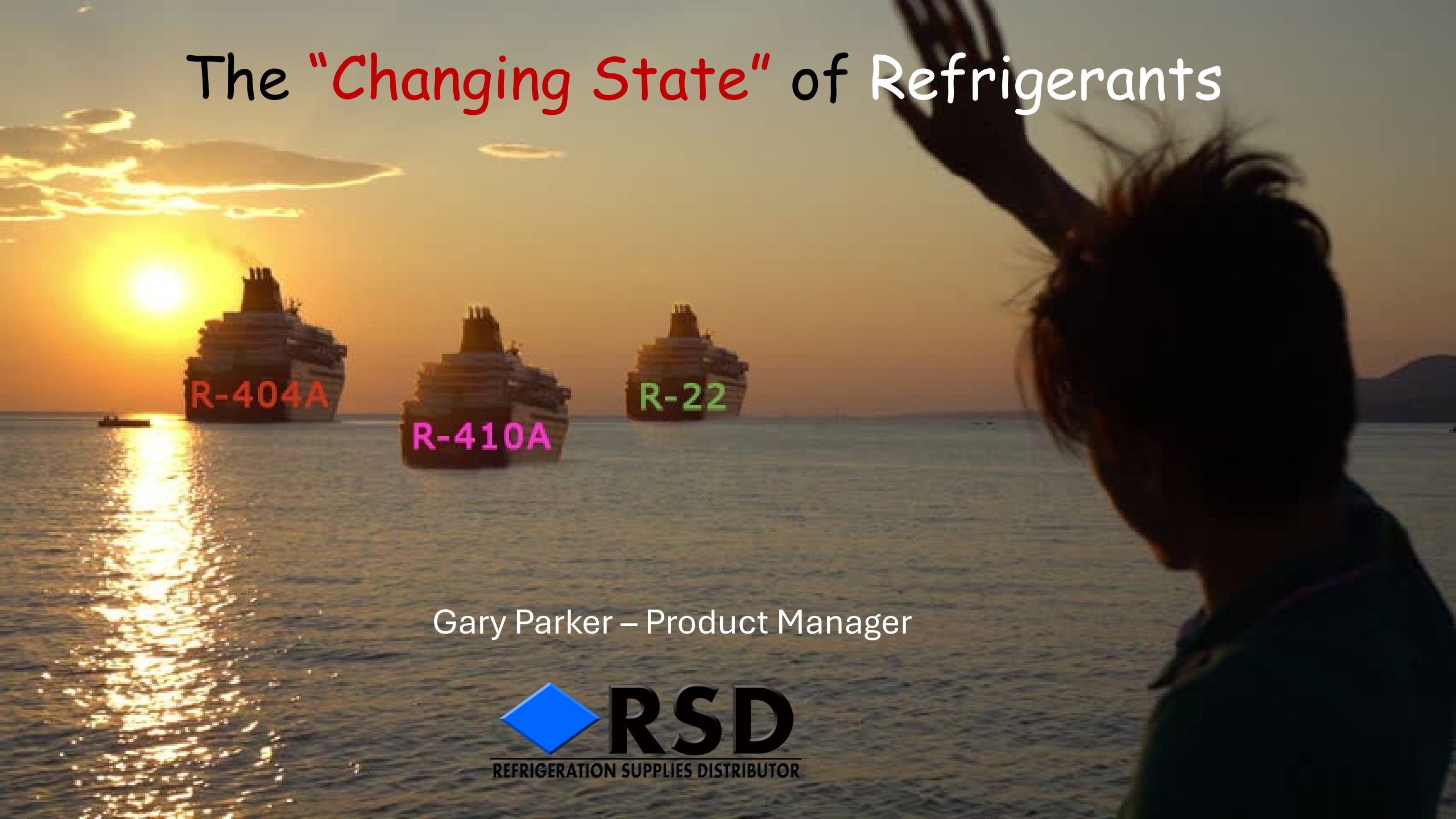
The "Changing State" of Refrigerants



Gary Parker – Product Manager

RSD
REFRIGERATION SUPPLIES DISTRIBUTOR

Refrigerant Suite

The RSD Refrigerant Suite is your central clearing house for all refrigerant related information, Literature - Technical Data, Rules, Regulations, Pending Legislations, Technician Certification, Refrigerant Recovery and more. Refrigerants industry is evolving rapidly and the RSD Refrigerants Suite will keep you "In the Know".

PT Chart EPA Certifications Request Training / Info

Home *Refrigerant Training* *Literature & Technical Data* *Regulations* *Refrigerant Recovery* *Refrigerant Digests*

What's New

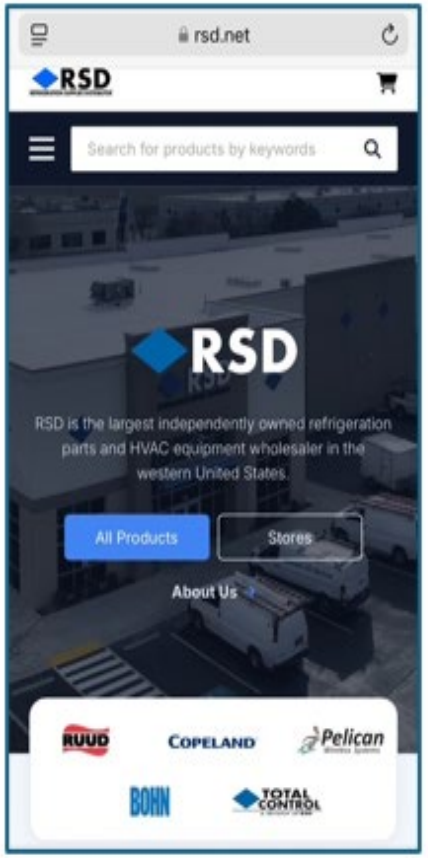
California roles out proposal to Reduce HFC Emissions

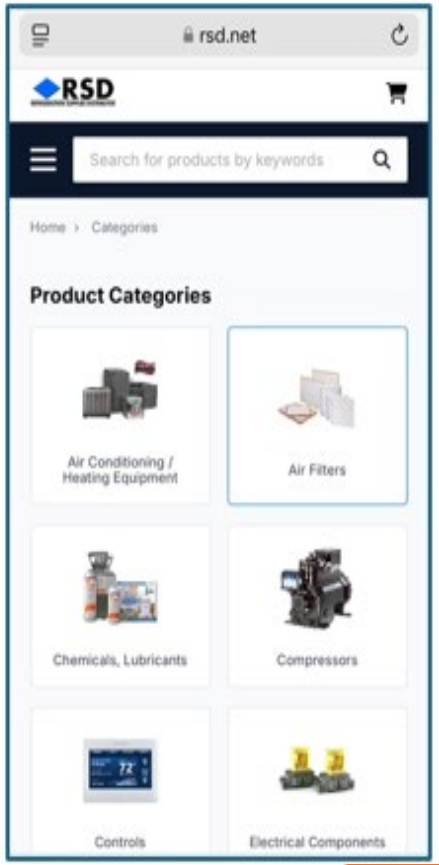
RSD Notes

Utilities

★★★★★ 22345

OPEN





❖ What Are A2L's and Why !

