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New U.S. Energy Efficiency Standards and Refrigerants for Residential ACs and Heat Pumps

Helen Walter-Terrinoni, VP Regulatory Affiars

February 1, 2022

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central AC & heating equipment

components for heating, AC & refrigeration systems

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commercial & industrial refrigeration equipment

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Overview

Brief overview of ACs/HPs

Introduction to energy efficiency ratings for central Air-conditioners (CACs) and Heat Pumps (HPs)

- SEER, EER, and HSPF ratings will become SEER2, EER2, and HSPF2 in 2023
  - Due to changes in the test procedure
- Minimum energy efficiency is increasing by approximately 7%

Equipment installation requirements in the U.S.

- Different rules in Southeast and Southwest regions
- DOE Guidance Document on Regional Standards published December 16, 2021

Longer term refrigerant changes to understand

- R-410A/R-407C refrigerants will be phased out in 2025 or 2026, depending on the product

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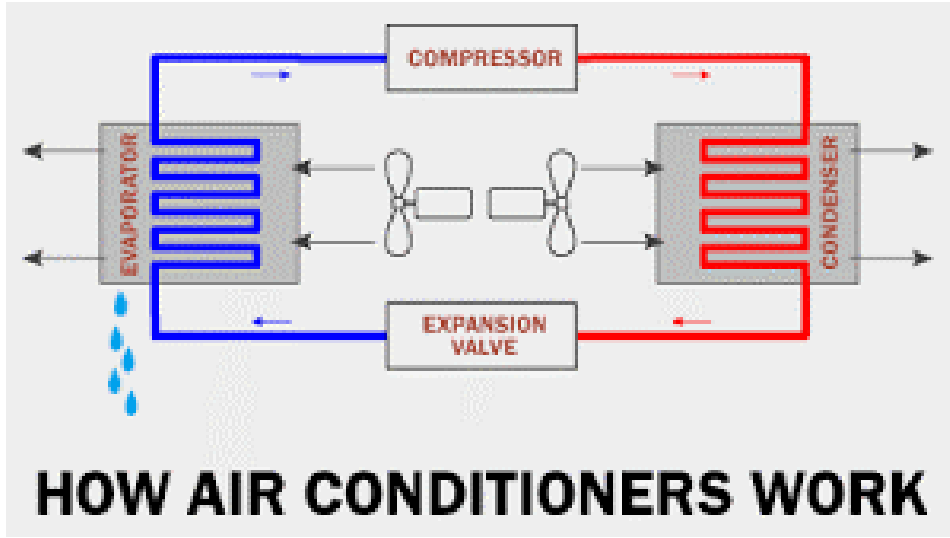
Air Conditioning Basics

- An air conditioner is a **system that is used to cool by removing heat from the space and moving it outdoors**
- Dehumidified air to improve comfort



- Most common products
  - Central ducted AC
  - Central ducted HP
  - Ductless mini-split
  - Multi-split

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Energy Efficiency

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Why is Energy Efficiency Important?

U.S. Department of Energy (DOE) has regulated residential central air conditioner and heat pump efficiencies since 1992

In an average size home, **air conditioning consumes more than 2,000 kilowatt-hours of electricity per year**, causing the average power plant to emit about 3,500 pounds of carbon dioxide and 31 pounds of sulfur dioxide.

The most efficient air conditioners today use 30- to 50-percent less energy to produce the same amount of cooling as air conditioners made in the mid 1970s.

Even if your air conditioner is only 10 years old, you may save 20- to 40-percent of your cooling energy costs by replacing it with a newer, more efficient model.

Source: https://www.energy.gov/energysaver/central-air-conditioning

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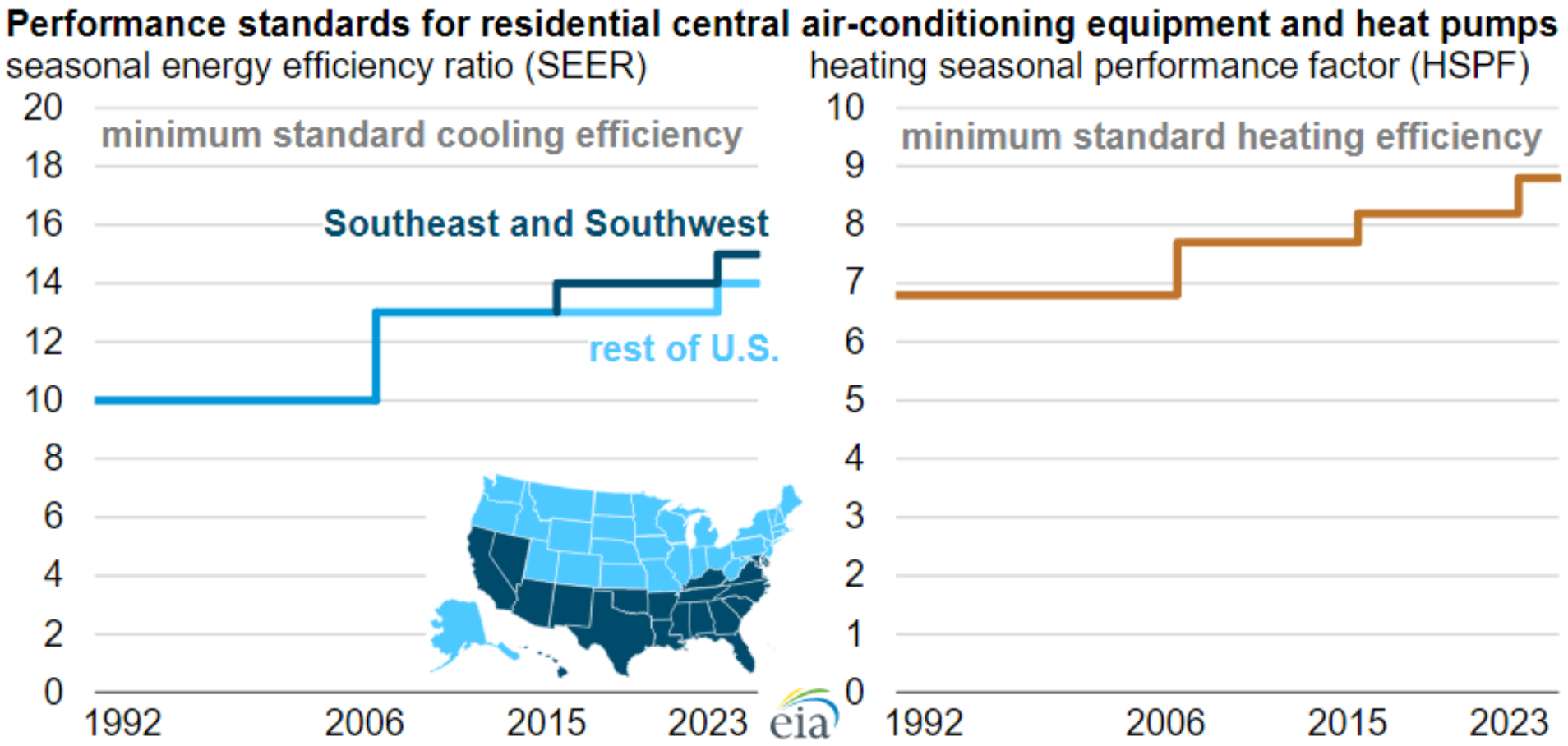
Efficiency Requirements for Residential Central AC and Heat Pumps to Rise in 2023



Source: U.S. Energy Information Administration, https://www.eia.gov/todayinenergy/detail.php?id=40232#

Testing for Energy Efficiency

- Ensures products sold in the U.S. meet energy and water conservation standards
- Equivalent procedures: AHRI Standard 210/240 (210/240-2023) and DOE Appendix M (M1)
  - Download AHRI Standards for free: https://ahrinet.org/search-standards
- Pictured: CAC/HP units awaiting testing at Intertek Lab in Cortland, NY

Energy Efficiency Metrics

- **Energy Efficiency Ratio** (EER) [Btu/Wh]

$$\frac{\text{Cooling Output}}{\text{Total Energy Usage}} = \textbf{EER Rating}$$

