

Fig. 9-8. Pressure-heat diagram for freezer application using R-12 as refrigerant. Heat is absorbed in evaporator from D to A. Vapors are compressed by compressor A' to B'. Heat is given off in the condenser B' to C'. Pressure drops from C' to D as refrigerant passes through refrigerant control without change in heat content.

is shown in Fig. 9-6. See Para. 1-54 for an explanation of enthalpy. Metric unit pressure-enthalpy diagram for R-12 is shown in Fig. 9-7. It is safe to use 30 lb. of R-12 for each 1000 cu. ft. of air conditioned space.

A typical R-12 cycle for a frozen foods unit is shown in Fig. 9-8. The dotted line labeled C' to D' shows the increased refrigerating effect when the liquid is sub-cooled in the condenser or liquid line. This sub-cooling uses a low ambient temperature or a heat exchanger.

R-12 is available in a variety of cylinder sizes. The cylinder code color is white. This is an important fact to remember when purchasing or using refrigerants. See Para. 9-27 for

R-22 is a synthetic (made by humans; not found in nature) refrigerant developed for refrigeration installations that need a low evaporating temperature. (See Fig. 9-9.) It is referred to as "monochlorodifluoromethane" and also as "chlorodifluoromethane."

One application is in fast freezing units which maintain a temperature of -20°F to -40°F (-29 to -40°C). It has also been successfully used in air conditioning units in household refrigerators. It is used with both reciprocating and centrifugal compressors. It is not necessary to use R-22 at below-atmosphere pressures in order to obtain these low temperatures.

R-22 is stable and is nontoxic, noncorrosive, nonirritating and nonflammable. R-22 has a boiling point of -41°F (-41°C) at atmospheric pressure. The normal heat of vaporization at 86 $^{\circ}\text{F}$ (30°C) is 173 psia or 158 psig (1.101 kPa), as shown in table in Fig. 9-9. The evaporator pressure for R-22 is 43 psia or 28 psig (296 kPa) at 5°F (-15°C). The latent heat of R-22 at 5°F (-15°C) is 83.28 Btu/lb. (217 J/g). Latent heat is difference of last two columns in Fig. 9-9.

Temp °F	PRESSURE		VOLUME VAPOR Cu. Ft./lb.	DENSITY LIQUID Lb./Cu. Ft.	HEAT CONTENT BTU/LB.	
	Psia	Psig			Liquid	Vapor
-150	0.272	29.37*	141.23	98.24	-25.97	87.52
-125	0.886	28.12*	46.69	96.04	-20.33	90.43
-100	2.398	25.04*	18.43	93.77	-14.56	93.37
-75	5.610	18.50*	8.36	91.43	- 8.64	96.29
-50	11.674	6.15*	4.22	89.00	- 2.51	99.14
-25	22.086	7.39	2.33	86.48	3.83	101.88
-15	27.865	13.17	1.87	85.43	6.44	102.94
-10	31.162	16.47	1.68	84.90	7.75	103.46
- 5	34.754	20.06	1.52	84.37	9.08	103.96
0	38.657	23.96	1.37	83.83	10.41	104.47
5	42.888	28.19	1.24	83.28	11.75	104.96
10	47.464	32.77	1.13	82.72	13.10	105.44
25	63.450	48.75	0.86	81.02	17.22	106.84
50	98.727	84.03	0.56	78.03	24.28	108.95
75	146.91	132.22	0.37	74.80	31.61	110.74
86	172.87	158.17	0.32	73.28	34.93	111.40
100	210.60	195.91	0.26	71.24	39.27	112.11
125	292.62	277.92	0.18	67.20	47.37	112.88
150	396.19	381.50	0.12	62.40	56.14	112.73

* Inches of mercury below one atmosphere.

Fig. 9-9. Properties of liquid and saturated vapor of refrigerant R-22. Note pressures corresponding to standard evaporating temperature of 5°F (-15°C) and condensing temperature of 86°F (30°C).