- Most Current Refrigerants have High Global Warming Potential
- GWP is based on Co2, assigned values are a multiple of that.
- Most of the replacements have Flammability Risk
- ASHRAE Flammability Categories
  - A1 – No Flame Propagation
  - A2L – Same as A2 with lower flame velocity (A2-Lite)
  - A2 – Flame Propagation and low flammability
  - A3 – High Flammability (Propane – Isobutene)
- Charge Limit for A2, A2L,A3 Refrigerants are Changing 150,300,500g +
- Today's Goal is to safely implement refrigerants < 700 GWP
- R410A (2088 GWP AR4)To be banned in New Equipment effective 1-1-2025
- A2L AC Choice:
  - R32 – Daikin: Used currently in Europe and Asia (Pure Fluid) Higher GWP
  - R454B – Carrier, Lennox, Rheem/RUUD, Trane ……(Low Glide) Lower GWP

Significant Regulation Changes

- 2016 Kigali Amendment began International HFC Phasedown*.

  **2018 US Federal Court suspended our participation*

- 2018 California Cooling Act *Mirrored the Kigali framework*
  - *Oregon HB4024 - Washington HB1112*
- 2020 R22 (HCFC) Production Ban
- 2020 U.S. AIM Act* Signed into Law (Re-started the HFC Phasedown)
- 2022 EPA Sector Controls
- 2023 New D.O.E. Efficiency Standard for AC and Heat Pumps
- 2025 California SB (Senate Bill)1206

- California Regulation History
  - 2012 Refrigerant Management Program - Regulates systems > 50-lbs
  - 2018 California Cooling Act – Adopted EPA SNAP Regulations*
  - Present – Stationary Refrigeration & AC Regulations
    - 2022 New Refrigeration Systems over 50# must be below 150 GWP
    - 2024 New Chiller Systems must be below 700 GWP
      * Effective based on date of manufacture…
    - 2025 New Air Conditioning Equipment must be below 700 GWP
      * Effective based on date of manufacture…
    - 2025 Sales Ban on Virgin Refrigerants over 2500 GWP
      - (R23 R404a R422B, R422D, R438A, R507, R508B)
    - 2030 A Blended 1400 GWP Target for Market chains over 25 locations

Changing State of Refrigerants – Digest 2021-10

The AIM Act Final Rule

On December 27th 2020: The American Innovation and Manufacturing (AIM) Act was signed into law. This Act authorizes the EPA to administrate a 15-year phasedown of HFC refrigerants. The goal is to achieve an -85% reduction (based on avg 2011 to 2013 levels) by 2036. **Phasedown Schedule:**

HFC Reduction based on Average 2011-2013 Consumption	Effective Year & Percentage Reduction	Allowance Caps (in MMTEV's)	
		Consumption	Production
Step - 1	2022 - 10%	273 m	344 m
Step - 2	2024 - 40%	182 m	229 m
Step - 3	**2029 - 70%**	**91 m**	**114 m**
Step - 4	**2034 - 80%**	**60 m**	**76 m**
Plateau	**2036 - 85%**	**45 m**	**57 m**

All State of Ca facilities must use reclaimed gas for systems requiring over 750 GWP

Changing State of Refrigerants – Digest 2024-6

Did You Know?

Effective 1-1-2025

California Senate Bill #1206

Bans the Sale of High GWP Refrigerants!

On September 30, 2022, the Governor of California signed Senate Bill 1206

SB1206 prohibits any person or company from offering for sale

Virgin High GWP Refrigerants per the following schedule:

- **Refrigerants Greater than 2200 GWP starting 1-1-2025**
- **Refrigerants Greater than 1500 GWP starting 1-1-2030**
- **Refrigerants Greater than 750 GWP starting 1-1-2033**

Common Refrigerants Impacted by this Bill:

AR4 GWP Value	Effective Date	Most Common* Refrigerants in this Group
Greater than 2200	1/1/2025	R404A, R421A, R422B, R422D, R434A, R438A, R507
Greater than 1500	1/1/2030	R407A, R407C, R407F, R410A, R458A
Greater than 750	1/1/2033	R134A, R448A, R449A

*Many other less popular refrigerants are also affected

❖ California Reclaimed Refrigerant Program

- Available Refrigerants: R11, R22, R123, R134A, R404A, R410A, R507
- Quantity will be limited at the branch level
- Buyback Program participants will have priority

❖ Other Available Program

- Clean & Repackage Programs are available
- Retrofit Technical support provided at no additional charge
- Recovery Cylinder Rental

System Performance Comparisons

Fluid	Evap T	SH	Evap Pressure	Capacity		Cont T	SC	Discharge Pressure	Mass Flow		Compression Ratio	Power		Glide	GWP	CA Sales Ban
	(°F)	(°F)	(psig)	(Btu/h)	Ratio	(°F)	(°F)	(psig)	(lb/s)	Ratio		(kW)	Ratio	(°F)		
R404A	0	9	32.9	2245.5		**130**	9	354.6	0.0170		10.78	0.461		0.7	3943	2025
R448A	0	9	27.1	2466	1.10	**130**	9	348.4	0.0129	0.76	12.86	0.451	0.98	6.5	1273	2033
R449A	0	9	26.8	2430.2	1.08	**130**	9	344.8	0.0129	0.76	12.87	0.446	0.97	5.8	1282	2033
R452A	0	9	30.6	2257.7	1.01	**130**	9	357.9	0.0169	1.00	11.70	0.455	0.99	3.8	1945	2030

Fluid	Evap T	SH	Evap Pressure	Capacity		Cont T	SC	Discharge Pressure	Mass Flow		Compression Ratio	Power		Glide	GWP	CA Sales Ban
	(°F)	(°F)	(psig)	(Btu/h)	Ratio	(°F)	(°F)	(psig)	(lb/s)	Ratio		(kW)	Ratio	(°F)		
R507A	0	9	34.8	2917.4		**105**	9	260	0.0180		7.47	0.402		0.0	3985	2025
R448A	0	9	27.6	2969.8	1.02	**105**	9	246.4	0.0130	0.72	8.93	0.382	0.95	7.6	1273	2033
R449A	0	9	27.3	2932.2	1.01	**105**	9	243.8	0.0131	0.73	8.93	0.377	0.94	6.8	1282	2033
R452A	0	9	31.1	2869.2	0.98	**105**	9	254.6	0.0171	0.95	8.19	0.388	0.97	4.7	1945	2030

System Evaluation:

Evaporator Capacity - R448/R449 conversion will deliver slightly higher capacty at the evaporator (2 to 3% depending on conditions)

Condenser Capacity - Due to higher Evaporator load, condenser capacity and discharge temps need to be evaluated.

Massflow - R448/R449 require 20 to to 30% less refrigerant flow than R404/R507. TXV adjustement will be required (replacement possible)

Lubricant - R448/R449 are compatable with POE oil. Generally no oil change is required. Check oil quality to confirm

Elastomers - All HFC/HFO refrigerants are Clorine free. No seal or o-ring changes are required

B - EPA HFC SECTOR-SPECIFIC PROHIBITIONS RULE NEW EQUIPMENT ONLY

INDUSTRY SECTOR	GWP LIMIT/RANGE	EXCLUDED PRODUCTS	WHEN	COMPLIANT PRODUCT
Residential & Light Commercial HVAC	700	R-410A	Jan 1, 2025	454B,R32
VRF	700	R-410A	Jan 1, 2026	454B,R32
Chillers (Excluding IPR with exciting fluid below - 50)	700	R-410A, R-134a	*2028 (-58F -> -22F)* 2026 (>-22F), Comfort Cooling	454B, 454C, L40X 515B, 513A,1234ze, 1233zd, 1234yf, N71
Data centers	700		Jan 1, 2027	515B, 513A, 454B, 1234ze, 1233zd, R471A
Industrial refrigeration (non-chiller)	150-700		2026-2028	515B, 513A,1234ze, 1234yf, 454C, R455A, N71
Retail	150-300	**R-448A**, R-404A, R-407's, R-410A, R- 507A, HFC-134A and more	2026 – 2028 (supermarket systems 2027)	R455A, 454C, N71, 515B, 1234ze, 1234yf
Ice Machines (Batch type w/ harvest rate <=1000 lb/24 hr ice and continuous type w/ harvest rate <=1000 lb/24 hr)	150	R-404A, R-407's, R-410A, R- 507A, HFC-134A and more	Jan 1, Jan 1, 2026	R455A, 454C, 1234yf
Cold Storage	150 - 300		2026	R455A, 454C, 1234ze, 1234yf

*Honeywell recommended products based on GWP limits and application requirements, list may change

❖ The Latest EPA “SNAP” Rules

Final Rule 25: In April 2023, the EPA approved the following A2L refrigerants {R32, R1234YF, R452B, R454A, R454B, R454C} for use in Residential Humidifiers and Centrifugal or Positive Displacement Chillers for Comfort Cooling and Industrial Process Air Conditioning *In January 2024/25, Chiller Manufactures must also meet the requirements of UL Standard 60335-2-40 3rd edition, pertaining to charge limits and leak detection requirements.