- **Seasonal Energy Efficiency Ratio** (SEER) [Btu/Wh]

$$\frac{\text{Cooling Output Over a Typical Cooling Season}}{\text{Energy it Uses over the Season}} = \textbf{SEER Rating}$$

- **Heating Seasonal Performance Factor** (HSPF) [Btu/Wh]

$$\frac{\text{Heating Output Over a Typical Heating Season}}{\text{Energy it Uses over the Season}} = \textbf{HSPF Rating}$$

- **EER2, SEER2 and HSPF2**
  - Represents the equipment efficiency with the new testing and calculation procedures that will take effect in 2023

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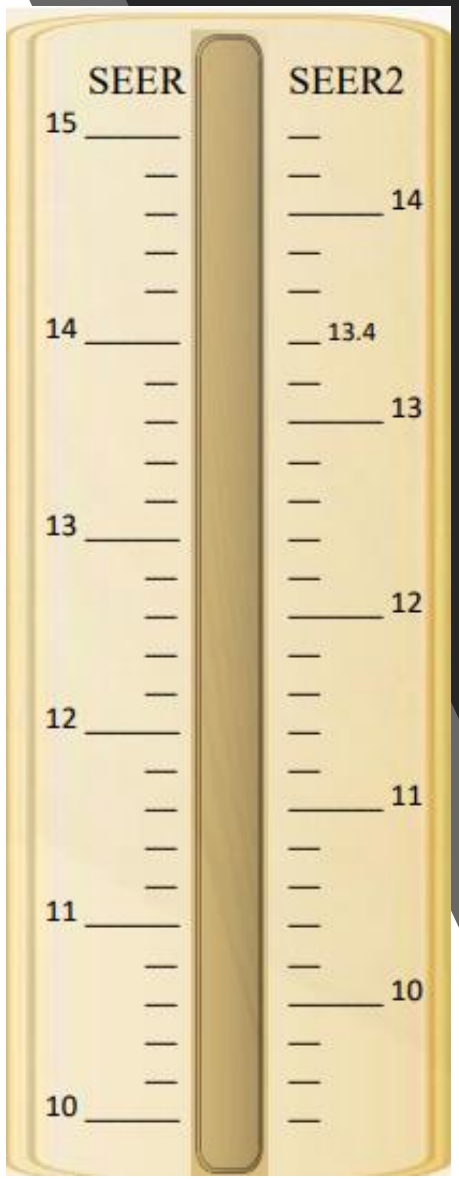


Changes to the Test Procedure

- DOE's Appendix M -> Appendix M1
  - Changes represent improvements that more accurately reflect field conditions
- Key changes:
  - Minimum air handler static pressure
  - Fan power for coil-only units
  - Heating load calculation
  - Heating mode test
  - Variable speed factor for SEER2
  - Off-mode power test
    - Note: Off-mode power test does not affect SEER2/HSPF2 and is regulated separately

Directory of Certified Product Performance

Enter AHRI Certified Reference Number | Search

Search By: AHRI Reference # | Model Number | Product Type

Additional Resources

User Guide and FAQs

AHRI Certification Program

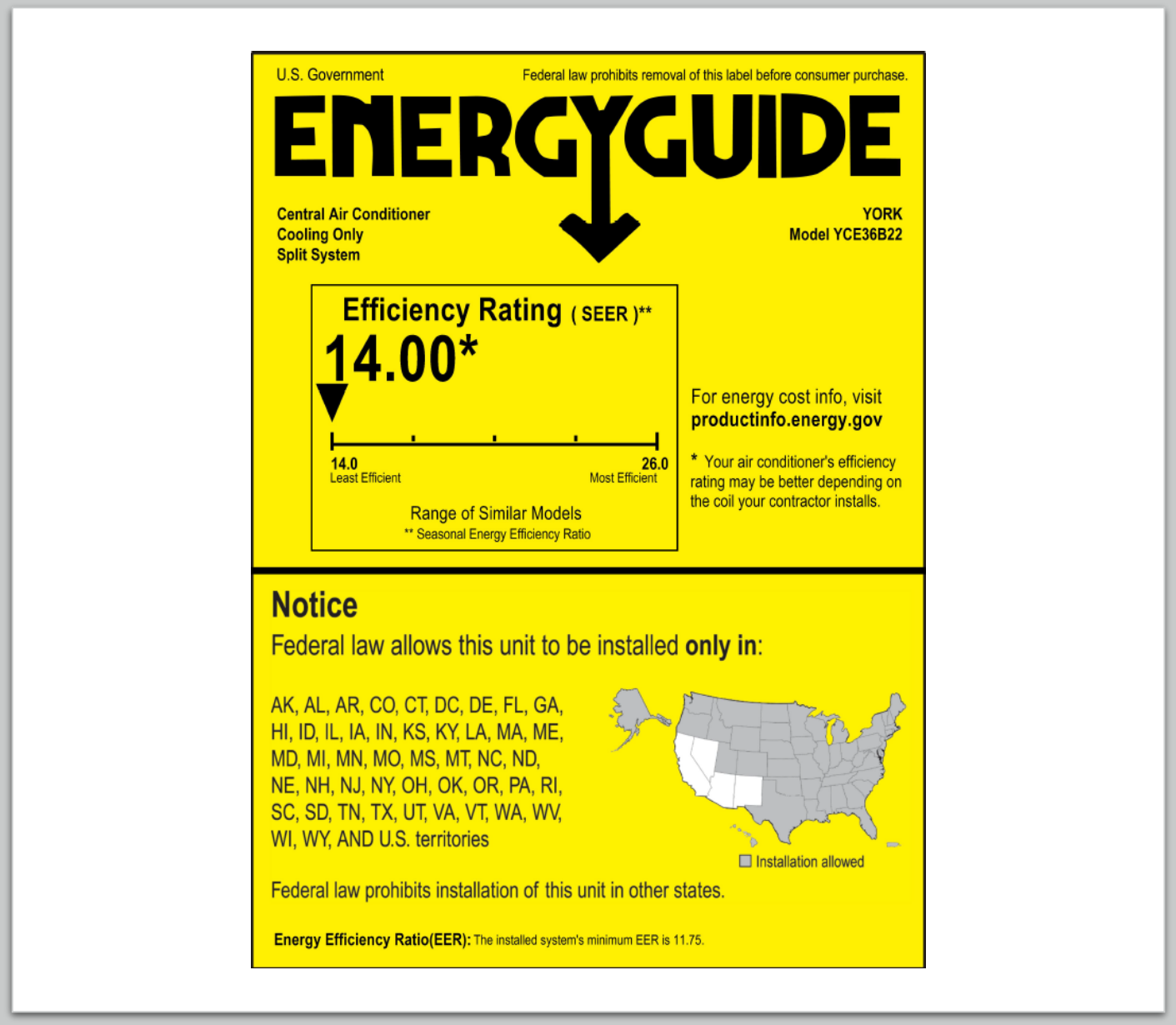
AHRI CERTIFIED® www.ahridirectory.org

Globally Recognized. Industry Respected.

- 7 million+ certified performance ratings for 40 product categories
- Real-time data
- Certificates of product performance

Reading the EnergyGuide Label

- Energy efficiency rating as determined by DOE test procedures
  - SEER, EER, HSPF
- Comparability range displaying the highest and lowest energy costs or efficiency ratings for all similar models
- Estimated annual energy cost
  - www.productinfo.energy.gov



AHRI Directory Certificate

- Visit AHRI Certification Directory website
  - Under Residential, select either Air Conditioner and Air Conditioner Coils or Heat Pumps and Heat Pump Coils
- You can see how the efficiency of the complete system changes with
  - A different furnace,
  - an alternative AC unit, or
  - an upgraded heat pump
- For an AHRI rating to be accurate, it must contain all of the matched equipment and required parts on the AHRI Certificate

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Certificate of Product Ratings

AHRI Certified Reference Number : 207430951 Date : 10-11-2021 Model Status : Active

AHRI Type : RCU-A-C (Split System: Air-Cooled Condensing Unit, Coil Alone)

Series : LX SERIES

Outdoor Unit Brand Name : YORK

Outdoor Unit Model Number (Condenser or Single Package) : YCG18B21

Indoor Unit Model Number (Evaporator and/or Air Handler) : CF18AXA1+TXV

Region : All (AK, AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, HI, ID, IL, IA, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WV, WI, WY, U.S. Territories)

Region Note : Central air conditioners manufactured prior to January 1, 2015 are eligible to be installed in all regions until June 30, 2016. Beginning July 1, 2016 central air conditioners can only be installed in region(s) for which they meet the regional efficiency requirement.

