What's R-32?

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R-32 THE MOST BALANCED REFRIGERANT

R-32 is the most balanced refrigerant in terms of environmental impact, energy efficiency, safety, and cost-effectiveness.

Refrigerant is a medium for conveying heat.

Air conditioners transfer heat while circulating refrigerant between the indoor and outdoor units.

Although there are various types of refrigerants, R-32 is a balanced refrigerant currently receiving attention.
Because R-32 efficiently conveys heat, it can reduce electricity consumption up to approximately 10% compared to that of air conditioners using refrigerant R-22. Furthermore, compared to the refriger for its low environmental impact.

*Source: Values for 100 year global warming potential (GWP) from IPCC Fourth Assessment Report. Comparative 100 year GWP: HFC410A, 2,090; HFC32, 675.

As the only manufacturer that develops and manufactures both air conditioners and refrigerants, Daikin launched the world's first residential-use air conditioner using R-32.

Refrigerant Trends

Environmental Impact of Air Conditioner Refrigerants and Trends

	Ozone Depletion Potential (ODP)	100 Year Global Warming Potential of Different Refrigerants*1
R12 (CFC)	1.0	10,900
R22 (HCFC)	0.055	1,810
R410A (HFC)	0	2,090
R32 (HFC)	0	675

Various refrigerants have been used in air conditioners until now. Regulations have increasingly become stricter from greater consideration for the global environment because of the Montreal Protocol Although the mainstream refrigerant R-410A has an ozone depletion potential (ODP) of 0, its global warming potential (GWP) still remains an issue.

While R-32 also has an ozone depletion potential of 0, the refrigerant has only approximately 1/3 of the GWP of R-410A. Consequently, investigation of R-32 has increased as a promising refrigerant w However, because R-32 had been an extremely difficult refrigerant to handle, its use was not practical until now. Daikin became the world's first company to succeed in applying R-32 to air conditioners
*1) Values for 100 year global warming potential (GWP) from IPCC Fourth Assessment Report. Comparative 100 year GWP: HFC410A, 2,090; HFC32, 675.

Cooperation with governments and international organizations has expanded technical assistance for emerging countries to each region and aims for widespread use of the refrigerant R
Aiming for widespread use throughout the world, Daikin not only manufactures and sells R-32, but it also provides technical assistance in emerging countries in cooperation with governments and inter In India, verification tests were conducted for inverter type R-32 air conditioners. In executing training for the proper handling of R-32, the technical level also improved. Consequently, Daikin has receiv manufacturers for technical assistance for conversion to R-32.

Year	Award Description
2014	"Director General Prize of Agency of Natural Resources and Energy in Japan" for the FIVE STAR ZEAS Series
2015	"Minister's Prize, The Ministry of Economy, Trade and Industry" for "Promotion of energy conservation through worldwide expansion of high efficiency HFC32 air conditioners"
	Recognized by the U.S. government as a company contributing to the protection of the environment
2016	"Minister of the Environment's 2016 Commendation for Global Warming Prevention Activity" for "Reduction of greenhouse gases by promotion of HFC32 air conditioners"

Such efforts as those mentioned above have earned Daikin high acclaim and a variety of awards.

R-32: The Most Balanced Refrigerant for Stationary Air Conditioners and Heat Pumps

Why We Choose Market Situation of R-32

Q. Why does Daikin choose R-32?

A. R-32 is the most balanced refrigerant in terms of Environmental Impact/Energy Efficiency/Safety/Cost

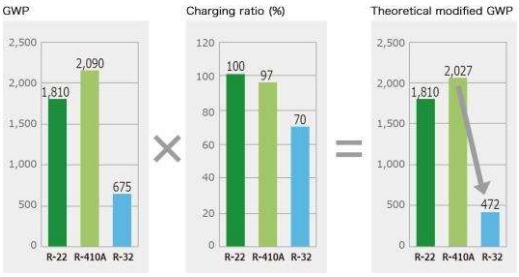
Daikin has assessed various refrigerants (R-32, blends, natural refrigerants, HFOs, etc.) based on four criteria (overall environmental impact, energy efficiency, safety and

After examining its key properties, Daikin has concluded that R-32 is a better refrigerant than others for direct expansion type cooling and heating equipment including sin

Smaller Impact on Environment

R-32 has zero ODP (Ozone Depletion Potential) and its GWP (Global Warming Potential) is 675, which is lower than the GWP of currently used R-410A or R-22. It could re lower GWP and the charging volume reduction.

