

MACURCO

GAS DETECTION
a DwyerOmega brand



VRF APPLICATION GUIDE: VARIABLE REFRIGERANT FLOW

This publication is intended to serve as a guideline for the use of Macurco products. It is not to be considered all-inclusive, nor is it intended to replace the policy and procedures for any facility. If there are any doubts about the applicability of the equipment to your situation, consult an industrial hygienist or call Macurco Sales at 1-877-367-7891





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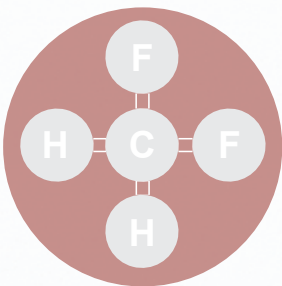
TYPES OF REFRIGERANTS

REFRIGERANT – Several types of refrigerants are used in VRF systems, each with its own advantages and disadvantages. The most common refrigerants used in VRF applications are R-410A and R-32.

R-410A is a popular refrigerant for VRF systems due to its high efficiency and low environmental impact. It has replaced the older R-22 refrigerant, which is no longer allowed in new systems due to its harmful effects on the ozone layer.

R-32 is another option gaining popularity due to its even lower global warming potential than R-410A. Blends of R-32 include: R-454A, R-454B, R-454C, R-455A.

Ultimately, the choice of refrigerant will depend on factors such as energy efficiency, environmental impact, safety, and cost and will vary depending on the specific needs of each application.



R-410A - is a hydrofluorocarbon (HFC) refrigerant that is composed of two main components: difluoromethane (CH_2F_2) and pentafluoroethane (CHF_2CF_3). R-410A is classified as an A1 non-flammable refrigerant under ASHRAE standards, requiring specific safety measures and equipment during installation, maintenance, and repair. R-410A is a nonvisible gas with a faint, ethereal odor. Regarding life safety, the main concern is that if a leak occurs, R-410A can displace oxygen in smaller areas such as hotel rooms, dormitories, apartments, nursing facilities, offices, etc.



**ASPHYXIAN
OR OXYGEN
DEPLETING**

- Where oxygen levels are too high, environments have the potential to become an explosive environment.
- Where Oxygen levels are too low, people within the environment can succumb to asphyxiation.
- Gases such as Refrigerants, Carbon Dioxide, Nitrogen, Helium, and Argon.