The manufacturer of this YORK product is responsible for the rating of this system combination.

Rated as follows in accordance with the latest edition of AHRI 210/240 with Addendum 1, Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment and subject to rating accuracy by AHRI-sponsored, independent, third party testing:

Cooling Capacity (A2) - Single or High Stage (95F), btuh : 17800

SEER : 15.50

EER (A2) - Single or High Stage (95F) : 12.75

Energy Efficiency Standards

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Minimum Energy Efficiency of AC/HP Increasing in 2023

- Efficiency levels increasing for residential CAC
  - Products under 45,000 Btu/hr will be 14 SEER in the North and 15 SEER in the Southeast and Southwest;
  - Products over 45,000 Btu/hr, will be 14.5 SEER in the Southeast and Southwest, and 14 SEER in the North
- Heat pump efficiency levels increasing to 15 SEER
- Increased minimum efficiency will achieve at least 7 percent savings
  - Changes to the test method and equipment rating will increase savings beyond the nominal change in SEER value
- Savings total about 300 million kWh over 30 years of sales, or about as much power as used by 27 million households in a year
- The cumulative utility bill savings is about $38 billion

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National Standard for Heat Pumps and Specialty ACs

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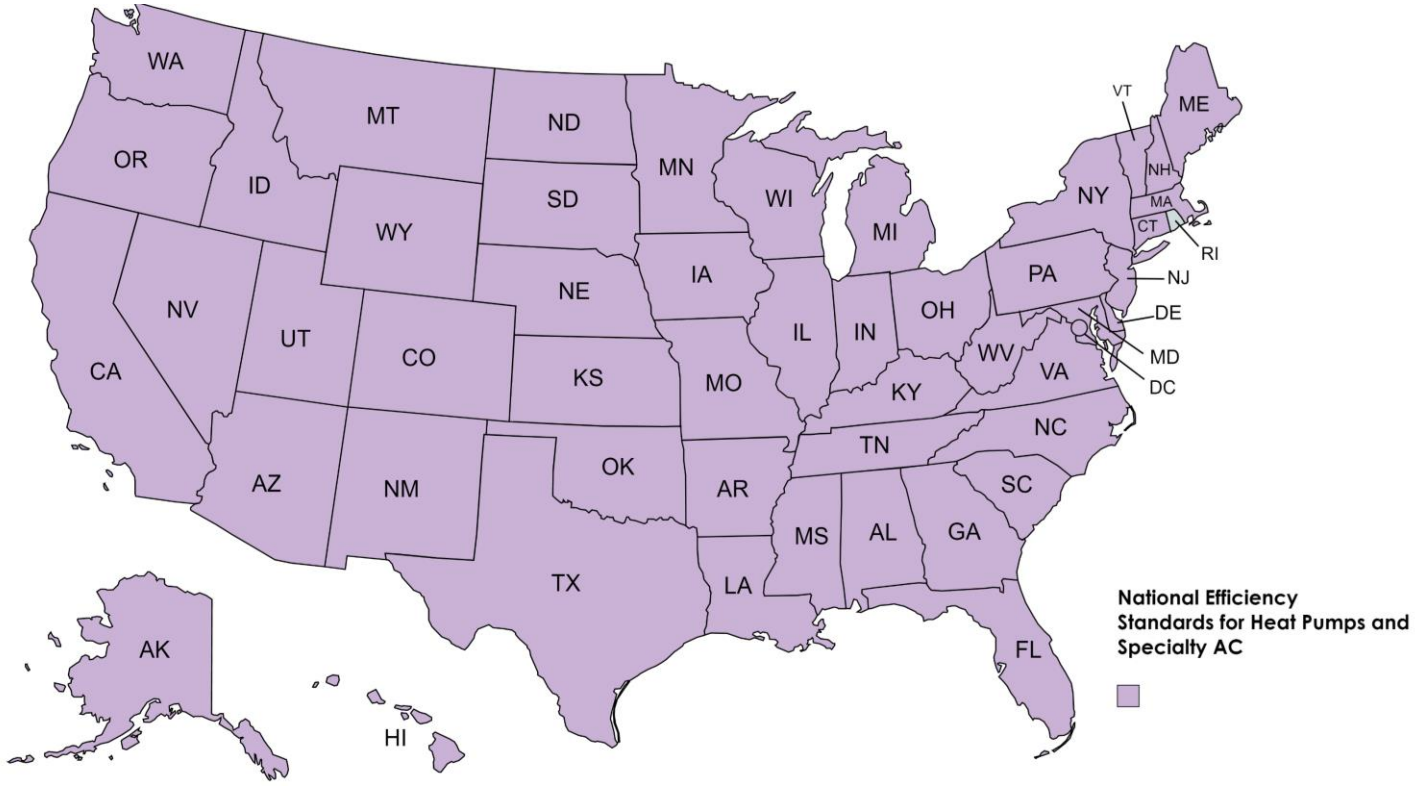
Efficiency Standards for HPs and Specialty AC/HP are National



- National standards are based on date of manufacture
  - Any product that complies with the regulation on the date it was manufactured can continued to be sold and installed anywhere in the U.S.
- Install any appropriately-sized product, applicable for your project, anywhere in the U.S.
- Manufacturers responsible for compliance (make compliant products)
- Specialty AC/HP
  - Space-constrained AC/HP
  - Small duct, high-velocity systems

Residential Heat Pumps and Specialty AC/HP Minimum Efficiency – Old versus New Procedures and Efficiency Levels

Applies to Entire United States

SEER / HSPF → SEER2 / HSPF2

Product Class	Current Efficiencies (Old Procedure "M")		2023 Efficiencies (Old Procedure "M")		2023 Efficiencies (New Procedure "M1")	
	SEER	HSPF	SEER	HSPF	SEER2	HSPF2
Split-system HP	14	8.2	15	8.8	14.3	7.5
Single package HP	14	8	14	8	13.4	6.7
Space-constrained AC	12	--	12		11.7	--
Space-constrained HP	12	7.4	12	7.4	11.9	6.3
Small duct high-velocity systems	12	7.2	12	7.2	12	6.1