Proposed Rule 26: In May 2023, the EPA proposed the approval of refrigerants {R32, R1234yf, R454A, R455B, R454C, R455A, R457A, R516A} for use in the following applications with specific use conditions. Commercial Ice Machines, Industrial Process Refrigeration, Cold Storage Warehouses, Ice Rinks, Retail Food Processing/Dispensing and Remote Condensing units.

Also, **Proposed Rule 26** will allow for the venting of R290 (Propane), and eliminate the need for recovery, which is currently required by the Clean Air Act Section 608

Refrigerant	AKA	Manufacture	HFC Fluids						Hydrocarbons			GWP
			R32	R125	R134a	R143a	R227ea	R236fa	R600	R600a	R601a	
R-404A	FX70/HP62	Arkema/Dupont		44.0	4.0	52.0						3922
R-407A	KLEA60	Ineos Fluor	20.0	40.0	40.0							1923
R-407C	KLEA 66 SUVA 9000	Ineos Fluor	23.0	25.0	52.0							1677
R-407F	22LT	Honeywell	30.0	30.0	40.0							1674
R-410A	AZ20 SUVA9100	Honeywell	50.0	50.0								2088
R-422D	MO29	Honeywell/Dupont		65.1	31.5					3.4		2473
R-427A	FX100	Arkema	15.0	25.0	50.0	10.0						2024
R-434A	RS-45	Ref. Services Inc		62.3	16.0	18.0				2.8		3246
R-438A	MO99	Chemours	8.5	45.0	44.2				1.7		0.6	2059
R-458A	TDX20	Bluon	20.5	4.0	61.4		13.5	0.6				1564

Refrigerant	AKA	Manufacture	HFC Fluids				Co2	HFO Fluids			Safty Class	GWP
			R32	R125	R134a	R227ea	R744	1234yf	1234ze	R1336M		
R-448A	N-40	Honeywell	26.0	26.0	21.0			20.0	7.0		A1	1273
R-449A	XP40	Chemours	24.3	24.7	25.7			25.3			A1	1282
R-450A	N13	Honeywell			42.0				58.0		A1	547
R454A	XL40	Chemours	35.0					65.0			A2L	239
R454B	XL-41	Chemours	68.9					31.1			A2L	466
R-454C	XL-20	Chemours	21.5					78.5			A2L	148
R-455A	L40X	Honeywell	21.5		10.2		3.0	75.5			A2L	148
R-471A	N71	Honeywell				4.3			78.7	17.0	A1	146
R-513A	XP10	Chemours			44.0			56.0			A1	573
R-515A	XP10	Chemours				12.0			88.0		A1	573

R410a – Transition

Production Deadlines:

Packaged & Self-Contained Equipment: Can be built until 12-31-24
- There is a 3-year sell through period

Split System Components: Can be built until 12-31-24
- There is a 1-year sell through period

Service Components: ~~There is no production ban on service components~~

Due to DOE Ruling

R410A Condensing units will no longer be produced

Refrigerant Transition

REFRIGERANT TRANSITION

Component Rules

EPA

Components are exempt from GWP prohibitions

Continued manufacture, sale and installation of components using prohibited substances are permitted indefinitely – for repair of existing systems only

Newly manufactured components must be labeled “For Service Only” starting in 2025

Final Rule

DOE

Outdoor units with no match (OUWNM) must be rated with strict indoor coil requirements

Indoor fin surface plus coefficient of degradation

Intended to account for “worst case” efficiency

DOE could change the requirements in the current open rulemaking, expected to finalize in late 2024

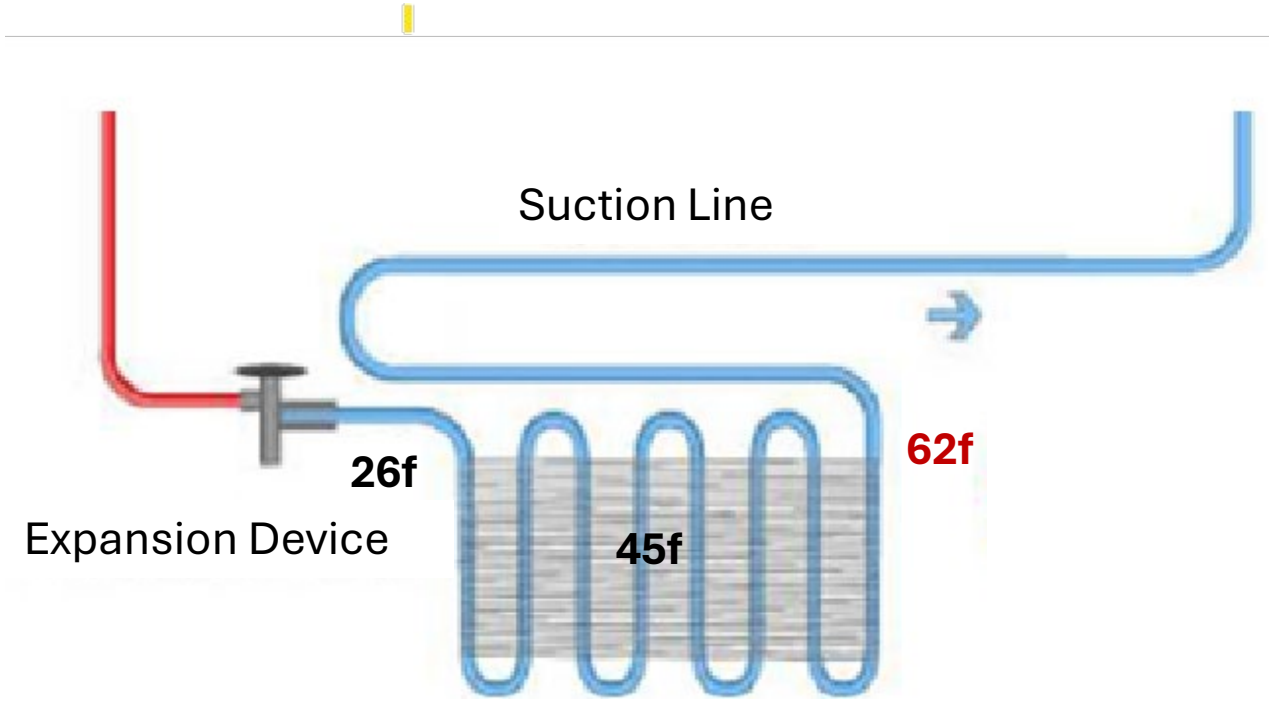
Open Rule

R410A vs R32 or R454B

Refrigerant	Evap T	SH	Cond T	SC	Discharge	Cooling Cap		Heating Cap		Power		Glide	GWP	Safety
	(°F)	(°F)	(°F)	(°F)	(psig)	(Btu/h)	Ratio	(lb/s)	Ratio	(kW)	BTU/W-C	(°F)		Class
R410A	45	9	115	9	391.7	9156		11493		0.684	13.39	0.40	1924	A1
R32	45	9	115	9	401.4	10054	1.098	12556	1.093	0.733	13.72	0.00	677	A2L
R454B	45	9	115	9	364.6	8882	0.970	11096	0.965	0.648	13.71	5.00	466	A2L
R470A (RS53)	45	9	115	9	395.1	7967	0.87			0.686	11.61	36	909	A1

