

**DuPont™ ISCEON® MO99™ (R-438A) Refrigerant**

Version 2.0

Revision Date 04/01/2015

Ref. 130000031356

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

**SECTION 1. PRODUCT AND COMPANY IDENTIFICATION**

Product name : DuPont™ ISCEON® MO99™ (R-438A) Refrigerant  
Tradename/Synonym : MO99  
ISCEON MO99™  
R-438A

Product Grade/Type : ASHRAE Refrigerant number designation: R-438A

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Product Use : Refrigerant

Restrictions on use : For professional users only.

Manufacturer/Supplier : DuPont  
1007 Market Street  
Wilmington, DE 19898  
United States of America

Product Information : +1-800-441-7515 (outside the U.S. +1-302-774-1000)  
Medical Emergency : 1-800-441-3637 (outside the U.S. 1-302-774-1139)  
Transport Emergency : CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

**SECTION 2. HAZARDS IDENTIFICATION**

**Product hazard category**  
Gases under pressure                      Liquefied gas

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**Label content**

Pictogram

:



Signal word

: Warning

Hazardous warnings

: Contains gas under pressure; may explode if heated.

Hazardous prevention  
measures

: Protect from sunlight. Store in a well-ventilated place.

**Other hazards**

Misuse or intentional inhalation abuse may lead to death without warning.

Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.

Rapid evaporation of the liquid may cause frostbite.

**SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS**

Component	CAS-No.	Concentration
Pentafluoroethane (HFC-125)	354-33-6	45 %
1,1,1,2-Tetrafluoroethane (HFC-134a)	811-97-2	44.2 %
Difluoromethane (HFC-32)	75-10-5	8.5 %


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n-Butane (HC-600)	106-97-8	1.7 %
2-Methylbutane (HC-601a)	78-78-4	0.6 %

**SECTION 4. FIRST AID MEASURES**

- General advice : Never give anything by mouth to an unconscious person. When symptoms persist or in all cases of doubt seek medical advice.
- Inhalation : Remove from exposure, lie down. Move to fresh air. Keep patient warm and at rest. Artificial respiration and/or oxygen may be necessary. Consult a physician.
- Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes. Take off all contaminated clothing immediately. Consult a physician. Wash contaminated clothing before re-use. Treat for frostbite if necessary by gently warming affected area.
- Eye contact : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Consult a physician if necessary.
- Ingestion : Is not considered a potential route of exposure.
- Most important symptoms/effects, acute and delayed : Anaesthetic effects Light-headedness irregular heartbeat with a strange sensation in the chest, heart thumping, apprehension, feeling of fainting, dizziness or weakness
- Protection of first-aiders : If potential for exposure exists refer to Section 8 for specific personal protective equipment.
- Notes to physician : Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, that may be used in situations of emergency life support should be used with special caution.

**SECTION 5. FIREFIGHTING MEASURES**

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- Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
- Unsuitable extinguishing media : No applicable data available.
- Specific hazards : Cylinders are equipped with pressure and temperature relief devices, but may still rupture under fire conditions. Decomposition may occur. Contact of welding or soldering torch flame with high concentrations of refrigerant can result in visible changes in the size and colour of the torch flame. 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 vapors from the work area before using any open flames. This substance is not flammable in air at temperatures up to 100 deg. C (212 deg. F) at atmospheric pressure. However, mixtures of this substance with high concentrations of air at elevated pressure and/or temperature can become combustible in the presence of an ignition source. This substance can also become combustible in an oxygen enriched environment (oxygen concentrations greater than that in air). Whether a mixture containing this substance and air, or this substance in an oxygen enriched atmosphere become combustible depends on the inter-relationship of 1) the temperature 2) the pressure, and 3) the proportion of oxygen in the mixture. In general, this substance should not be allowed to exist with air above atmospheric pressure or at high temperatures; or in an oxygen enriched environment. For example this substance should NOT be mixed with air under pressure for leak testing or other purposes. Experimental data have also been reported which indicate combustibility of this substance in the presence of certain concentrations of chlorine.
- Special protective equipment for firefighters : In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment. Wear neoprene gloves during cleaning up work after a fire.
- Further information : Cool containers/tanks with water spray. Water runoff should be contained and neutralized prior to release.