Regional Standards for Air Conditioners

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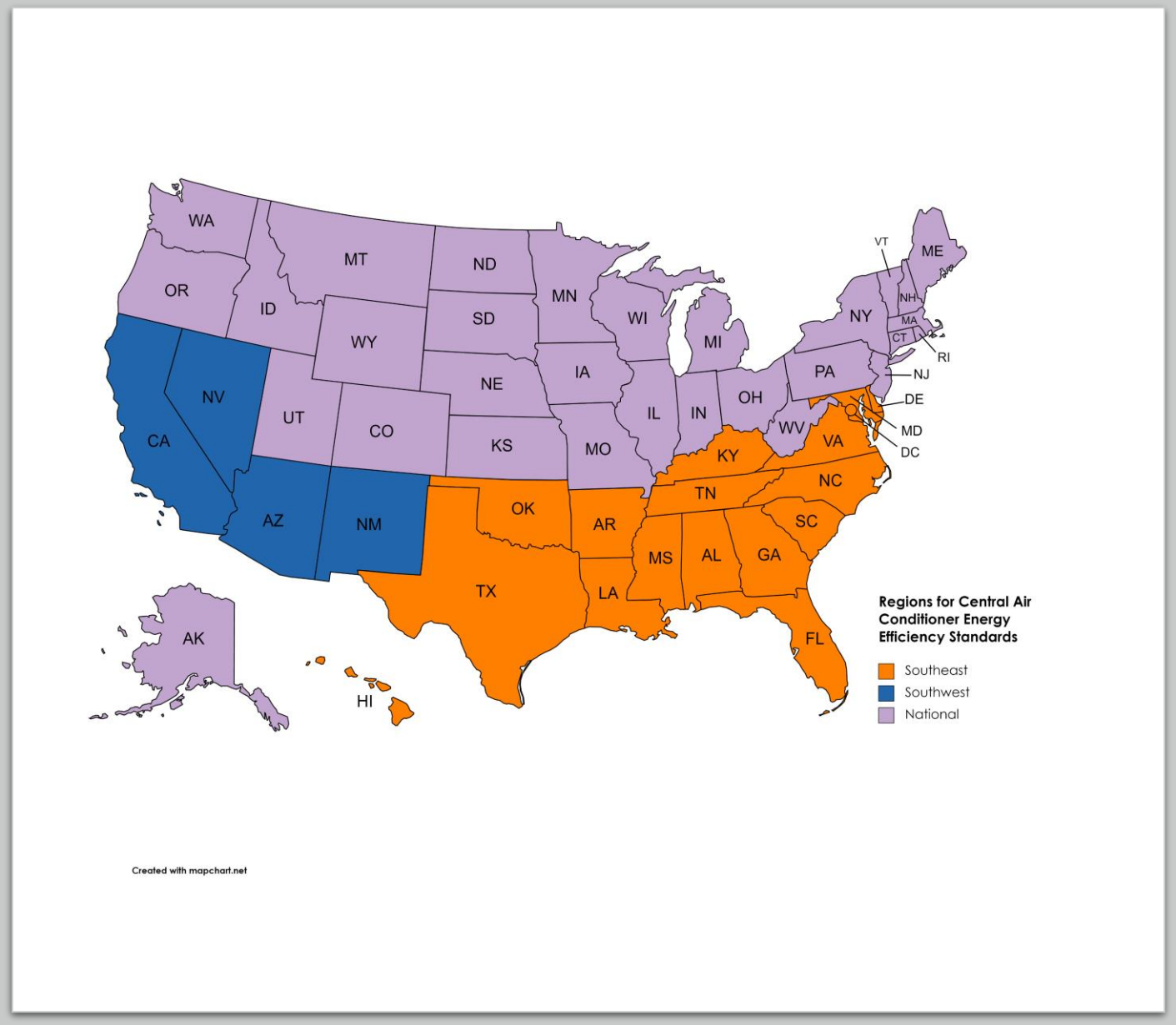
Regional Standards for Central AC

- Energy efficiency standards and installation requirements are different for
  - National (North), and
  - Regions (SE and SW)
- Separation based on three climate regions
  - National (North) and South regions are based on the number of heating degree days (HDD)
  - South regions are further divided based on cooling operating hours and relative humidity



Residential Split-System and Single-Packaged Air Conditioners Minimum Efficiency – Old versus New Procedures and Levels – Regional Standards

SEER / HSPF /EER → **SEER2 / HSPF2 / EER2**

Product Class	Current Efficiencies (Old Procedure "M")				2023 Efficiencies (Old Procedure "M")				2023 Efficiencies (New Procedure "M1")			
	National	SE	SW		National	SE	SW		National	SE	SW	
	SEER	SEER	SEER	EER	SEER	SEER	SEER	EER	SEER2	SEER2	SEER2	EER2
Split AC <45 kBtu/h	13	14	14	12.2	14	15	15	12.2/10.2[a]	13.4	14.3	14.3	11.7/9.8[a]
Split AC ≥45 kBtu/h	13	14	14	11.7	14	14.5	14.5	11.7/10.2[a]	13.4	13.8	13.8	11.2/9.8[a]
Single package AC	14	14	14	11	14	14	14	11	13.4	13.4	13.4	10.6

Note a: The lower EER requirement is for equipment at or above 16.0 SEER using the M test method (or 15.2 SEER2 using the M1 test method).

Regional Equipment Installation Requirements for AC

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Who else should care about installation in SE & SW regions? And why?

- Distributors, dealers, contractors/installers
  - It is a violation to knowingly sell to and/or install for an end user a central air conditioner subject to regional standards with the knowledge that such product will be installed in violation of any regional standard applicable to the product (10 CFR 429.102(c) Violations of regional standards)
- DOE enforces regional standards
  - If in violation, installer should replace the non-compliant ACs at no cost to consumer
  - Manufacturers/distributors unable to do business with routine violators
  - If you believe your air conditioner installer has installed an illegal air conditioner, you may report it to DOE at EnergyEfficiencyEnforcement@doe.gov or 202-287-6997

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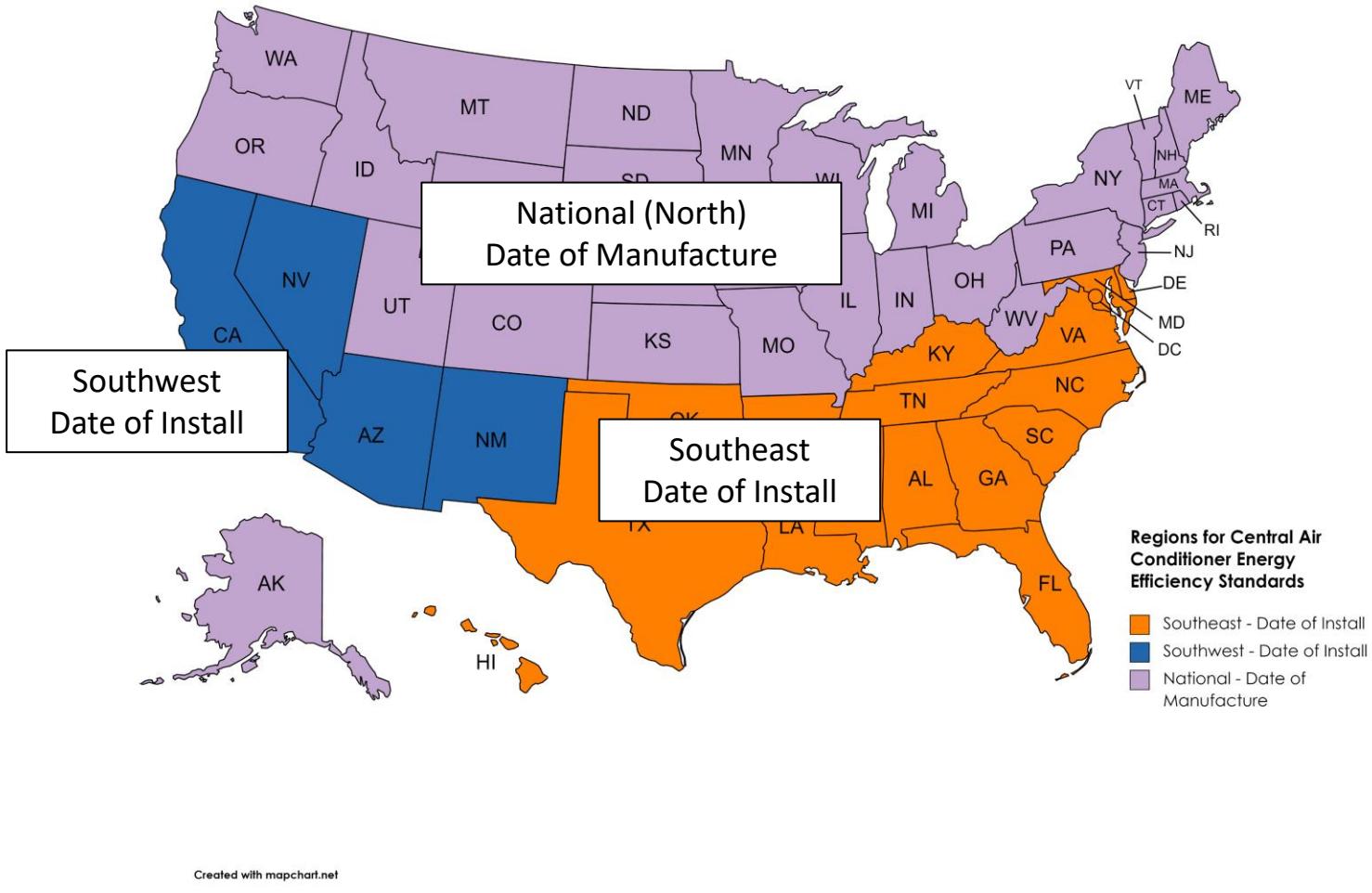
Installation Requirements

- Air conditioners must
  - Comply new efficiency standards, and
  - Test procedures on 1/1/23
- Continued installation of AC manufactured pre-1/1/23
  - National (North)
  - Products that meet the 2023 standards by cross reference



What does “installed” mean in the SE & SW?