SOURCE: MODERN REFRIGERATION AND AIR-CONDITIONING
ALTHOUSE/TURNQUIST/BRACCIANO



Material Safety Data Sheet

R-22 (MONOCHLORO DI FLUOROMETHANE) - CHCLF₂

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: R-22
DISTRIBUTOR: National Refrigerants, Inc.
661 Kenyon Avenue
Bridgeport, New Jersey 08302

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-5:00pm)
1-800-262-0012

IN CASE OF EMERGENCY CALL:
CHEMTREC: 1-800-424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS NUMBER	WEIGHT %
Chlorodifluoromethane	75-45-6	100

Trace impurities and additional material names not listed above may also appear in Section 15 toward the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Colorless, volatile liquid with ethereal and faint sweetish odor. Non-flammable material. Overexposure may cause dizziness and loss of concentration. At higher levels, CNS depression and cardiac arrhythmia may result from exposure. Vapors displace air and can cause asphyxiation in confined spaces. At higher temperatures, (>250°C), decomposition products may include Hydrochloric Acid (HCl), Hydrofluoric Acid (HF) and carbonyl halides.

POTENTIAL HEALTH HAZARDS

SKIN: Irritation would result from a defatting action on tissue. Liquid contact could cause frostbite.

EYES: Liquid contact can cause severe irritation and frostbite. Mist may irritate.

INHALATION: R-22 is low in acute toxicity in animals. When oxygen levels in air are reduced to 12-14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur.

INGESTION: Ingestion is unlikely because of the low boiling point of the material. Should it occur, discomfort in the gastrointestinal tract from rapid evaporation of the material and consequent evolution of gas would result. Some effects of inhalation and skin exposure would be expected.

DELAYED EFFECTS: None Known



R-22

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

INGREDIENT NAME NTP STATUS IARC STATUS OSHA LIST

No ingredients listed in this section

4. FIRST AID MEASURES

SKIN: Promptly flush skin with water until all chemical is removed. 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. Get medical attention if symptoms persist.

EYES: Immediately flush eyes with large amounts of water for at least 15 minutes (in case of frostbite, water should be lukewarm, not hot) lifting eyelids occasionally to facilitate irrigation. Get medical attention if symptoms persist.

INHALATION: Immediately remove to fresh air. If breathing has stopped, give artificial respiration. Use oxygen as required, provided a qualified operator is available. Get medical attention immediately. DO NOT give epinephrine (adrenaline).

INGESTION: Ingestion is unlikely because of the physical properties and is not expected to be hazardous. DO NOT induce vomiting unless instructed to do so by a physician.

ADVICE TO PHYSICIAN: Because of the possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution and only in situations of emergency life support. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT: Gas, not applicable per DOT regulations

FLASH POINT METHOD: Not applicable

AUTOIGNITION TEMPERATURE: Unknown

UPPER FLAME LIMIT (volume % in air): None*

LOWER FLAME LIMIT (volume % in air): None*

FLAME PROPAGATION RATE (solids): Not applicable

OSHA FLAMMABILITY CLASS: Not applicable

EXTINGUISHING MEDIA: Use any standard agent – choose the one most appropriate for type of surrounding fire (material itself is not flammable)

UNUSUAL FIRE AND EXPLOSION HAZARDS:

R-22 is not flammable at ambient temperatures and atmospheric pressure. However, this material will become combustible when mixed with air under pressure and exposed to strong ignition sources. Contact with certain reactive metals may result in formation of explosive or exothermic reactions under specific conditions (e.g. very high temperatures and/or appropriate pressures).



R-22

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

Firefighters should wear self-contained, NIOSH-approved breathing apparatus for protection against possible toxic decomposition products. Proper eye and skin protection should be provided. Use water spray to keep fire-exposed containers cool.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE:

(Always wear recommended personal protective equipment.)
Evacuate unprotected personnel. Protected personnel should remove ignition sources and shut off leak, if without risk, and provide ventilation. Unprotected personnel should not return until air has been tested and determined safe, including low-lying areas.
Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

7. HANDLING AND STORAGE

NORMAL HANDLING:

(Always wear recommended personal protective equipment.)
Avoid breathing vapors and liquid contact with eyes, skin or clothing. Do not puncture or drop cylinders, expose them to open flame or excessive heat. Use authorized cylinders only. Follow standard safety precautions for handling and use of compressed gas cylinders.
R-22 should not be mixed with air above atmospheric pressure for leak testing or any other purpose. See Section 5: Unusual Fire and Explosion Hazards

STORAGE RECOMMENDATIONS:

Store in a cool, well-ventilated area of low fire risk and out of direct sunlight. Protect cylinder and its fittings from physical damage. Storage in subsurface locations should be avoided. Close valve tightly after use and when empty.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS:

Provide local ventilation at filling zones and areas where leakage is probable. Mechanical (general) ventilation may be adequate for other operating and storage areas.

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION:

Skin contact with refrigerant may cause frostbite. General work clothing and gloves (leather) should provide adequate protection. If prolonged contact with liquid or gas is anticipated, insulated gloves constructed of PVA, neoprene or butyl rubber should be used. Any contaminated clothing should be promptly removed and washed before reuse.

EYE PROTECTION:

For normal conditions, wear safety glasses. Where there is reasonable probability of liquid contact, wear chemical safety goggles.

MSDS:

R-22

Current Issue Date: December, 2008

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RESPIRATORY PROTECTION:

None generally required for adequately ventilated work situations. For accidental release or non-ventilated situations, or release into confined space, where the concentration may be above the PEL of 1,000 ppm, use a self-contained, NIOSH approved breathing apparatus or supplied air respirator. For escape, use the former or a NIOSH approved gas mask with organic vapor canister.

ADDITIONAL RECOMMENDATIONS:

Where contact with liquid is likely, such as in a spill or leak, impervious boots and clothing should be worn. High dose-level warning signs are recommended for areas of principle exposure. Provide eyewash stations and quick-drench shower facilities at convenient locations. For tank cleaning operations, see OSHA regulations, 29 CFR 1910.132 and 29 CFR 1910.133.

EXPOSURE GUIDELINES

INGREDIENT NAME	ACGIH TLV	OSHA PEL	OTHER LIMIT
Chlorodifluoromethane	1000 ppm TWA (8hr)	1000 ppm TWA (8hr)	None

OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS:

Hydrogen Fluoride: ACGIH TLV = 3ppm ceiling

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Clear, colorless liquid and vapor
PHYSICAL STATE: Gas at ambient temperatures
MOLECULAR WEIGHT: 86.45
CHEMICAL FORMULA: CHClF₂
ODOR: Faint ethereal odor
SPECIFIC GRAVITY (water = 1.0): 1.21 @ 21.1°C (70°F)
SOLUBILITY IN WATER (weight %): 0.3 wt% @ 25°C and 1 atmosphere
pH: Neutral
BOILING POINT: -40.8°C (-41.4°F)
FREEZING POINT: -160°C (-256°F)
VAPOR PRESSURE: 136.1 psia @ 70°F
VAPOR DENSITY (air = 1.0): 3.0
EVAPORATION RATE: >1
% VOLATILES: 100
FLASH POINT: Not applicable
(Flash point method and additional flammability data are found in Section 5.)

COMPARED TO: CCl₄ = 1



R-22

10. STABILITY AND REACTIVITY

NORMALLY STABLE? (CONDITIONS TO AVOID):

The product is stable.

Do not mix with oxygen or air above atmospheric pressure. Any source of high temperatures, such as lighted cigarettes, flames, hot spots or welding may yield toxic and/or corrosive decomposition products.

INCOMPATIBILITIES:

(Under specific conditions: e.g. very high temperatures and/or appropriate pressures) - Freshly abraded aluminum surfaces (may cause strong exothermic reaction). Chemically reactive metals: potassium, calcium, powdered aluminum, magnesium, and zinc.

HAZARDOUS DECOMPOSITION PRODUCTS:

Halogens, halogen acids and possibly carbonyl halides.

HAZARDOUS POLYMERIZATION:

Will not occur.

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:

LC₅₀: 4 hr. (rat) - $\geq 300,000$ ppm / Cardiac Sensitization threshold (dog) - 50,000 ppm

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

Subchronic inhalation (rat) NOEL - 10,000 ppm

Not mutagenic in *in-vitro* or *in-vivo* tests

Not teratogenic

OTHER DATA:

Lifetime exposure of male rats was associated with a small increase in salivary gland fibrosarcomas.