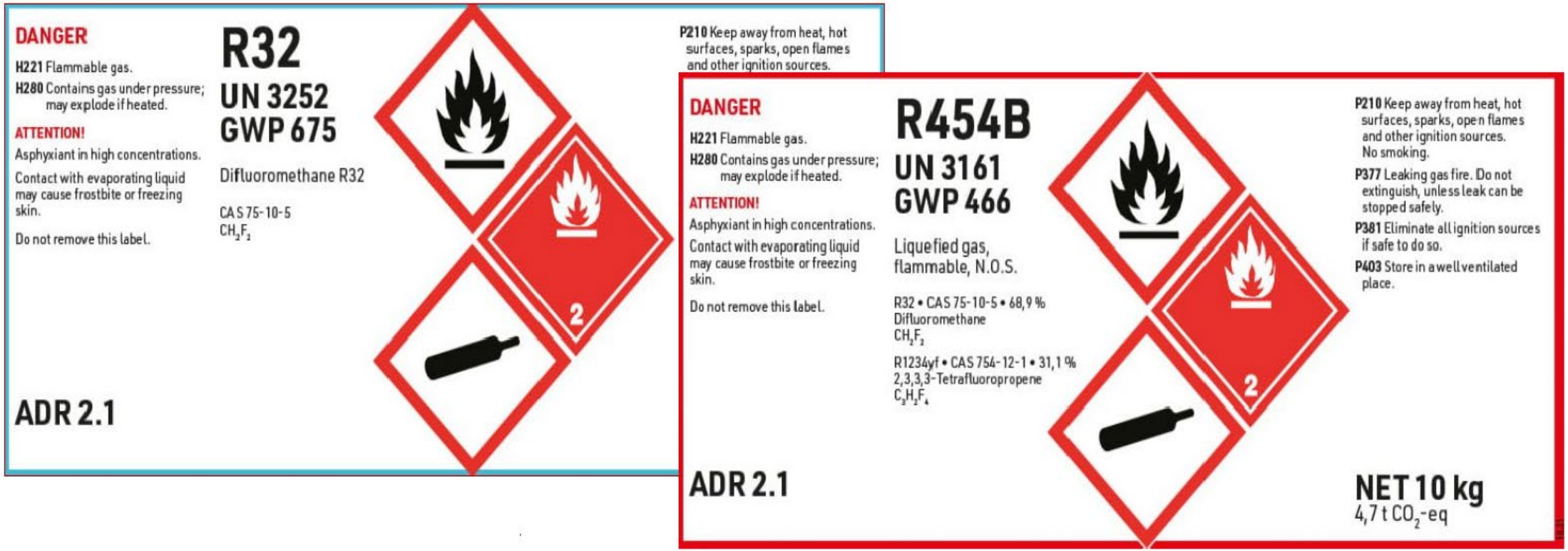
- R32 Has Higher capacity than R410 +2% Higher Discharge Pressure Just under the 700 GWP Limit
- R454B Has Slightly lower Capacity than R410 -7% lower Discharge Pressure Significantly lower GWP
- R-32 and R-454B are A2L Refrigerants for new Equipment ONLY - **ARE NOT RETROFIT OPTIONS**
- What About R470A RS53 - The “Internet” says it’s a drop in..... ????

Why R470a is not a viable Retrofit Option



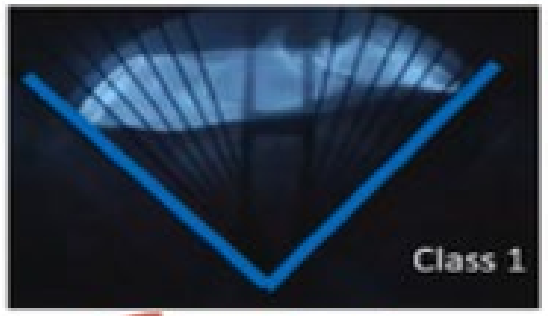
1. Due to the glide the temperature entering the evaporator is ~ 26ºF – This should ice the coil.
2. Leaving temp is 62ºF, this is above the 40-45ºF required for heat transfer and dehumidification.

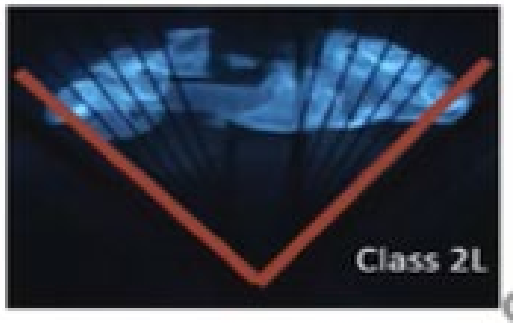
- R32 and R454B
  - To the Fire Authority "it is either flammable, or it's not.."

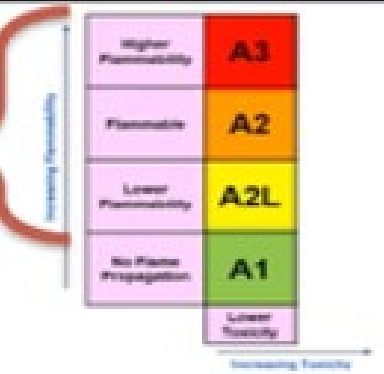


ASTM E681 Test Examples

- Flame spread > 90° indicates "flammability"
- There are three flammable classes:
  - 3 – higher flammability
  - 2 – flammable
  - 2L – lower flammability



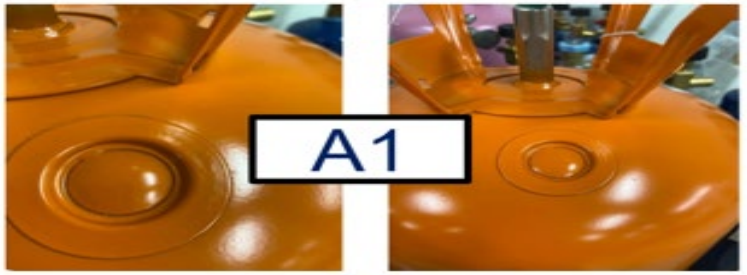




Comparison of Flammability Parameters

Refrigerant ASHRAE Designation	Opteon™ XL41 (R-454B)	Propane (R-290)
ASHRAE Safety Group	A2L	A3
Lower Flammability Limit (LFL) (g/m³)	297	38
Minimum Ignition Energy (MIE) (mJ)	100 - 300	0.25

- A2L cylinders will have left-handed threads
- ¼ A2L tank adapter is required to connect manifold hoses
  - Tanks under 50 lbs. will need a CGA 164 fitting
  - Tanks containing more than 50 lbs. will need a CGA 670 fitting
- A2L cylinders will have an anti-counterfeit shrink wrap on the head
- A2L cylinders will have a relief valve safety, not a rupture disc



A2L Refrigerant Recovery

Regulations will require unique cylinders for A2L recovery

A1

A2L

A2L will have Left-Hand Thread

Flammable Placard be may required

Lower Flammability Limit (LFL)

- The lower flammability limit (LFL) is the minimum concentration of a flammable substance, in this case a refrigerant, that is capable of ignition when there is a sufficient mixture of air and the substance.
- The LFL is expressed as refrigerant percentage by volume.
- Refrigerant flammability is determined by the ASHRAE-modified ASTM E-681 Flammability test.