- Compliant installations after 1/1/23 – Must meet 2023 Efficiency Standards!
  - AC rated to Appendix M that meet the 2023 standards
  - Products rated to Appendix M1 that meet the 2023 standards
    - (i.e. SEER2 minimum of 13.8 if ≥45,000 Btu/h or 14.3 < 45,000 Btu/h)
- Department of Energy issued guidance on 12/16/21
  - Applies to single stage and two-stage air conditioners
  - Install-through provision 10 CFR 429.102(c)(4)(i) allows existing stock of discontinued Central Air Conditioner basic model combinations to be installed in the SE or SW regions
    - Basic model groups, previously certified, must be compliant with 2023 regional standard minimums at the time of installation.
  - https://www.energy.gov/sites/default/files/2021-12/cac-regional-guidance.pdf

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Does your outdoor unit installation comply in the SE/SW Regions?

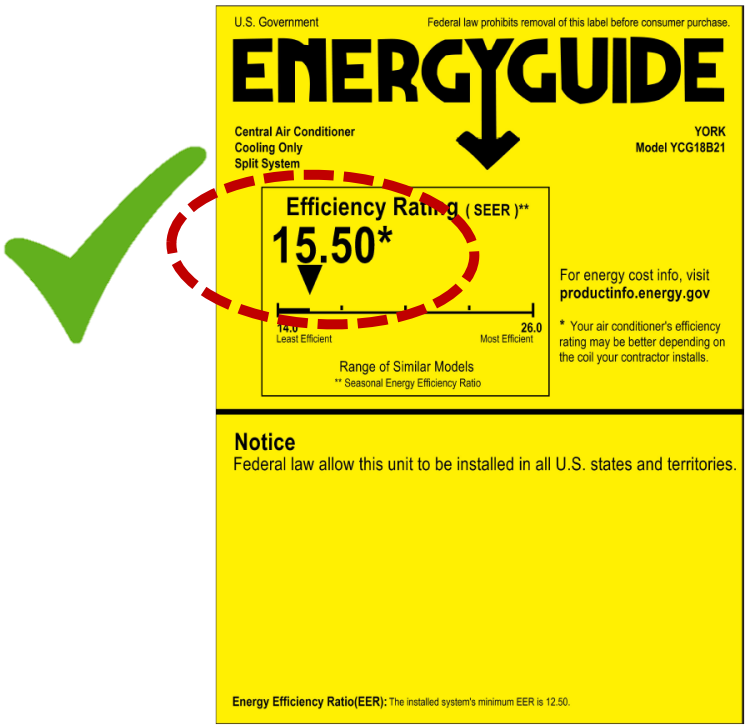
ACs rated with coil-only indoor unit (least efficient match) must meet the 2023 standards (Use FTC Label to check compliance)

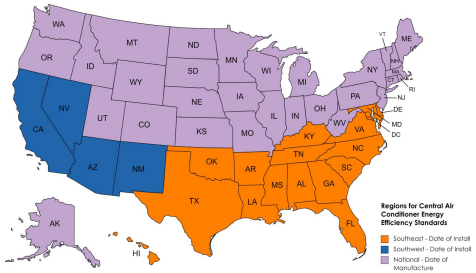
- **SE example**: SEER 15 is the new minimum (< 45,000 Btu/h)
  - EnergyGuide label for the condensing unit must show ≥ 15 SEER

Product Class	2023 Efficiencies (Old Procedure "M")			
	National	SE	SW	
	SEER	SEER	SEER	EER
Split AC <45 kBtu/h	14	15	15	12.2/10.2[a]
Split AC ≥45 kBtu/h	14	14.5	14.5	11.7/10.2[a]
Single package AC	14	14	14	11

Note a: The lower EER requirement is for equipment ≥16.0 SEER using the M test method

FTC ratings requirements are located in [10 CFR 305.20(g)(5)]





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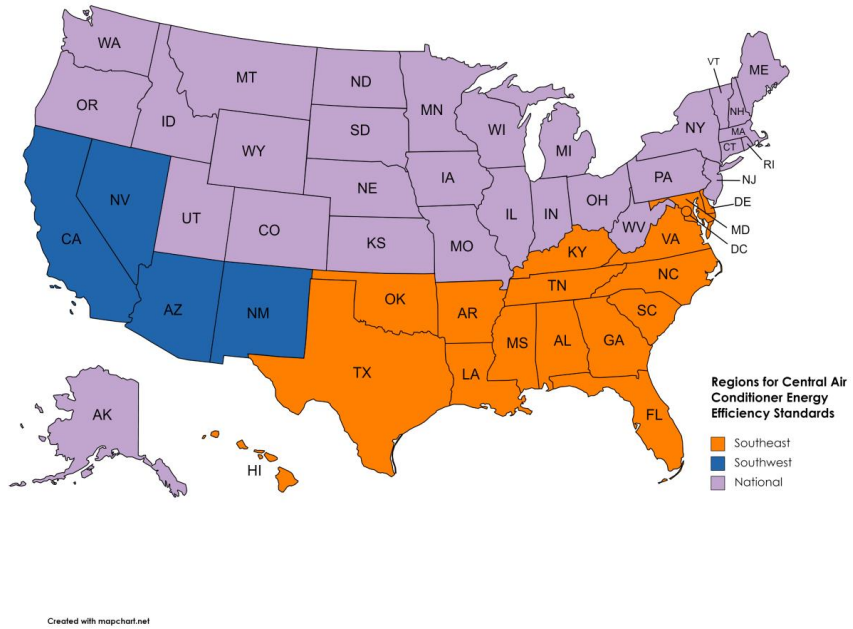
After January 1, 2023

Outdoor units manufactured prior to January 1, 2023, rated using Appendix M (SEER & EER), can be installed in the SE and SW Regions, if its lowest FTC label rating is at or above the new minimum efficiency requirements below.

Product Class	2023 Efficiencies (Old Procedure "M")			2023 Efficiencies (New Procedure "M1")		
	SE	SW		SE	SW	
	SEER	SEER	EER	SEER2	SEER2	EER2
Split AC <45 kBtu/h	15	15	12.2/10.2[a]	14.3	14.3	11.7/9.8[a]
Split AC ≥45 kBtu/h	14.5	14.5	11.7/10.2[a]	13.8	13.8	11.2/9.8[a]
Single package AC	14	14	11	13.4	13.4	10.6

Note a: The lower EER requirement is for equipment at or above 16.0 SEER using the M test method (or 15.2 SEER2 using the M1 test method).



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DOE Guidance: Install-through provision 10 CFR 429.102(c)(4)(i)

All combinations within the basic model must have previously shown compliance with the regional standard applicable at the time of installation

- Including a coil-only combination representative of the least-efficient combination in which the specific outdoor unit is distributed in commerce

Product Class	2023 Efficiencies (Old Procedure "M")			2023 Efficiencies (New Procedure "M1")		
	SE	SW		SE	SW	
	SEER	SEER	EER	SEER2	SEER2	EER2
Split AC <45 kBtu/h	15	15	12.2/10.2[a]	14.3	14.3	11.7/9.8[a]
Split AC ≥45 kBtu/h	14.5	14.5	11.7/10.2[a]	13.8	13.8	11.2/9.8[a]
Single package AC	14	14	11	13.4	13.4	10.6

Note a: The lower EER requirement is for equipment at or above 16.0 SEER using the M test method (or 15.2 SEER2 using the M1 test method).

The FTC label SEER rating is based on the least efficient coil-only combination.

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In summary for CAC….

Can I install an outdoor unit, manufactured before 1/1/23, if the FTC label is less than region allows?