12. ECOLOGICAL INFORMATION

Degradability (BOD):

R-22 is a gas at room temperature; therefore, it is unlikely to remain in water.
Octanol Water Partition Coefficient: Unknown

13. DISPOSAL CONSIDERATIONS

RCPRA

Is the unused product a RCRA hazardous waste if discarded?

Not a hazardous waste
Not applicable

If yes, the RCRA ID number is:



R-22

OTHER DISPOSAL CONSIDERATIONS:

Disposal must comply with federal, state, and local disposal or discharge laws. R-22 is subject to U.S. Environmental Protection Agency Clean Air Act Regulations Section 608 in 40 CFR Part 82 regarding refrigerant recycling.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT PROPER SHIPPING NAME: Chlorodifluoromethane

US DOT HAZARD CLASS: 2.2

US DOT PACKING GROUP: Not applicable

US DOT ID NUMBER: UN1018

For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: Listed on the TSCA inventory

OTHER TSCA ISSUES: None

SARA TITLE III / CERCLA

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients:

INGREDIENT NAME

SARA / CERCLA RQ (lb.)

SARA EHS TPQ (lb.)

No ingredients listed in this section

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS:

IMMEDIATE PRESSURE

SARA 313 TOXIC CHEMICALS:

The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section 2.

INGREDIENT NAME

Chlorodifluoromethane (HCFC-22)

COMMENT

None

STATE RIGHT-TO-KNOW

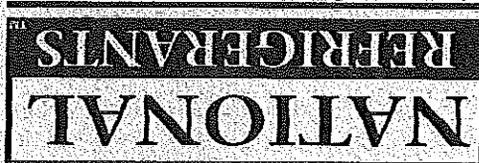
In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.

INGREDIENT NAME

No ingredients listed in this section

WEIGHT %

COMMENT



R-22

ADDITIONAL REGULATORY INFORMATION:

R-22 is subject to U.S. Environmental Protection Agency Clean Air Act Regulations at 40 CFR Part 82.

WARNING: DO NOT vent to the atmosphere. To comply with provisions of the U.S. Clean Air Act, any residual must be recovered. Contains Chlorodifluoromethane, an HCFC substance which harms public health and the environment by destroying ozone in the upper atmosphere. Destruction of the ozone layer can lead to increased ultraviolet radiation which, with excess exposure to sunlight, can lead to an increase in skin cancer and eye cataracts.

WHMIS CLASSIFICATION (CANADA):

This product has been evaluated in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

FOREIGN INVENTORY STATUS:

Canada - Listed on DSL
EU - EINECS # 2008719

16. OTHER INFORMATION

CURRENT ISSUE DATE: December, 2008
PREVIOUS ISSUE DATE: August, 2007

OTHER INFORMATION:

HMIS Classification: Health - 1, Flammability - 1, Reactivity - 0
NFPA Classification: Health - 2, Flammability - 1, Reactivity - 0
ANSI/ASHRAE 34 Safety Group - A1
UL Classified

Regulatory Standards:

1. OSHA regulations for compressed gases: 29 CFR 1910.101
2. DOT classification per 49 CFR 172.101
3. Clean Air Act Class II Substance

17. DISCLAIMER

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NATIONAL REFRIGERANTS™

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STATE RIGHT-TO-KNOW

In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.

<u>INGREDIENT NAME</u>	<u>WEIGHT %</u>	<u>COMMENT</u>
No ingredients listed in this section		

ADDITIONAL REGULATORY INFORMATION:

R-407C is subject to U.S. Environmental Protection Agency Clean Air Act Regulations at 40 CFR Part 82.

WARNING: Do not vent to the atmosphere. To comply with provisions of the U.S. Clean Air Act, any residual must be recovered. Contains Pentafluoroethane (HFC-125), Difluoromethane (HFC-32), and Tetrafluoroethane (HFC-134a), greenhouse gases which may contribute to global warming.