IMPORTANCE OF A FIXED GAS DETECTION SYSTEM



Protection of people and property 24 / 7 / 365



Advance notification



Explosion prevention



Low-cost investment to help prevent accidents

REFRIGERANT GAS CHART

Gas Type	Chemical Symbol	Safety Classification	RCL Values	Vapor Density (Air = 1)	LEL%	UEL%	Risks
R22	CHClF ₂	A1	13 lbs.	3	NA	NA	Asphyxiants
R-32	CH ₂ F ₂	A2L	4.8 lbs.	3.82	14.4	31	Asphyxiants/Flammable
R-125	C ₂ HF ₅	A1	23 lbs.	4.2	NA	NA	Asphyxiants
R-134a	CH ₂ FCF ₃	A1	13 lbs.	3.5	NA	NA	Asphyxiants
R-143a	C ₂ H ₃ F ₃	A2L	4.4 lbs.	2.9	7.1	16.1	Asphyxiants/Flammable
R-227ea	C ₃ HF ₇	A1	36 lbs.	5.9	NA	NA	Asphyxiants
R-290	C ₃ H ₈	A3	0.59 lbs.	1.56	2.1	9.5	Flammable
R-404A	(R-125/R-143a/R-134a) 44/52/4%	A1	31 lbs.	3.34	NA	NA	Asphyxiants
R-407A	(R-32/R125/R134a) 20/40/40%	A1	19 lbs.	2.54	NA	NA	Asphyxiants
R-407C	(R-32/R-125/R-134a) 23/25/52%	A1	18 lbs.	3	NA	NA	Asphyxiants
R-407F	(R-32/R125/R124a) 30/30/40%	A1	20 lbs.	2.54	NA	NA	Asphyxiants
R-410A	(R-32/R-125) 50/50%	A1	26 lbs.	3	NA	NA	Asphyxiants
R-417A	(R-125/R-134a/R-600) 46.6/50/3.4%	A1	3.5 lbs.	3.8	NA	NA	Asphyxiants
R-422D	(R-125/R-134a/R-600) 65.1/31.5/3.4%	A1	16 lbs.	3	NA	NA	Asphyxiants
R-448A	(R-32/R-125/R-134a/R1234yf/R-1234ze) 26/26/21/20/7%	A1	22 lbs.	2.98	NA	NA	Asphyxiants
R-449A	(R32/R125/R1234yf/R134a) 24.3/24.7/25.3/25.7%	A1	23 lbs.	3.07	NA	NA	Asphyxiants
R-450A	(R-134a/R1234ze) 42/58%	A1	20 lbs.	NA	NA	NA	Asphyxiants
R-452B	(HFC-32/C3H2F4) 30-50/50-70%	A2L	4.8 lbs.	NA	11.9	23.3	Asphyxiants/Flammable
R-454A	(HFC-32/R-1234yf) 35/65%	A2L	4.4 lbs.	2.83	6.3	15	Asphyxiants/Flammable
R-454B	(HFC-32/R-1234yf) 68.9/31.1%	A2L	4.6 lbs.	2.2	7.7	22	Asphyxiants/Flammable
R-454C	(HFC-32/R-1234yf) 21.5/78.5%	A2L	4.6 lbs.	3.1	6.2	15	Asphyxiants/Flammable
R-455A	(CO2/R32/R-1234yf) 3/21.5/75.5%	A2L	6.8 lbs.	NA	11.8	12.9	Asphyxiants/Flammable
R-507	(R-125/R-143a) 50/50%	A1	32 lbs.	NA	NA	NA	Asphyxiants
R-513A	(R-134a/R-1234yf) 30-50/50-70%	A1	20 lbs.	NA	NA	NA	Asphyxiants
R-600	C ₄ H ₁₀	A3	0.15 lbs.	2.0	1.8	8.4	Flammable
R-717	NH ₃	B2L	0.014 lbs.	0.6	15	28	Toxic/Flammable
R-744	CO ₂	A1	4.5 lbs.	1.52	NA	NA	Asphyxiants/Toxic
R-1233zd	C ₃ H ₂ ClF ₃	A1	5.3 lbs.	NA	NA	NA	Asphyxiants
R-1234yf	C ₃ H ₂ F ₄	A2L	4.5 lbs.	4	6.2	12.3	Asphyxiants/Flammable
R-1234ze	C ₃ F ₄ H ₂	A2L	4.7 lbs.	4	6.5	15	Asphyxiants/Flammable

Color - Colorless

Smell - Faint Ethereal Odor

Sensor Type - NDIR

% in Atmosphere - NA

Mounting Height - ~12" Above Floor

Per ASHRAE 34 Standard - LFL ppm v/v values

SAFETY STANDARDS

VRF SAFETY STANDARDS – The safety classification of R-410A in Standard 34 is group 1 (meaning non-toxic and non-flammable), has no ozone depletion potential, and meets the stringent mandates of the Montreal Protocol and the U.S. Environmental Protection Agency. However, due to the ability to displace oxygen, Addendum L to **ASHRAE Standard 34-2010** has established the maximum Refrigerant Concentration Limit (RCL) to 26 lbs. / 1000 ft³ of room volume for occupied spaces for Institutional Occupancies, the limit is reduced to 50% (13 lbs. / 1000 ft³). Since the indoor unit fan coils are in direct contact with the air being distributed, the system is classified as a Direct System according to Standard 15. By definition, a Direct System is also classified as a High Probability system, meaning that a refrigerant leak can potentially enter an occupied space.