Yes, in the North

No, in SE or SW regions

Must also comply with EER requirements

The FTC label must meet or exceed new regional requirements to allow installation in SE and SW Regions after 1/1/2023

Product Class	2023 Efficiencies (Old Procedure "M")		
	SE	SW	
	SEER	SEER	EER
Split AC <45 kBtu/h	15	15	12.2/10.2[a]
Split AC ≥45 kBtu/h	14.5	14.5	11.7/10.2[a]
Single package AC	14	14	11

Note a: The lower EER requirement is for equipment at or above 16.0 SEER using the M test method (or 15.2 SEER2 using the M1 test method).

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All combinations in the basic model group must meet the regional standard

Can I install a basic model if one of the individual combinations is not compliant in that region after 1/1/23?

Yes, in the North

No, in SE or SW Regions

The SEER rating is based on the least efficient coil-only combination ensuring compliance with this requirement

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AHRI Directory “Model Status” Definitions –

Applies to AHRI Certification Program Participant, Not the Distributor

- Production Stopped
  - Existing products can continue to be sold (but no longer manufactured)
  - Keeps coil-only ratings; allows OD only installation but not mix match ratings (OD unit < 2023 min for the region but match > 2023 min)
  - Product is in the market, certificates available
- Discontinued
  - Discontinued products are no longer sold **by the manufacturer**
  - Manufacturers will identify products that are discontinued
  - Certificates still available for products

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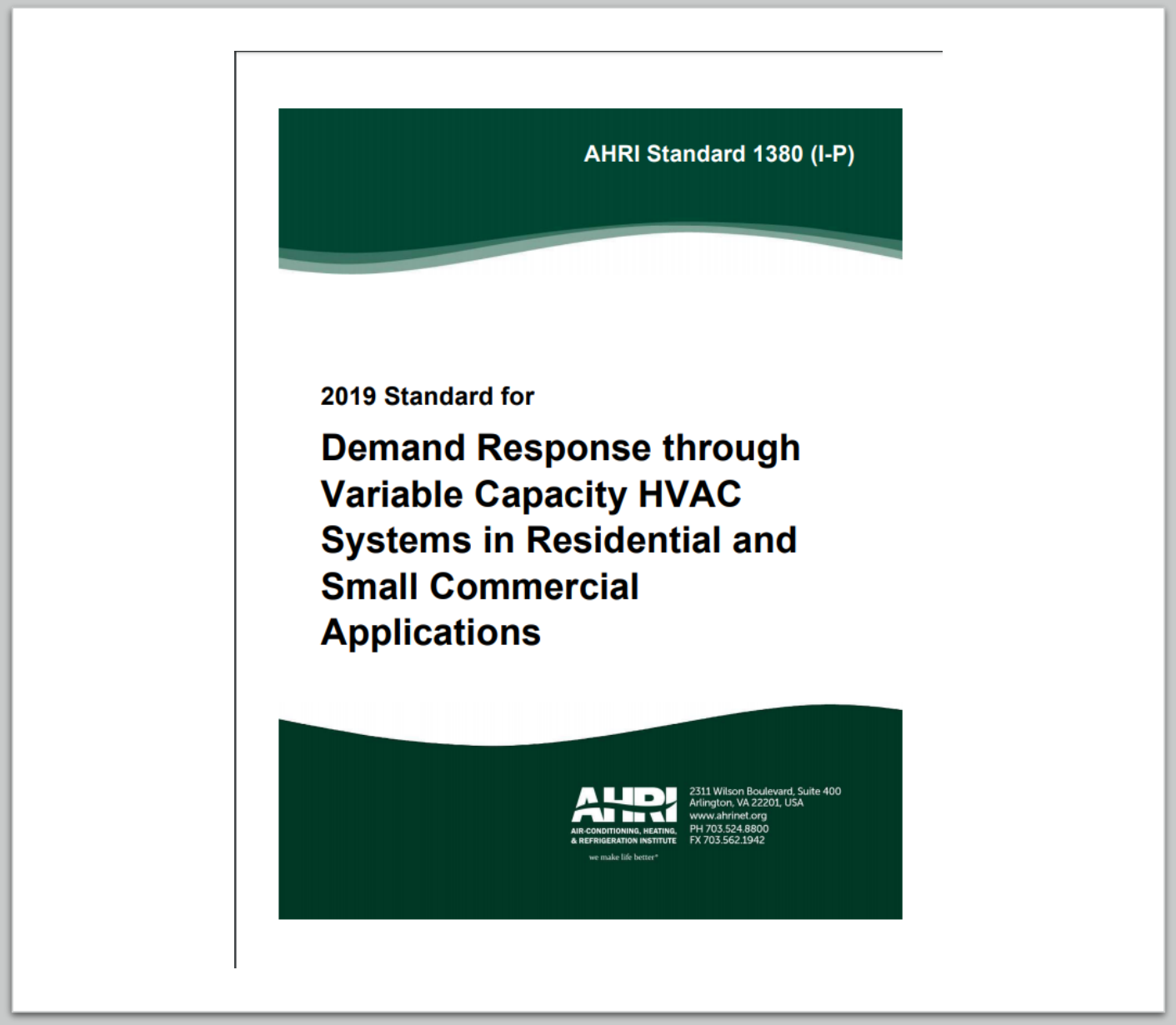
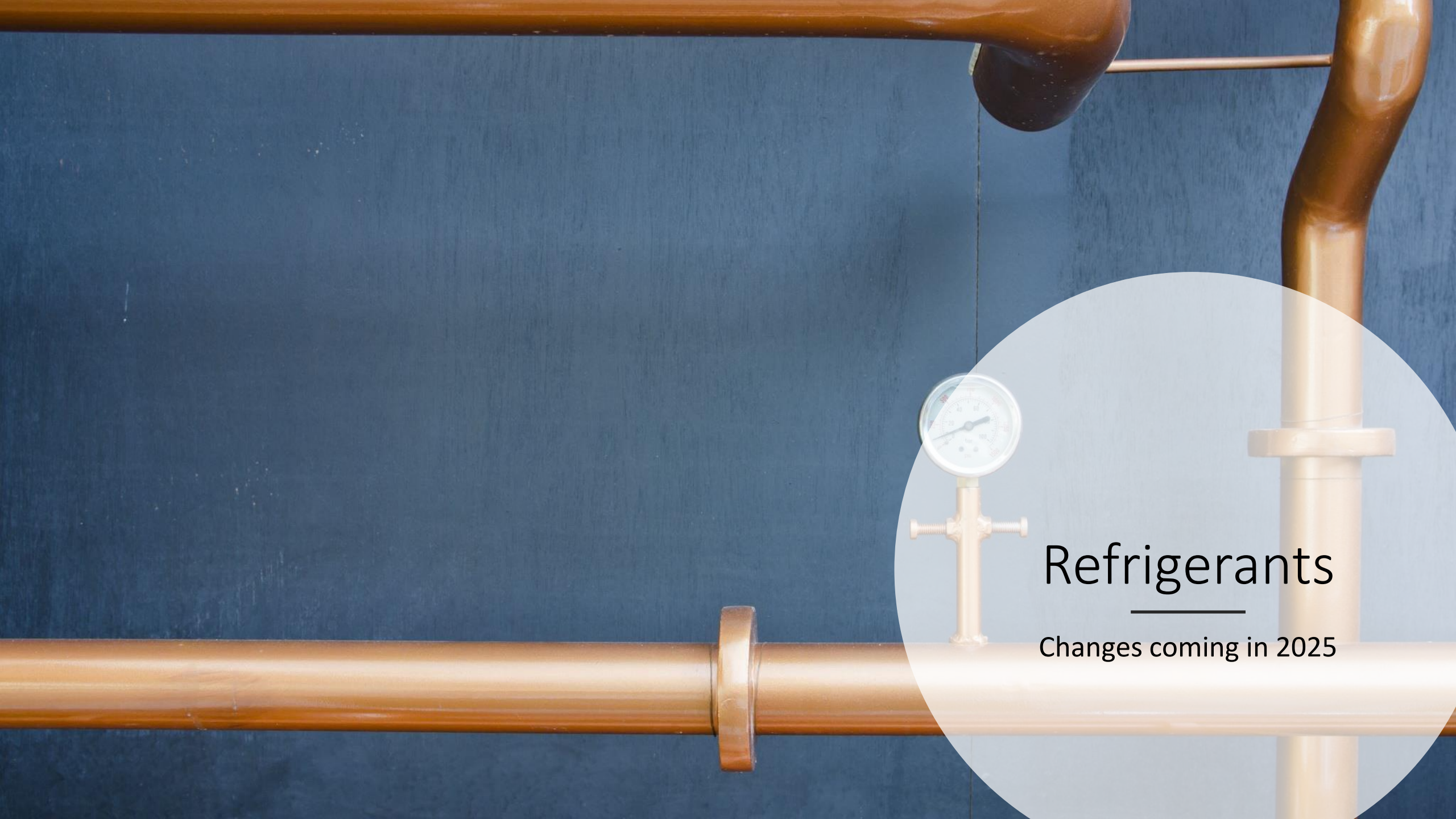
EPA ENERGY STAR®

