

Air Conditioning Repairs: Maintenance Required

Who Am I?



- CAMT
- EPA + R-410A Certified
- HVAC EX Pro. Certified
- 11 Years On Site
- 11+ Years training

Paul Rhodes

National Maintenance and Safety Instructor
NAAEI

Concerned Technician

Audience Question:

Audience Question:

What is your AC responsibility at your community?

- A. I answer resident questions about AC
- B. I perform basic repairs (filter, open vents)
- C. I repair/replace units (major repairs)
- D. I hire contractors to repair/replace systems

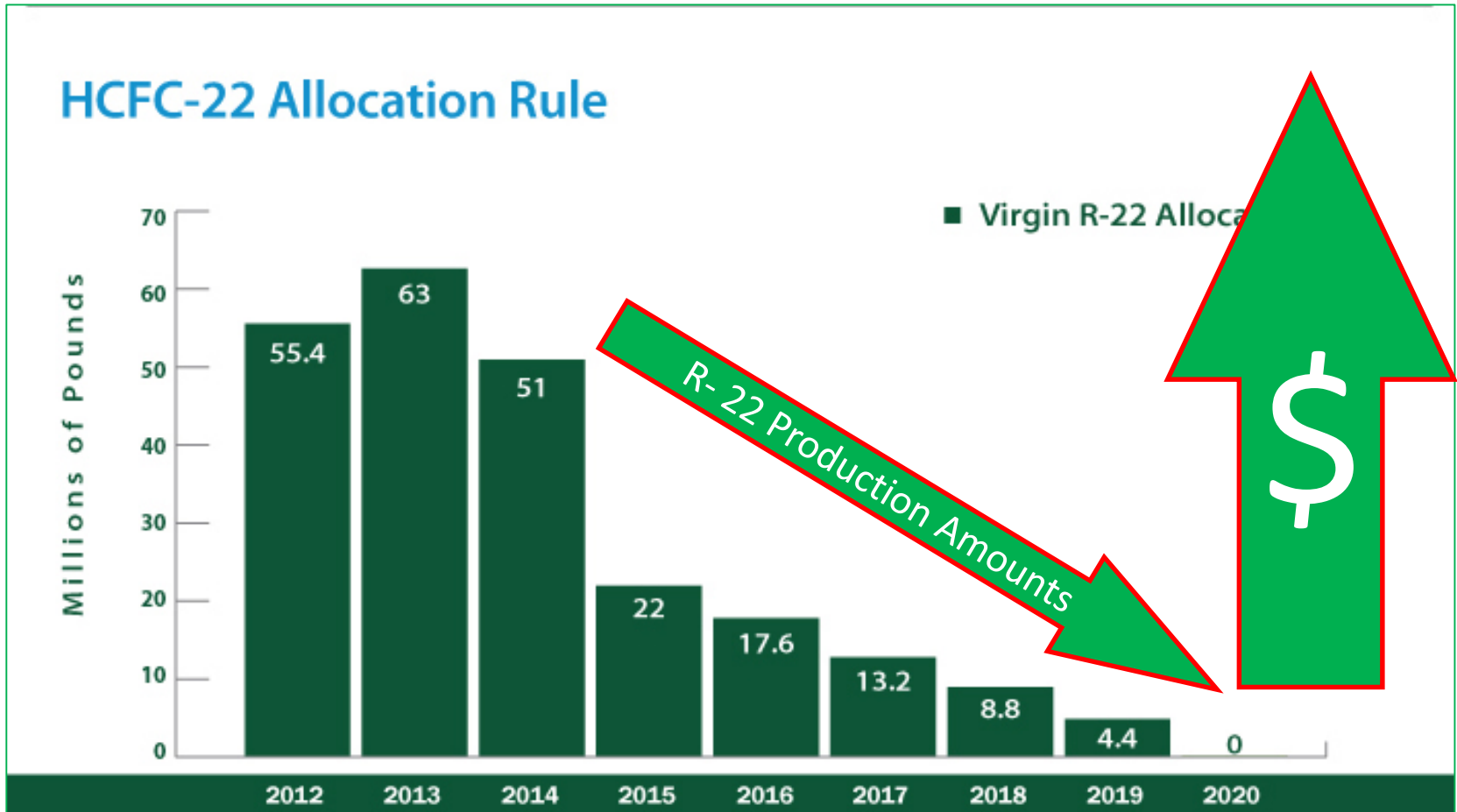
The Situation:

- Montreal Protocol (Ozone Protection)
 - CFC's stop production (~1995)
 - HCFC's stated as transitional
 - Production ends 2020
 - Repair with Reclaimed refrigerant till 2030
 - HFC's deemed as replacement
 - Retrofit refrigerants used for R-22 Equipment
 - R-410A requires new equipment



NOW

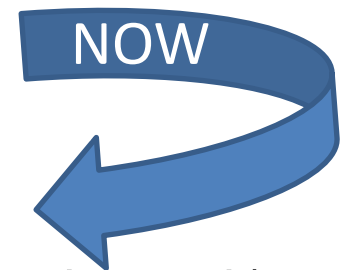
Available R-22



Source: PhaseOutFacts.org (AHRI)

The Situation:

- Montreal Protocol (Ozone Protection)
 - CFC's stop production (~1995)
 - HCFC's stated as transitional
 - Production ends 2020
 - Repair with Reclaimed refrigerant till 2030
 - HFC's deemed as replacement
 - Retrofit refrigerants used for R-22 Equipment
 - R-410A requires new equipment
- Department Of Energy
 - Requires energy conservation
 - 13 SEER minimum nationwide (2007)
 - Regional standards implemented (14 SEER across the south)



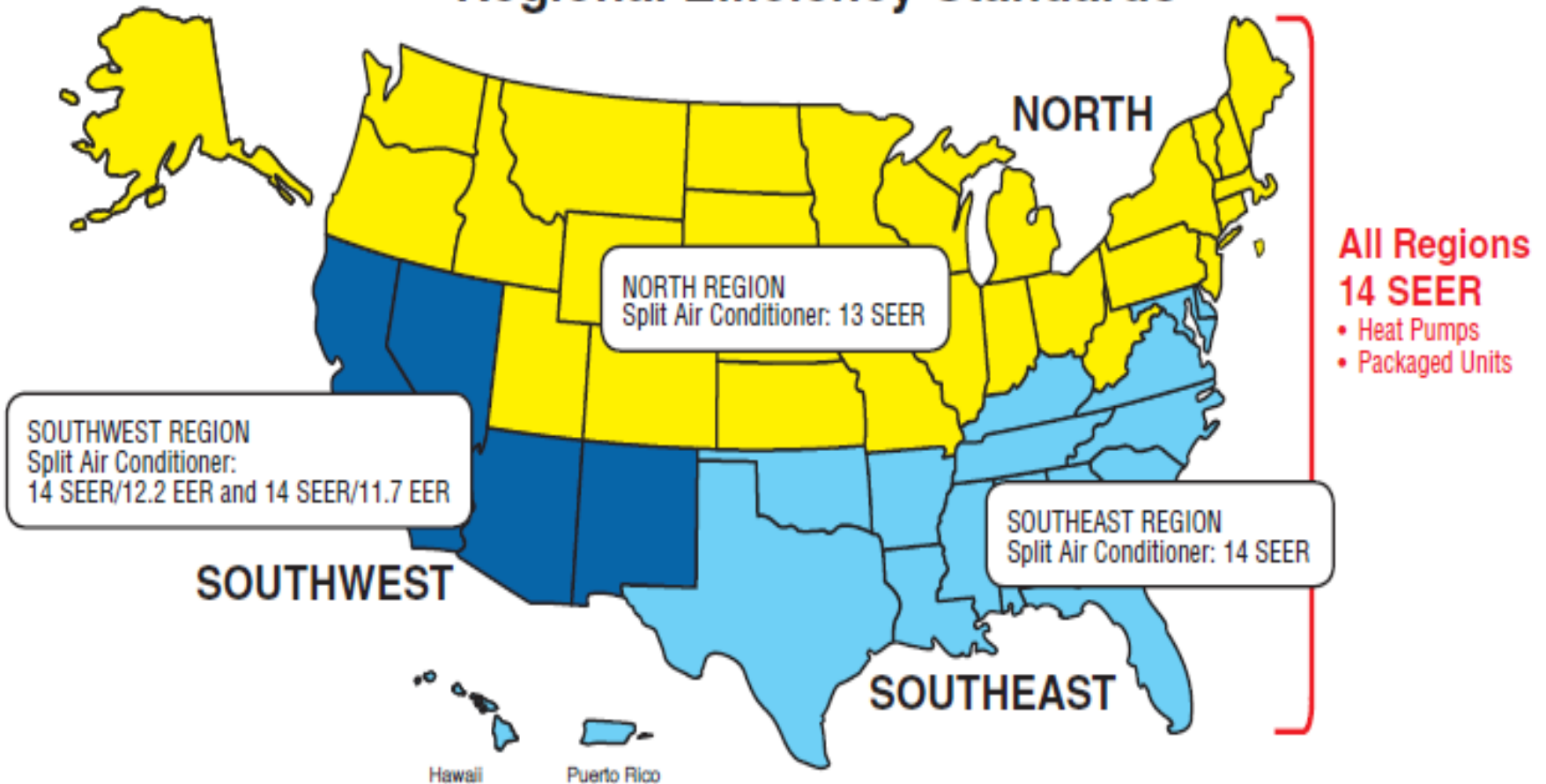
DOE Final Rule

- August 15, 2016
- “A person cannot install a replacement condensing unit unless it is certified as part of a combination that meets the applicable standard; and
- A person cannot install a condensing unit that has a certified combination with a rating that is less than the applicable standard.”

10 CFR Parts 429 and 430 Energy Conservation Program:
Enforcement of Regional Standards for Central Air Conditioners: Section I-2,3

DOE Regions:

Regional Efficiency Standards



Summary of Situation:

Due to these regulatory restrictions, there are no more R-22 condensing units available and all system installs must meet or exceed Regional SEER Requirements.

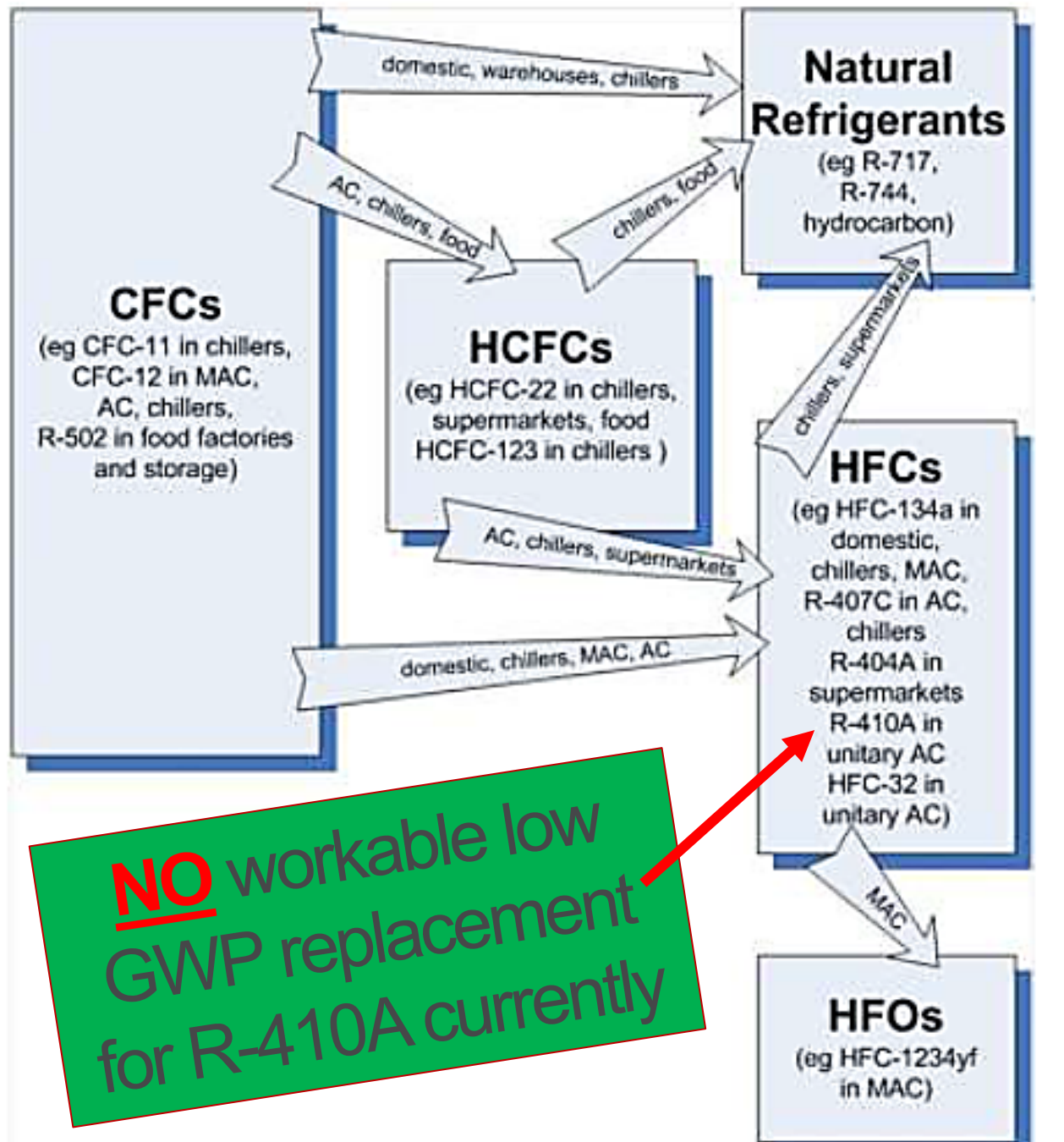
Under Proposal: EPA

(Not Official Yet^{***})

