Why R32

ERIC KRAVITZ
TECHNICAL SUPPORT & TRAINING MANAGER

HVAC
PARTNERS FOR SUCCESS

Agenda

- **Industry Regulatory Update**
- R32 Benefits
- Flammability

Goodman® Air Conditioning & Heating

Amana® Heating & Air Conditioning

DAIKIN AIR INTELLIGENCE

Environmental Challenges Driving Industry Transitions

2016

Non-Ozone Depleting – high GWP

Global Warming Potential (GWP): The potential for a gas to trap heat in the atmosphere, resulting in climate change.

Ozone Depletion Potential (ODP): The potential for substances to reduce the amount of ozone in the atmosphere that blocks harmful radiation from the sun.

1985

Ozone Depleting – High CFC/HFC

Kigali Amendment (HFC)

Phase *Down*

ASHRAE 34 "R"-#	ODP	GWP	Composition
R-410A	0.0	2,088	R-32/125
R-454B	0.0	466	R-32/1234yf
R-32	0.0	675	CH_2F_2 (HFC)

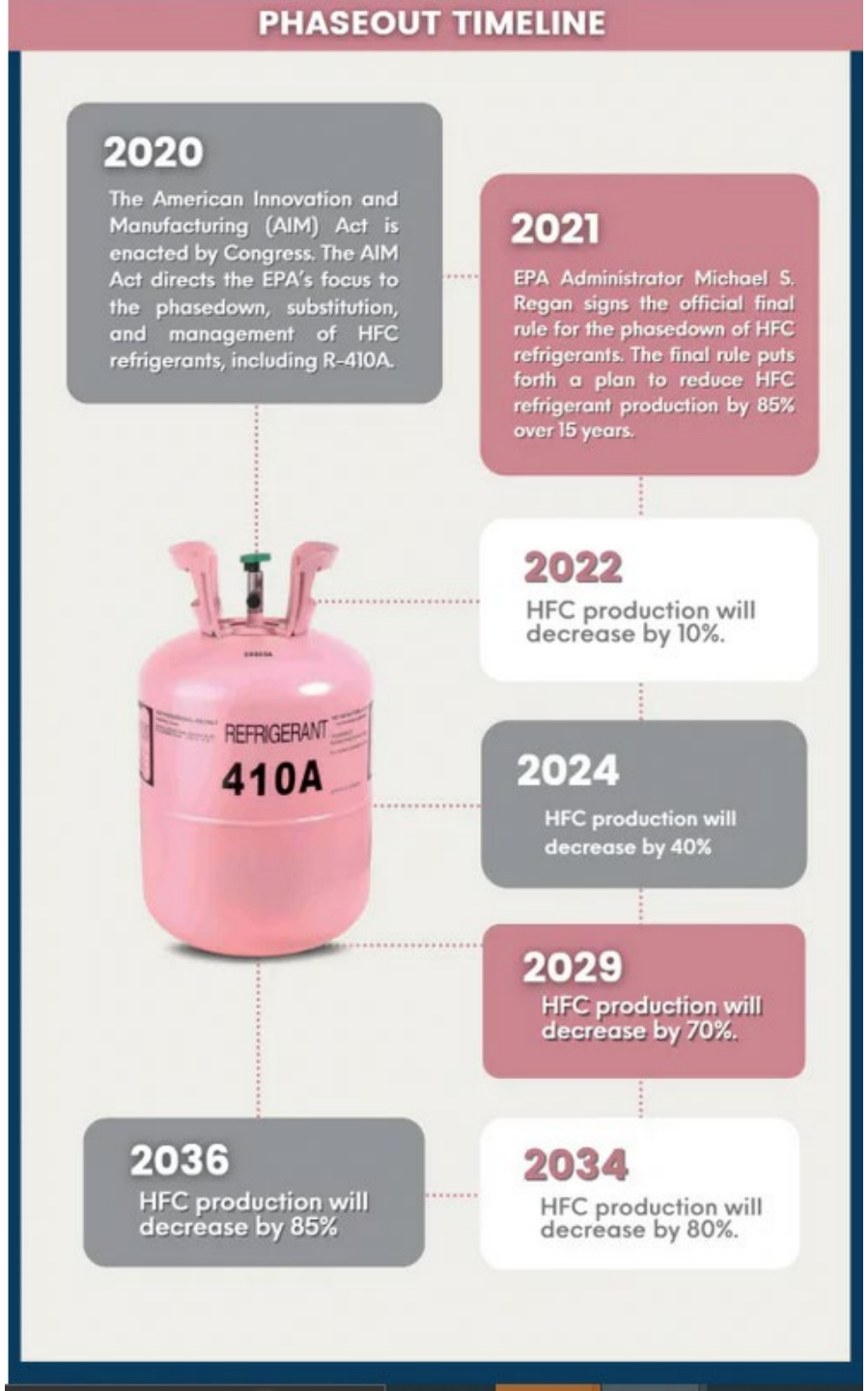
Montreal Protocol (CFC/HCFC)