Theoretical Modified GWP



Note: GWP values are based on the Fourth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC 4th AR).

Energy Efficiency: High Energy Efficiency

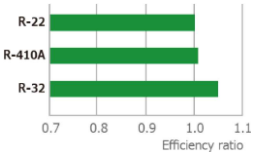
The potential refrigerating effect of R-32 is 1.5 times that of R-22 or R-410A. The cooling seasonal performance factor (CSPF) of R-32 is higher than conventional refrigeran high demand.

CSPF

Preconditions for calculations

1. 3.5 kW split-type cooling only model
2. CSPFs are calculated based on ISO 16358-1.
3. The peak power consumptions are based on indoor/outdoor temperatures of 27/35°CDB.
4. Comparison among India, Indonesia and Malaysia.

* Based on Daikin's calculation



Safety: Flammability

International Standard ISO 817:2014 segregates the flammability of refrigerants into 4 categories as follows: Class 1 (No flame propagation), Class 2L (Lower flammability) flammable categories and are defined by having a burning velocity of less than 10 cm per second. The characteristic of this low burning velocity is that the flame front does velocity than the burning velocity. This effectively means that a Class 2L refrigerant is not explosive if ignited because the flame only propagates in an upwards direction fro assessments using refrigerant in equipment to confirm safety.

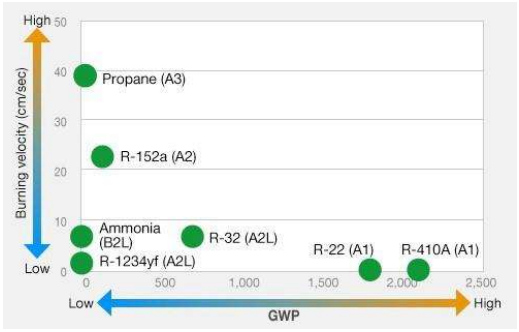
ISO 817:2014 Safety Group Classification

	Flammability		
Class 3	Higher flammability	A3	Propane, Isobutane, O
Class 2	Flammable	A2	R-152a
Class 2L	Lower flammability	A2L	R-32(675), R-1234yf(4
Class 1	No flame propagation	A1	R-410A(2090), R-134a

Lo

A2L and B2L are lower flammability refrigerants with a maximum burning velocity ≤ 10 cm/s (3.9 in./s) GWP value is indicated in parenthesis based on IPCC 4th AR.

Relationship between Burning Velocity and GWP



Safety Group Classification is indicated in parentheses.

Source: Japan Refrigeration and Air Conditioning Industry Association (JRAIA)

Risk Assessment of Mildly Flammable Refrigerants 2013 Progress Report, April 2014, The Japan Society of Refrigerating and Air Conditioning Engineers

Behavior of Flames

Classification	Class 3	Class 2
	A3	A2
Substance	Propane	R-152a
GWP	3	124
Burning velocity	39 cm/sec	23 cm/sec
Heat of combustion	46 MJ/kg	16 MJ/kg
Combustion state		

2L refrigerants do not horizontally propagate due to their slow burning velocity. Additionally, heat of the combustion of R-32 is low and the range of any impact by its flame is limited.

Note: GWP values are based on the Fourth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC 4th AR).

Related information is available at The Japan Society of Refrigerating and Air Conditioning Engineers: Risk Assessment of Mildly Flammable Refrigerants: Final Report 2

Related information is available at the AREMA (The Air Conditioning and Refrigeration Equipment Manufacturers Association of Australia) homepage.