System Installation

- The maximum charge size for the A2L equipment being installed will be limited by the cubic feet of airspace served by the equipment.
- The space must be large enough, and have enough air, to keep the refrigerant at or below a percentage of the lower flammability limit (LFL) should the entire charge leak into the space (referred to as dispersal volume)

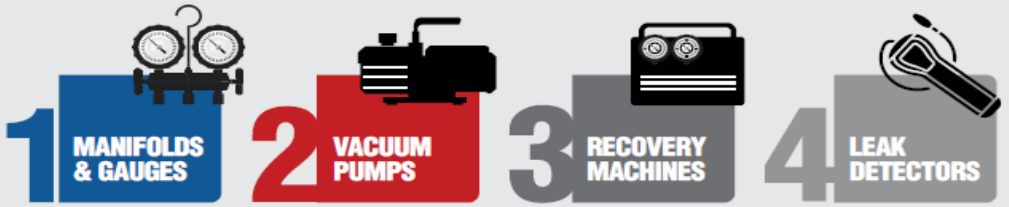
Transportation

- In most circumstances, 2Ls can typically be transported from a storage area to the jobsite in the same manner as other flammable gases such as oxygen and acetylene in a service vehicle.
- Refrigerant cylinders should be transported in the upright position so that the pressure relief valve is in contact with the vapor space of the cylinder.
- Depending on state or local codes, placards and ventilation may be required on the service vehicle. These requirements vary depending on the volume of gas being transported.
- DOT regulations require refrigerant cylinders containing over 2.2 lbs. of a 2L refrigerant to be equipped with a pressure relief valve instead of a rupture disc

SERVICING A2L SYSTEMS : THE FOUR MAIN TOOLS TECHNICIANS WILL NEED

While service technicians may believe they will need to purchase all new tools to work with A2L refrigerants, many of the tools they use each day will remain the same.

In general, tools that don't touch the refrigerant circuit—such as non-electric hand tools,access valves and valve core removal tools—can usually be used for both A1 and A2L systems.



JB OFFERS ALL THE ESSENTIAL SERVICE TOOLS FOR TECHNICIANS TO WORK SAFELY AND EFFICIENTLY WITH A2L REFRIGERANTS

MANIFOLDS AND GAUGES

SHOWN:

PATRIOT 22633
2-Valve Brass Manifold

MADE IN THE USA

VACUUM PUMPS

SHOWN:

PLATINUM PRO
DV-240DC 8.4 CFM

Also available in:
6, 10, 12 CFM and Spark Proof

MADE IN THE USA

RECOVERY

SHOWN:

F6-BOOST
BLDC Ignition-proof
Refrigerant Recovery
Machine

LEAK DETECTORS

SHOWN:

PROWLER LD-5000
Electrochemical Leak
Detector

MICRON GAUGES

SHOWN:

CLIMATE CLASS
DV-22W Wireless Digital
Vacuum Gauge

WIRELESS TOOLS

SHOWN:

CLIMATE CLASS
WP-2 Wireless Digital
Probes and DM4-ZW
ZEPPELIN Wireless
Digital Manifold

A2L CYLINDER DIFFERENCES AND HELPFUL ACCESSORIES

A2L reclaim and recovery cylinders have three distinct features to help distinguish them from other types of refrigerants.

JB offers American-made A2L accessories such as our KOBRA Charging Hoses with reverse-thread fittings and reverse-thread hose adapters to help technicians safely access A2L refrigerant and charge systems.

MADE IN THE USA

SHOWN:

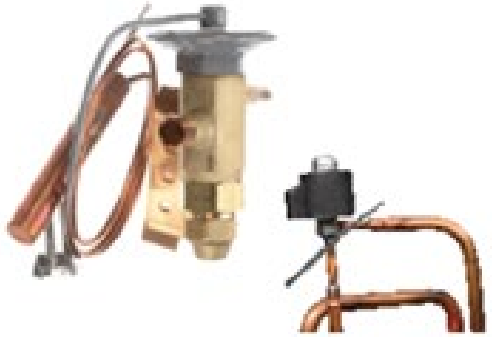
KOBRA CCLBV-A2L-60 1/4" x 60" Hose Set with Ball-Valve and A2L Adapter

Reverse-thread, left-handed A2L Adapters

What is New with R454B

Leak Detector

Scroll and Rotary Compressors



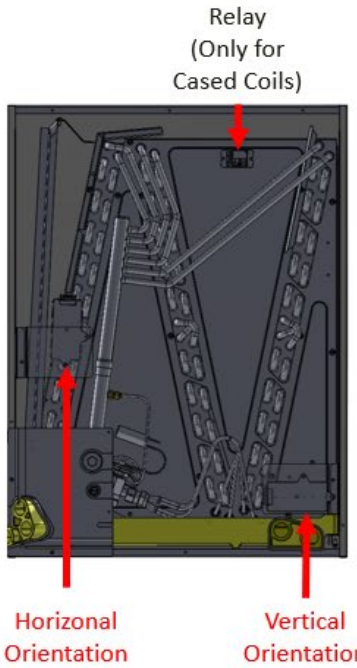
TXV / EEV

Electrical Components

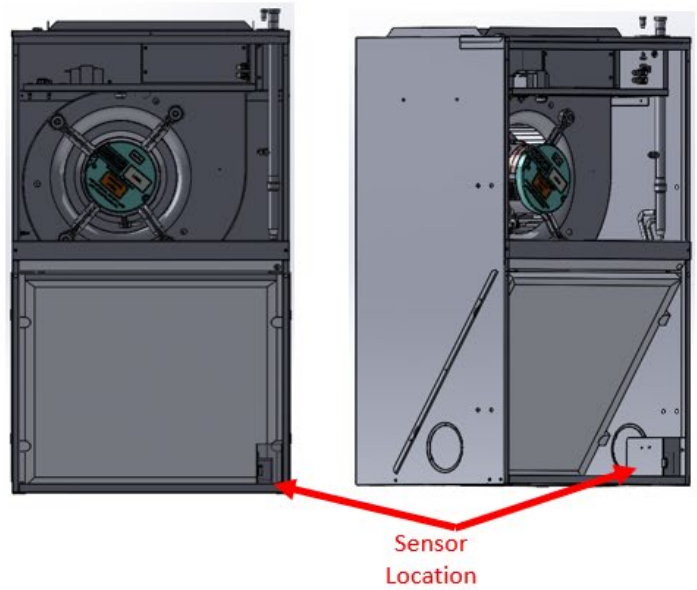
RUUD

COILS AND AIR HANDLERS

COILS/AIR HANDLERS

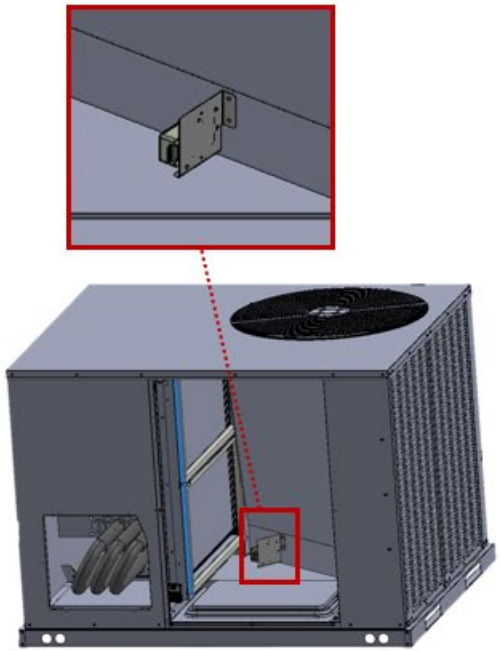


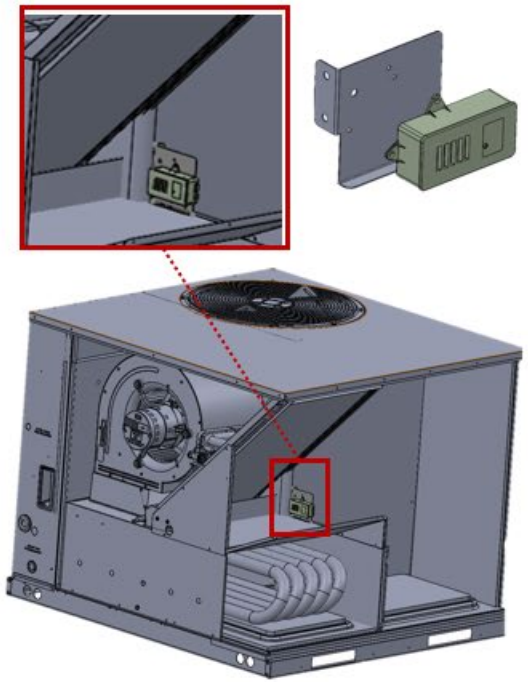
FRONT RETURN AIR HANDLERS

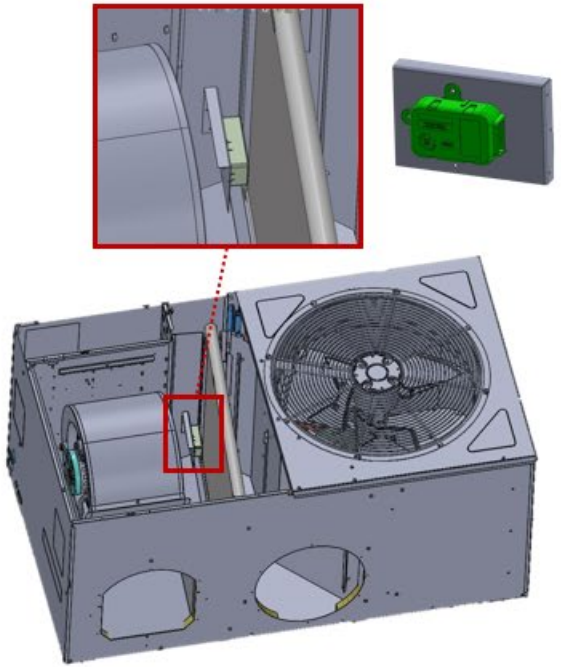


Rheem RUUD SURE COMFORT COMMERCIAL

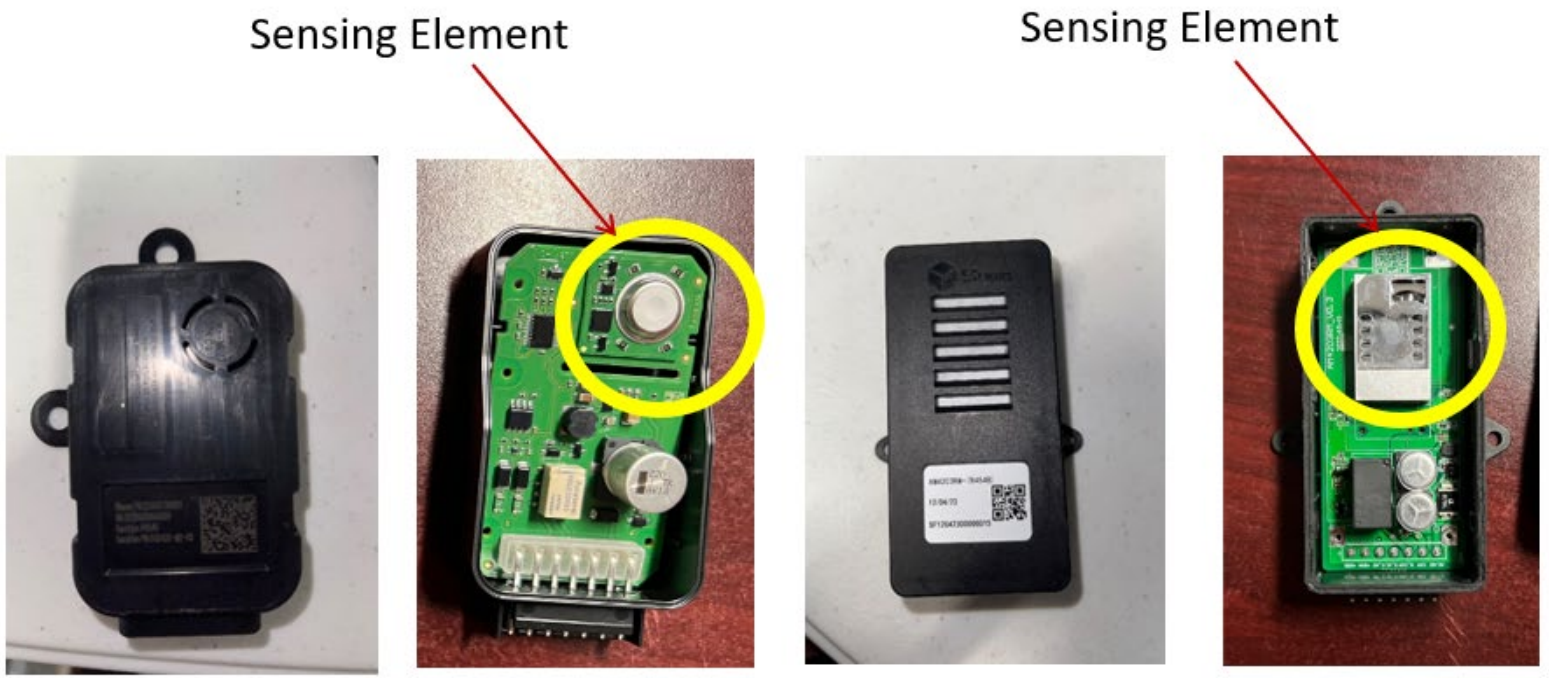
PACKAGED UNITS







SENSOR DESIGN & QUALIFICATION



Installation

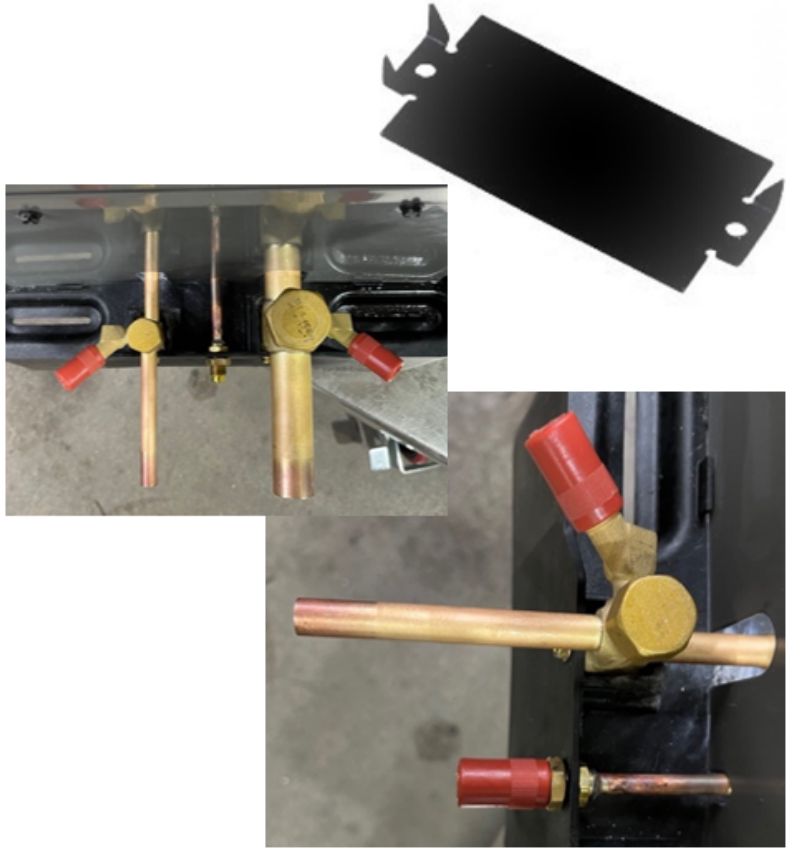
- The procedures you use today to install systems using R-410A will, for the most part, be the same when installing a system using an A2L refrigerant just with some minor changes

Refrigerant Piping

- Existing line sets can be reused as long as they are:
  - Properly sized
  - Flushed and clean
  - Pressure tested to manufacturers' requirements
  - Free from leaks
  - Comply with national and local codes

Refrigerant Piping

- Striker plates must be used when installing lines inside of a wall
- Provides protection from nails or screws puncturing lines
  - Refer to local and national codes for types and placement
- Service valve connection
  - May vary between manufacturers and product families
  - Service ports will be marked red for identification
  - Image for sample purpose only, style of marking may vary

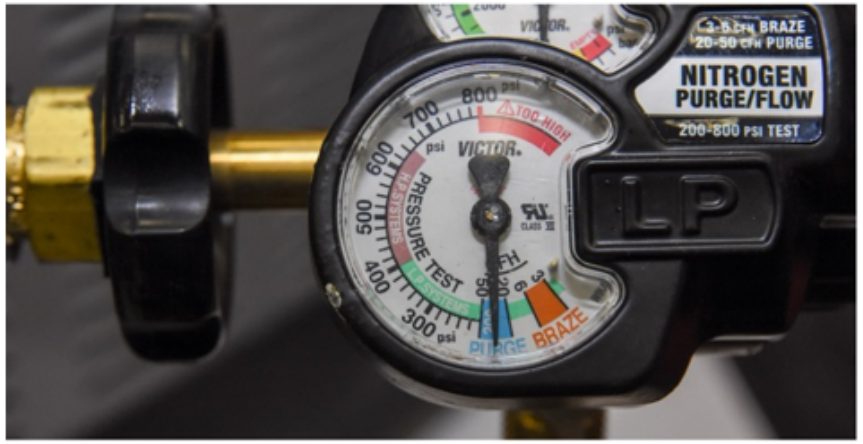


Refrigerant Piping

- Pressure testing
  - The line set must be pressure tested to the manufacturer's specifications and the pressure must be held for a specific period to ensure the system is leak-free
  - Recommendation 500 PSI for 60 minutes

Refrigerant Piping

- Flushing the line set
  - The line set must be purged with dry nitrogen before making final connections for existing line sets, new line sets or when performing service work
  - Removes oil, debris and residual refrigerant
  - Purge nitrogen through lines and out the other side
  - Then set the regulator or flow device to braze setting



R134a Chiller Retrofit Option

Fluid	Evap T	SH	Cond T	SC	Cooling Capacity		Mass Flow		Power		GWP		ASHRAE
	(°F)	(°F)	(°F)		(Btu/h)	Ratio	(lb/s)	Ratio	(kW)	Ratio		Reduction	Safety Class
R134a	45	10	113	10	4402.2		0.01865		0.291		1300		A1
R513A	45	10	113	10	4465.4	101.44%	0.02205	118.23%	0.301	103.44%	572	44.00%	A1

- R513A is the near drop in for R134A
- Equal Capacity
- No Oil Change Required - Works with POE
- -66% Lower GWP
- +18% Mass flow – Will require TXV adjust, or possible Replacement if the valve is already oversized

Refrigeration Transition Dates

January 1st, 2025

Retail Food – Refrigeration Stand Alone Units
Refrigerant must be < 150 GWP

January 1st, 2026

Cold Storage Warehouses
Refrigerant charge > 200 lbs. = 150 GWP
Refrigerant charge < 200 lbs. = 300 GWP

Retail Food – Remote Condensing Units
Refrigerant charge > 200 lbs. = 150 GWP
Refrigerant charge < 200 lbs. = 300 GWP

January 1st, 2027

Retail Food - Supermarkets
Refrigerant charge > 200 lbs. = 150 GWP
Refrigerant charge < 200 lbs. = 300 GWP

A2L Refrigerants for Small to Medium Systems

< 150 GWP		< 300 GWP
		

HRP will use (3) A2L refrigerants for its product portfolio

Low & Med Temp Transition

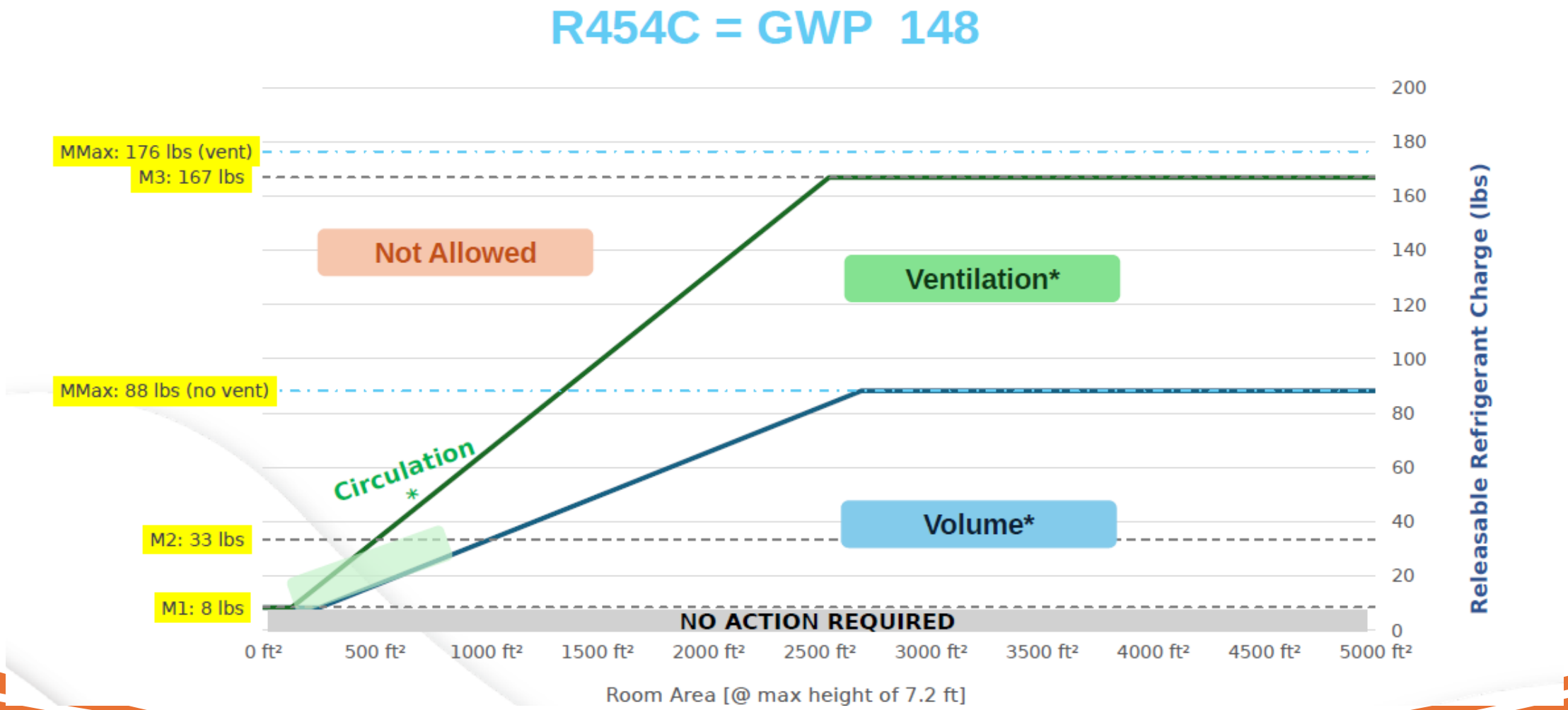
Refrigerant	Evap T	SH	Cond T	SC	Capacity		Mass Flow		Power		GWP	Safety Class
	(°F)	(°F)	(°F)	(°F)	(Btu/h)	Ratio	(lb/s)	Ratio	(kW)	BTU/W		
R404A	0	9	105	9	2720.1		0.0162		0.372	7.31	3943	A1
Current Refrofit Options												
R448A	0	9	105	9	2821.3	1.037	0.0124	0.765	0.363	7.77	1273	A1
R449A	0	9	105	9	2785.6	1.024	0.0124	0.767	0.359	7.76	1282	A1
R452A	0	9	105	9	2725.7	1.002	0.0162	1.002	0.368	7.41	1945	A1
New Equipment Options												
R454A	0	9	105	9	2965.8	1.090	0.0125	0.775	0.383	7.74	237	A2L
R454C	0	9	105	9	2482.6	0.913	0.0117	0.723	0.320	7.76	146	A2L
R455A	0	9	105	9	2734.2	1.005	0.0124	0.764	0.355	7.70	146	A2L