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

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- Safeguards (Personnel) : Evacuate personnel to safe areas. Ventilate area, especially low or enclosed places where heavy vapours might collect.
- Environmental precautions : Should not be released into the environment.  
In accordance with local and national regulations.
- Spill Cleanup : Evaporates.  
Ventilate area using forced ventilation, especially low or enclosed places where heavy vapors might collect.
- Accidental Release Measures : Avoid open flames and high temperatures. Self-contained breathing apparatus (SCBA) is required if a large release occurs.

**SECTION 7. HANDLING AND STORAGE**

- Handling (Personnel) : Avoid breathing vapours or mist. Avoid contact with skin, eyes and clothing. Provide sufficient air exchange and/or exhaust in work rooms. For personal protection see section 8.
- Handling (Physical Aspects) : Contact with chlorine or other strong oxidizing agents should also be avoided.
- Dust explosion class : Not applicable
- Storage : Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems. Never attempt to lift cylinder by its cap. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Cylinders should be stored upright and firmly secured to prevent falling or being knocked over.  
Separate full containers from empty containers. Keep at temperature not exceeding 52°C. Do not store near combustible materials. Avoid area where salt or other corrosive materials are present.  
The product has an indefinite shelf life when stored properly.
- Storage period : > 10 yr
- Storage temperature : < 52 °C (< 126 °F)


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**SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

- Engineering controls : Normal ventilation for standard manufacturing procedures is generally adequate. Local exhaust should be used when large amounts are released. Mechanical ventilation should be used in low or enclosed places. Refrigerant Concentration monitors may be necessary to determine vapor concentrations in work areas prior to use of torches or other open flames, or if employees are entering enclosed areas.
- Personal protective equipment
- Respiratory protection : Under normal manufacturing conditions, no respiratory protection is required when using this product.
- Hand protection : Additional protection: Impervious gloves
- Eye protection : Wear safety glasses with side shields. Additionally wear a face shield where the possibility exists for face contact due to splashing, spraying or airborne contact with this material.
- Protective measures : Self-contained breathing apparatus (SCBA) is required if a large release occurs.

**Exposure Guidelines**  
**Exposure Limit Values**

Pentafluoroethane (HFC-125)			
AEL *	(DUPONT)	1,000 ppm	8 & 12 hr. TWA
1,1,1,2-Tetrafluoroethane (HFC-134a)			
AEL *	(DUPONT)	1,000 ppm	8 & 12 hr. TWA
Difluoromethane (HFC-32)			
AEL *	(DUPONT)	1,000 ppm	8 & 12 hr. TWA
Butane (<0.1% butadiene)			
TLV	(ACGIH)	1,000 ppm	STEL

2-Methylbutane


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TLV	(ACGIH)	1,000 ppm	TWA
Pentafluoroethane AEL *	(DUPONT)	1,000 ppm	8 & 12 hr. TWA
1,1,1,2-Tetrafluoroethane AEL *	(DUPONT)	1,000 ppm	8 & 12 hr. TWA
Difluoromethane AEL *	(DUPONT)	1,000 ppm	8 & 12 hr. TWA
Butane (<0.1% butadiene) TLV	(ACGIH)	1,000 ppm	STEL

\* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

## Appearance

Physical state : gaseous  
Form : Liquefied gas  
Color : colourless

Odor : slight, ether-like

Odor threshold : No applicable data available.

pH : neutral

Melting point/freezing point : Melting point/range  
Not available for this mixture.

