



# Update and Overview of DOE Rulemakings for ASHRAE 90.1 Equipment

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6/26/2011

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- The “ASHRAE Trigger”:
  - EPCA directs DOE to review its minimum standards for certain commercial and industrial equipment whenever ASHRAE Standard 90.1 is amended with respect to such equipment. (42 USC 6313(a)(6)(A))
  - The “ASHRAE Trigger” requires DOE review when ASHRAE Standard 90.1 raises its efficiency level in comparison to the current Federal minimum standard.

- Equipment subject to the “ASHRAE Trigger” includes any equipment within the following general types:
  - Small, Large, and Very Large Commercial Package Air Conditioning and Heating Equipment
  - Single Package Vertical Air Conditioners and Heat Pumps
  - Packaged Terminal Air Conditioners and Heat Pumps
  - Warm-air Furnaces
  - Commercial Packaged Boilers
  - Storage Water Heaters, Instantaneous Water Heaters, and Unfired Hot Water Storage Tanks
- EISA 2007 amended EPCA to add a separate provision that requires DOE to review whether standards for ASHRAE equipment should be amended within 6 years of the last final rule amending standards. (42 USC 6313(a)(6)(C))
- EISA 2007 amended EPCA to require that test procedures for ASHRAE equipment be reviewed at least once every 7 years. (42 USC 6314(a)(1)(A))

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- ASHRAE Standard 90.1-2010 was officially released on October 29, 2010.
- ASHRAE Standard 90.1-2010:
  - Increased its efficiency levels for small, large, and very large water-cooled and evaporatively-cooled air conditioners, and certain small (only those with cooling capacity <17,000 Btu/h) and large variable refrigerant flow water-source heat pumps;
  - Separated variable refrigerant flow commercial package air conditioners and heating equipment from other classes of commercial package air conditioners and heating equipment
  - Expanded its scope to include air conditioners and condensing units serving computer rooms
- DOE published an initial assessment of the potential for energy savings at the ASHRAE 90.1-2010 levels and more stringent standard levels in a NODA published on May 5, 2011.

- Next Steps:
  - If DOE determines it will adopt ASHRAE 90.1 levels for any class of covered equipment, DOE must do so within 18 months of the publication of the updated ASHRAE standard 90.1 (i.e., 4/29/2012 for ASHRAE Standard 90.1-2010)
  - If DOE determines more stringent standards may be justified, DOE will adopt more stringent standards within 30 months of the publication of the updated ASHRAE standard 90.1 (i.e., 4/29/2013 for ASHRAE Standard 90.1-2010)

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# Overview of ASHRAE 90.1 Equipment Types

## Small Commercial Packaged Air Cooled Air Conditioners and Heating Equipment with Cooling Capacity <65,000 Btu/h – 3 phase

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled DOE Standards Rulemaking Activities
Split System and Single Package AC (including SDHV TTW, and VRF product designs)	SEER = 13	10 CFR 431.96 (Incorporates ARI 210/240-2003)	54 Trillion Btu Primary (2010)*	None	Waiting for ASHRAE Trigger
Split System and Single Package HP (including SDHV TTW, and VRF product designs)	SEER = 13 HPSF = 7.7		7 Trillion Btu Primary (2010)*		Waiting for ASHRAE Trigger

\*Screening Analysis for EPACT-Covered Commercial HVAC and Water-Heating Equipment, April 2000

\*\* DOE recently released a direct final rule for residential central air conditioners and heat pumps in June 2011, adopting amended energy conservation standard levels for these products.

# Overview of ASHRAE 90.1 Equipment Types

## Small Commercial Packaged Air-Cooled Air Conditioners and Heating Equipment with Cooling Capacity $\geq 65,000$ Btu/h and $< 135,000$ Btu/h

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled DOE Standards Rulemaking Activities
Air-cooled AC with electric resistance (including VRF)	EER = 11.2	10 CFR 431.96 (Incorporates ARI 340/360-2004)	163.4 Trillion Btu Primary (2010)*	None	Waiting for ASHRAE trigger
Air-cooled AC other	EER = 11.0				
Air-cooled HP with electric resistance (including VRF with or without heat recovery)	EER = 11.0 COP = 3.3		16.8 Trillion Btu Primary (2010)*		
Air-cooled HP other	EER = 10.8 COP = 3.3				

\* Screening Analysis for EPCAT-Covered Commercial HVAC and Water-Heating Equipment, April 2000

# Overview of ASHRAE 90.1 Equipment Types

## Small Commercial Packaged Water-Cooled, Evaporatively-Cooled, and Water Source Air Conditioners and Heating Equipment with Cooling Capacity <65,000 Btu/h