Phase *Out*

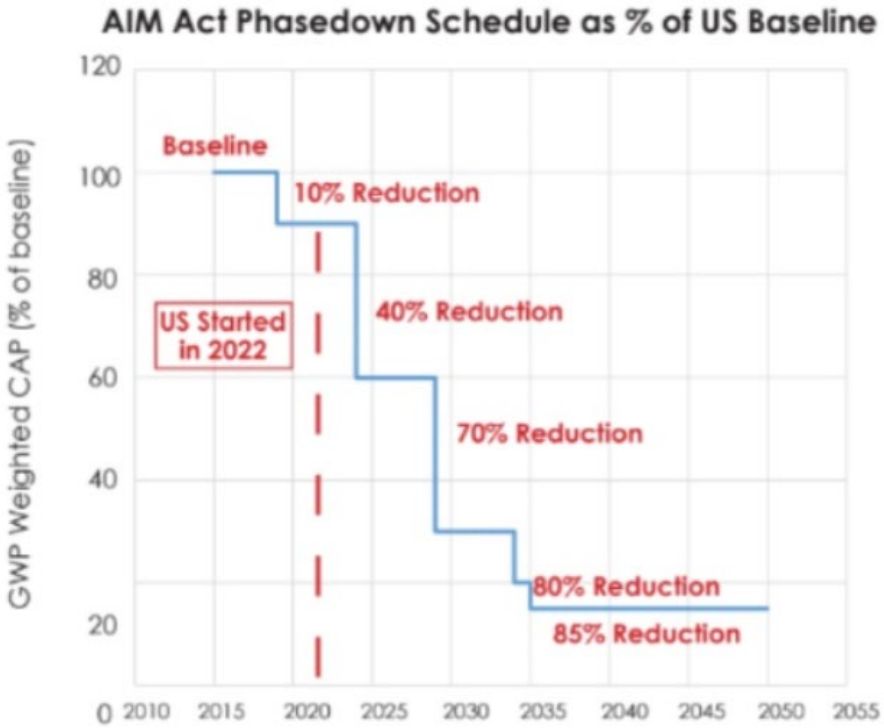
ASHRAE 34 "R"-#	ODP	Composition
R-12	1.00	CCl_2F_2 (CFC)
R-22	0.50	$CHClF_2$ (HCFC)
R-410A	0.0	R-32/125

High GWP HFC's: > 700 GWP

Phaseout



**Baseline established from 2019 full R410a production amount



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June 19, 2024 — The EPA expanded the ruling

January 1, 2025 — The Manufacture or Import of *non-3ph VRV Equipment,* and *Products* of all phases containing high GWP HFC's will be prohibited.

January 1, 2026 — The Sale and Installation of *non-3ph VRV Systems* containing high HFC's will be prohibited

The Manufacture or Import of *3ph VRV Equipment* containing high GWP HFC's will be prohibited.

January 1, 2027 — The Installation and Sale of *3ph VRV Systems* containing high GWP HFC's will be prohibited

January 1, 2028 — The Installation and Sale of *Products* containing high GWP HFC's will be prohibited.

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EPA FINAL RULING Retrofits of Existing Systems

AIM Technology Transition re: “Date Of Installation”

Retrofits of Existing Systems Allowed but not “Complete System installs”

- **R-410A components, heat exchangers, valves are not impacted by the TT Rule**
- **Individual R410A split ODU’s, indoor coils & ahu’s all can continue to be installed indefinitely***

*MUST MEET DOE REGIONAL GUIDELINES

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Agenda

- Industry Regulatory Update
- **R32 Benefits**
- Flammability

Goodman® Air Conditioning & Heating

Amana® Heating & Air Conditioning

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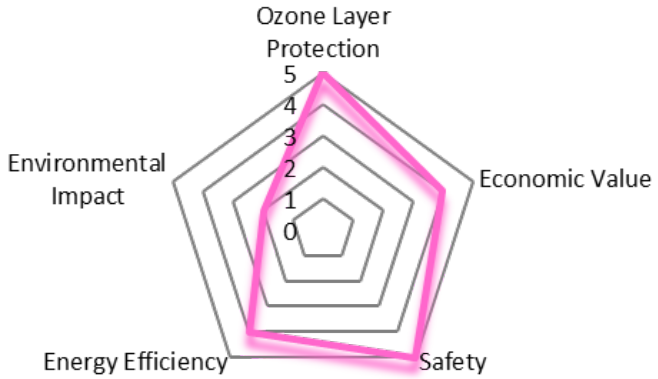
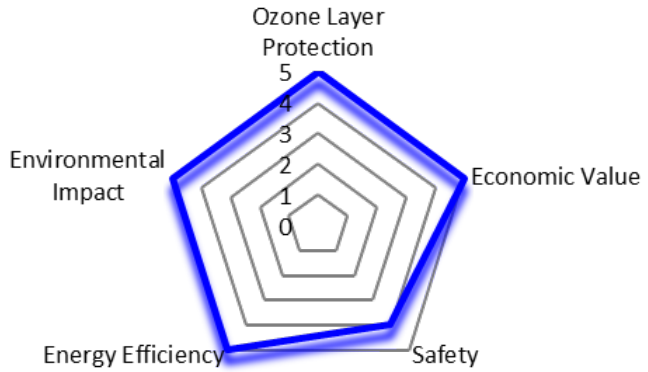
MANY FACTORS INFORM THE RIGHT CHOICE

- No one-size-fits all solution
- The right choice is determined by many factors including efficiency and capacity, GWP, value, availability, cost, ease of reuse and reclamation
- The right combination results in the best value for the owner and optimal environmental value for the planet
- **Daikin has selected R-32 as the best overall replacement for R-410 based on these 5 criteria**



R-410A



R-32

Figure shows COP comparisons based on simulation of a basic vapor compression cycle for an air-conditioner employing a typical forced-convection, air-to-refrigerant heat exchanger, maintaining the same heat flux in the evaporator for a fair comparison.

