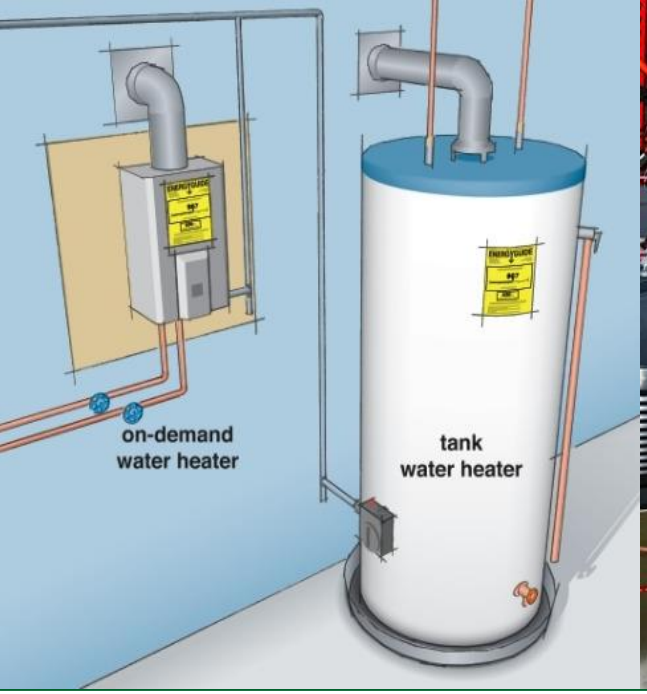

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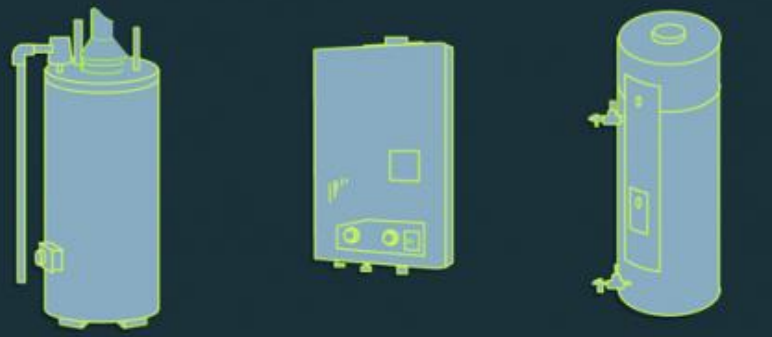

Appliance and Equipment Standards: Water Heating

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Appliance Standards Program Overview

Standards Save *BIG*: Product Profile

Over **60** covered products

Consumer

Commercial and Industrial

Lighting

Plumbing

90% of residential energy use covered

60% of commercial energy use covered

30% of industrial energy use covered

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Standards Save *BIG*: Money and Energy

$529

Today, a typical household saves about $321 per year off their energy bills as a result of standards and can expect to save over $529 annually by 2030.

$2 Trillion

The cumulative utility bill savings to **consumers** are estimated to be more than $1 trillion by 2020 and more than $2 trillion by 2030.

142 quadrillion Btu

The cumulative energy savings of standards completed through 2016 are expected to save 71 quadrillion British thermal units (quads) of energy by 2020 and nearly 142 quads through 2030—40 percent more energy than the entire nation consumes in one year.

Consumer Water Heater Standards

- Water heating accounts for approximately **16%** of residential U.S. household energy use.
- Consumer water heaters standards history:
  - NAECA established the initial standards mandatory in 1990.
  - DOE revised the levels in a final rule published in 2001 with standards mandatory in 2004. For products shipped from 2004 to 2030, the revised standards were projected to:
    - save 4.6 quads of energy
    - result in NPV of consumer benefits of $2.0bn
  - DOE most recently amended standards for a second time in a final rule published in 2010 with standards mandatory in 2015. For products shipped from 2015 to 2045 the revised standards are projected to:
    - save 2.6 quads of energy
    - result in NPV of consumer benefits between $1.4bn (at 7% discount) to $8.7bn (at 3% discount rate)

