ORAFON R-404a

MATERIAL SAFETY DATA SHEET (MSDS)

1. PRODUCT AND COMPANY INDENTIFICATION

Product Name : ORAFON R-404a
Synonyms : HFC-404a

Supplier : ORANOSS CO.,LTD.
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2. HAZARDS IDENTIFICATION

EC Classification
EC Directive 67/548/EEC — Not classified as hazardous
Regulation (EC) No. 1272/2008 (CLP) — Gases under pressure – Liquefied gas

Hazard statement(s) — H280: Contains gas under pressure; may explode if heated
Signal word(s) — Warning
Hazard pictogram(s)

Precautionary statement(s)
Storage — P410 + P403: Protect from sunlight. Store in a well-ventilated place.

Potential Health Effects

Eyes: Eye contact with liquid may include eye irritation with discomfort, tearing, or blurring of vision.

Skin: Skin contact with liquid can cause frostbite. Prolonged overexposure may cause de-fatting or dryness of the skin.

Inhalation: Inhalation of high concentration of vapour is harmful and may cause heart irregularities, unconsciousness or death. Intentional misuse of deliberate in halation may cause death without warning. Vapour reduces oxygen available for breathing and is heavier than air. Higher exposures may lead to temporary alteration of the heart's electrical activity with irregular pulse, palpitations, or inadequate circulation. Gross exposure may be fatal.

Individuals with pre-existing diseases of the central nervous of cardiovascular system may have increased susceptibility to the toxicity of excessive exposures.

Inhalation may include temporary nervous systems depression, with anesthetic effects such as dizziness, headache, confusion, incordination and loss of consciousness.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name: Pentafluoroethane, 1,1,1,2-Tetrafluoroethane, 1,1,1-Trifluoroethane
Chemical Family: Hydrofluorocarbons
Chemical Formula: $CHF_2CF_3/CH_2FCF_3/CH_3CF_3$

Material Name	CAS No.	Typical Wt %
Pentafluoroethane (R-125)	354-33-6	44
1,1,1,2-tetrafluoroethane (R-134a)	811-97-2	4
1,1,1-trifluoroethane (R-143a)	420-46-2	52

4. FIRST AID MEASURES

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.
Skin: In case of contact, flush area with lukewarm water. Do not use hot water. Call a physician.
Inhalation: If inhaled, immediately remove to fresh air. Keep person clam. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion: Not a probable rout, however in case of accidental ingestion, call a physician.

Notes to Physicians:
This material may make heart more susceptible to Arrhythmias. Catehlolamines such as adrenaline and other compounds having similar effects should be reserved for emergencies and use only with special caution.

5. FIRE-FIGHTING MEASURES

Flammable Properties:
Upper, Flammable Limits in Air (% by volume) : Not applicable
Lower, Flammable Limits in Air (% by volume) : Not applicable
Flash point : Will not burn
Auto-ignition Temperature : Not Determined

Contact of welding or soldering torch flame with high concentrations of refrigerant can result in visible changes in the size and colour of torch flames. This flame effect will only occur in concentrations of product well above the recommended exposure limit, therefore stop all work and ventilate to disperse refrigerant vapour from work area before using any open flame.

R-404A is not flammable at temperatures up to 100^{O}C (212^{O}F) at atmospheric pressure. However, mixtures of R-404A with high concentrations of air at elevated pressure can become combustible at ambient temperature. As the temperature of the mixture is increased, lower pressure (but still greater than atmospheric pressure) can create the same effect. Therefore, R404A should not be mixed with air under pressure for leak testing or other purposes. In general, R-404A should not be used or allowed to exist with high concentrations of air above atmospheric pressure.

Unusual Fire and Explosion Hazards:
Containers may rupture under fire conditions. Decomposition may occur.

Extinguishing Media:
Use extinguishing media appropriate to surrounding fire conditions.

Fire Fighting Instructions:
Use water spray or fog to cool containers. Self -contained breathing apparatus (SCBA) is required if cylinders rupture or contents are released under fire conditions. Water runoff should be contained and neutralized prior to release.

6. ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel) : Review fire fighting measures and handling (personnel) sections before proceeding with clean up. Use appropriate personal protective equipment during clean up.

Accidental Release Measures : Ventilate area, especially low or enclosed places where heavy vapours might collect. Remove open flames. Use self-contained breathing apparatus (SCBA) for large spills or releases.

7. HANDLING AND STORAGE

Handling (Personnel) : Avoid breathing vapors. Avoid liquid contact with eyes and skin. Use sufficient ventilation to keep employee exposure below recommended limits. R404A should not be mixed with air for leak testing. In general it should not be allowed to for material to be present with high concentrations of air above atmospheric pressure. Contact with chlorine or other strong oxidizing agents should also be avoided.

Storage : Keep in a clean, dry area. Do not heat above 52 ^{O}C (125 ^{O}F).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls: Avoid breathing vapours. Avoid contact with skin or eyes. Use with sufficient ventilation to keep employee exposure below recommended exposure limit. Local exhaust should be used if large amounts are released. Mechanical ventilation should be used in low or enclosed places.

Personal Protective Equipment: Impervious gloves should be used to avoid prolonged or repeated exposure. Chemical splash goggles should be available for use as needed to prevent eye contact. Under normal manufacturing conditions, no respiratory protection is required when using this product. Self-contained breathing apparatus (SCBA) is required if large release occurs.