MANY FACTORS INFORM THE RIGHT CHOICE:

	R-410A Benchmark	R-32
Global Warming Potential (GWP)	2,088	675
Total Emissions (kg CO_2-eq.)	17,263	14,916 (13.6% lower)
Composition	R-32 50% R-125 50%	R-32 100%
Refrigerant Safety Classification	A1	A2L
Temperature Glide	Yes	No
System Capacity	100%	>110%
System Efficiency	100%	>107%
Refrigerant Charge Size	-	Up to 40% smaller
Proprietary	No	No

High GWP HFC's > 700 GWP

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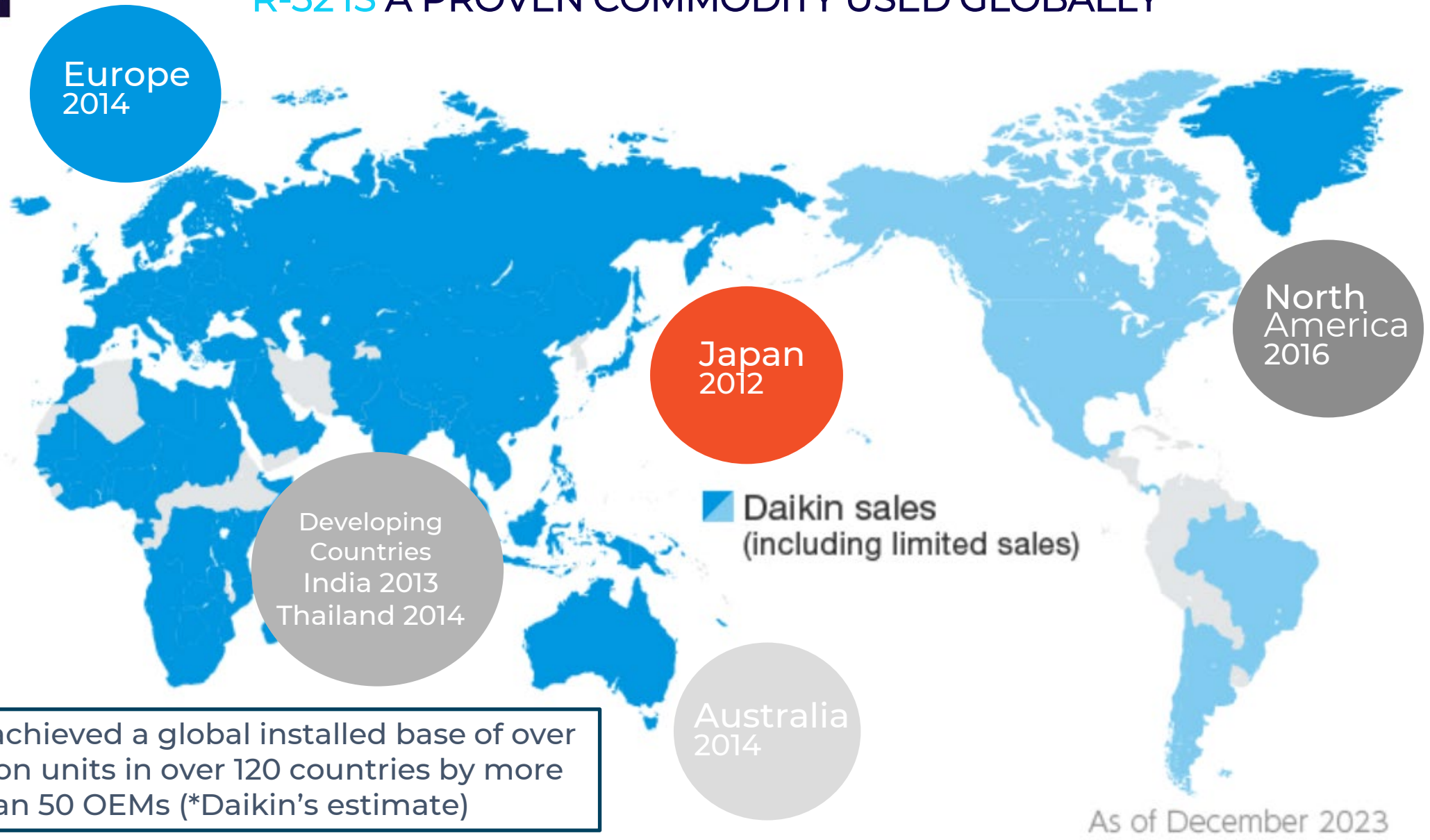
R32

R-32 IS A PROVEN COMMODITY USED GLOBALLY



R-32 has achieved a global installed base of over 280 million units in over 120 countries by more than 50 OEMs (*Daikin's estimate)

R32

Many factors inform the right choice.

✓ More eco-friendly

The biggest benefit of R32 is drastically reduced GWP levels. R32 has one-third the GWP of R410-A, which means it is much better for the environment and has a much lower impact on the ozone layer.

✓ Less flammable

R32 refrigerant has a lower flammability than A2s & A3s, making them easier to store and transport.