- EPA currently revising 608
 - Re-test or Re-certification not required
 - Decrease recordkeeping threshold
 - Add focus on Global Warming (Climate Change) Potential
 - GWP or CCP new evaluation method for refrigerants
 - Potential acceleration of HCFC scarcity
 - Phase out HFC's due to Hydrocarbon limits
 - More info at www.epa.gov

R-410A is a high
CCP refrigerant





NO workable low GWP replacement for R-410A currently

Refrigerant Comparison

MARKET DESCRIPTION*	FREON 22	M099	ΔR22	NU22B	ΔR22	SUVA 407C	ΔR22	Suva 410A	ΔR22
ASHRAE NUMBER	R-22	R-438A		R-422B		R-407C		R-410A	
Manufacturer	DuPont	DuPont		Icor		DuPont		DuPont	
Cooling Capacity (BTU/min) [bigger is better]	396	364	-8%	347	-12%	393	-1%	568	43%
Compressor Discharge Temperature (F) [lower believed to be better]	194	161	-17%	153	-21%	176	-9%	189	-3%
Lubricant	Mineral Oil	Mineral Oil		Mineral Oil		POE		POE	
GWP (AR4) [carbon footprint]	1810	2264	25%	2526	40%	1774	-2%	2088	15%
Comments	Baseline	* 8% loss to cooling capacity;		* 12% loss to cooling capacity;		* Requires POE;		* 43% more cooling capacity; * Requires POE;	

* ARI 540 Test Conditions, 65F return gas, superheat included in capacity, 45 F Avg. Evaporator, 115 Avg. Condenser, Subcooled liquid to 100F

Same Safety Rating...

R-22

WARNING!
LIQUID AND GAS UNDER PRESSURE. VAPOR REDUCES OXYGEN AVAILABLE FOR BREATHING, CAN CAUSE RAPID SUFFOCATION. INHALATION OR MISUSE OF PRODUCT CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH. MAY DECOMPOSE IN CONTACT WITH HOT METAL SURFACES TO RELEASE TOXIC, CORROSIVE DECOMPOSITION PRODUCTS. CONTACT OF LIQUID WITH SKIN OR EYES MAY CAUSE IRRITATION AND FROSTBITE. OVERHEATING, PRESSURIZING, OR RUSTING CAN CAUSE CYLINDER TO BURST, RESULTING IN SERIOUS PERSONAL INJURY OR DEATH.

- Do not inhale vapors.
- Store and use with adequate ventilation, never in a closed space.
- Avoid contact with skin, eyes or clothing.
- Do not store in direct sunlight or heat above 125°F (51.7°C).
- Do not store in damp areas.
- Do not drop or subject this cylinder to rough handling.
- Do not tamper with pressure relief device or valve.

FIRST AID
If inhaled, remove to fresh air. If breathing is difficult, call a physician. Do not give artificial respiration. In case of contact, flush with lukewarm water for at least 15 minutes. Do not rub. Remove clothing if it sticks to skin slowly.

Do not attempt to repair or use with non-releasable valve.
Empty cylinder may present hazard.
Disposal:
• For additional safety information visit Safety Data Sheet.
• To request a Safety Data Sheet information, call 1-800-392-4282.

R-410A

WARNING!
LIQUID AND GAS UNDER PRESSURE. VAPOR REDUCES OXYGEN AVAILABLE FOR BREATHING, CAN CAUSE RAPID SUFFOCATION. INHALATION OR MISUSE OF PRODUCT CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH. MAY DECOMPOSE IN CONTACT WITH HOT METAL SURFACES TO RELEASE TOXIC, CORROSIVE DECOMPOSITION PRODUCTS. CONTACT OF LIQUID WITH SKIN OR EYES MAY CAUSE IRRITATION AND FROSTBITE. OVERHEATING, PRESSURIZING, OR RUSTING CAN CAUSE CYLINDER TO BURST, RESULTING IN SERIOUS PERSONAL INJURY OR DEATH.