Exposures Guidelines:

Pentafluoroethane	ACGIH (TLV)	None Established
	OSHA (PEL)	None Established
	AIHA (WEEL)	1000 ppm, 4900 mg/m^3, 8hour TWA None Established
1,1,1,2-tetrafluoroethane	ACGIH (TLV)	TWA None Established
	OSHA (PEL)	None Established
	AIHA (WEEL)	1000 ppm, 4240 mg/m^3, 8 hour
	TWA	None Established
1,1,1-trifluoroethane	ACGIH (TLV)	TWA None Established
	OSHA (PEL)	None Established
	AIHA (WEEL)	1000 ppm, 3400 mg/m^3, 8 hour TWA

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Appearance	Clear, Colourless liquid and vapour
Odor	Slightly ethereal
pH	N/A
Boiling Point	-46.56 ~ -45.78 ^{O}C @ 760 mmHg
Freezing Point	-112.2 ^{O}C (1,1,1-Trifluoroethane)
Vapour Pressure	182.7 psia @ 25 ^{O}C (77 ^{O}F) Saturated
Vapour Density	3.30@ 25^{O}C (77 ^{O}F) (Air=1)
Specific Gravity	1.05 @ 25^{O}C (77 ^{O}F) (H_2O=1)
Solubility in Water	Negligible
Molecular Weight	97.60

10. STABILITY AND REACTIVITY

Chemical Stability:
This material is chemically stable under specific conditions, storage shipment and/or use. However avoid open flames and high temperatures.

Incompatibility with other materials:
In compatible with alkali or alkaline earth metals - powdered Al, Zn. Be, etc

Decomposition:
This material can be decomposed in high temperatures (open flames, glowing metal surfaces etc) thus, forming hydrochloric and hydrofluoric acids, and possibly carbonyl halides. These materials are toxic and irritating. Contact should be avoided.

Polymerization: Will not occur

11. TOXICOLOGICAL INFORMATION

1,1,1,2-tetrafluoroethane:
No skin allergy was observed in guinea pigs following repeated exposure. Acute inhalation exposure produced anesthetic effects in mice, dogs, cats and monkeys. Repeated inhalation exposure produced no adverse effects in rats. Inhalation of this material, followed by intravenous injection of epinephrine to simulate stress reactions, resulted in cardiac sensitization in dogs. Following long-term inhalation studies in rats, an increased incidence of benign tumors (at high concentrations) in the test were the only tumors observed. No birth defects were noted in the offspring of rats exposed to this material by inhalation during pregnancy, even at dosages which produced significant adverse effects in the mother. This material produced no genetic changes in standard tests using bacterial or animal cells and whole animals. Single exposure (acute) studies indicate:

Inhalation- Practically non-toxic to rats (4-hr LC50>500,000 ppm; 30 min LC50 ~ 750,000 ppm)
Eye Irritation - Slightly irritating to rabbits
Skin Irritation - Slightly irritating to rabbits

1,1,1-trifluoroethane:
Inhalation, follow by intravenous injection of epinephrine to simulate stress reactions, resulted in cardiac sensitization in dogs. Following repeated inhalation exposure, lung irritant effects including mild bronchitis and pneumonia were observed in rats and guinea pigs. No adverse effects were observed in long-term oral studies with rats. No birth defects were noted in the offspring of rats or rabbits exposed by inhalation during pregnancy. No genetic changes were observed in standard tests using animal cells or whole animals. Both positive and negative results have been reported in tests using bacteria. Single exposure (acute) studies indicate:

Inhalation - Practically non-toxic to rats (4-hr LC50 > 800,000ppm)

Pentafluoroethane:

Inhalation, follow by intravenous injection of epinephrine to simulate stress reactions, resulted in cardiac sensitization in dogs. Following repeated inhalation exposure, lung irritant effects including mild bronchitis and pneumonia were observed in rats. No adverse effects were observed in long-term oral studies with rats. No birth defects were noted in the offspring of rats or rabbits exposed by inhalation during pregnancy. No genetic changes were observed in standard tests using animal cells or whole animals. Both positive and negative results have been reported in tests using bacteria. Single exposure (acute) studies indicate:

Inhalation - Practically non-toxic to rats (4-hr LC50 > 800,000 ppm)

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

1,1,1,2-Tetrafluoroethane: Based on its low n-octanol/water partition coefficient (log Pow 1.06), bioaccumulation of this material is considered unlikely. When evaluated in a 28 day activated sludge test, 3% degradation of this material was observed.

1,1,1-Trifluoroethane: This material is practically non-toxic to Daphnia magna (48-hr LC50 300 mg/l) and no more than slightly toxic to rainbow trout (96-hr LC50 > 40 mg/l).

13. DISPOSABLE CONSIDERATIONS

Waste Disposal: Comply with local regulations. Reclaim by distillation or remove to a permitted waste facility.

14. TRANSPORTATION INFORMATION

Shipping Information
DOT/IMO:

Proper Shipping Name	:	Refrigerant Gas R404A
DOT Name	:	Refrigerant Gas R404A
IMO Class (Hazard Class)	:	2.2
UN no.	:	3337
DOT/IMO Label	:	Non-Flammable Gas

15. REGULATORY INFORMATION

Hazard Categories under SARA Title III Rules (40CFR Part 370)

Acute : Yes
Chronic : No
Fire : No
Reactivity: No
Pressure : Yes

16. OTHER INFORMATION

The information given corresponds to the current state of our knowledge and experience of the product, and is not exhaustive. This applies to product that confirms to the specification, unless otherwise stated. In the case of combinations and mixtures one must make sure that no new dangers can arise. In any case, the user is not exempt from observing all legal, administrative and regulatory procedures relating to the product, personal hygiene, and protection of human welfare and environment.

ORANOSS CO., LTD.