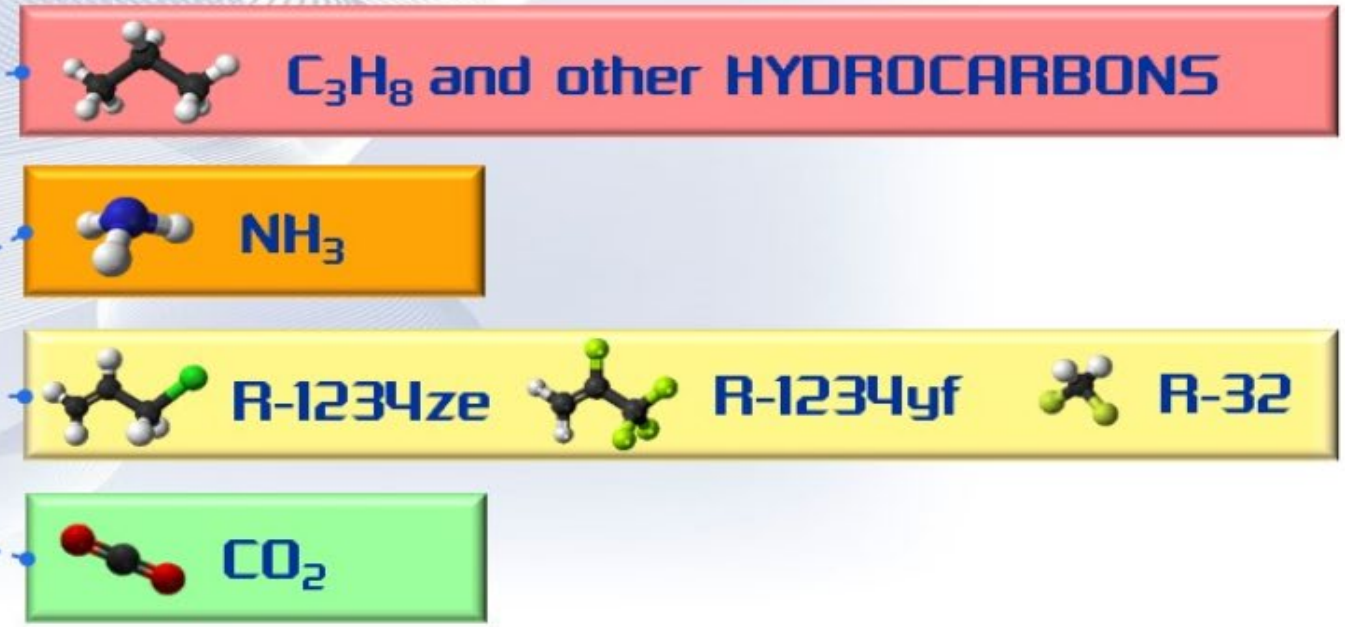
✓ Less toxic

R32 is less harmful to health than the “B” refrigerants, which makes for easier handling and refilling.

R32

- **ISO Standard 817:2014 Refrigerants—Designation and Safety Classification** establishes a system for assigning a safety classification to refrigerant gases based on toxicity and flammability.
- To express the flammability properties of the new unsaturated HFCs (referred to as **HFOs**) and other refrigerants with similar properties (such as Ammonia), ISO 817-2014 made **2L** a **separate class**, characterized by **burning velocities less than or equal to 10 cm/s**.

REFRIGERANT SAFETY GROUPS		
Class 3 – Higher Flammability	A3	B3
Class 2 – Lower Flammability	A2	B2
Class 2L – Lower Burning Velocity	A2L	B2L
Class 1 – No Flame Propagation	A1	B1
	Lower Toxicity	Higher Toxicity



n.e.t. innovative gas sensing

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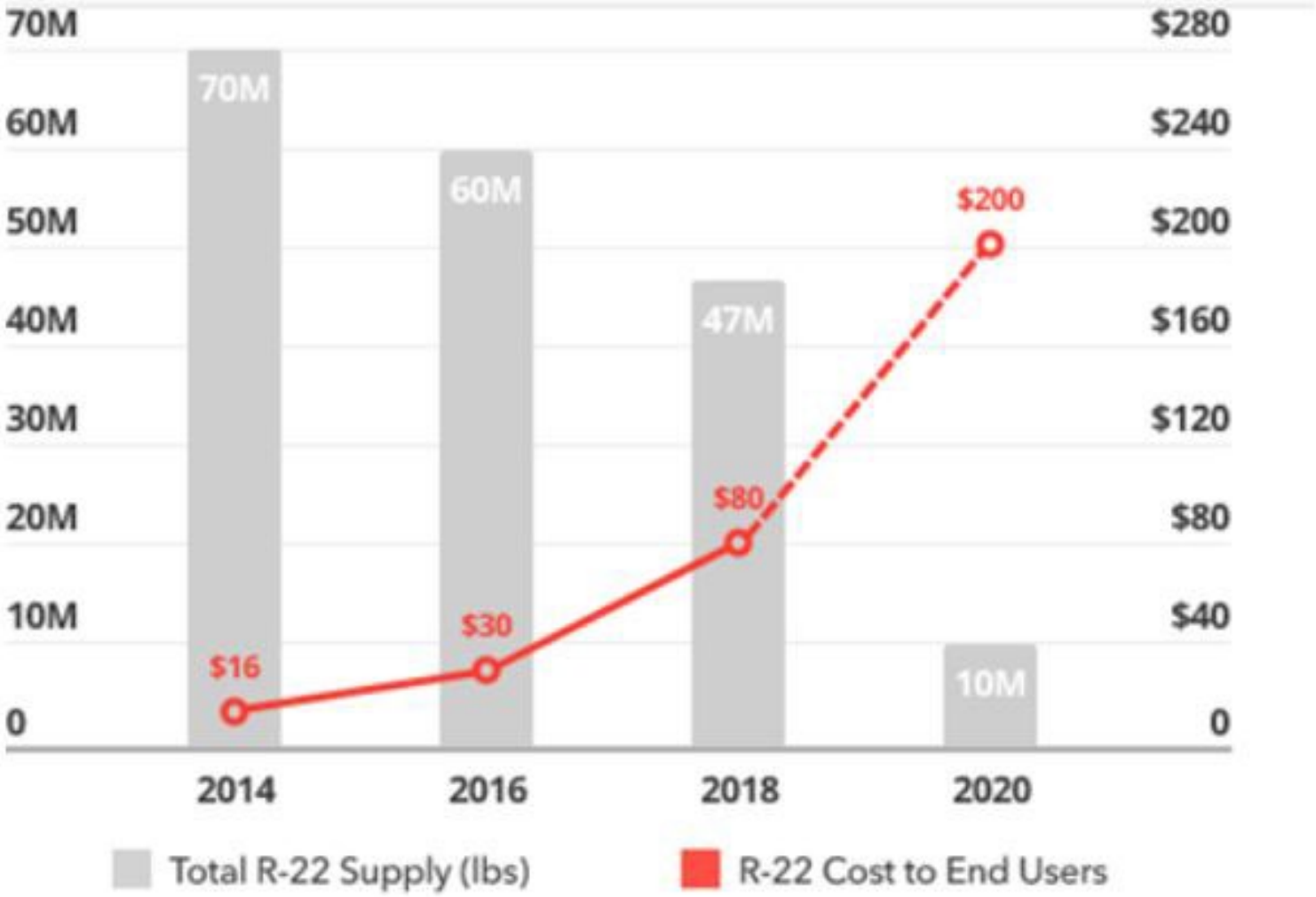
✓ More efficient

