in the formula was used because the test procedure provided lower EF values as the volume of the model increased. Yet, the development of the equation was based on models that all had the same recovery efficiency and met the same maximum standby loss requirement.

This example shows how the minimum efficiency <u>standard</u> for residential water heaters is related to the storage volume. But, the actual <u>efficiency of a model</u> of residential storage water heater as designed and produced by a manufacturer is not directly influenced by the storage volume; there is no direct relation. Additionally, the development of the standard used the rated volume because it established the same requirement for all models of a particular size. It had a secondary benefit that it is a value readily available from any number of sources, thus allowing anyone to determine the minimum EF requirement for each size water heater.

The actual volume of the storage tank is significant only when measuring the standby loss of the water heater. The measured volume relates to the energy being stored by the unit and the standby loss portion of the test measures the energy consumed to replace energy lost from that stored amount. That is why the volume of the unit being tested is measured. This will always need to be the case regardless of the rated volume. In the case of standby loss, a larger volume model holds more energy and thus has the potential to lose more during standby periods. But, the standby loss that will be measured by the test procedure for any given model is influenced by design factors such as the type and amount of insulation on the tank, the number of penetrations in the jacket and other heat leakage paths, and the design of the flue tube and associated baffle. Those factors do not directly relate to the storage volume.

AHRI appreciates DOE's consideration of our petition and the opportunity to provide these comments.

Respectively Submitted,
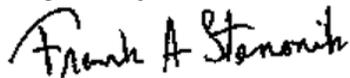
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