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
Air Conditioners < 65,000 Btu/h (including VRF equipment)	12.1 EER	10 CFR 431.96 (Incorporates ARI 210/240-2003)	0.4 Trillion Btu Primary (2010)*	None	Waiting for ASHRAE Trigger
Heat Pumps < 17,000 Btu/h (not including VRF equipment)	11.2 EER, 4.2 COP	10 CFR 431.96 (Incorporates ISO-13256-1 (1998))	5.6 Trillion Btu Primary (2010)*	None	Waiting for ASHRAE Trigger
Heat Pumps < 17,000 Btu/h (VRF equipment only)	11.2 EER, 4.2 COP			April 2012 –April 2013**	Review 6 years after publication of final rule.
Heat Pumps ≥17,000 and < 65,000 Btu/h (including VRF equipment)	12.0 EER, 4.2 COP		33.0 Trillion Btu Primary (2010)*	None	Waiting for ASHRAE Trigger

\* Screening Analysis for EPACK-Covered Commercial HVAC and Water-Heating Equipment, April 2000

\*\* See May 2011 NODA

# Overview of ASHRAE 90.1 Equipment Types

## Small Commercial Packaged Water-Cooled, Evaporatively-Cooled, and Water Source Air Conditioners and Heating Equipment with Cooling Capacity $\geq 65,000$ Btu/h and $< 135,000$ Btu/h

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled DOE Standards Rulemaking Activities
Water-cooled AC with electric resistance	EER = 11.5	10 CFR 431.96 (Incorporates ARI 340/360-2004)	0.8 Trillion Btu Primary (2010)*	April 2012 – April 2013**	Review 6 years after publication of final rule.
Water-cooled AC other	EER = 11.3				
Evaporatively-cooled AC with electric resistance	EER = 11.5		N/A		
Evaporatively-cooled AC other	EER = 11.3				
Water Source HP (including VRF with or without heat recovery)	EER = 12.0 COP = 4.2	10 CFR 431.96 (Incorporates ISO-13256-1 (1998))	4.5 Trillion Btu Primary (2010)*	None	Waiting for ASHRAE trigger

\* Screening Analysis for EPACK-Covered Commercial HVAC and Water-Heating Equipment, April 2000

\*\* See May 2011 NODA

# Overview of ASHRAE 90.1 Equipment Types

## Large Commercial Packaged Air-Cooled Air Conditioners and Heating Equipment with Cooling Capacity $\geq 135,000$ Btu/h and $< 240,000$ Btu/h

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled DOE Standards Rulemaking Activities
Air-cooled AC with electric resistance (including VRF)	EER = 11.0	10 CFR 431.96 (Incorporates ARI 340/360-2004)	131.1 Trillion Btu Primary (2010)*	None	Waiting for ASHRAE trigger
Air-cooled AC other	EER = 10.8				
Air-cooled HP with electric resistance (including VRF with or without heat recovery)	EER = 10.6 COP = 3.2		6.1 Trillion Btu Primary (2010)*		
Air-cooled HP other	EER = 10.4 COP = 3.2				

\* Screening Analysis for EPACK-Covered Commercial HVAC and Water-Heating Equipment, April 2000

# Overview of ASHRAE 90.1 Equipment Types

## Large Commercial Packaged Water-Cooled, Evaporatively-Cooled, and Water Source Air Conditioners and Heating Equipment with Cooling Capacity $\geq 135,000$ Btu/h and $< 240,000$ Btu/h

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled DOE Standards Rulemaking Activities
Water-cooled AC with electric resistance	EER = 11.0	10 CFR 431.96 (Incorporates ARI 340/360-2004)	1.2 Trillion Btu Primary (2010)*	April 2012 – April 2013**	Review 6 years after publication of final rule.
Water-cooled AC other	EER = 11.0				
Evaporatively-cooled AC with electric resistance	EER = 11.0				
Evaporatively-cooled AC other	EER = 11.0				
VRF Water Source HP without heat recovery	None	N/A	N/A		
VRF Water Source HP with heat recovery	None				

\*\*Screening Analysis for EPACK-Covered Commercial HVAC and Water-Heating Equipment, April 2000

\* See May 2011 NODA

# Overview of ASHRAE 90.1 Equipment Types

## Very Large Commercial Packaged Air-Cooled Air Conditioners and Heating Equipment with Cooling Capacity $\geq 240,000$ Btu/h and $< 760,000$ Btu/h