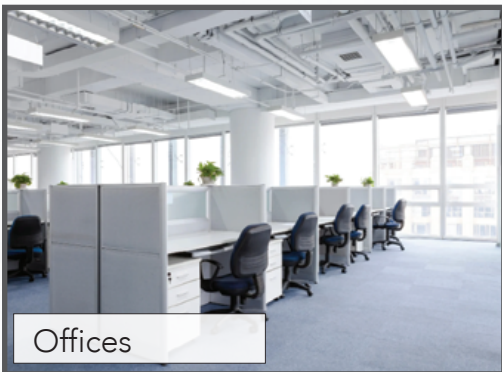
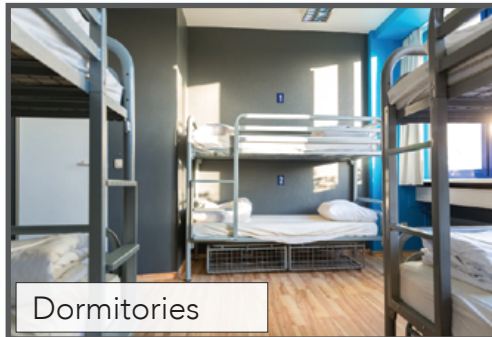
APPLICATION OVERVIEW

APPLICATION OVERVIEW - Variable Refrigerant Flow (VRF) is a type of HVAC system that offers high energy efficiency and flexibility in commercial and residential buildings. VRF systems use refrigerant to transport heat from the outdoor unit to multiple indoor units, allowing for individualized temperature control in each zone. This technology allows for precise temperature control, zoning capabilities, and efficient operation by adjusting the refrigerant supplied to each indoor unit based on its specific cooling or heating needs.

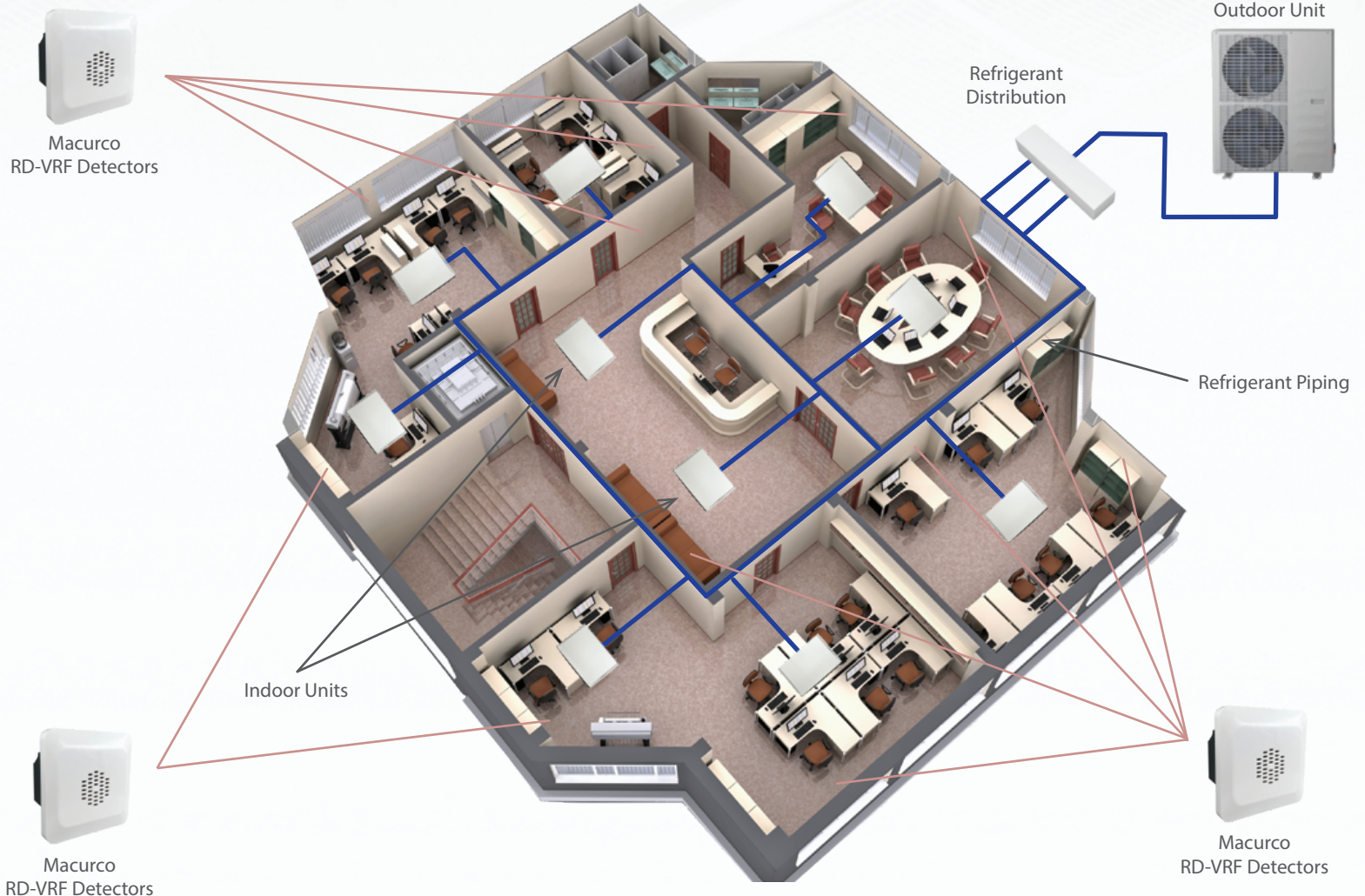
VRF systems are suitable for various applications, from small office buildings to large multi-use complexes. They are known for their quiet operation, easy installation, and low maintenance requirements, making them a popular choice for modern buildings looking for efficient and customizable heating and cooling solutions.