Boiling point/boiling range : Boiling point  
-42.3 °C (-44.1 °F)

Flash point : does not flash

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Evaporation rate	: No applicable data available.
Flammability (solid, gas)	: Not applicable
Upper explosion limit	: Method: None per ASTM E681
Lower explosion limit	: Method: None per ASTM E681
Vapor pressure	: 11,171 hPa at 25 °C (77 °F)
Vapor density	: 3.5 at 25°C (77°F) and 1013 hPa (Air=1.0)
Specific gravity (Relative density)	: 1.15 at 25 °C (77 °F)
Water solubility	: No applicable data available.
Solubility(ies)	: No applicable data available.
Partition coefficient: n-octanol/water	: No applicable data available.
Auto-ignition temperature	: No applicable data available.
Decomposition temperature	: No applicable data available.
Viscosity, kinematic	: No applicable data available.
Viscosity	: No applicable data available.
% Volatile	: 100 %

**SECTION 10. STABILITY AND REACTIVITY**

Reactivity	: No applicable data available.
Chemical stability	: Stable under recommended storage conditions.
Possibility of hazardous reactions	: Polymerization will not occur.
Conditions to avoid	: The product is not flammable in air under ambient conditions of temperature and pressure. When pressurised with air or oxygen, the mixture may become flammable. Certain mixtures of HCFCs or HFCs with chlorine may become




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flammable or reactive under certain conditions.

Incompatible materials : Alkali metals Alkaline earth metals, Powdered metals, Powdered metal salts

Hazardous decomposition products : Decomposition products are hazardous., This material can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrofluoric acid and possibly carbonyl fluoride., These materials are toxic and irritating., Avoid contact with decomposition products

**SECTION 11. TOXICOLOGICAL INFORMATION**
**Pentafluoroethane (HFC-125)**

Inhalation 4 h LC50 : > 800000 ppm , Rat

Inhalation No Observed Adverse Effect Concentration : 100000 ppm , Dog  
Cardiac sensitization

Inhalation Low Observed Adverse Effect Concentration (LOAEC) : 75000 ppm , Dog  
Cardiac sensitization

Skin sensitization : Does not cause respiratory sensitisation., human

Repeated dose toxicity : Inhalation  
Rat  
-  
gas  
NOAEL: > 50000,  
No toxicologically significant effects were found.

Carcinogenicity : Not classifiable as a human carcinogen.  
Overall weight of evidence indicates that the substance is not carcinogenic.

Mutagenicity : Animal testing did not show any mutagenic effects.  
Evidence suggests this substance does not cause genetic damage in cultured mammalian cells.  
Did not cause genetic damage in cultured bacterial cells.

Reproductive toxicity : No toxicity to reproduction  
Animal testing showed no reproductive toxicity.

Teratogenicity : Animal testing showed no developmental toxicity.


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Further information	: Cardiac sensitisation threshold limit : 490000 mg/m3
1,1,1,2-Tetrafluoroethane (HFC-134a)	
Inhalation 4 h LC50	: > 567000 ppm , Rat
Inhalation No Observed Adverse Effect Concentration	: 40000 ppm , Dog Cardiac sensitization
Inhalation Low Observed Adverse Effect Concentration (LOAEC)	: 80000 ppm , Dog Cardiac sensitization
Skin irritation	: No skin irritation, Rabbit
Eye irritation	: No eye irritation, Rabbit
Skin sensitization	: Does not cause skin sensitisation., Guinea pig  Does not cause respiratory sensitisation., Rat
Repeated dose toxicity	: Inhalation Rat - gas NOAEL: 50000, No toxicologically significant effects were found.
Carcinogenicity	: Not classifiable as a human carcinogen. Overall weight of evidence indicates that the substance is not carcinogenic.
Mutagenicity	: Animal testing did not show any mutagenic effects. Tests on bacterial or mammalian cell cultures did not show mutagenic effects.
Reproductive toxicity	: No toxicity to reproduction No effects on or via lactation Animal testing showed no reproductive toxicity.
Teratogenicity	: Animal testing showed no developmental toxicity.
Further information	: Cardiac sensitisation threshold limit : 334000 mg/m3
Difluoromethane (HFC-32)	
Inhalation 4 h LC50	: > 520000 ppm , Rat