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled DOE Standards Rulemaking Activities
Air-cooled AC with electric resistance (including VRF)	EER = 10.0	10 CFR 431.96 (Incorporates ARI 340/360-2004)	N/A	None	Waiting for ASHRAE trigger
Air-cooled AC other	EER = 9.8				
Air-cooled HP with electric resistance (including VRF with or without heat recovery)	EER = 9.5 COP = 3.2				
Air-cooled HP other	EER = 9.3 COP = 3.2				

# Overview of ASHRAE 90.1 Equipment Types

## Very Large Commercial Packaged Water-cooled, Evaporatively-cooled, and Water Source Air Conditioners and Heating Equipment with Cooling Capacity $\geq 240,000$ Btu/h and $< 760,000$ Btu/h

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled DOE Standards Rulemaking Activities
Water-cooled AC with electric resistance	EER = 11.0	10 CFR 431.96 (Incorporates ARI 340/360-2004)	N/A	April 2012 – April 2013*	Review 6 years after publication of final rule.
Water-cooled AC other	EER = 10.8				
Evaporatively-cooled AC with electric resistance	EER = 11.0				
Evaporatively-cooled AC other	EER = 10.8				

\*See May 2011 NODA

# Overview of ASHRAE 90.1 Equipment Types

## Package Terminal Air Conditioners (PTACs) and Heat Pumps (PTHPs)

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
PTAC, Standard Size, <7,000 Btu/h	EER = 11.7	10 CFR 431.96 (Incorporates) AHRI 310/380-2004)	N/A	None	Proposed rule in 2014*
PTAC, Standard Size, 7,000 – 15,000 Btu/h	EER = 13.8 – (0.300 x Cap)				
PTAC, Standard Size, >15,000 Btu/h	EER = 9.3				
PTAC, Non-Standard Size, <7,000 Btu/h	EER = 9.4				
PTAC, Non-Standard Size, 7,000 – 15,000 Btu/h	EER = 10.9 – (0.213 x Cap)				
PTAC, Non-Standard Size, >15,000 Btu/h	EER = 7.7				

\* Required by 6-year “lookback” provision

# Overview of ASHRAE 90.1 Equipment Types

## Package Terminal Air Conditioners (PTACs) and Heat Pumps (PTHPs) (Continued)

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
PTHP, Standard Size, <7,000 Btu/h	EER=11.9 COP=3.3	10 CFR 431.96 (Incorporates) AHRI 310/380-2004)	N/A	None	Proposed rule in 2014*
PTHP, Standard Size, 7,000 – 15,000 Btu/h	EER = 14.0 – (0.300 x Cap) COP = 3.7 – (0.052 x Cap)				
PTHP, Standard Size, >15,000 Btu/h	EER=9.5 COP=2.9				
PTHP, Non-Standard Size, <7,000 Btu/h	EER=9.3 COP=2.7				
PTHP, Non-Standard Size, 7,000 – 15,000 Btu/h	EER = 10.8 – (0.213 x Cap) COP = 2.9 – (0.026 x Cap)				
PTHP, Non-Standard Size, >15,000 Btu/h	EER=7.6 COP=2.5				

\* Required by 6-year “lookback” provision

# Overview of ASHRAE 90.1 Equipment Types

## Single Package Vertical Air Conditioners and Heat Pumps

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
SPVAC < 65,000 Btu/h	9.0 EER	None*	N/A	April 2012 –April 2013	Proposed rule in 2014.**
SPVAC ≥65,000 and <135,000 Btu/h	8.9 EER				
SPVAC ≥135,000 and <240,000 Btu/h	8.6 EER				
SPVAC < 65,000 Btu/h	9.0 EER, 3.0 COP				
SPVAC ≥65,000 and <135,000 Btu/h	8.9 EER, 3.0 COP				
SPVAC ≥135,000 and <240,000 Btu/h	8.6 EER, 2.9 COP				

\* EISA 2007 set standards for SPVU but did not specify a test procedure. As a consequence, in the final rule/technical amendment establishing standards for SPVU. DOE did not adopt a specific test procedure.