Commercial Water Heater Standards

- Water heating accounts for approximately **4%** of U.S. commercial building energy use.
- Commercial water heaters standards history:
  - EPACT 1992 established initial standards mandatory in 1994
  - DOE revised the standards in a final rule published in 2001 by adopting ASHRAE 90.1-1999 levels for certain commercial WH classes.
    - For equipment shipped from 2004 to 2030, the revised standards were projected to save 0.07 quads of energy.
  - DOE most recently revised standards for oil-fired storage commercial water heaters in a final rule published in 2015, which adopted the ASHRAE 90.1-2013 levels for this equipment.
    - For equipment shipped from 2015 to 2044 the revised standards are projected to save 0.002 quads of energy.

Water Heater Standards Coverage

1 Appliance Standards Program Overview

2 Water Heater Standards Coverage

3 Recent Updates

4 Ongoing Activities

Consumer Water Heater Standards Coverage

- Initial standards set by EPCA were expressed in terms of the Energy Factor (EF) metric and apply to all consumer water heaters meeting the EPCA definitions, including:

Consumer Water Heater	Maximum Input Rating
Gas-fired Storage	75,000 Btu/h
Oil-fired Storage	105,000 Btu/h
Electric Storage	12 kW
Gas-fired Instantaneous	200,000 Btu/h
Oil-fired Instantaneous	210,000 Btu/h
Electric Instantaneous	12 kW

- DOE adopted amended EF-based standards for certain consumer water heaters in a final rule published April 16, 2010.
  - The amended standards apply to a subset of consumer water heaters for which DOE established an EF test procedure.

Uniform Energy Factor and Transition

- DOE adopted a revised test procedure and metric expressed in terms of Uniform Energy Factor for consumer water heaters in July of 2014. 79 FR 40541.
  - The provisions in the July 2014 final rule became effective on July 11, 2015.
- UEF TP is conceptually similar to EF TP
  - A maximum Gallons Per Minute test (Max GPM) or First-Hour Rating (FHR) test for determining delivery capacity
  - A 24-hour simulated use test (SUT) for determining UEF
- To determine UEF, a water heater is tested to one of four possible draw patterns
  - Draw patterns vary in length, flow rate, number of draws.
  - Result of the max GPM or FHR test is used to determine the appropriate draw pattern for the UEF test.
- Scope of applicability of the test procedure was expanded to include all consumer water heaters and certain commercial water heaters (i.e., "Residential-Duty Commercial Water Heater").

Commercial Water Heater Standards Coverage

Equipment	Nominal Input
Gas-fired storage water heaters [a]	> 75,000 Btu/h
Oil-fired storage water heaters [a]	> 105,000 Btu/h
Electric storage water heaters [a]	> 12 kW (40,956 Btu/h)
Gas-fired instantaneous water heaters and hot water supply boilers [b]	> 200,000 Btu/h
Oil-fired instantaneous water heaters and hot water supply boilers [b]	> 210,000 Btu/h

[a] Water Heaters and hot water supply boilers having more than 140 gallons of storage capacity need not meet the standby loss requirement if (1) the tank surface area is thermally insulated to R-12.5 or more, (2) a standing pilot light is not used and (3) for gas- and oil-fired storage water heaters, they have a fire damper or a fan assisted combustion.

[b] For hot water supply boilers with a capacity of less than 10 gallons: (1) the standards are mandatory for products manufactured on and after October 21, 2005, and (2) products manufactured prior to that date, and on or after October 23, 2003, must meet either the standards listed in this table or the applicable standards in subpart E of this part for a "commercial packaged boiler."