- Current specification, v5.0 will end 12/31/21
- Specification v6.0 optional starting in 2022, mandatory in 2023
  - Higher efficiencies
  - Cold climate products
  - Controls verification procedure
  - Communicating products
- AHRI is an EPA–recognized certification body (CB)
  - Find ENERGY STAR certified products on AHRI's Directory

Connected Product Certification Program *Coming Soon*

- AHRI Standard 1380 (I-P/2019) published
- Applicable to multi-stage and continuously variable systems
- Communication and responses to information shared though an open interface
- Verification of system's response to specific utility signals



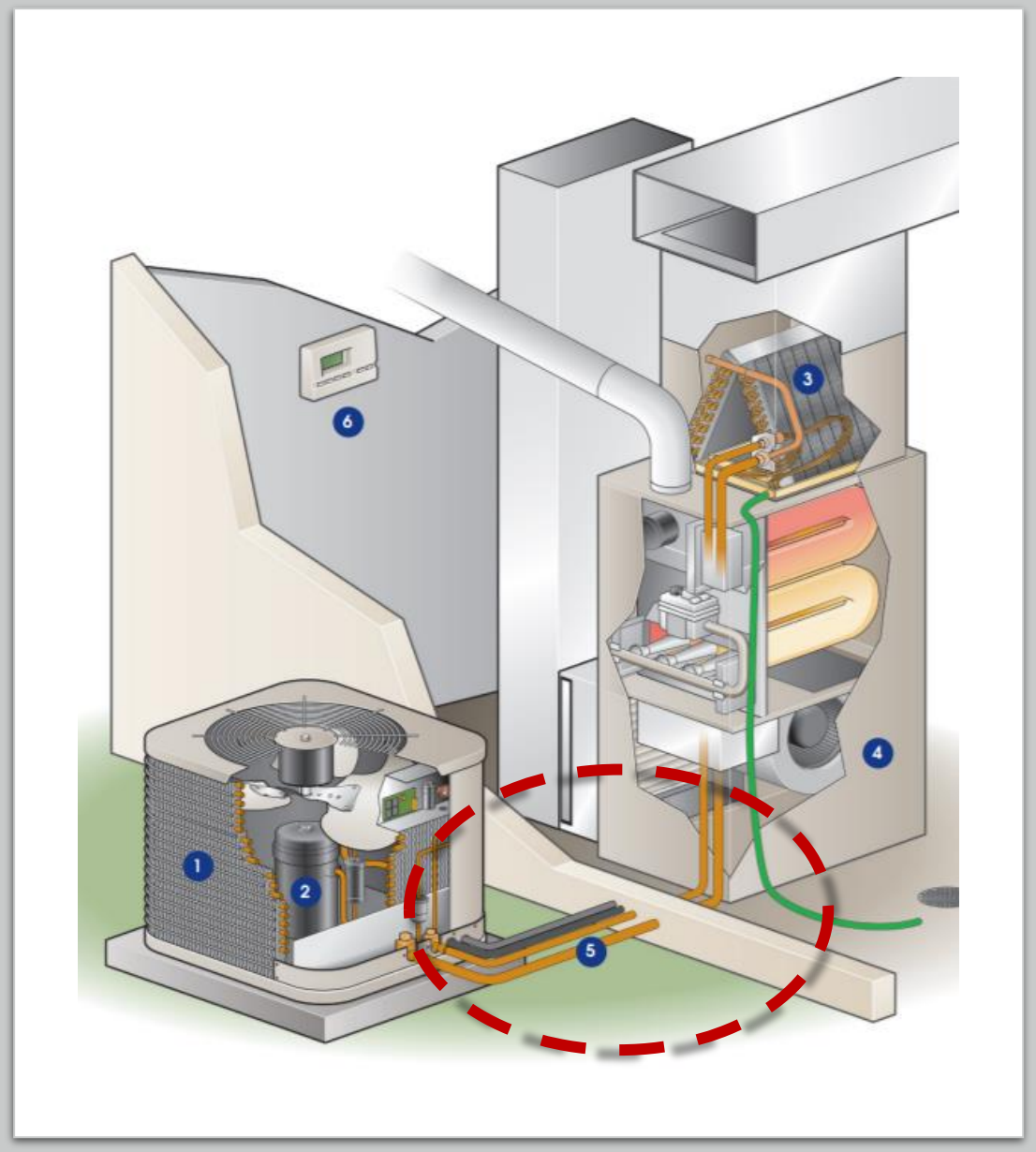


Refrigerants

Changes coming in 2025

Why are refrigerants important?

- Without refrigerants, air conditioning does not work
- Regulated by Environmental Protection Agency (EPA)
- Refrigerant regulations are expected to change in **2025 for residential CAC**
  - PTACs in CA – 2023
  - Residential VRF - 2026
- 250 million tons of CO_2 emission reductions **per year** 2025-2036 from implementation of AIM Act



Refrigerant Transition

- Previous refrigerant transitions addressed ozone depletion potential (ODP), and the next refrigerant transition will address global warming potential (GWP)
- Today's dominant unitary refrigerant, R410A, has a 0 ODP but very high GWP - 2,088
- EPA and state regulations will push GWP limit to <750 in 2025 for CAC/HP

CFC	HCFC	HFC	HFC/HFO
High GWP High ODP	High GWP Low ODP	High GWP Zero ODP	Low GWP Zero ODP

Preparing for Transitions

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Recommendations for Preparing for the Residential CAC/HP Changes

In 2023, DOE minimum efficiency standards change (single-phase products only)

- Detailed information on implementation of new efficiency requirements will be posted soon on AHRI's website

In 2024, a 40% reduction in available supply of HFCs including (R-410a) in preparation for 2025 refrigerant changes

- Consider purchasing reclaimed refrigerants in 2024 and beyond

In 2025, 750 GWP limit becomes effective

- Lower GWP replacement of R-410A/R-407C equipment
- Based on date of manufacture

Good planning is key!

- Know which products to specify for projects, and
- What to do with CAC systems that do not meet regional standards
  - Transfer products to the North or
    - Install prior to 1/1/23 in SE/SW

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Thank you!
Questions?

Please contact us with any Policy questions!

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Regional Installation Examples

Adapted from DOE Final Guidance Issued December 16, 2021

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Example 1: Can I install an outdoor unit manufactured prior to 1/1/23 in the SE or SW regions?

Product Class	2023 Efficiencies (Old Procedure "M")			2023 Efficiencies (New Procedure "M1")		
	SE	SW		SE	SW	
	SEER	SEER	EER	SEER2	SEER2	EER2
Split AC <45 kBtu/h	15	15	12.2/10.2[a]	14.3	14.3	11.7/9.8[a]
Split AC ≥45 kBtu/h	14.5	14.5	11.7/10.2[a]	13.8	13.8	11.2/9.8[a]
Single package AC	14	14	11	13.4	13.4	10.6

Note a: The lower EER requirement is for equipment at or above 16.0 SEER using the M test method (or 15.2 SEER2 using the M1 test method).