- Do not inhale vapors.
- Store and use with adequate ventilation, never in a closed space.
- Avoid contact with skin, eyes or clothing.
- Do not store in direct sunlight or heat above 125°F (51.7°C).
- Do not store in damp areas.
- Do not drop or subject this cylinder to rough handling.
- Do not tamper with pressure relief device or valve.

FIRST AID
If inhaled, remove to fresh air. If breathing is difficult, call a physician. Do not give artificial respiration. In case of contact, flush with lukewarm water for at least 15 minutes. Do not rub. Remove clothing if it sticks to skin slowly.

Do not attempt to repair or use with non-releasable valve.
Empty cylinder may present hazard.
Disposal:
• For additional safety information visit Safety Data Sheet.
• To request a Safety Data Sheet information, call 1-800-392-4282.

SAME

“Do not store in direct sunlight or heat above 125° F”

So What?

If a technician is working with R-22 correctly, they should have no problem using any other refrigerant on a typical residential system.

This means on residential systems, regardless of refrigerant, correct service procedures are very familiar.

Audience Question:

What is the **ONLY** procedural difference between using a blended refrigerant (R-438 or R-410A) instead of R-22?

- A. Charge by Superheat or Subcool
- B. Remove from the tank as a liquid
- C. Separate vacuum pump is required
- D. PPE is not required

ANSWER:

A blended refrigerant **must** leave the tank as a liquid.



Note: Using a charging adapter will make it easier for the refrigerant to vaporize before reaching compressor.

3 Options ***

1. Keep R-22 equipment OEM

–Service Correctly



2. Use retrofit in R-22 equipment

–Maintain Appropriately



3. Replace equipment to R-410A

–Install and Maintain Properly



*** NAA, NAAEI or CAMT do not endorse one option over another

Audience Question:

Which of the following is the **MOST** common cause of Air Conditioning service requests?

- A. Air flow issues
- B. Improper refrigerant level
- C. Non-Certified technician
- D. Mercury filled thermostat

Most Common AC Problem:

Air Flow



It's All About Air Flow

- Clear away debris (landscaping, bushes, trash)
- Hose it clean (for severe cases, use coil cleaner)



Air Flow!

Evaporator Coil (Inside)



Condenser (Outside)



AIR FLOW!!!

- Air needs to circulate, even when doors are closed
- Vents must be open
- Windows closed



EPA and DOE not involved:

- Change the filter
- Verify/establish airflow
- Observe operation
- Open vent registers
- Open room doors
- Check electrical components
- Communicate with resident



BEFORE CHECKING REFRIGERANT!

How were you “learned”?

For me:

Blue Hose, Green Jug and a
Fat Pipe....

Beer cold



Superheat or Subcool

NOT

“Beer Can Cold”
Temp plus 30
Charge to 70psi

SYSTEM SUPERHEAT					
Ambient Condenser Inlet Temperature (°F Drybulb)	Return Air Temperature (°F Drybulb)				
	65	70	75	80	85
100				5	5
95			5	5	5
90			7	12	18
85		5	10	17	20
80		5	12	21	26
75	5	10	17	25	29
70	5	14	20	28	32
65	13	19	26	32	35
60	17	25	30	33	37

Source: ESCO Press System Performance (used with permission).

Audience question:

Which of the following will have the greatest effect in shortening a refrigerant system's lifespan?

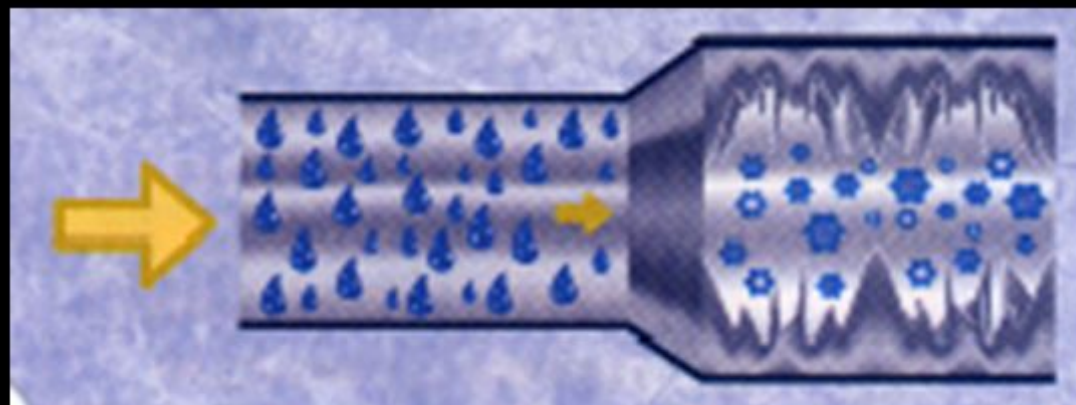
- A. Charging through the liquid access valve
- B. Using analog gauges instead of digital
- C. Dirty blower motor squirrel cage
- D. Moisture in the system