Recent Updates

1. Appliance Standards Program Overview
2. Water Heater Standards Coverage
3. **Recent Updates**
4. Ongoing Activities

Recent Updates

- Consumer Water Heaters
  - Conversion Factor Final Rule Published December 2016:
    - Translates standards for consumer and residential-duty commercial waters from EF to UEF; and
    - Provides a method to convert EF test data to UEF test data for certain consumer water heaters and certain residential-duty commercial water heaters.
- Commercial Water Heating Equipment
  - Energy Conservation Standards NOPR Published May 2016:
    - Proposes amendments to existing standards for certain commercial water heating equipment. 81 FR 34440.
  - Test Procedure Final Rule Published November 2016.
    - Adopts revisions to the test procedure for commercial water heating equipment. 81 FR 79261.
  - Energy Conservation Standards NODA Published December 2016:
    - Updates the proposed standards from the May 2016 NOPR for residential-duty commercial water heaters based on Dec. 2016 conversion factor final rule. 81 FR 94238.

Consumer UEF Water Heater Standards Coverage

- DOE translated the EF-based standards from the April 2010 final rule to equivalent UEF-based standards for the following types of consumer water heaters in a final rule published on Dec. 29, 2016.

Consumer Water Heater	Maximum Input Rating	Storage Volume
Gas-fired Storage	75,000 Btu/h	≥20 to ≤100 gal
Oil-fired Storage	105,000 Btu/h	≤ 50 gal
Electric Storage	12 kW	≥20 to ≤120 gal
Tabletop [a]	12 kW	≥20 to ≤120 gal
Gas-fired Instantaneous	200,000 Btu/h	<2 gal and >50,000 Btu/h
Electric Instantaneous	12 kW	<2 gal
Grid-Enabled [b]	12 kW	>75 gal

[a] Tabletop water heaters were established as a separate product class in a final rule on January 17, 2001. 66 FR 4474.

[b] Grid-Enabled water heaters are electric storage water heaters and were added as a separate product class on August 11, 2015. 80 FR 48004.

Key Points – Conversion Factor and Standards

- Test data and physics-based equations were used to derive a set of mathematical operations to convert EF-tested values to UEF-tested values.
  - Conversions should be applied to tested values and NOT rated values.
  - To compute rated values, apply 10 CFR 429.17 requirements to converted tested values.
- A separate UEF-based standard equation was derived for each product class and draw pattern.
- In response to manufacturers' concerns, DOE articulated an enforcement policy in the conversion factor final rule and how it applies to various consumer and residential-duty commercial water heaters distributed into commerce in the US.

Key Points – Commercial Water Heater Test Procedure

- Incorporated by reference certain provisions from most recent industry standards.
- Significant revisions included:
  - Test setup, conditions, and equipment settings
  - Conditions for establishing steady-state operation
  - Measurement of fuel input rate and related enforcement provision
- New test procedures for certain equipment:
  - Standby loss test for flow or externally thermostatically-activated instantaneous water heaters
  - Commercial heat pump water heaters
- Representations using the new test procedure are mandatory starting on November 6, 2017.

Ongoing Activities

1. Appliance Standards Program Overview
2. Water Heater Standards Coverage
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4. **Ongoing Activities**

Ongoing Activities

- Consumer Water Heater Energy Conservation Standard
  - DOE is preparing a request for information (RFI) which will commence the data gathering and analysis for the next round of rulemaking required by EPCA.
  - DOE was legislatively required to issue a proposed amended standard or a determination of no new amended standards by April 2016.

- Commercial Water Heater Energy Conservation Standard
  - NOPR published on May 31, 2016. 81 FR 34440.
  - NODA published on December 23, 2016. 81 FR 94238.
  - Final Rule legislatively required by May 2018.

For further information

- Consumer Water Heaters EERE Website: https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=32
- Commercial Water Heating Equipment EERE Website: https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=36&action=viewlive
- Conversion Factor Docket: https://www.regulations.gov/docket?D=EERE-2015-BT-TP-0007
- Commercial Water Heating Equipment Test Procedure Docket: https://www.regulations.gov/docket?D=EERE-2014-BT-TP-0008
- Commercial Water Heating Equipment Energy Conservation Standards Docket: https://www.regulations.gov/docket?D=EERE-2014-BT-STD-0042