SECTION 1. IDENTIFICATION

Product name	:	R454B
Number	:	000000025450
Product Use Description	:	Refrigerant
Manufacturer or supplier's details	:	A-Gas (U.S. Headquarters) 1100 Haskins Rd. Bowling Green, OH 43402 United States agas.com/us
For more information call	:	1-419-867-8990
In case of emergency call	:	**1-800-633-8253**
	:	**International 1-801-629-0667**
	:	(24 hours/day, 7 days/week)

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Form	:	Liquefied gas
Color	:	colourless
Odor	:	slight ether-like

Classification of the substance or mixture

Classification of the substance or mixture	:	Flammable gases, Category 1B Gases under pressure, Liquefied gas Simple Asphyxiant

GHS Label elements, including precautionary statements

Symbol(s) :

Signal word : Danger

Hazard statements	: H221	Flammable gas.
	H280	Contains gas under pressure; may explode if heated.
	None	May displace oxygen and cause rapid suffocation.
Precautionary statements	: **Prevention:**	
	P210	Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
	Response:	
	P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
	P381	In case of leakage, eliminate all ignition sources.
	Storage:	
	P410 + P403	Protect from sunlight. Store in a well-ventilated place.

Carcinogenicity

No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP, IARC, or OSHA.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature : Mixture

Chemical name	CAS-No.	Concentration
Difluoromethane	75-10-5	68.90 %
2,3,3,3-Tetrafluoropropene	754-12-1	31.10 %

SECTION 4. FIRST AID MEASURES

General advice	:	First aider needs to protect himself. Move out of dangerous area. Take off all contaminated clothing immediately.
Inhalation	:	Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Use oxygen as required, provided a qualified operator is present. Call a physician.
Skin contact	:	Rapid evaporation of the liquid may cause frostbite. If there is evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. Wash contaminated clothing before re-use. Consult a physician.
Eye contact	:	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In case of frostbite water should be lukewarm, not hot. Call a physician.
Ingestion	:	Unlikely route of exposure. As this product is a gas, refer to the inhalation section. Do not induce vomiting without medical advice. If conscious, drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Notes to physician

Indication of immediate medical attention and special treatment needed, if necessary	:	Treat frost-bitten areas as needed. Treat symptomatically.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Specific hazards during	:	Flammable gas.

firefighting		Contents under pressure. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Vapors may travel to areas away from work site before igniting/flashing back to vapor source. Fire or intense heat may cause violent rupture of packages. Cool closed containers exposed to fire with water spray. Do not allow run-off from fire fighting to enter drains or water courses. In case of fire hazardous decomposition products may be produced such as: Hydrogen fluoride Carbonyl halides Carbon monoxide Carbon dioxide (CO2)
Special protective equipment for firefighters	:	In the event of fire and/or explosion do not breathe fumes. Wear self-contained breathing apparatus and protective suit. No unprotected exposed skin areas.
Further information	:	Evacuate personnel to safe areas. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Immediately evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Wear personal protective equipment. Unprotected persons must be kept away. Wear self-contained breathing apparatus and protective suit. Eliminate all ignition sources if safe to do so. Avoid skin contact with leaking liquid (danger of frostbite). Ventilate the area. Vapors may travel to areas away from work site before igniting/flashing back to vapor source. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing. Avoid accumulation of vapours in low areas. Unprotected personnel should not return until air has been tested and determined safe.

Ensure that the oxygen content is >= 19.5%.

Environmental precautions	:	Prevent further leakage or spillage if safe to do so. The product evaporates readily. Discharge into the environment must be avoided.
Methods and materials for containment and cleaning up	:	Use explosion-proof equipment. No sparking tools should be used. Ventilate the area. Allow to evaporate.

SECTION 7. HANDLING AND STORAGE

Handling

Precautions for safe handling	:	Handle with care. Wear personal protective equipment. Do not breathe vapor. Avoid contact with skin, eyes and clothing. Use only in well-ventilated areas. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Follow all standard safety precautions for handling and use of compressed gas cylinders. Use authorized cylinders only. Protect cylinders from physical damage. Do not puncture or drop cylinders, or expose them to open flame or excessive heat. Do not remove screw cap until immediately ready for use. Always replace cap after use.
Advice on protection against fire and explosion	:	Container hazardous when empty. Vapours may form flammable mixture with air. Keep product and empty container away from heat and sources of ignition. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Take measures to prevent the build up of electrostatic charge. Electrical equipment should be protected to the appropriate standard. Use explosion-proof equipment. No sparking tools should be used. No smoking.

Storage

Conditions for safe storage, including any incompatibilities	:	Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Storage rooms must be properly ventilated. Ensure adequate ventilation, especially in confined areas. Protect cylinders from physical damage. Store away from incompatible substances. Store in original container.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Protective measures	:	Ensure that eyewash stations and safety showers are close to the workstation location. Do not breathe vapor. Avoid contact with skin, eyes and clothing.
Engineering measures	:	Use with local exhaust ventilation.
Eye protection	:	Safety goggles
Hand protection	:	Protective gloves Gloves must be inspected prior to use. Replace when worn.
Skin and body protection	:	Avoid skin contact with leaking liquid (danger of frostbite). Wear suitable protective equipment.
Respiratory protection	:	No personal respiratory protective equipment normally required. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Use NIOSH approved respiratory protection.
Hygiene measures	:	Handle in accordance with good industrial hygiene and safety practice. Ensure adequate ventilation, especially in confined areas. When using do not eat, drink or smoke. Remove and wash contaminated clothing before re-use.

Keep working clothes separately.
Do not breathe vapor.
Avoid contact with skin, eyes and clothing.

Exposure Guidelines

Components	CAS-No.	Value	Control parameters	Update	Basis
Difluoromethane	75-10-5	TWA : Time weighted average	2,200 mg/m3 (1,000 ppm)	2007	WEEL:US Workplace Environmental Exposure Level
Difluoromethane	75-10-5	TWA : Time weighted average	(1,000 ppm)	1994	Honeywell:Limit established by Honeywell International Inc.
2,3,3,3-Tetrafluoropropene	754-12-1	TWA : Time weighted average	(500 ppm)	03 15 2010	Honeywell:Limit established by Honeywell International Inc.
2,3,3,3-Tetrafluoropropene	754-12-1	TWA : Time weighted average	(500 ppm)	2020	WEEL:US Workplace Environmental Exposure Level
2,3,3,3-Tetrafluoropropene	754-12-1	STEL : Short term exposure limit	(1,500 ppm)	03 15 2010	Honeywell:Limit established by Honeywell International Inc.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state : Liquefied gas

Color : colourless

Odor	:	slight ether-like
Odor threshold	:	Note: No data available
pH	:	Note: neutral
Melting point/ range	:	Note: No data available
Boiling point/boiling range	:	-50.9 °C
Flash point	:	Note: Not applicable
Evaporation rate	:	> 1 Method: Compared to CCl4.
Flammability	:	Flammable gas.
Lower flammability limit	:	11.25 %(V)at23 °C
Upper flammability limit	:	22 %(V)at 23 °C
Vapor pressure	:	1,411 kPa at 21 °C(70 °F)
Vapor density	:	2.2 Note: (Air = 1.0)
Density	:	Note: No data available
Water solubility	:	Note: No data available
Partition coefficient: n-octanol/water	:	Note: No data available
Ignition temperature	:	496 °C

Viscosity, dynamic	:	Note: No data available
Viscosity, kinematic	:	Note: No data available
Oxidizing properties	:	The substance or mixture is not classified as oxidizing.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Not classified as a reactivity hazard.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	Hazardous polymerisation does not occur.
Conditions to avoid	:	Keep away from heat and sources of ignition. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Decomposes under high temperature. Some risk may be expected of corrosive and toxic decomposition products.
Incompatible materials	:	Alkali metals Oxidizers (e.g. peroxide residues present in insufficiently cured rubbers) Finely divided metal powders such as aluminum, magnesium, or zinc.
Hazardous decomposition products	:	In case of fire hazardous decomposition products may be produced such as: Hydrogen fluoride Carbonyl halides Carbon monoxide Carbon dioxide (CO2)

SECTION 11. TOXICOLOGICAL INFORMATION

Acute inhalation toxicity
Difluoromethane : LC50: > 520000 ppm
Exposure time: 4 h
Species: Rat

2,3,3,3-Tetrafluoropropene : LC50: > 400000 ppm, vapour
Exposure time: 4 h
Species: Rat
Method: OECD Test Guideline 403

Skin irritation : Note: Not applicable study technically not feasible

Eye irritation : Note: Not applicable study technically not feasible

Sensitisation
Difluoromethane : Cardiac sensitization
Species: dogs
Note: No-observed-effect level
>350 000 ppm

2,3,3,3-Tetrafluoropropene : Dermal
Note: Not applicable, as this product is a gas.
study technically not feasible

Repeated dose toxicity
Difluoromethane : Species: Rat
Application Route: Inhalation
Exposure time: (90 d)
NOEL: 50000 ppm
Subchronic toxicity

2,3,3,3-Tetrafluoropropene : Species: Rat
Application Route: Inhalation
Exposure time: (2 Weeks)
No-observed-effect level: 50000 ppm
Method: OECD Test Guideline 412

Species: Rat
Application Route: Inhalation
Exposure time: (4 Weeks)

NOAEL (No observed adverse effect level): 50000 ppm
Method: OECD Test Guideline 412

Species: Rat
Application Route: Inhalation
Exposure time: (13 Weeks)
NOAEL (No observed adverse effect level): 50000 ppm
Method: OECD Test Guideline 413

Species: Rabbit, male
Application Route: Inhalation
Exposure time: (28 d)
No-observed-effect level: 500 ppm
Method: OECD Test Guideline 412
There are no observed toxicological effects, which result in classification as a specific target organ toxicant.

Species: Rabbit, female
Application Route: Inhalation
Exposure time: (28 d)
No-observed-effect level: 1000 ppm
Method: OECD Test Guideline 412
There are no observed toxicological effects, which result in classification as a specific target organ toxicant.

Species: Mini-pig
Application Route: Inhalation
Exposure time: (28 d)
NOAEL (No observed adverse effect level): 10000 ppm
highest exposure tested

Genotoxicity in vitro

Difluoromethane : Test Method: Ames test
Result: negative

2,3,3,3-Tetrafluoropropene : Test Method: Ames test
Result: 20% and higher, positive in TA 100 and e. coli WP2 uvrA, negative in TA98, TA100, and TA1535.
Method: OECD Test Guideline 471

: Cell type: Human lymphocytes
Result: negative
Method: Mutagenicity (in vitro mammalian cytogenetic test)

: Test Method: Chromosome aberration test in vitro
Result: negative

: Test Method: Chromosome aberration test in vitro
Cell type: Human lymphocytes
Result: negative
Method: OECD Test Guideline 473
Note: Dose 760,000 ppm

Genotoxicity in vivo

Difluoromethane : Species: Mouse
Cell type: Bone marrow
Method: Mutagenicity (micronucleus test)
Result: negative

2,3,3,3-Tetrafluoropropene : Species: Mouse
Cell type: Micronucleus
Dose: up to 200,000 ppm (4 hour)
Method: OECD Test Guideline 474
Result: negative

: Test Method: Unscheduled DNA synthesis
Dose: up to 50,000 ppm (4 weeks)
Method: OECD Test Guideline 486
Result: negative

: Species: Rat
Cell type: Micronucleus
Dose: up to 50,000 ppm (4 weeks)
Method: OECD Test Guideline 474
Result: negative

Carcinogenicity

2,3,3,3-Tetrafluoropropene : Species: Rat
Note: Not classified as a human carcinogen. Substance not expected to be a carcinogen based on available data.

Teratogenicity

Difluoromethane : Species: Rat

Dose: NOEL - 50,000 ppm
Note: Did not show teratogenic effects in animal experiments.

Species: Rabbit
Dose: NOEL - 50,000 ppm
Note: Did not show teratogenic effects in animal experiments.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity to fish
2,3,3,3-Tetrafluoropropene : LC50: > 197 mg/l
Exposure time: 96 h
Species: Cyprinus carpio (Carp)
Method: OECD Test Guideline 203
Note: No demonstrable toxic effect in saturated solution.

Toxicity to daphnia and other aquatic invertebrates
2,3,3,3-Tetrafluoropropene : EC50: > 83 mg/l
Exposure time: 48 h
Species: Daphnia magna (Water flea)
Method: OECD Test Guideline 202

Toxicity to algae
2,3,3,3-Tetrafluoropropene : EC50: > 100 mg/l
Species: Scenedesmus capricornutum (fresh water algae)
Method: OECD Test Guideline 201

Bioaccumulation
2,3,3,3-Tetrafluoropropene : Note: Due to the distribution coefficient n-octanol/water, accumulation in organisms is not expected.