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Inhalation Low Observed Adverse Effect Concentration (LOAEC)	:	> 350000 ppm , Dog Cardiac sensitization
Inhalation No Observed Adverse Effect Concentration	:	350000 ppm , Dog Cardiac sensitization
Skin irritation	:	No skin irritation, Not tested on animals Not expected to cause skin irritation based on expert review of the properties of the substance.
Eye irritation	:	No eye irritation, Not tested on animals Not expected to cause eye irritation based on expert review of the properties of the substance.
Skin sensitization	:	Does not cause skin sensitisation., Not tested on animals Not expected to cause sensitization based on expert review of the properties of the substance.  There are no reports of human respiratory sensitization.
Repeated dose toxicity	:	Inhalation Rat - No toxicologically significant effects were found.
Mutagenicity	:	Animal testing did not show any mutagenic effects. Tests on bacterial or mammalian cell cultures did not show mutagenic effects.
Reproductive toxicity	:	No toxicity to reproduction Animal testing showed no reproductive toxicity. Information given is based on data obtained from similar substances.
Teratogenicity	:	Animal testing showed no developmental toxicity.
Further information	:	Cardiac sensitisation threshold limit : > 735000 mg/m3
n-Butane (HC-600) Inhalation 4 h LC50	:	277018 ppm , Rat Target Organs: Respiratory Tract, Central nervous system Irritating to respiratory system. Central nervous system depression narcosis


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Dermal	:	Not applicable
Oral	:	Not applicable
Skin irritation	:	No skin irritation, Not tested on animals Not expected to cause skin irritation based on expert review of the properties of the substance.
Eye irritation	:	No eye irritation, Not tested on animals Not expected to cause eye irritation based on expert review of the properties of the substance.
Skin sensitization	:	Not tested on animals There are no reports of human skin sensitization. Not expected to cause sensitization based on expert review of the properties of the substance.
Repeated dose toxicity	:	Inhalation multiple species - No toxicologically significant effects were found.
Mutagenicity	:	Animal testing did not show any mutagenic effects.
2-Methylbutane (HC-601a) Inhalation 4 h LC50	:	1,281.9 mg/l , Rat Target Organs: Central nervous system Central nervous system depression narcosis
Inhalation 4 h LC50	:	70000 ppm , Rat
Oral LD50	:	> 2,000 mg/kg , Rat
Skin irritation	:	slight irritation, human
Eye irritation	:	No eye irritation, Rabbit
Skin sensitization	:	Did not cause sensitisation on laboratory animals., Guinea pig
Repeated dose toxicity	:	Inhalation Rat -


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No toxicologically significant effects were found.

- Mutagenicity : Tests on bacterial or mammalian cell cultures did not show mutagenic effects.  
Animal testing did not show any mutagenic effects.
- Reproductive toxicity : No toxicity to reproduction  
Animal testing showed no reproductive toxicity.
- Teratogenicity : Animal testing showed no developmental toxicity.

**Carcinogenicity**

The carcinogenicity classifications for this product and/or its ingredients have been determined according to HazCom 2012, Appendix A.6. The classifications may differ from those listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or those found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition).

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

**SECTION 12. ECOLOGICAL INFORMATION**
**Aquatic Toxicity**
**Pentafluoroethane (HFC-125)**

- 96 h LC50 : Oncorhynchus mykiss (rainbow trout) 450 mg/l  
Information given is based on data obtained from similar substances.
- 96 h ErC50 : Algae 142 mg/l  
Information given is based on data obtained from similar substances.
- 72 h NOEC : Pseudokirchneriella subcapitata (green algae) 13.2 mg/l  
Information given is based on data obtained from similar substances.
- 48 h EC50 : Daphnia magna (Water flea) 980 mg/l  
Information given is based on data obtained from similar substances.