WHMIS CLASSIFICATION (CANADA):

This product has been evaluated in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

FOREIGN INVENTORY STATUS:

EU – EINECS # 2065578 – HFC-125
2008394 – HFC-32
223770 – HFC-134a

16. OTHER INFORMATION

CURRENT ISSUE DATE: December, 2008
PREVIOUS ISSUE DATE: August, 2007

OTHER INFORMATION: HMIS Classification: Health – 1, Flammability – 1, Reactivity – 0
NFPA Classification: Health – 2, Flammability – 1, Reactivity – 0
ANSI / ASHRAE 34 Safety Group – A1

Regulatory Standards:

1. OSHA regulations for compressed gases: 29 CFR 1910.101
 2. DOT classification per 49 CFR 172.101
- Toxicity information per PAFT Testing

17. DISCLAIMER

National Refrigerants, Inc. believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY, OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN. The information provided herein relates only to the specific product designated and may not be valid where such product is used in combination with any other methods or use of the product and of the information referred to herein are beyond the control of National Refrigerants. National Refrigerants expressly disclaims any and all liability as to any results obtained or arising from any use of the product or reliance on such information.

NATIONAL REFRIGERANTS™

R-407C

13. DISPOSAL CONSIDERATIONS

RCRA

Is the unused product a RCRA hazardous waste if discarded?
If yes, the RCRA ID number is:

Not a hazardous waste.
Not applicable.

OTHER DISPOSAL CONSIDERATIONS:

Disposal must comply with federal, state, and local disposal or discharge laws. R-407C is subject to U.S. Environmental Protection Agency Clean Air Act Regulations Section 608 in 40 CFR Part 82 regarding refrigerant recycling.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT PROPER SHIPPING NAME: Refrigerant gas R 407C
US DOT HAZARD CLASS: 2.2
US DOT PACKING GROUP: Not applicable
US DOT ID NUMBER: UN3340

For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: Components listed on the TSCA inventory
OTHER TSCA ISSUES: None

SARA TITLE III / CERCLA

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

INGREDIENT NAME

SARA / CERCLA RQ (lb.)

SARA EHS TPO (lb.)

No ingredients listed in this section

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: IMMEDIATE PRESSURE

SARA 313 TOXIC CHEMICALS:

The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section 2.

INGREDIENT NAME

COMMENT

No ingredients listed in this section

NATIONAL REFRIGERANTS™

R-407C

10. STABILITY AND REACTIVITY

NORMALLY STABLE? (CONDITIONS TO AVOID):

The product is stable.

Do not mix with oxygen or air above atmospheric pressure. Any source of high temperature, such as lighted cigarettes, flames, hot spots or welding may yield toxic and/or corrosive decomposition products.

INCOMPATIBILITIES:

(Under specific conditions: e.g. very high temperatures and/or appropriate pressures) – Freshly abraded aluminum surfaces (may cause strong exothermic reaction). Chemically active metals: potassium, calcium, powdered aluminum, magnesium and zinc.

HAZARDOUS DECOMPOSITION PRODUCTS:

Halogens, halogen acids and possibly carbonyl halides.

HAZARDOUS POLYMERIZATION:

Will not occur.

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:

HFC-32: LC₅₀ : 4 hr. (rat) - 520,000 ppm / Cardiac Sensitization threshold (dog) 350,000 ppm
HFC-125: LC₅₀ : 4 hr. (rat) - > 800,000 ppm / Cardiac Sensitization threshold (dog) 75,000 ppm
HFC-134a: LC₅₀ : 4 hr. (rat) - > 500,000 ppm / Cardiac Sensitization threshold (dog) > 80,000 ppm

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

HFC-32: Teratogenic NOEL (rat and rabbit) – 50,000 ppm
Subchronic inhalation (rat) NOEL – 50,000 ppm
HFC-125: Teratogenic NOEL (rat and rabbit) – 50,000 ppm
Subchronic inhalation (rat) NOEL - ≥ 50,000 ppm
Chronic NOEL – 10,000 ppm
HFC-134a: Teratogenic NOEL (rat and rabbit) – 40,000 ppm
Subchronic inhalation (rat) NOEL – 50,000 ppm
Chronic NOEL – 10,000 ppm

OTHER DATA:

HFC-32, HFC-125, HFC-134a: Not active in four genetic studies

12. ECOLOGICAL INFORMATION

Degradability (BOD):

R-407C is a gas at room temperature; therefore, it is unlikely to remain in water.