Biodegradability
Difluoromethane : Note: Minimal

2,3,3,3-Tetrafluoropropene : Result: Not readily biodegradable.
Method: OECD Test Guideline 301F

Further information on ecology

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods : Observe all Federal, State, and Local Environmental regulations.

SECTION 14. TRANSPORT INFORMATION

DOT

UN/ID No.	:	UN 3161
Proper shipping name	:	LIQUEFIED GAS, FLAMMABLE, N.O.S. (Difluoromethane, 2,3,3,3-Tetrafluoropropene)
Class		2.1
Packing group		
Hazard Labels		2.1

IATA

UN/ID No.	:	UN 3161
Description of the goods	:	LIQUEFIED GAS, FLAMMABLE, N.O.S. (Difluoromethane, 2,3,3,3-Tetrafluoropropene)
Class		2.1
Hazard Labels	:	2.1
Packing instruction (cargo aircraft)	:	200

IMDG

UN/ID No.	:	UN 3161
Description of the goods	:	LIQUEFIED GAS, FLAMMABLE, N.O.S. (DIFLUOROMETHANE, 2,3,3,3-Tetrafluoropropene)
Class	:	2.1
Hazard Labels	:	2.1
EmS Number	:	F-D, S-U
Marine pollutant	:	no

IMDG Code segregation group according chapter 3.1.4.4 : NONE,

SECTION 15. REGULATORY INFORMATION

Inventories

USA. List of Active Substances on the Toxic Substances Control Act (TSCA) Chemical : All substances listed as active on the TSCA inventory

Substances Inventory, as amended		
Australian Inventory of Industrial Chemicals	:	All components are listed on the inventory, regulatory obligations/restrictions apply
Canada. Domestic Substances List (DSL), as amended	:	All components of this product are on the Canadian DSL
Japan. Kashin-Hou Law List	:	On the inventory, or in compliance with the inventory
Korea. Existing Chemicals Inventory (KECI)	:	On the inventory, or in compliance with the inventory
Philippines. Inventory of Chemicals and Chemical Substances (PICCS)	:	On the inventory, or in compliance with the inventory
China. Inventory of Existing Chemical Substances (IECSC)	:	On the inventory, or in compliance with the inventory
Thailand. Existing Chemicals Inventory from FDA (TECI List)	:	On the inventory, or in compliance with the inventory
Taiwan Chemical Substance Inventory (TCSI)	:	On the inventory, or in compliance with the inventory
TSCA 5A	:	US. Toxic Substances Control Act (TSCA) Section 5(a)(2) Proposed Significant New Use Rules (SNURs) (40 CFR 721, Subpt E) The following substance(s) is/are subject to a Significant New Use Rule: 2,3,3,3-Tetrafluoropropene 754-12-1
TSCA 12B	:	US. Toxic Substances Control Act (TSCA) Section 12(b) Export Notification (40 CFR 707, Subpt D) The following substance(s) is/are subject to TSCA 12(b) export notification requirements: 2,3,3,3-Tetrafluoropropene 754-12-1

National regulatory information

US. Toxic Substances Control Act (TSCA) Section 5(a)(2) Final Significant New Use Rules (SNURs) (40 CFR 721, Subpt E)	:	: Issued.	
	:	2,3,3,3-Tetrafluoropropene	754-12-1
SARA 302 Components	:	No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.	
SARA 313 Components	:	This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.	
SARA 311/312 Hazards	:	Fire Hazard Sudden Release of Pressure Hazard Acute Health Hazard	
California Prop. 65	:	**WARNING:** This product can expose you to chemicals, listed below, known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov. Dichloromethane 75-09-2 Chloromethane 74-87-3	
Massachusetts RTK	:	Dichloromethane	75-09-2
Pennsylvania RTK	:	Difluoromethane	75-10-5

SECTION 16. OTHER INFORMATION

		HMIS III	NFPA
Health hazard	:	1	2
Flammability	:	4	4
Physical Hazard	:	0	
Instability	:		0

Hazard rating and rating systems (e.g. HMIS® III, NFPA): This information is intended solely for the use of individuals trained in the particular system.

Further information

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. Final determination of suitability of any material is the sole responsibility of the user. This information should not constitute a guarantee for any specific product properties.

Changes since the last version are highlighted in the margin. This version replaces all previous versions.
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