**1,1,1,2-Tetrafluoroethane (HFC-134a)**

- 96 h LC50 : Oncorhynchus mykiss (rainbow trout) 450 mg/l
- 96 h ErC50 : Algae 142 mg/l  
Information given is based on data obtained from similar substances.


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72 h NOEC : Pseudokirchneriella subcapitata (green algae) 13.2 mg/l  
Information given is based on data obtained from similar substances.

48 h EC50 : Daphnia magna (Water flea) 980 mg/l

## Difluoromethane (HFC-32)

96 h LC50 : Fish 1,507 mg/l

96 h EC50 : Algae 142 mg/l

48 h EC50 : Daphnia (water flea) 652 mg/l

30 d : NOEC Fish (unspecified species) 65.8 mg/l

## n-Butane (HC-600)

96 h LC50 : Fish (unspecified species) > 1,000 mg/l

## 2-Methylbutane (HC-601a)

96 h LC50 : Oncorhynchus mykiss (rainbow trout) 4.26 mg/l

72 h ErC50 : Pseudokirchneriella subcapitata (green algae) 25.12 mg/l

72 h ErC50 : Scenedesmus capricornutum (fresh water algae) 10.7 mg/l

72 h EbC50 : Scenedesmus capricornutum (fresh water algae) 7.51 mg/l

48 h EC50 : Daphnia magna (Water flea) 2.3 mg/l

28 d : NOEC Oncorhynchus mykiss (rainbow trout) 7.6 mg/l

21 d : NOEC Daphnia magna (Water flea) 13.29 mg/l

## Environmental Fate

## Difluoromethane (HFC-32)

Biodegradability : 5 % OECD Test Guideline 301D  
Not readily biodegradable.

## n-Butane (HC-600)

Biodegradability : 100 %  
Readily biodegradable

## 2-Methylbutane (HC-601a)


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Biodegradability : 71.43 %  
Readily biodegradable

Bioaccumulation : Bioconcentration factor (BCF) : 171  
Bioaccumulation is unlikely.

**SECTION 13. DISPOSAL CONSIDERATIONS**

Waste disposal methods - Product : Can be used after re-conditioning. Recover by distillation or remove to a permitted waste disposal facility. Comply with applicable Federal, State/Provincial and Local Regulations.

Contaminated packaging : Empty pressure vessels should be returned to the supplier.

**SECTION 14. TRANSPORT INFORMATION**

DOT	UN number	: 1078
	Proper shipping name	: Refrigerant gases, n.o.s. (1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
	Class	: 2.2
	Labelling No.	: 2.2
	Reportable Quantity	: 10 lbs
IATA_C	UN number	: 1078
	Proper shipping name	: Refrigerant gas, n.o.s. (1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
	Class	: 2.2
	Labelling No.	: 2.2
IMDG	UN number	: 1078
	Proper shipping name	: REFRIGERANT GAS, N.O.S. (1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
	Class	: 2.2
	Labelling No.	: 2.2

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**SECTION 15. REGULATORY INFORMATION**

SARA 313 Regulated Chemical(s)	: 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.
PA Right to Know Regulated Chemical(s)	: Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances): Butane (<0.1% butadiene), Difluoromethane
NJ Right to Know Regulated Chemical(s)	: Substances on the New Jersey Workplace Hazardous Substance List present at a concentration of 1% or more (0.1% for substances identified as carcinogens, mutagens or teratogens): Butane (<0.1% butadiene), Difluoromethane
CERCLA Reportable Quantity	: 4301 lbs Based on the percentage composition of this chemical in the product.: Chloropentafluoroethane
California Prop. 65	: Chemicals known to the State of California to cause cancer, birth defects or any other harm: none known

**SECTION 16. OTHER INFORMATION**

ISCEON is a registered trademark of E. I. du Pont de Nemours and Company

® DuPont's registered trademark

Before use read DuPont's safety information.

For further information contact the local DuPont office or DuPont's nominated distributors.

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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.

Significant change from previous version is denoted with a double bar.





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