

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Compressed gas, flammable, n.o.s. (Hydrogen, Boron Trifluoride) (MSDS No. P-19-6381)	Trade Names: Not applicable.
Chemical Name: Mixture of Boron Trifluoride & Hydrogen	Synonyms: Mixture of Trifluoroborane & Hydrogen
Chemical Family: Not applicable.	Product Grades: None assigned.
Telephone: Emergencies: 1-800-645-4633* CHEMTREC: 1-800-424-9300* Routine: 1-800-PRAXAIR	Company Name: Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113

**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. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Flammable high-pressure gas.
May cause eye, skin, and respiratory tract burns
May form explosive mixtures with air.
May cause dizziness and drowsiness.
Self-contained breathing apparatus and protective clothing
must be worn by rescue workers.
Under ambient conditions, this mixture is a colorless gas with
a slight pungent odor.

OSHA REGULATORY STATUS: The components of this mixture are considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Asphyxiant. Lack of oxygen can kill. May cause headache, drowsiness, dizziness, excitation, excess salivation, vomiting, and unconsciousness. Lack of oxygen can kill. Irritating to the mucous membranes and the upper respiratory tract. May cause coughing, a choking sensation, chills, chest pain, pulmonary edema, and death.

Skin Contact. May irritate the skin, producing marked local redness and swelling. High concentrations may cause burns, which could result in absorption of potentially harmful amounts of material.

Swallowing. An unlikely route of exposure. This product is a gas at normal temperature and pressure.

Eye Contact. Irritating; causes mild excess redness and swelling of the conjunctiva. High concentrations may cause corneal burns.

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Effects of Repeated (Chronic) Overexposure. Repeated overexposure may cause dryness of the nasal membranes, nosebleed, dental fluorosis (discoloration of the teeth), bronchiolitis (asthma), and pneumonitis (chemical pneumonia).

Other Effects of Overexposure. May damage the respiratory system.

Medical Conditions Aggravated by Overexposure. Inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease.

CARCINOGENICITY: The components of this mixture are not listed by NTP, OSHA, and IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None known. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Boron Trifluoride	7637-07-2	9.5-10.5%
Hydrogen	1333-74-0	Balance

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. **Warning: To avoid possible chemical burns, rescuer should avoid breathing any exhaled air from the victim.** If breathing is difficult, qualified personnel should give oxygen at half-hour intervals for 3 to 4 hours. Call a physician.

SKIN CONTACT: Immediately remove contaminated clothing and shoes, and flush skin with plenty of water for at least 15 minutes. Soak burned areas in an iced aqueous Epsom salt ($MgSO_4$) solution for at least 30 minutes. Call a physician. Wash clothing before reuse. Discard contaminated shoes.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: Immediately flush eyes thoroughly with 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: *Boron trifluoride hydrolyzes to hydrofluoric acid. There is no specific antidote; direct treatment to control of symptoms and the clinical condition of the patient. Keep victims of exposure under medical observation for 72 hours for delayed onset of pulmonary edema. For skin exposure, the affected area should be covered with 20% magnesium oxide in glycerine. The development of severe burns has been prevented by infiltrating the skin and subcutaneous tissues with 10% calcium glycolate solution, along with a local anesthetic.*

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Flammable gas. May form explosive mixtures with air and oxidizing agents.

SUITABLE EXTINGUISHING MEDIA: CO_2 , dry chemical, water spray, or fog

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PRODUCTS OF COMBUSTION: Water (H₂O). See section 10 for hazardous decomposition products.

PROTECTION OF FIREFIGHTERS: DANGER! Flammable high-pressure gas. 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; then move them away from fire if without risk. Continue cooling water spray while moving cylinders. Do not extinguish flames emitted from cylinders; allow them to burn out. Shut off leak if without risk. Reverse flow into cylinder may cause rupture. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. 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 a cylinder should be subjected to a temperature higher than 125°F (52°C). If venting or leaking gas catches fire, do not extinguish flames. Flammable gas may spread from leak, creating an explosive re-ignition hazard. Vapors can be irritating and may burn skin and eyes on contact. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with approved explosion meter.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! Flammable high-pressure gas.

Personal Precautions. May form explosive mixtures with air. Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Approach suspected leak area with caution. Remove all sources of ignition if without risk. Reduce gas with fog or fine water spray. Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area. Flammable gas may spread from leak. Before entering area, especially confined areas, check atmosphere with an appropriate device.

Environmental Precautions. 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 HANDLING: Do not breathe vapors. Do not get vapors in eyes, on skin, or on clothing. Keep away from heat, sparks, and open flame. Use only spark-proof tools and explosion-proof equipment. Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Leak check system with soapy water; never use a flame. Have safety showers and eyewash fountains immediately available. Protect cylinders from damage. 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. Close valve after each use; keep closed even when empty. For other precautions, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Store only where temperature will not exceed 125°F (52°C). Separate cylinders from oxygen, chlorine, 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. Always secure cylinders upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the cylinder is not in use. 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. Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use, see Praxair publication P-14-153, *Guidelines for Handling Gas Cylinders and Containers*. Obtain from your local supplier. For further information specific to hydrogen, see NFPA 55, *Standard for Gaseous Hydrogen Systems at Consumer Sites*, published by the National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101; 1-800-344-3555; www.nfpa.org.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2008)
Boron Trifluoride	1 ppm (c)*	1 ppm (c)*
Hydrogen	N.E.*	Simple asphyxiant

*(c) – ceiling. Ceiling values are not Time-Weighted-Average (TWA).

**N.E.–Not Established.

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = 25 ppm (Boron Trifluoride)

ENGINEERING CONTROLS:

Local Exhaust. Insufficient. See special.

Mechanical (General). Not recommended as a primary ventilation system to control worker's exposure. See special.

Special. A corrosion-resistant, closed system.

Other. See special.

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear work gloves for cylinder handling and metatarsal shoes for cylinder handling. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

Eye/Face Protection. Wear safety glasses when handling cylinders. Select per OSHA 29 CFR 1910.133.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure the respirator has the appropriate protection

factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas
ODOR:	Slightly pungent
ODOR THRESHOLD:	Not available.
PHYSICAL STATE:	Colorless gas at normal temperature and pressure
pH:	Not applicable.
MELTING POINT at 1 atm:	Not applicable.
BOILING POINT at 1 atm:	-422.97°F (-252.76°C)*
FLASH POINT (test method):	Not applicable.
EVAPORATION RATE (Butyl Acetate = 1):	Not applicable.
FLAMMABILITY:	Flammable
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: 4.0%* UPPER: 75.0%*
VAPOR PRESSURE at 10°F (-12.25°C):	721 psia (49.75 kPa, abs)**
VAPOR DENSITY at 70°F (21.1°C) and 1 atm:	0.0052 lb/ft ³ (0.083 kg/m ³)*
SPECIFIC GRAVITY (H ₂ O = 1) at 19.4°F (-7°C):	Not available.
SPECIFIC GRAVITY (Air = 1) at 32°F (0°C) and 1 atm:	0.07*
SOLUBILITY IN WATER 68°F (20°C):	Reacts
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	932°F (500°C)*
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	Not available.
MOLECULAR FORMULA:	Mixture of BF ₃ & H ₂

*For Hydrogen only

**For Boron Trifluoride only

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable Stable

CONDITIONS TO AVOID: Air and other oxidizing agents.

INCOMPATIBLE MATERIALS: Water, rubber, many plastics, organics, alkali metals, alkaline earth metals (except magnesium), calcium oxide, silver

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition may produce boron and fluorine.

POSSIBILITY OF HAZARDOUS REACTIONS: May Occur Will Not Occur

Forms explosive mixtures with air and oxidizing agents.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC₅₀ for BF₃, 1 hr, rat = 806 ppm (time adjusted). Hydrogen is a simple asphyxiant.

STUDY RESULTS: None known about this mixture.

12. Ecological Information

ECOTOXICITY: No known effects.

OTHER ADVERSE EFFECTS: No adverse ecological effects expected. The components of this mixture do not contain any Class I or Class II ozone-depleting chemicals.

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: Compressed gas, flammable, n.o.s. (Hydrogen, Boron Trifluoride)

HAZARD CLASS:	PACKING GROUP/Zone:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.1	NA/NA*	UN1954	None

SHIPPING LABEL(s): FLAMMABLE GAS

PLACARD (when required): FLAMMABLE GAS

*NA=Not applicable.

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.

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)].

MARINE POLLUTANTS: The components of this mixture are not listed as marine pollutants by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product 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

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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):

TPQ: 500 lb (226.8 kg) for BF₃

EHS RQ (40 CFR 355): 500 lb (226.8 kg) for BF₃

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes

PRESSURE: Yes

DELAYED: Yes

REACTIVITY: No

FIRE: Yes

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

Boron Trifluoride is subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and 40CFR Part 372.

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.

Boron Trifluoride is listed as a regulated substance in quantities of 5,000 lb (2,268 kg) or greater. Hydrogen is listed as a regulated substance in quantities of 10,000 lb (4,536 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: The components of this mixture are 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.

Boron is listed in Appendix A as a highly hazardous chemical in quantities of 250 lb (113.4 kg) or greater. Hydrogen 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: The components of this mixture are not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: The components of this mixture are 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: *Flammable high-pressure gas.* Use only in a closed system. Use piping and equipment adequately

designed to withstand pressures and temperatures to be encountered. 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. Gas can cause rapid suffocation due to oxygen deficiency. Store and use with adequate ventilation. 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. Never place a compressed gas cylinder where it may become part of an electrical circuit.

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.

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.

HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH = 1
FLAMMABILITY = 4
INSTABILITY = 1
SPECIAL = None

HMIS RATINGS:

HEALTH = 1
FLAMMABILITY = 4
PHYSICAL HAZARD = 3

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: CGA-350.
PIN-INDEXED YOKE: Not applicable.
ULTRA-HIGH-INTEGRITY CONNECTION: Not applicable.

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

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

AV-1	<i>Safe Handling and Storage of Compressed Gases</i>
P-1	<i>Safe Handling of Compressed Gases in Containers</i>
SB-2	<i>Oxygen-Deficient Atmospheres</i>
V-1	<i>Compressed Gas Cylinder Valve Inlet and Outlet Connections</i>
—	<i>Handbook of Compressed Gases, Fourth Edition</i>

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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.

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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Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113