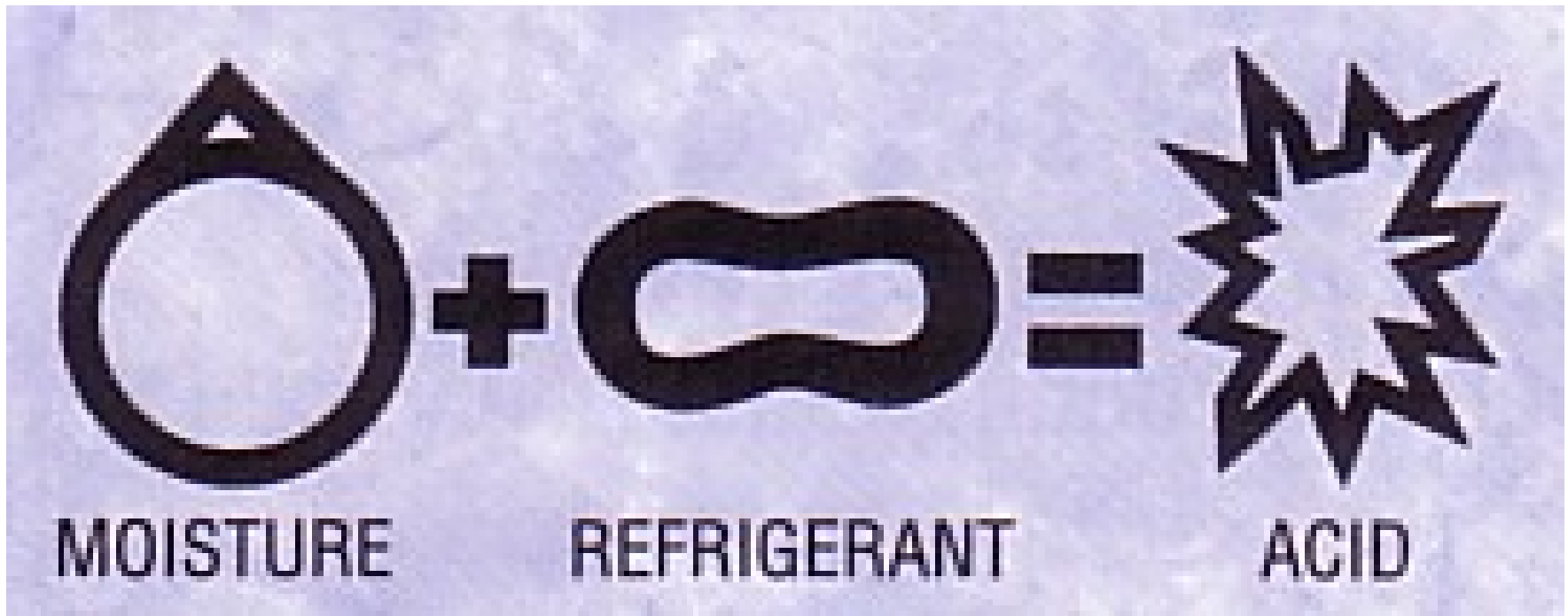
Most Detrimental to
System:

Moisture

Here is what it does to a system:

- First, it creates "freeze-ups."
- Moisture will be picked up by the refrigerant and be transported through the refrigerant lines in a fine mist which forms ice crystals at the point of expansion (piston, or TXV).





Moisture Removal

- Vacuum system before any refrigerant is added
 - At installation
 - After major repair
- Deep vacuum turns liquid to vapor for removal
- **NEEDS?**



Needs:

- Fresh oil in the vacuum pump:
 - Carrier: “Replace oil every 10 hours of service”
 - Common practice: “Replace oil after every use”
 - Appion: “Replace early and often”

**AS OIL IS USED, IT IS
LESS EFFECTIVE.**

Refrigerant Oil

Before



During/After



Needs:

- Fresh oil in the vacuum pump:
 - Carrier: “Replace oil every 10 hours of service”
 - Common practice: “Replace oil after every use”
 - Appion: “Replace early and often”

**AS OIL IS USED, IT IS
LESS EFFECTIVE.**

Use Micron gauge to determine when replacement is needed (<50microns = good oil)

Needs:

- Micron Gauge:
 - Manifold gauges are just NOT accurate enough.