Capacity based on 1-cu/ft displacement

Refrigerant	Evap T	SH	Cond T	SC	Capacity		Mass Flow		Power		GWP	Safety Class
	(°F)	(°F)	(°F)	(°F)	(Btu/h)	Ratio	(lb/s)	Ratio	(kW)	BTU/W		
R404A	-20	9	105	9	1690.6		0.0107		0.309	5.47	3943	A1
Current Refrofit Options												
R448A	-20	9	105	9	1745.1	1.032	0.0080	0.748	0.296	5.90	1273	A1
R449A	-20	9	105	9	1722.2	1.019	0.0080	0.750	0.293	5.88	1282	A1
R452A	-20	9	105	9	1677.6	0.992	0.0106	0.993	0.303	5.54	1945	A1
New Equipment Options												
R454A	-20	9	105	9	1858.9	1.100	0.0082	0.766	0.316	5.88	237	A2L
R454C	-20	9	105	9	1528.1	0.904	0.0076	0.709	0.261	5.85	146	A2L
R455A	-20	9	105	9	1685.8	0.997	0.0080	0.750	0.290	5.81	146	A2L

Capacity based on 1-cu/ft displacement

Charge Limit based on LFL (Charge vs Box Size)

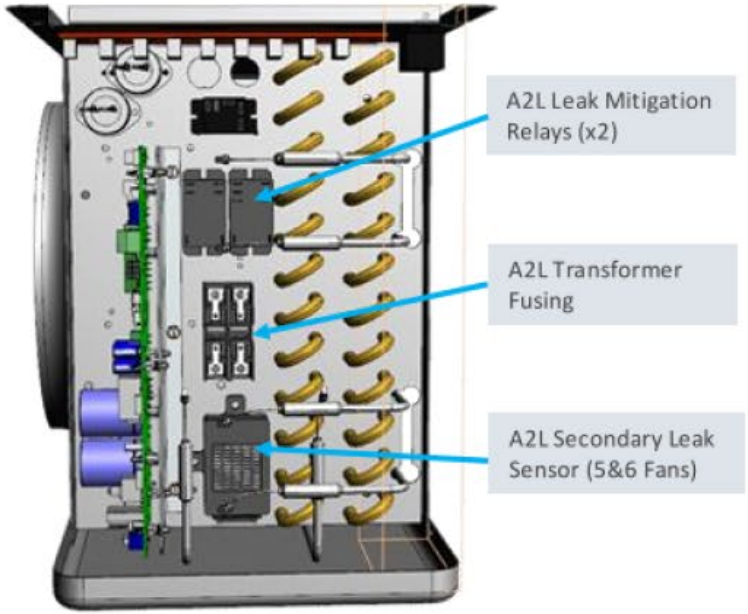


Refrigerant Comparison – Condensing Units

- R454A
  - Slightly higher condensing pressure to R448A
  - Similar condensing temperature to R448A
  - Similar discharge temperature to R448A
  - Best A2L efficiency
  - Smallest glide
  - GWP: 238
- R454C
  - Lower condensing pressure to R448A
  - Higher condensing temperature to R448A
  - Higher discharge temperature to R448A
  - GWP: 148
- R455A
  - Similar condensing pressure to R448A
  - Highest A2L condensing temperature
  - Highest A2L discharge temperature
  - Worst A2L efficiency
  - Performance issues at high ambient conditions
  - Largest glide
  - GWP: 146

Proposed Evaporator Changes

Return (Electrical) End



Safety Markings

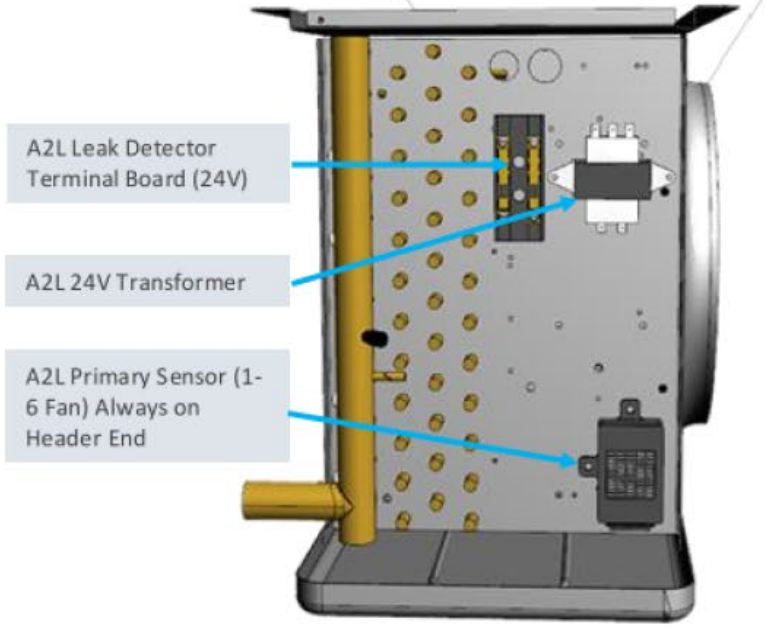
Isolation Valves

Safety Shut Off Valves

New liquid line solenoid (SSOV) and suction line check valves (CSOV) to be used in conjunction with the leak mitigation strategy

Requirements:
-Shipped loose for field install
-Mounted outside the refrigerated space

Header (Piping) End



A2L Interconnect Wiring Required
1-6 Fan (10 Additional Wires)

Thank you !

For More information go to:

www.RSD.net/Refrigerant Suite

1-800-245-8007 ex 00405

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