Up to 12% more efficient than R410A. This translates to more savings.

✓ Lower Cost

- As the AIM act timeline progresses and R410A production decreases, the refrigerant will be superseded and become harder to source.

R32



Total Supply = new import + existing stockpiles + reclaimed
R-22 price based on national average

R32

Many factors inform the right choice.

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- As the AIM act timeline progresses and R410A production decreases, the refrigerant will be superseded and become harder to source.
- R32 is an open patent that is produced by multiple manufacturers. R454B is a proprietary blend made by just one.
- 40% less charge means 40% less cost to recharge a system

R32 FOR MORE INFORMATION VISIT R32REASONS.COM.

R-32 IS ENDORSED BY DAIKIN Amana Heating & Air Conditioning Goodman

Agenda

- Industry Regulatory Update
- A2L's & Refrigerant Classifications
- **Flammability**

R32

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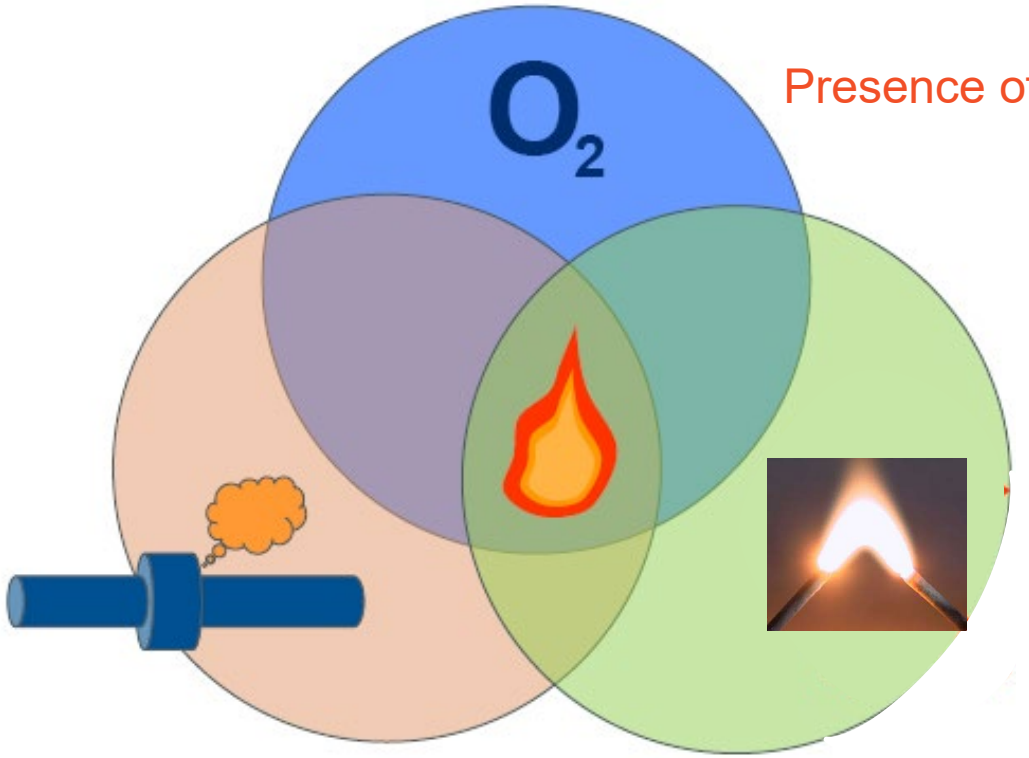
Goodman Air Conditioning & Heating

Amana Heating & Air Conditioning

DAIKIN AIR INTELLIGENCE

Conditions for A2L refrigerant ignition

- An ignition of any flammable agent can only be triggered if all 3 conditions are met
- Adequate measures must be taken to prevent such situations from occurring



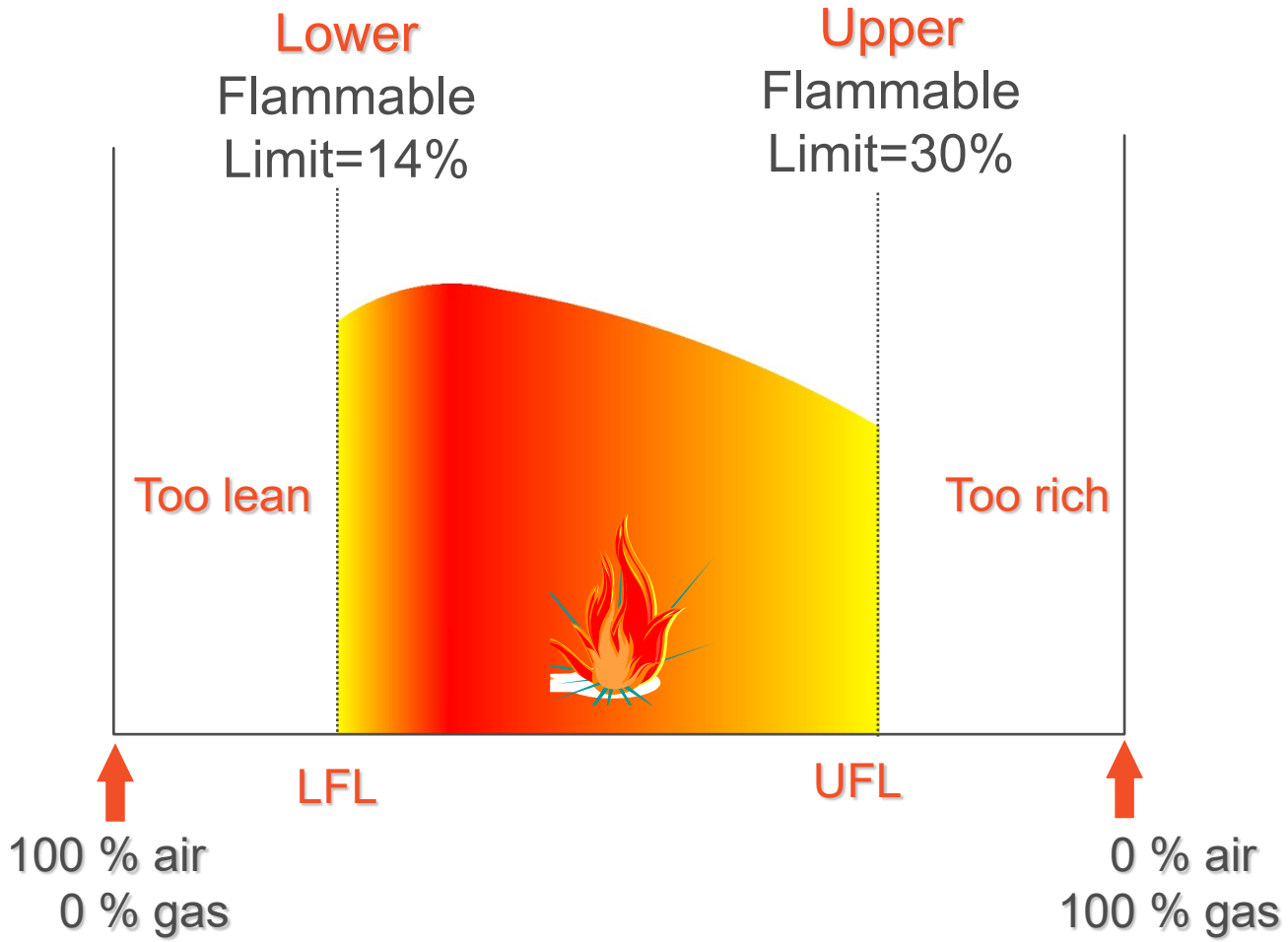
Presence of oxygen

Occurrence of a refrigerant leak

Presence/contact with minimum ignition energy source

Flammable Concentration Range

- The Lower Flammable Limit (LFL) and Upper Flammable Limit (UFL) are the minimum and maximum concentrations of refrigerant in air that is capable of burning



Refrigerant Flammability Comparison

- The minimum ignition energy (MIE) is the minimum electrical spark energy, in millijoules (mJ), required to ignite a flammable gas/air mixture.
- As a reference point, consider the spark from a high-voltage spark plug. It produces 20-30 mJ of ignition energy.

Refrigerant	R-32	R-454B	R-1234yf	R-717 Ammonia	R-152a	R-290 Propane	R-600a Isobutane
Safety Group	A2L	A2L	A2L	B2L	A2	A3	A3
LFL	14.4%	11.8%	6.2%	15%	3.9%	2.1%	1.8%
Auto Ignition Temperature	648°C 1,198.4°F	496°C 924.8°F	405°C 761°F	651°C 1,203.8°F	440°C 824°F	455°C 851°F	460°C 860°F
Minimum Ignition Energy (MIE)	30 – 100 mJ	100-300 mJ	5,000 – 10,000 mJ	100 – 300 mJ	0.38 mJ	0.25 mJ	0.6 – 0.7 mJ
Burning Velocity	6.7 cm/s	5.2 cm/s	1.5 cm/s	7.2 cm/s	23 cm/s	46 cm/s	41 cm/s
Heat of Combustion (HOC)	3,869 Btu/lb	4,420 Btu/lb	4,408 Btu/lb	9,673 Btu/lb	2,708 Btu/lb	19,905 Btu/lb	19,000 – 19,200 Btu/lb