Octanol Water Partition Coefficient: Unknown for mixture

NATIONAL REFRIGERANTS

R-407C

EYE PROTECTION:

For normal conditions, wear safety glasses. Where there is reasonable probability of liquid contact, wear chemical safety goggles.

RESPIRATORY PROTECTION:

None generally required for adequately ventilated work situations. For accidental release or non-ventilated situations, or release into confined space, where the concentration may be above the PEL of 1,000 ppm, use a self-contained, NIOSH-approved breathing apparatus or supplied air respirator. For escape: use the former or a NIOSH-approved gas mask with organic vapor canister.

ADDITIONAL RECOMMENDATIONS:

Where contact with liquid is likely, such as in a spill or leak, impervious boots and clothing should be worn. High dose-level warning signs are recommended for areas of principle exposure. Provide eyewash stations and quick-drench shower facilities at convenient locations. For tank cleaning operations, see OSHA regulations, 29 CFR 1910.132 and 29 CFR 1910.133.

EXPOSURE GUIDELINES

<u>INGREDIENT NAME</u>	<u>ACGIH TLV</u>	<u>OSHA PEL</u>	<u>OTHER LIMIT</u>
Difluoromethane	None	None	*1000 ppm TWA (8hr)
Pentafluoroethane	None	None	*1000 ppm TWA (8hr)
1,1,1,2-Tetrafluoroethane	None	None	*1000 ppm TWA (8hr)

* = Workplace Environmental Exposure Level (AIHA)

OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS:

Hydrogen Fluoride: ACGIH TLV: 3 ppm ceiling

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Clear, colorless liquid and vapor	
PHYSICAL STATE:	Gas at ambient temperatures	
MOLECULAR WEIGHT:	86.2	
CHEMICAL FORMULA:	CH ₂ F ₂ , CF ₃ CHF ₂ , CH ₂ FCF ₃	
ODOR:	Faint ethereal odor	
SPECIFIC GRAVITY (water = 1.0):	1.16 @ 21.1°C (70°F)	
SOLUBILITY IN WATER (weight %):	Unknown	
pH:	Neutral	
BOILING POINT:	-43°C (-45.4°F)	
FREEZING POINT:	Not determined	
VAPOR PRESSURE:	156.2 psia @ 70°F 356.7 psia @ 130°F	
VAPOR DENSITY (air = 1.0):	3.0	COMPARED TO: CCl₄ = 1
EVAPORATION RATE:	>1	
% VOLATILES:	100	
FLASH POINT:	Not applicable	

(Flash point method and additional flammability data are found in Section 5.)

NATIONAL REFRIGERANTSTM

R-407C

UNUSUAL FIRE AND EXPLOSION HAZARDS:

R-407C is not flammable at ambient temperatures and atmospheric pressure. However, this material will become combustible when mixed with air under pressure and exposed to strong ignition sources.

Contact with certain reactive metals may result in formation of explosive or exothermic reactions under specific conditions (e.g. very high temperatures and/or appropriate pressures).

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

Firefighters should wear self-contained, NIOSH-approved breathing apparatus for protection against possible toxic decomposition products. Proper eye and skin protection should be provided. Use water spray to keep fire-exposed containers cool.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE:

(Always wear recommended personal protective equipment.)

Evacuate unprotected personnel. Protected personnel should remove ignition sources and shut off leak, if without risk, and provide ventilation. Unprotected personnel should not return until air has been tested and determined safe, including low-lying areas.

Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

7. HANDLING AND STORAGE

NORMAL HANDLING:

(Always wear recommended personal protective equipment.)

Avoid breathing vapors and liquid contact with eyes, skin or clothing. Do not puncture or drop cylinders, expose them to open flame or excessive heat. Use authorized cylinders only. Follow standard safety precautions for handling and use of compressed gas cylinders.