Q. Is R-32 popular in the world?

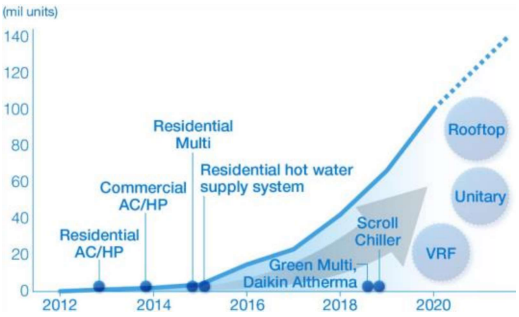
A. Approximately 280 million units of R-32 air conditioners are on the market in the world,[*1] achievin

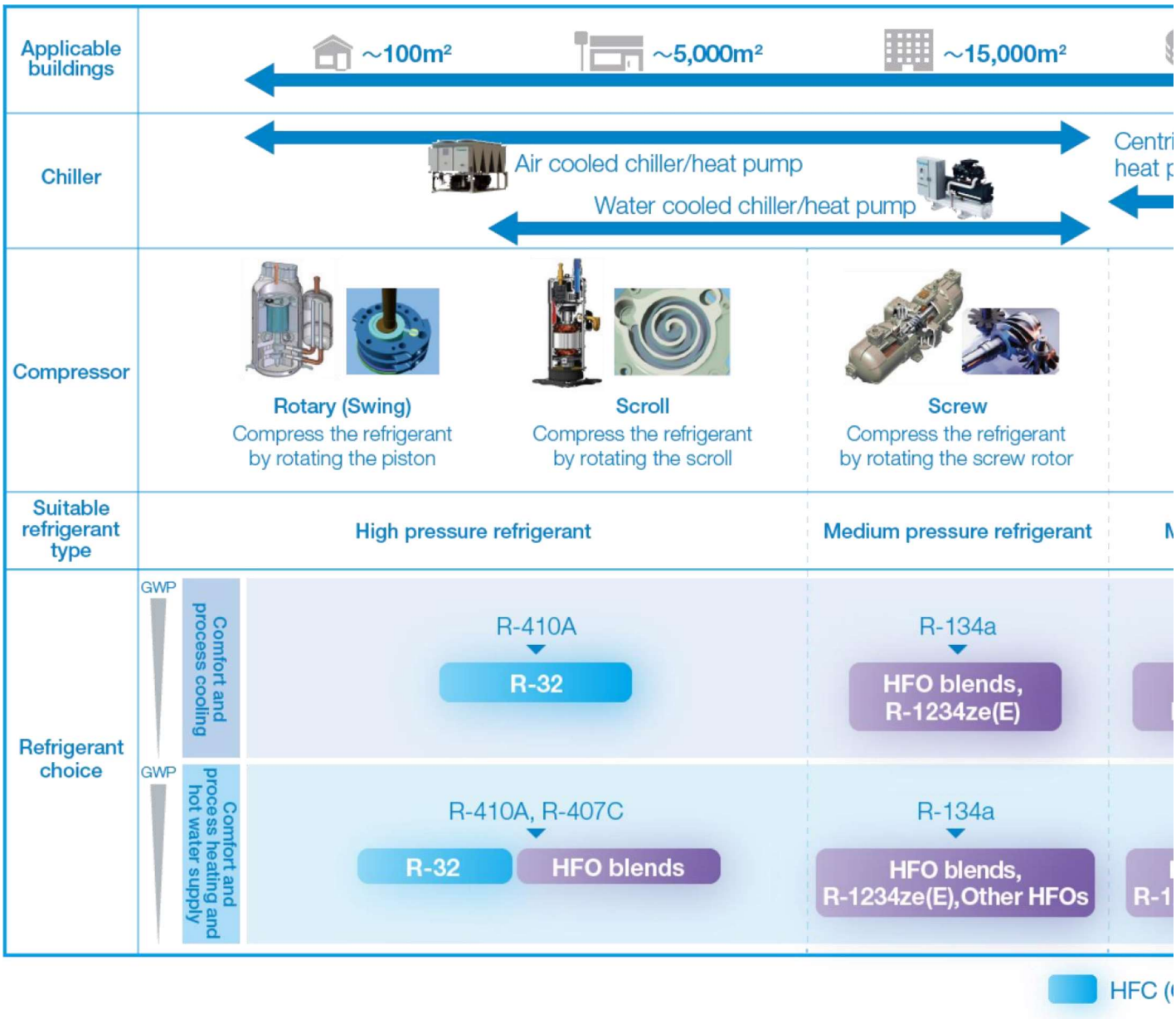
Daikin was the first to introduce air-conditioning and heat pump technology utilizing the refrigerant R-32, starting in Japan in November 2012. As of December 2023, we hav approximately 280 million units of R-32 equipment are estimated to have been sold globally[*1]. If all presently used R-410A refrigerant were replaced by R-32, the total CO_2 usual scenarios, along with a significantly reduced amount of indirect CO_2 emissions due to lower energy consumption. This is the equivalent of 50% of the annual carbon a of R-32 technology, and contribute to standard making to expand range of our products using R-32.

