Material Safety Data Sheet

DuPont™ ISCEON® MO99™ refrigerant

Version 2.3

FREON MO99 Refrigerant

Revision Date 07/18/2014 Ref. 130000031356

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

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	DuPont™ ISCEON® MO99™ refrigerant
Product Grade/Type	:	ASHRAE Refrigerant number designation: R-438A
Tradename/Synonym	:	MO99 ISCEON MO99™ R-438A
MSDS Number	:	130000031356
Product Use	:	Refrigerant
Manufacturer	:	E.I. du Pont Canada Company P.O. Box 2200, Streetsville Mississauga, ON L5M 2H3 Canada
Product Information	:	1-800-387-2122
Medical Emergency	:	1-800-441-3637 (24 hours)

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

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.

Potential Health Effects

Skin	:	Contact with liquid or refrigerated gas can cause cold burns and frostbite. May cause skin irritation. May cause: Discomfort, itching, redness, or swelling.
Eyes	:	Contact with liquid or refrigerated gas can cause cold burns and frostbite. May cause eye irritation. May cause: Tearing, redness, or discomfort.

Inhalation : Misuse or intentional inhalation abuse may cause death without warning symptoms, due to cardiac effects.
Other symptoms potentially related to misuse or inhalation abuse are: Anaesthetic effects, Light-headedness, dizziness, confusion, incoordination, drowsiness, or unconsciousness, irregular heartbeat with a strange sensation in the chest, heart thumping, apprehension, feeling of fainting, dizziness or weakness, Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing..

Ingestion
2-Methylbutane : Aspiration hazard if swallowed - can enter lungs and cause damage.

Target Organ
Butane (<0.1% butadiene) : Respiratory Tract
Central nervous system

2-Methylbutane : Central nervous system

Carcinogenicity
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 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 %
Butane (<0.1% butadiene)	106-97-8	1.7 %

2-Methylbutane	78-78-4	0.6 %

SECTION 4. FIRST AID MEASURES

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.

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.

Ingestion : Is not considered a potential route of exposure.

General advice : Never give anything by mouth to an unconscious person. When symptoms persist or in all cases of doubt seek medical advice.

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

Flammable Properties
Flash point : does not flash

Lower explosion limit/ lower flammability limit : Method : None per ASTM E681

Upper explosion limit/ upper flammability limit : Method : None per ASTM E681

Fire and Explosion Hazard	:	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.
Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Firefighting Instructions	:	In the event of fire, wear self-contained breathing apparatus. 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.

Safeguards (Personnel)	:	Evacuate personnel to safe areas. Ventilate area, especially low or enclosed places where heavy vapours might collect.
Spill Cleanup	:	Recover free liquid for reuse or reclamation.
Accidental Release Measures	:	Prevent material from entering sewers, waterways, or low areas.

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.
Handle in accordance with good industrial hygiene and safety practice.

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.

Storage temperature : < 52 °C (< 126 °F)

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			
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

Form	:	Liquefied gas
Color	:	colourless
Odor	:	slight, ether-like
pH	:	neutral
Melting point/range	:	Not available for this mixture.
Boiling point	:	-42.3 °C (-44.1 °F)
% Volatile	:	100 %
Vapour Pressure	:	11,171 hPa at 25 °C (77 °F)
Specific gravity	:	1.15 at 25 °C (77 °F)
Vapour density	:	3.5 at 25 °C (77 °F) and 1013 hPa (Air=1.0)

SECTION 10. STABILITY AND REACTIVITY

Stability	:	Stable under recommended storage conditions.
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 flammable or reactive under certain conditions.
Incompatibility	:	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
Hazardous reactions	:	Polymerization will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

Pentafluoroethane (HFC-125)

Inhalation 4 h LC50	:	> 800000 ppm , Rat
Inhalation No Observed	:	100000 ppm , Dog

Adverse Effect Concentration		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 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.
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 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
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

Butane (<0.1% butadiene)

Dermal : Not applicable

Oral : Not applicable

Inhalation 4 h LC50 : 277018 ppm , Rat
Target Organs: Respiratory Tract, Central nervous system
Irritating to respiratory system.
Central nervous system depression
narcosis

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

Oral LD50	:	> 2,000 mg/kg , Rat
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
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 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.

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.
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

Butane (<0.1% butadiene)

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

2-Methylbutane

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.

Butane (<0.1% butadiene)

Biodegradability : 100 %
Readily biodegradable.

2-Methylbutane

Biodegradability : 71.43 %
Readily biodegradable.

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

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Disposal : 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.

Environmental Hazards : Empty pressure vessels should be returned to the supplier.

SECTION 14. TRANSPORT INFORMATION

TDG_ROAD	UN number	: 1078
	Proper shipping name	: REFRIGERANT GAS, N.O.S. (1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
	Class	: 2.2
	Labelling No.	: 2.2
TDG_RAIL	UN number	: 1078
	Proper shipping name	: REFRIGERANT GAS, N.O.S. (1,1,1,2-Tetrafluoroethane, Pentafluoroethane)
	Class	: 2.2
	Labelling No.	: 2.2
IATA_C	UN number	: 1078

DuPont™ ISCEON® MO99™ refrigerant

Version 2.3

Revision Date 07/18/2014 Ref. 130000031356

	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

SECTION 15. REGULATORY INFORMATION

DSL : All components of this product are on the Canadian DSL.

WHMIS Classification : A - Compressed Gas

Remarks : One or more components of this product are subject to a Significant New Activity (SNAc) restriction under the Canadian Environmental Protection Act (CEPA).

SECTION 16. OTHER INFORMATION

MSDS preparation date : 07/18/2014

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.

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.

DuPont™ ISCEON® MO99™ refrigerant

Version 2.3

Revision Date 07/18/2014 Ref. 130000031356