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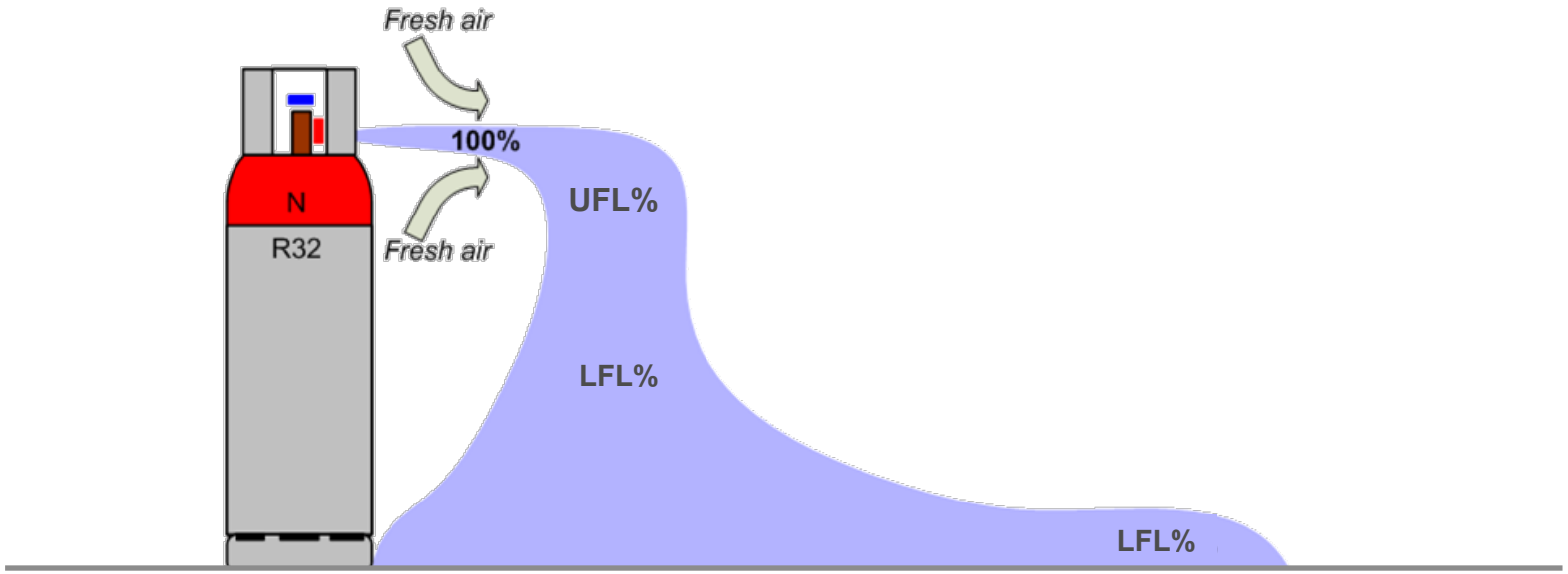
Density

Density of a flammable gas is important to know

- A2Ls are heavier than air, when the gas escapes from a container and no ventilation is present, it will tend to spread over the bottom of the floor where it will mix with air, lowering its concentration.



	Lower limit	Upper limit
R-32 flammability limits	13.8%	29.9%

ASHRAE 15.2 - A2L Maximum design charge limits & Minimum Room Size

Table 9-3 M for A2L Systems Based on 7.2 ft (2.2 m) Dispersal Height[a]

Area[b]		M[c]			
		With *Circulation*		Without *Circulation*	
ft^2	m^2	lb_m	kg	lb_m	kg
100	9.3	6.9	3.1	6.9	3.1
125	11.6	8.6	3.9	8.6	3.9
150	13.9	10.3	4.7	10.3	4.7
175	16.3	12.1	5.5	11.1	5.0
200	18.6	13.8	6.3	11.9	5.4
225	20.9	15.5	7.0	12.6	5.7
250	23.2	17.2	7.8	13.3	6.0
275	25.5	18.9	8.6	13.9	6.3
300	27.9	20.7	9.4	14.6	6.6
325	30.2	22.4	10.2	15.2	6.9
350	32.5	24.1	10.9	15.7	7.1
375	34.8	25.8	11.7	16.3	7.4
400	37.2	27.6	12.5	16.8	7.6

ASHRAE 15.2 - A2L Maximum design charge limits & Minimum Room Size

Table 9-4 Additional Charge Permitted for A2L Systems Using Ventilation

Ventilation Rate		MV[a]			
		With *Circulation*		Without *Circulation*	
cfm	m^3/h	lb_m	kg	lb_m	kg
20	34	0.8	0.4	0.4	0.2
40	68	1.4	0.6	0.7	0.3
60	102	2.2	1.0	1.1	0.5
80	136	2.8	1.2	1.4	0.6
100	170	3.6	1.6	1.8	0.8
120	204	4.2	2.0	2.1	1.0
140	238	5.0	2.2	2.5	1.1
160	272	5.6	2.6	2.8	1.3
180	306	6.4	2.8	3.2	1.4
200	340	7.0	3.2	3.5	1.6
220	374	8.4	3.8	4.2	1.9
240	408	9.2	4.2	4.6	2.1
260	442	10.0	4.6	5.0	2.3


ASHRAE

ADDENDA

ANSI/ASHRAE Addendum a to
ANSI/ASHRAE Standard 15.2-2022

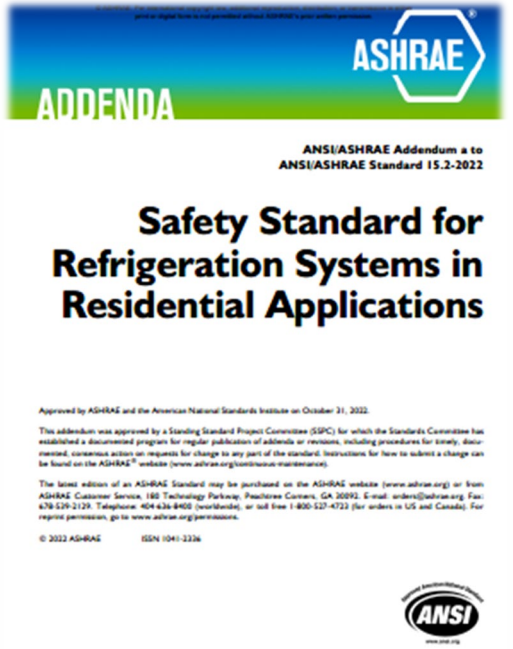
Safety Standard for Refrigeration Systems in Residential Applications