*1 Daikin's estimation as of December 2023.

*2 Comparison to business as usual scenarios with currently used R-410A and R-22.

R-32 Dissemination in the world





Major Refrigerants' Properties

Applied product applications and new refrigerant choices

- Toxicity and Flammability classification: International Standard ISO 817 and US standard ASHRAE34 classify the toxicity of refrigerant into 2 categories of Class A (Low flame propagation), Class 2L (Lower flammability), Class 2 (Flammable) and Class 3 (Higher flammability).
- GWP (Global Warming Potential): A value indicating the degree of contribution to global warming of various GHGs based on CO_2 as a standard.
- Composition: There are two types of refrigerants, single-component refrigerant which has only one molecule and refrigerant blends which are made up of two or more
- Saturated Temperature (boiling point), Saturated Pressure: Appropriate temperature and pressure rage vary based on appilcation and usage.

	Refrigerant number	Class *1		GWP*2	Nominal composition (mass fraction %) *1	Saturated Temperature (°C)*3	Saturated pressure (MPa)25°C *3
		Toxicity	Flammability				
HFC	R-22	A	1	1810	R-22 (100)	-40.8	1.04
	R-404A	A	1	3922	R-125/143a/134a (44.0/52.0/4.0)	(BP)-46.2 (DP)-45.5	(Liquid)1.25 (Vapor)1.24
	R-410A	A	1	2088	R-32/125 (50.0/50.0)	(BP)-51.4 (DP)-51.4	(Liquid)1.66 (Vapor)1.65
	R-407C	A	1	1774	R-32/125/134a (23.0/25.0/52.0)	(BP)-43.6 (DP)-36.6	(Liquid)1.19 (Vapor)1.02
	R-407H	A	1	1495	R-32/125/134a (32.5/15.0/52.5)	(BP)-44.6 (DP)-37.6	(Liquid)1.24 (Vapor)1.06
	R-134a	A	1	1430	R-134a (100)	-26.1	0.67

	R-32	A	2L	675	R-32 (100)	-51.7	1.69
HFOs / HFO blend	R-513A	A	1	573	R-1234yf/134a (56.0/44.0)	-29.6	0.71
	R-1233zd(E)	A	1	1	R-1233zd (100)	18.3	0.13
	R-1234ze(E)	A	2L	<1	R-1234ze (100)	-19.0	0.50
	R-1234yf	A	2L	<1	R-1234yf (100)	-29.5	0.68
Natural Refrigerant	Propane / R-290	A	3	3	R-290 (100)	-42.1	0.95
	Isobutane / R-600a	A	3	3	R-600a (100)	-11.7	0.35
	CO_2 / R-744	A	1	1	R-744 (100)	-78.5	6.43
	Ammonia / R-717	B	2L	<1	R-717 (100)	-33.3	1.00