R-407C should not be mixed with air above atmospheric pressure for leak testing or any other purpose.

STORAGE RECOMMENDATIONS:

Store in a cool, well-ventilated area of low fire risk and out of direct sunlight. Protect cylinder and its fittings from physical damage. Storage in subsurface locations should be avoided. Close valve tightly after use and when empty.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS:

Provide local ventilation at filling zones and areas where leakage is probable. Mechanical (general) ventilation may be adequate for other operating and storage areas.

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION:

Skin contact with refrigerant may cause frostbite. General work clothing and gloves (leather) should provide adequate protection. If prolonged contact with the liquid or gas is anticipated, insulated gloves constructed of PVA, neoprene or butyl rubber should be used. Any contaminated clothing should be promptly removed and washed before reuse.

NATIONAL REFRIGERANTS™

R-407C

INGESTION: Ingestion is unlikely because of the low boiling point of the material. Should it occur, discomfort in the gastrointestinal tract from rapid evaporation of the material and consequent evolution of gas would result. Some effects of inhalation and skin exposure would be expected.

DELAYED EFFECTS: None known.

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

<u>INGREDIENT NAME</u>	<u>NTP STATUS</u>	<u>IARC STATUS</u>	<u>OSHA LIST</u>
No ingredients listed in this section			

4. FIRST AID MEASURES

SKIN: Promptly flush skin with water until all chemical is removed. 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. Get medical attention if symptoms persist.

EYES: Immediately flush eyes with large amounts of water for at least 15 minutes (in case of frostbite water should be lukewarm, not hot) lifting eyelids occasionally to facilitate irrigation. Get medical attention if symptoms persist.

INHALATION: Immediately remove to fresh air. If breathing has stopped, give artificial respiration. Use oxygen as required, provided a qualified operator is available. Get medical attention. Do not give epinephrine (adrenaline).

INGESTION: Ingestion is unlikely because of the physical properties and is not expected to be hazardous. Do not induce vomiting unless instructed to do so by a physician.

ADVICE TO PHYSICIAN: Because of the possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution and only in situations of emergency life support. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT:	Gas, not applicable per DOT regulations
FLASH POINT METHOD:	Not applicable
AUTOIGNITION TEMPERATURE:	Unknown for mixture
UPPER FLAME LIMIT (volume % in air):	None*
LOWER FLAME LIMIT (volume % in air):	None*
	*Based on ASHRAE Standard 34 with match ignition
FLAME PROPAGATION RATE (solids):	Not applicable
OSHA FLAMMABILITY CLASS:	Not applicable

EXTINGUISHING MEDIA:

Use any standard agent – choose the one most appropriate for type of surrounding fire (material itself is not flammable)



Material Safety Data Sheet

R-407C

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: R-407C
DISTRIBUTOR: National Refrigerants, Inc.
661 Kenyon Avenue
Bridgeton, New Jersey 08302

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-5:00pm)
1-800-262-0012

IN CASE OF EMERGENCY CALL:
CHEMTREC: 1-800-424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

Table with 3 columns: INGREDIENT NAME, CAS NUMBER, WEIGHT %. Rows include Difluoromethane (HFC-32), Pentafluoroethane (HFC-125), and 1,1,1,2-Tetrafluoroethane (HFC-134a).

Trace impurities and additional material names not listed above may also appear in Section 15 toward the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Colorless, volatile liquid with ethereal and faint sweetish odor. Non-flammable material. Overexposure may cause dizziness and loss of concentration. At higher levels, CNS depression and cardiac arrhythmia may result from exposure. Vapors displace air and can cause asphyxiation in confined spaces. At higher temperatures, (>250°C), decomposition products may include Hydrofluoric Acid (HF) and carbonyl halides.

POTENTIAL HEALTH HAZARDS

SKIN: Irritation would result from a defatting action on tissue. Liquid contact could cause frostbite.

EYES: Liquid contact can cause severe irritation and frostbite. Mist may irritate.

INHALATION: R-407C is low in acute toxicity in animals. When oxygen levels in air are reduced to 12-14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur.