

## Praxair Material Safety Data Sheet

### 1. Chemical Product and Company Identification

<b>Product Name:</b> Liquefied gas, toxic, flammable, n.o.s. (hexafluoro-1,3-butadiene) (MSDS No. P-6269)	<b>Trade Name:</b> Hexafluoro-1,3-butadiene (C <sub>4</sub> F <sub>6</sub> )
<b>Chemical Name:</b> Hexafluoro-1,3-butadiene	<b>Synonyms:</b> Perfluoro-1,3-butadiene, perfluorobutadiene, 1,1,2,3,4,4-Hexafluoro- 1,3-butadiene
<b>Formula:</b> C <sub>4</sub> F <sub>6</sub>	<b>Chemical Family:</b> Diene
<b>Telephone:</b>	<b>Company Name:</b> Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113
<b>Emergencies:</b> 1-800-645-4633* <b>CHEMTREC:</b> 1-800-424-9300* <b>Routine:</b> 1-800-PRAXAIR	

\* Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

### 2. Composition/Information on Ingredients

See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCENTRATION	OSHA PEL	ACGIH TLV-TWA (2001)
Hexafluoro-1,3-butadiene	685-63-2	>99%*	None currently established.	None currently established.

\*The symbol > means "greater than"; the symbol <, "less than."

### 3. Hazards Identification

#### EMERGENCY OVERVIEW



**DANGER! Toxic, flammable liquid and gas under pressure.  
Harmful or fatal if inhaled.**



**May form explosive mixtures with air.**

**May cause frostbite.**

**May cause dizziness and drowsiness.**

**Self-contained breathing apparatus and protective clothing  
must be worn by rescue workers.**

**Odor: Unknown**

**THRESHOLD LIMIT VALUE:** TLV-TWA, none currently established (ACGIH, 2001).

**EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:**

**INHALATION**—Toxic by inhalation per animal tests. (See section 11.) No details available on toxic effects in humans, but should be considered harmful or fatal if inhaled. Moderate concentrations may cause lung irritation, irregular heartbeat, headache, drowsiness, dizziness, excitation, excess salivation, vomiting, and unconsciousness. Asphyxiant—lack of oxygen can kill.

**SKIN CONTACT**—No harm expected from gas. Liquid may cause frostbite.

**SWALLOWING**—An unlikely route of exposure. Hexafluoro-1,3-butadiene is a gas at normal temperature and pressure, but frostbite of the lips and mouth may result from contact with the liquid.

**EYE CONTACT**—No harm expected from gas. Liquid may cause frostbite.

**EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE:** None known.

**OTHER EFFECTS OF OVEREXPOSURE:** None known.

**MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:** None known.

**SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION:** None known.

**CARCINOGENICITY:** Hexafluoro-1,3-butadiene is not listed by NTP, OSHA, or IARC.

<b>4. First Aid Measures</b>
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**INHALATION:** Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

**SKIN CONTACT:** For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). In case of massive exposure, remove contaminated clothing while showering with warm water. Call a physician.

**SWALLOWING:** An unlikely route of exposure. Hexafluoro-1,3-butadiene is a gas at normal temperature and pressure.

**EYE CONTACT:** Immediately flush eyes thoroughly with warm water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

**NOTES TO PHYSICIAN:** *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

<b>5. Fire Fighting Measures</b>
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<b>FLASH POINT</b> (test method):	Flammable gas	
<b>AUTOIGNITION TEMPERATURE:</b>	Not available.	
<b>FLAMMABLE LIMITS IN AIR</b> , % by volume:	<b>LOWER:</b> 7.4%	<b>UPPER:</b> 29.4%

**EXTINGUISHING MEDIA:** CO<sub>2</sub>, dry chemicals, foam

**SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Toxic, flammable liquid and gas under pressure (see section 3).** Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately cool cylinders with water spray from maximum distance, taking care not to extinguish flames. Solid streams of water may be ineffective. Remove ignition sources if without risk. If flames are accidentally extinguished, explosive reignition may occur. Reduce toxic vapors with water spray or fog. Stop flow of gas if without risk, while continuing

cooling water spray. Remove all containers from area of fire if without risk. Allow fire to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** Forms explosive mixtures with air and oxidizing agents. Heat of fire can build pressure in cylinder and cause it to rupture. Cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) No part of cylinder should be subjected to a temperature higher than 104°F (40°C). If leaking or spilled product catches fire, do not extinguish flames. Flammable and toxic vapors may spread from leak and could explode if reignited by sparks, static discharge, or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check with an appropriate device. To protect persons from cylinder fragments and toxic fumes should a rupture occur, evacuate the area if the fire cannot be brought under immediate control.

**HAZARDOUS COMBUSTION PRODUCTS:** See section 10.

## 6. Accidental Release Measures

**STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Toxic, flammable liquid and gas under pressure (see section 3).** Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Gas forms explosive mixtures with air (see section 5). Toxic, flammable vapors may spread from spill. Before entering area, especially a confined area, check atmosphere with an appropriate device. Remove all sources of ignition if without risk. Reduce vapors with fog or fine water spray. Shut off flow if without risk. Ventilate area of leak or move cylinder to well-ventilated area. Prevent runoff from contaminating surrounding environment.

**WASTE DISPOSAL METHOD:** Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

## 7. Handling and Storage

**PRECAUTIONS TO BE TAKEN IN STORAGE:** Store and use with adequate ventilation and out of direct sunlight. Separate cylinders from oxygen and other oxidizers by at least 20 ft (6.1 m) or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53 m) high and have a fire resistance rating of at least ½ hour. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 104°F (40°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods. Post "No Smoking or Open Flames" signs in storage and use areas. There must be no sources of ignition. All electrical equipment in storage areas must be explosion-proof. Storage areas must meet national electric codes for Class 1 hazardous areas.

**PRECAUTIONS TO BE TAKEN IN HANDLING:** Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Electrical equipment must be non-sparking or explosion-proof. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using hexafluoro-1,3-butadiene, see section 16.

## 8. Exposure Controls/Personal Protection

### VENTILATION/ENGINEERING CONTROLS:

**LOCAL EXHAUST**—Use explosion-proof local exhaust ventilation with sufficient air flow to prevent worker exposure to toxic levels of this product.

**MECHANICAL (general)**—Not recommended as a primary ventilation system to control worker exposure.

**SPECIAL**—A canopy type of forced-air fume hood equipped with an explosion-proof device may be more desirable for certain applications.

**OTHER**—None

**RESPIRATORY PROTECTION:** Use air-supplied respirators for concentrations up to 10 times the applicable permissible exposure limit. For higher concentrations, a full-face, self-contained breathing apparatus is required. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134.

**SKIN PROTECTION:** Wear work gloves for cylinder handling; rubber gloves where contact with product is possible.

**EYE PROTECTION:** Wear safety glasses when handling cylinders. Wear protective goggles and a face shield where contact with product is possible. Select per OSHA 29 CFR 1910.133.

**OTHER PROTECTIVE EQUIPMENT:** Metatarsal shoes for cylinder handling and protective clothing where needed. Select per OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

## 9. Physical and Chemical Properties

<b>MOLECULAR WEIGHT:</b>	162.03
<b>LIQUID DENSITY</b> at 59°F (15°C) and 1 atm:	89.1 lb/ft <sup>3</sup> (1426.8 kg/m <sup>3</sup> )
<b>VAPOR PRESSURE</b> at 68°F (20°C):	25.9 psia (178.8 kPa, abs)
<b>SOLUBILITY IN WATER:</b>	Insoluble
<b>PERCENT VOLATILES BY VOLUME:</b>	100
<b>BOILING POINT</b> at 1 atm:	42.4°F (5.8°C)
<b>MELTING POINT</b> at 1 atm:	-202°F (-130°C)
<b>APPEARANCE, ODOR, AND STATE:</b> Not available.	

## 10. Stability and Reactivity

**STABILITY:**  Unstable  Stable

**INCOMPATIBILITY (materials to avoid):** Oxidizers, oxygen

**HAZARDOUS DECOMPOSITION PRODUCTS:** CO, CO<sub>2</sub>, hydrogen fluoride, carbonyl fluoride

**HAZARDOUS POLYMERIZATION:**  May Occur  Will Not Occur

**CONDITIONS TO AVOID:** Fire, elevated temperatures

### 11. Toxicological Information

LC<sub>50</sub> = 1334 ppm, 1 hr, rat

### 12. Ecological Information

No adverse ecological effects expected. Hexafluoro-1,3-butadiene does not contain any Class I or Class II ozone-depleting chemicals. Hexafluoro-1,3-butadiene is not listed as a marine pollutant by DOT.

### 13. Disposal Considerations

**WASTE DISPOSAL METHOD:** Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

### 14. Transport Information

**DOT/IMO SHIPPING NAME:** Liquefied gas, toxic, flammable, n.o.s. (hexafluoro-1,3-butadiene)

HAZARD CLASS:	ZONE:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.3	C	UN 3160	None

**SHIPPING LABEL(s):** POISON GAS, FLAMMABLE GAS\*

**PLACARD (when required):** POISON GAS, FLAMMABLE GAS\*

\*The words in the POISON GAS diamond are INHALATION HAZARD.

**SPECIAL SHIPPING INFORMATION:** Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

**Additional Marking Requirement:** INHALATION HAZARD

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

### 15. Regulatory Information

The following selected regulatory requirements may apply to hexafluoro-1,3-butadiene. Not all such requirements are identified. Users of hexafluoro-1,3-butadiene are solely responsible for compliance with all applicable federal, state, and local regulations.

#### U.S. FEDERAL REGULATIONS:

##### EPA (ENVIRONMENTAL PROTECTION AGENCY)

**CERCLA:** COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

**Reportable Quantity (RQ):** None

**SARA:** SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

**SECTIONS 302/304:** Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

**Threshold Planning Quantity (TPQ):** None

**EHS RQ (40 CFR 355):** None

**SECTIONS 311/312:** Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for hexafluoro-1,3-butadiene are as follows:

**IMMEDIATE:** Yes

**DELAYED:** No

**PRESSURE:** Yes

**REACTIVITY:** No

**FIRE:** Yes

**SECTION 313:** Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Hexafluoro-1,3-butadiene does not require reporting under Section 313.

**40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION:** Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Hexafluoro-1,3-butadiene is not listed as a regulated substance.

**TSCA: TOXIC SUBSTANCES CONTROL ACT:** Hexafluoro-1,3-butadiene is listed on the TSCA inventory.

**OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:**

**29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS:** Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Hexafluoro-1,3-butadiene is not listed in Appendix A as a highly hazardous chemical. However, any process that involves a flammable gas on site in one location in quantities of 10,000 lb (4536 kg) or greater is covered under this regulation unless the gas is used as a fuel.

#### STATE REGULATIONS:

**CALIFORNIA:** Hexafluoro-1,3-butadiene is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

**PENNSYLVANIA:** Hexafluoro-1,3-butadiene is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

### 16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

**OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE:** *Toxic, flammable liquid and gas under pressure.* Harmful if inhaled. Do not breathe gas. Use only with adequate ventilation or respiratory protection. (See section 8.) Do not get liquid or vapor in eyes, on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. Use piping and equipment adequately designed to withstand pressures to be encountered. Use only with compatible materials and equipment. Use only in a closed system. *May form explosive mixtures with air.* Keep away from heat, sparks, and open flame. Use only spark-proof tools and explosion-proof equipment. Ground all equipment. Store and use with adequate ventilation at all times. Keep away from oxidizing agents and other flammables. *Prevent reverse flow.* Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. *Never work on a pressurized system.* If there is a leak, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. *Follow safe practices when returning cylinder to supplier.* Be sure valve is closed, then tightly install valve outlet plug or cap. *Never place a compressed gas cylinder where it may become part of an electrical circuit.*

**Recommended Equipment:** In semiconductor process gas and other suitable applications, Praxair recommends the use of engineering controls such as gas cabinet enclosures, automatic gas panels (used to purge systems on cylinder changeout), excess-flow valves throughout the gas distribution system, double containment for the distribution system, and continuous gas monitors.

**MIXTURES:** When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

#### HAZARD RATING SYSTEMS:

##### NFPA RATINGS:

HEALTH	= 3
FLAMMABILITY	= 4
REACTIVITY	= 0
SPECIAL	= None

##### HMIS RATINGS:

HEALTH	= 2
FLAMMABILITY	= 4
REACTIVITY	= 0

*NOTE: The hazards of this material have not been fully investigated.*

#### STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

<b>THREADED:</b>	CGA-350
<b>PIN-INDEXED YOKE:</b>	Not applicable
<b>ULTRA-HIGH-INTEGRITY CONNECTION:</b>	CGA-724

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5<sup>th</sup> Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700.

AV-1	<i>Safe Handling and Storage of Compressed Gases</i>
P-1	<i>Safe Handling of Compressed Gases in Containers</i>
V-1	<i>Compressed Gas Cylinder Valve Inlet and Outlet Connections</i>
—	<i>Handbook of Compressed Gases, Fourth Edition</i>

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

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The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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