\*\* DOE currently responding to EISA requirements for review of SPVAC and SPVHP

# Overview of ASHRAE 90.1 Equipment Types

## Commercial Warm-Air Furnaces

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
Gas-Fired, $\geq 225,000$ Btu/h	Et =80%	10 CFR 431.76 (Incorporates ANSI Z21.47-1998)	N/A	None	Waiting for ASHRAE Trigger
Oil-Fired, $\geq 225,000$ Btu/h	Et =81%	10 CFR 431.76 (Incorporates UL 727 -1994)			

# Overview of ASHRAE 90.1 Equipment Types

## Commercial Packaged Boilers

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Site Energy Consumption (MBtu/h)	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
Hot Water, Gas-Fired, $\geq 300,000$ Btu/h and $\leq 2,500,000$ Btu/h	Ec=80% Et=80.0% (3/2/2011)	10 CFR 431.86 (Incorporates HI BTS-2000 (Rev 06.07))	1,077	None	Proposed rule in 2015.*
Hot Water, Gas-Fired, $> 2,500,000$ Btu/h	Ec =80% Ec =82.0% (3/2/2011)		4,013		
Hot Water, Oil-Fired, $\geq 300,000$ Btu/h and $\leq 2,500,000$ Btu/h	Ec =83% Et =82.0% (3/2/2011)		1,051		
Hot Water, Oil-Fired, $> 2,500,000$ Btu/h	Ec =83% Ec =84.0% (3/2/2011)		3,940		

\* Required by 6-year “lookback” provision

# Overview of ASHRAE 90.1 Equipment Types

## Commercial Packaged Boilers (Continued)

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Site Energy Consumption (MBtu/h)	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
Steam, Gas-Fired, Not Natural Draft, ≥300,000 Btu/h and ≤2,500,000 Btu/h	Ec =80% Et =79.0% (3/2/2011)	10 CFR 431.86 (Incorporates HI BTS-2000 (Rev 06.07))	1,091	None	Proposed rule in 2015.*
Steam, Gas-Fired, Not Natural Draft, >2,500,000 Btu/h	Ec =80% Et =79.0% (3/2/2011)		4,090		
Steam, Gas-Fired, Natural Draft, ≥300,000 Btu/h and ≤2,500,000 Btu/h	Ec =80% Et =77.0% (3/2/2011) Et =79.0% (3/2/2022)		1,119		
Steam, Gas-Fired, Natural Draft, >2,500,000 Btu/h	Ec =80% Et =77.0% (3/2/2011) Et =79.0% (3/2/2022)		4,196		
Steam, Oil-Fired, ≥300,000 Btu/h and ≤2,500,000 Btu/h	Ec =83% Et =81.0% (3/2/2011)		1,064		
Steam, Oil-Fired, >2,500,000 Btu/h	Ec =83% Et =81.0% (3/2/2011)		3,989		

\* Required by 6-year “lookback” provision

# Overview of ASHRAE 90.1 Equipment Types

## Commercial Water Heaters and Unfired Hot Water Storage Tanks

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
Electric Storage	Et =N/A SL=0.30+27/Vm (%/hr)	10 CFR 431.106 (Incorporates ANSI Z21.10.3- 1998)	N/A	None	Waiting for ASHRAE Trigger
Gas-Fired Storage	Et =80% SL=Q/800+110(Vr)1/2 (Btu/hr)				
Oil-Fired Storage	Et =78% SL=Q/800+110(Vr)1/2 (Btu/hr)				
Unfired Hot Water Storage Tank	R-12.5 (Minimum Thermal Insulation)	N/A			

# Overview of ASHRAE 90.1 Equipment Types

## Commercial Water Heaters and Unfired Hot Water Storage Tanks

Equipment Class	Current Federal Standard	Current Federal Test Procedure	Annual Energy Consumption	Current DOE Rulemaking Activity	Future Scheduled Standards Rulemaking Activities
Gas-Fired Instantaneous Water Heaters and Hot Water Supply Boilers, <10 gal	Et =80% SL=N/A	10 CFR 431.106 (Incorporates ANSI Z21.10.3-1998)	N/A	None	Waiting for ASHRAE Trigger
Gas-Fired Instantaneous Water Heaters and Hot Water Supply Boilers, >=10 gal	Et =80% SL=Q/800+110(Vr) 1/2 (Btu/h)				
Gas-Fired Instantaneous Water Heaters and Hot Water Supply Boilers, <10 gal	Et =80% SL=N/A				
Gas-Fired Instantaneous Water Heaters and Hot Water Supply Boilers, >=10 gal	Et =78% SL=Q/800+110(Vr) 1/2 (Btu/h)				

## Future Test Procedure Rulemakings

- As noted earlier, EISA 2007 amended EPCA to require that DOE review its test procedures for all types of ASHRAE Equipment at least once every 7 years.
- Therefore, DOE will review test procedures for all types of ASHRAE Equipment no later than December 2014 (i.e., 7 years after the enactment of EISA 2007).\*

\* Since the enactment of EISA 2007, DOE has reviewed and adopted updated test procedures for commercial packaged boilers in July 2009.