COMMON APPLICATIONS



RD-VRF OFFICE LAYOUT



This image illustrates a common configuration of the Macurco RD-VRF

An RD-VRF is normally mounted low in the room on a wall or column one foot above the floor in a central area where air movement is generally good. Generally Macurco recommends spacing 30-foot centers, 900 square feet per detector (84 sq. meters). The coverage depends on air movement within the room or facility. Extra detectors may be needed near any areas where people work, or sleep, or where the air is stagnant. The RD-VRF mounts on a 2 gang PVC electrical box supplied by the contractor. Mount the unit near the discharge of the fan coil.

RD-VRF SERIES



- 10-year sensor life
- Easy installation to double gang box or 4x4 electrical box
- Aesthetically pleasing – flush mount face plate
- Stable and accurate NDIR sensor
- Same model provides either 24V or 120V options
- Internal display for programming/testing
- Minimal maintenance required
 - Recommend calibration yearly
- 2 SPDT (Form C) relays
- Digital output: Modbus (STD), BACnet (optional)
- Multicolor LED status indicator
- Built in cal-port connection
- Works with Macurco digital control panels

Gas Types: R-32, R-134a, R-404A, R-407C, R-410A, R-449A, R-452B, R-454A, R-454B, R-454C, R-455A, R-1234yf, R-1234ze

For additional refrigerant gases, please contact Macurco.

MAINTENANCE DEMONSTRATION AND TRAINING

Inspect the components, equipment installation and electrical connections for compliance with requirements. Test the alarm set points of the gas detection system with calibration and test gases and verify sequence of operation. Perform demonstrations and train maintenance personnel to adjust, operate, troubleshoot, calibrate and maintain the gas detection and ventilation control systems. Calibration and test kits should be provided with the gas detection system. Calibration and test intervals should comply with manufacturer's recommendations. If required, prepare a written report to record test procedures, test results and corrective actions. The report should also cover the requirements for accessories like acceptability of alarm types, signs and protective equipment. Any repair or replacement of malfunctioning units should be performed by Macurco.



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Celebrating over 50 years of gas detection, the Macurco product line offers equipment for residential, commercial, and industrial applications. Since 1972 Macurco has been providing detection options for a number of different gases including carbon monoxide (CO), nitrogen dioxide (NO₂), hydrogen (H₂), propane (LP), methane (natural gas), hydrogen sulfide (H₂S), ammonia (NH₃), oxygen (O₂), carbon dioxide (CO₂), and refrigerants.

Headquartered in Sioux Falls, South Dakota, Macurco strives to provide the highest quality detection, safety and security solutions to customers worldwide. Whether you are looking for gas detection for a security system, building automation, or HVAC system, for personal safety or for monitoring specific gases in potentially hazardous environments, Macurco has a gas detector to meet your needs.



GAS DETECTION IS ALL WE DO, AND WE DO IT BEST.

Visit www.macurco.com for additional product information and training.



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