For a split AC <45kBtu/h, manufactured before 1/1/23

Yes, if the FTC label old "M" rating is SEER ≥ 15

No, if FTC label old "M" rating is SEER < 15

Must also comply with EER requirements

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Example 2: Can I install an outdoor unit manufactured prior to 1/1/23 in the SE and SW regions?

Product Class	2023 Efficiencies (Old Procedure "M")			2023 Efficiencies (New Procedure "M1")		
	SE	SW		SE	SW	
	SEER	SEER	EER	SEER2	SEER2	EER2
Split AC <45 kBtu/h	15	15	12.2/10.2[a]	14.3	14.3	11.7/9.8[a]
Split AC ≥45 kBtu/h	14.5	14.5	11.7/10.2[a]	13.8	13.8	11.2/9.8[a]
Single package AC	14	14	11	13.4	13.4	10.6

Note a: The lower EER requirement is for equipment at or above 16.0 SEER using the M test method (or 15.2 SEER2 using the M1 test method).

For a split AC ≥ 45kBtu/h, manufactured before 1/1/23

Yes, if the FTC label old "M" rating is SEER ≥ 14.5

Must also comply with EER requirements

No, if the FTC label old "M" rating is SEER < 14.5

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Example 3: Can I install a single package AC unit manufactured prior to 1/1/23 in the SE and SW regions?

Product Class	2023 Efficiencies (Old Procedure "M")			2023 Efficiencies (New Procedure "M1")		
	SE	SW		SE	SW	
	SEER	SEER	EER	SEER2	SEER2	EER2
Split AC <45 kBtu/h	15	15	12.2/10.2[a]	14.3	14.3	11.7/9.8[a]
Split AC ≥45 kBtu/h	14.5	14.5	11.7/10.2[a]	13.8	13.8	11.2/9.8[a]
Single package AC	14	14	11	13.4	13.4	10.6

Note a: The lower EER requirement is for equipment at or above 16.0 SEER using the M test method (or 15.2 SEER2 using the M1 test method).

For a single package AC manufactured before 1/1/23

Yes, all the FTC label old "M" SEER ratings are ≥ 14

Must also comply with EER requirements

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Additional Information

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Two Leading Candidates to Replace R410A: R32 and R454B

Similar performance to R410A

Both R32 and R454B are classified as lower flammability (A2L) refrigerants by ASHRAE

- Not “drop-in” due to different safety classification and performance characteristics
- For split systems: both the **indoor and outdoor unit must be replaced together**
- Additional safety measures placed on the equipment (product standards) and application (building codes)

Some OEMs have publicly announced their chosen refrigerant

Next steps:

- Referenced in the International Mechanical Code (2024)
- 33% of states have codes or legislation allowing use
- Reference in Uniform Mechanical Code
- Complete adoption in other states and municipalities
- Contractor and installer training

Refrigerant	GWP (AR4)	ODP
R-410A	2,088	0
R-22	1,810	0.055
R-466A	733	0
R-32	**675**	**0**
R-454B	**466**	**0**
R-744 (CO_2)	1	0

750 GWP Limit

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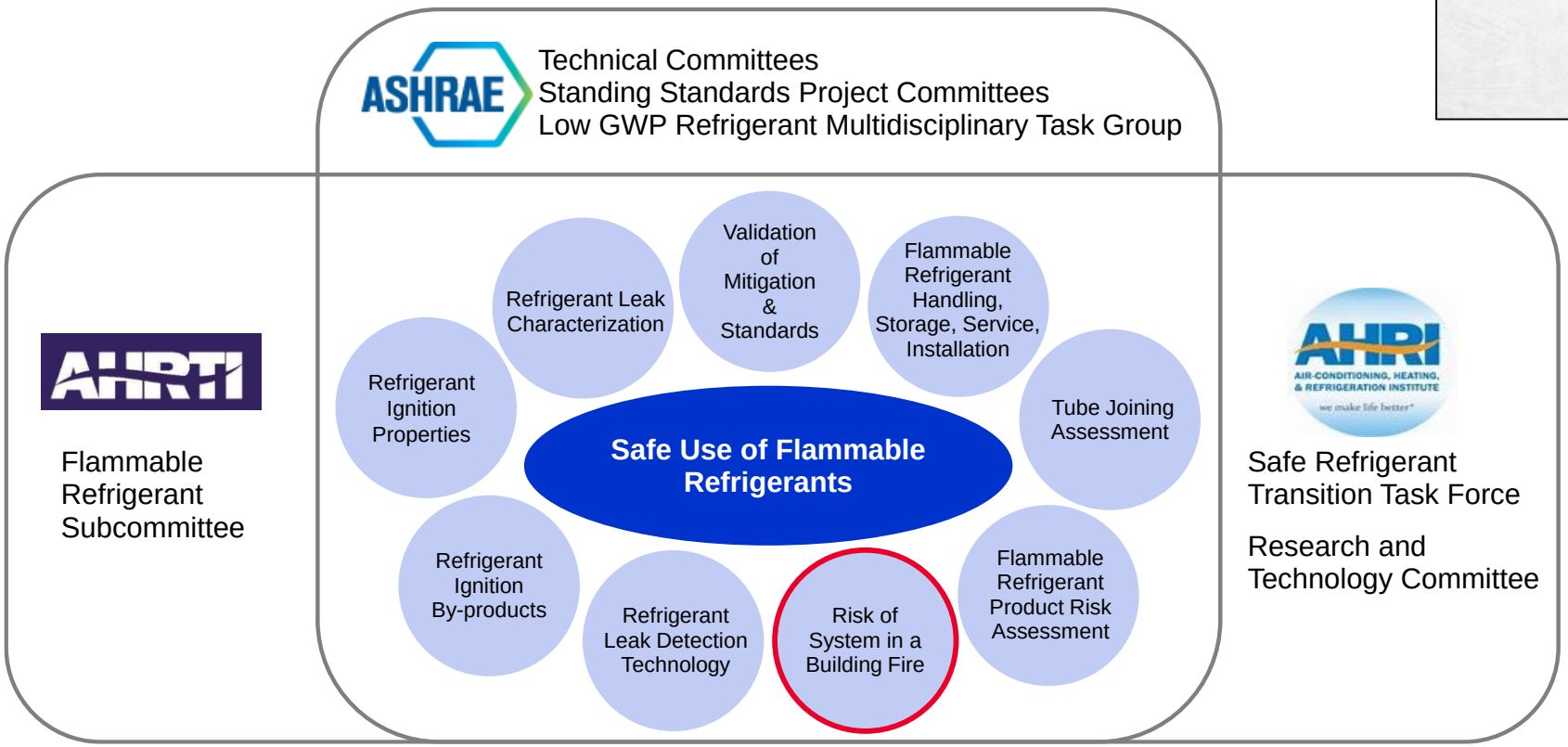
Refrigerants and Firefighter Tactical Considerations

Over $ 7 Million Spent on Research for Flammable Refrigerants

https://training.ulfirefightersafety.org

Designed by firefighters for firefighters



First project of its kind related to fire impinging on refrigerants and equipment to provide practical information for first responders for the purpose of developing training

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- AHRI Safe Refrigerant Transition Task Force webinar series
- HVACR technician training: ACCA, ESCO, and North American Technician Excellence (NATE).
- Safe Refrigerant Transition Task Force Newsletter

Webinar 1: Air Conditioning Applications	Webinar 2: Commercial Refrigeration Applications	Webinar 3: Understanding Refrigerant Sensors
Webinar 4: Predictive Tools for Refrigerant Behaviors	Webinar 5: Refrigerant Ignition in Open Flame/Hot Surfaces: Has Anything Fundamentally Changed?	Webinar 6: A2L Refrigerant Behavior in a Structure Fire
Webinar 7: Refrigerant Detection Systems 101	Webinar 8: Servicing A2L Refrigerant Systems	Webinar 9: A2L Refrigerants and Tactical Considerations for Firefighters
Webinar 10: Codes and Standards "Unlocked"	Webinar 11: Joint Types and A2L Refrigerants	Webinar 12: HVACR Equipment Needed for the Safe Refrigerant Transition

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