ANSI

ASHRAE 15.2 - A2L Maximum design charge limits & Minimum Room Size

Table 9-2 *LFL* Conversion Factor

Refrigerant	*C*
R-32	1.00
R-452B	1.02
R-454A	0.92
R-454B	0.97
R-454C	0.95
R-457A	0.71



But what does all of this really mean?

Factory Charge & Minimum Room Size

	ALZS5BA 1810A*	ALZS5BA 2410A*	ALZS5BA 3010A*	ALZS5BA 3610A*	ALZS5BA 4210A*	ALZS5BA 4810A*	ALZS5BA 6010A*
NOMINAL CAPACITIES							
Cooling (BTU/h)	18,000	24,000	30,000	36,000	42,000	48,000	60,000
Heating (BTU/h)	18,000	24,000	30,000	36,000	42,000	48,000	60,000
SEER2	15.2	15.2	15.2	15.2	15.2	15.2	15.2
Decibels	70.0	73.0	73.0	71.1	72.0	73.6	74.8
COMPRESSOR							
RLA	9.3	11.4	12.9	18.4	16.1	21.6	30.2
LRA	44.3	59.3	76.0	88.0	112.2	127.7	178.0
Stage	Single	Single	Single	Single	Single	Single	Two
Type	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
CONDENSER FAN MOTOR							
Horsepower	1/6	1/6	1/6	1/6	1/4	1/4	1/5
FLA	0.95	0.95	0.97	1.0	1.3	1.3	1.0
REFRIGERATION SYSTEM							
Refrigerant Line Size[1]							
Liquid Line Size ("O.D.)	¼"	¼"	¼"	⅜"	⅜"	⅜"	⅜"
Suction Line Size ("O.D.)	⅝"	⅝"	⅝"	¾"	⅞"	⅞"	⅞"
Refrigerant Connection Size							
Liquid Valve Size ("O.D.)	⅜"	⅜"	⅜"	⅜"	⅜"	⅜"	⅜"
Suction Valve Size ("O.D.)	¾"	¾"	¾"		⅞"	7⅛"	⅞"
Valve Connection Type	Sweat	Sweat	Sweat	Sweat	Sweat	Sweat	Sweat
Refrigerant Charge (oz.)	88	83	94	95	139	174	185

5.9 lbs.

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Factory Charge & Minimum Room Size

GH5SAN5: Product Data

Physical Data

UNIT SIZE SERIES	18	24	30	36	42	48	60
Compressor Type	Scroll						
REFRIGERANT	Puron Advance™ (R-454B)						
Factory Charge lb (kg)*	6.5(2.95)	5.4(2.45)	6.1(2.77)	7.6(3.45)	7.3(3.31)	10.5(4.76)	8.7(3.95)
Outdoor Heating Piston #	42	46	52	52	61	65	70
COND FAN	Forward Swept or Propeller Type, Direct Drive						
Air Discharge	Vertical						
Air Qty (CFM)	1900	3500	3000	3500	3000	3800	4300
Motor HP	1/12	1/10	1/10	1/4	1/5	1/4	1/4
Motor RPM	800	825	825	825	1100	1110	800
COND COIL							
Face Area (Sq ft)	17.2	19.3	21.4	17.2	17.2	21.4	22.6
Fins per In.	20	20	20	20	20	20	20
Rows	1	1	1	2	2	2	2
Circuits	7	6	7	8	10	12	12
VALVE CONNECT. (In. ID)							
Vapor	5/8	5/8	3/4	3/4	7/8	7/8	7/8
Liquid	3/8"						
REFRIGERANT TUBES* (In. OD)							
Rated Vapor†	5/8	5/8	3/4	3/4	7/8	7/8	1 1/8
Rated Liquid Line‡	3/8"						

ASHRAE 15.2 - A2L Maximum design charge limits & Minimum Room Size

Table 9-3 M for A2L Systems Based on 7.2 ft (2.2 m) Dispersal Height[a]

Area[b]		M[c]			
		With *Circulation*		Without *Circulation*	
ft^2	m^2	lb_m	kg	lb_m	kg
83	9.3	6.9	3.1	6.9	3.1
104	11.6	8.6	3.9	8.6	3.9
150	13.9	10.3	4.7	10.3	4.7
175	16.3	12.1	5.5	11.1	5.0
200	18.6	13.8	6.3	11.9	5.4
225	20.9	15.5	7.0	12.6	5.7
250	23.2	17.2	7.8		
275	25.5	18.9	8.6		
300	27.9	20.7	9.4		
325	30.2	22.4	10.2		
350	32.5	24.1	10.9		
375	34.8	25.8	11.7		
400	37.2	27.6	12.5		

3-ton R32 - 5.9 lbs.

3-ton R454b - 7.6 lbs.

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R32

There's more than one good reason to choose R-32.

In fact, there are 32 of them.

1 Up to 12% more efficient than 410A.

2 Light weight units.

3 Better than R-410A for the planet.

4 Easy to work with.

5 Globally

6 Non-

7 Lower price

8 Pure,

www.r32reasons.com

R32