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Safety Data Sheet

Product – Refrigerating Machines – R454B

Version 1

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Milwaukee, WI 53202

414-524-1200

24 Hour Emergency Response Information: 3E Company 1-800-451-8346

SECTION 1. IDENTIFICATION

1.1. Product name : Chillers
Commercial name : Refrigerating Machines – Refrigerant R454B

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

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

Classification of the substance or mixture

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

GHS Label elements, including precautionary statements.



Signal word : Danger

Hazard statements : Extremely flammable gas.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements : **Prevention:**
Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.

Response:
Leaking gas fire: Do not extinguish unless leak can be stopped safely.
Eliminate all ignition sources if safe to do so.

Storage:
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

Difluoromethane	75-10-5	68.90 %
2,3,3,3-Tetrafluoroprop-1-ene	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 : Treat frost-bitten areas as needed. Treat symptomatically. medical attention and special treatment needed, if necessary

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.
Vapors 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 firefighting 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.
Vapors are heavier than air and can cause suffocation by
reducing oxygen available for breathing.
Avoid accumulation of vapors in low areas.
Unprotected personnel should not return until air has been tested
and determined safe.

Ensure that the oxygen content is $\geq 19.5\%$.

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
used. up

: Use explosion-proof equipment.
No sparking tools should be
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, 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.
Vapors 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 buildup 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, expose including any even incompatibilities : Pressurized container; protect from sunlight and do not to temperatures exceeding 50 °C. Do not pierce or burn, 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 vapors.
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/m ³ (1,000 ppm)	2007	WEEL:US. OARS. WEELs Workplace Environmental Exposure Level Guide, as amended
Difluoromethane	75-10-5	TWA: Time weighted average	(1,000 ppm)	1994	Honeywell: Limit established by Honeywell International Inc.
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	TWA: Time weighted average	(500 ppm)	2009	WEEL:US. OARS. WEELs Workplace Environmental Exposure Level Guide, as amended
2,3,3,3-Tetrafluoroprop-1-ene	754-12-1	TWA: Time weighted average	(500 ppm)	03 15 2010	Honeywell: Limit established by Honeywell International Inc.
2,3,3,3-Tetrafluoroprop-1-ene	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 : colorless
 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) at 23 °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- : Note: No data available

octanol/water

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
occur. reactions : Hazardous polymerisation does not

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 (CO ₂)

SECTION 11. TOXICOLOGICAL INFORMATION

Acute inhalation toxicity Difluoromethane	: LC50: > 520000 ppm Exposure time: 4 h Species: Rat
2,3,3,3-Tetrafluoroprop-1-ene	: LC50: > 400000 ppm Exposure time: 4 h Species: Rat Method: OECD Test Guideline 403
Skin irritation 2,3,3,3-Tetrafluoroprop-1-ene	: Note: Not applicable study technically not feasible
Eye irritation 2,3,3,3-Tetrafluoroprop-1-ene	: Note: Not applicable study technically not feasible
Sensitization Difluoromethane	: Cardiac sensitization Species: dogs Note: No-observed-effect level >350 000 ppm
2,3,3,3-Tetrafluoroprop-1-ene	: 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
Sub chronic toxicity

2,3,3,3-Tetrafluoroprop-1-
ene

: 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-Tetrafluoroprop-1-
ene

: 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-Tetrafluoroprop-1-
ene

: 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

SECTION 12. ECOLOGICAL INFORMATION

Toxicity to fish
2,3,3,3-Tetrafluoroprop-1-ene : LC50: > 197 mg/l ene
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-Tetrafluoroprop-1-ene : 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-Tetrafluoroprop-1-ene : EC50: > 100 mg/l
Species: Scenedesmus capricornutum (freshwater algae)
Method: OECD Test Guideline 201

Bioaccumulation
2,3,3,3-Tetrafluoroprop-1-ene : Note: Due to the distribution coefficient n-octanol/water, accumulation in organisms is not expected.

Biodegradability
Difluoromethane : Note: Minimal

2,3,3,3-Tetrafluoroprop-1-ene : Result: Not readily biodegradable.
Method: OECD Test Guideline 301F

SECTION 13. DISPOSAL CONSIDERATIONS

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

SECTION 14. TRANSPORT INFORMATION

DOT & MXDG UN/ID No.: UN 3358

Proper shipping name: Refrigerating machines, containing flammable, non-toxic, liquefied gas

Hazard Class: 2.1

Hazard Label: 2.1

Special Provision – Less than 12 kg net of refrigerant gas, these units are not subject to federal or international regulations.

IATA UN/ID No.: UN 3358 (FORBIDDEN FOR AIR TRANSPORT)

Proper shipping name: Refrigerating machines, containing flammable, non-toxic, liquefied gas

Hazard Class: 2.1

Hazard Label: 2.1

IMDG UN/ID No.: UN 3358

Proper shipping name: Refrigerating machines, containing flammable, non-toxic, liquefied gas

Hazard Class: 2.1

Hazard Label: 2.1

Special Provision 291 – Less than 12 kg net of refrigerant gas, these units are not subject to federal or international regulations.

SECTION 15. REGULATORY INFORMATION

Inventories

US. Toxic Substances Control Act	: On TSCA Inventory
Australia. Industrial Chemical (Notification and Assessment) Act	: On the inventory, or in compliance with the inventory
Canada. Canadian Environmental Protection Act (CEPA). Domestic Substances List (DSL)	: 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. The Toxic Substances and Hazardous and Nuclear Waste Control Act	: 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
New Zealand. Inventory of Chemicals (NZIoC), as published by ERMA New Zealand	: On the inventory, or in compliance with the inventory
TSCA 12B	: US. Toxic Substances Control Act (TSCA) Section 12(b) Export

Notification (40 CFR 707, Subpt D)

2,3,3,3-Tetrafluoroprop-1-ene 754-12-1

National regulatory information

- 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.