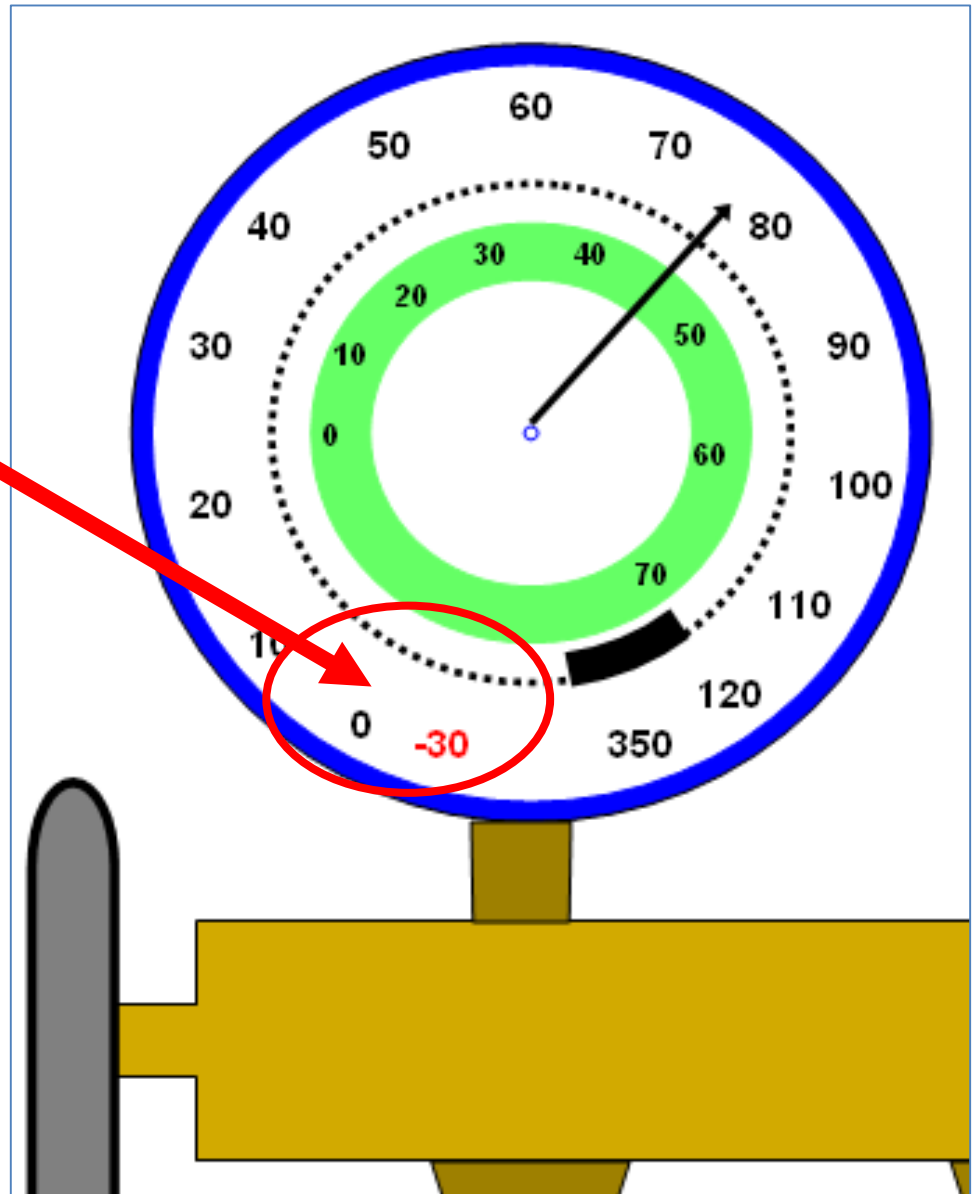


Boiling Point of Water

Microns – absolute pressure (.001 millimeters of mercury)	Vacuum (inches of mercury below ATM)	Boiling point of water in degrees Fahrenheit)
760000	0	212
500000	10.24	192
200000	22.05	152
100000	25.98	125
50000	27.95	101
30000	28.74	84
20000	29.13	72
15000	29.33	63
10000	29.53	52
8000	29.69	39
4000	29.76	29
2000	29.84	15
1000	29.88	1
500	29.90	-12
300	29.91	-21
200	29.91	-28
150	29.92	-33
100	29.92	-40
50	29.92	-50
0	29.921	-90

(25,000 microns = 1" Hg)

Is 29 inches
of mercury
even
displayed
on the
gauge???

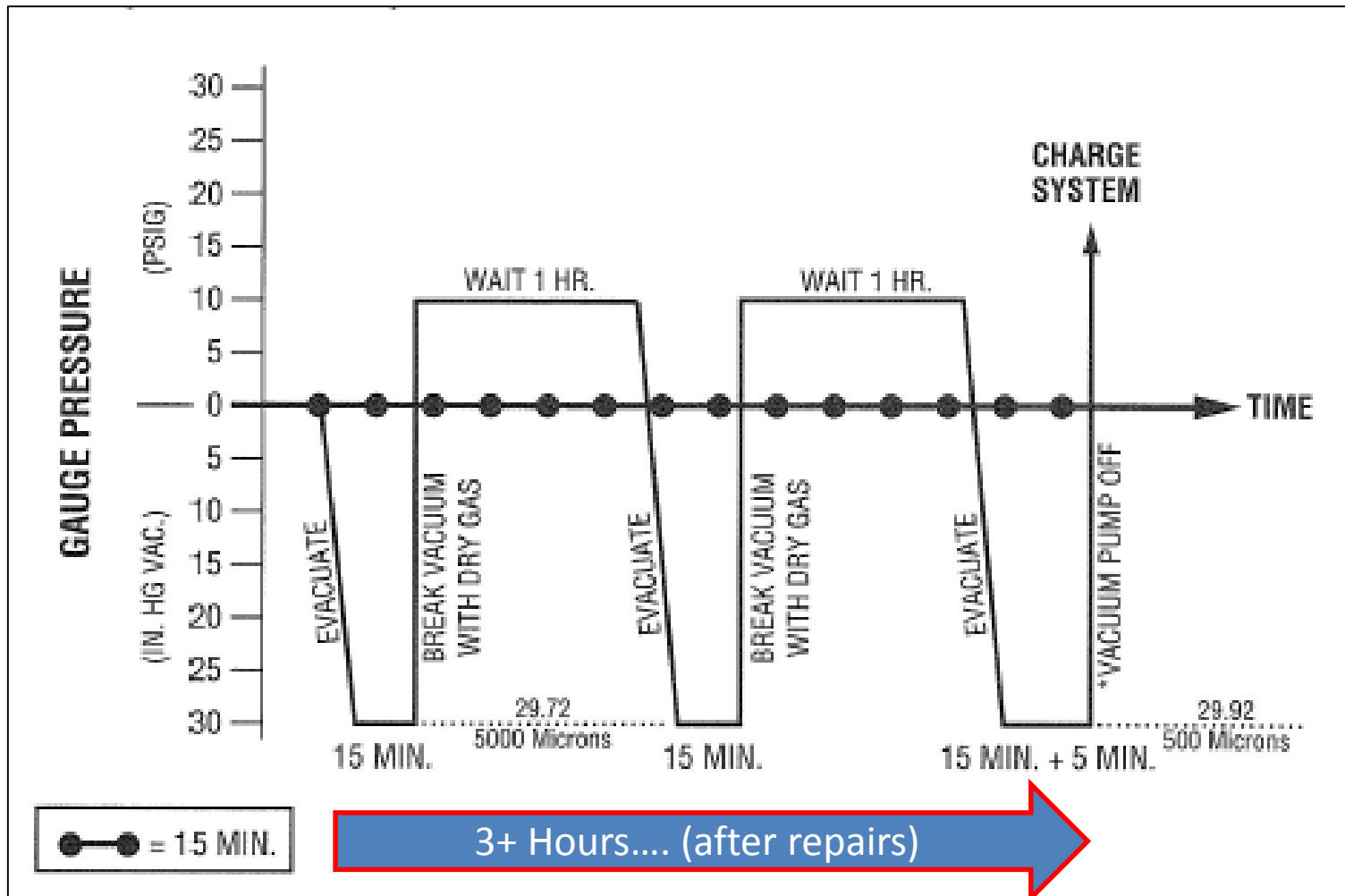


The Biggest Need?

According to manufacturers and maintenance technicians across the country....



TIME!



Source: Carrier

For Action:

- Be aware of regulatory changes as they occur
 - EPA
 - DOE
- Review choices for refrigerant repair
 - Maintain current equipment (R-22 or Retrofits)
 - Change full system to R-410A
- Start repairs with simple diagnosis
 - Filter
 - Air Flow
- Maintain current equipment correctly for long life.
 - Install refrigerant correctly (Superheat-Subcool)
 - Completely evacuate moisture

Q



A



Paul Rhodes

prhodes@naahq.org

@maintmanpaul

