

Linde Gas LLC (216) 642-6600  
 P.O. Box 94737  
 Cleveland, Ohio 44101  
 www.us.lindegas.com

**MATERIAL SAFETY DATA SHEET**

No. 22

<b>PRODUCT NAME</b> Diborane Mixtures DIBORANE IS UNSTABLE - SEE NOTE ON PAGE 4	<b>CAS #</b> 19287-45-7
<b>TRADE NAME AND SYNONYMS</b> Diborane Mixtures, Compressed, (D.O.T.); Boron Hydride; Boroethane	<b>DOT I.D. No.:</b> Na 1911 (See Note pg. 4)
<b>CHEMICAL NAME AND SYNONYMS</b> Boron Hydride	<b>DOT Hazard Class:</b> Division 2.1
<b>ISSUE DATES AND REVISIONS</b> Revised April 1998	<b>Formula</b> B <sub>2</sub> H <sub>6</sub>
	<b>Chemical Family:</b> Metal Hydride

**HEALTH HAZARD DATA**

<b>TIME WEIGHTED AVERAGE EXPOSURE LIMIT</b> 0.1 molar ppm (ACGIH 1997).	<b>OSHA 1995 PEL (8hr. TWA) = 0.1 Molar PPM</b>
<b>SYMPTOMS OF EXPOSURE</b> It is an irritant to the respiratory system causing headache, fatigue, drowsiness, shortness of breath, coughing and eventual convulsions convulsions and death.  Prolonged exposure to very low concentrations may result in dizziness, vertigo, chill, fatigue or muscular weakness.	
<b>TOXICOLOGICAL PROPERTIES</b> LC <sub>50</sub> Human, Inhalation = 159 molar PPM for 15 Minutes Also Lethal Dose, Human, Inhalation = 30-90 mg/m <sup>3</sup> for 4 hours  Its toxicity seems to be similar to that for phosgene, chlorine, fluorine, and arsine. Damage to the lungs resulting in pulmonary edema will most probably occur as well as kidney and liver damage. The signs of the intoxication may be delayed for up to 24 hours or occur immediately after the exposure.	
<b>RECOMMENDED FIRST AID TREATMENT</b> PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO DIBORANE. RESCUE PERSONAL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD  <u>INHALATION:</u> Move affected person to an uncontaminated area. If breathing has stopped, give assisted respiration. Oxygen should be administered by a qualified person. Keep victim warm and calm. Seek immediate medical assistance. Continued treatment should be symptomatic and supportive.	

Information contained in this material safety data sheet is offered without charge for use by technically qualified personnel at their discretion and risk. All statements, technical information and recommendations contained herein are based on tests and data which we believe to be reliable, but the accuracy or completeness thereof is not guaranteed and no warranty of any kind is made with respect thereto. This information is not intended as a license to operate under or a recommendation to practice or infringe any patent of this Company or others covering any process, composition of matter or use.  
 Since the Company shall have no control of the use of the product described herein, the Company assumes no liability for loss or damage incurred from the proper or improper use of such product.

# Diborane

## HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Pure diborane is flammable in air over a very wide range. It will ignite spontaneously in moist air at room temperatures. It also reacts violently with oxides, ammonia, alcohols, lithium and similar reactive metals, halogens and halogenated compounds

## PHYSICAL DATA

BOILING POINT -134.5°F (-92.5°C)	LIQUID DENSITY AT BOILING POINT 26.3 lb/ft <sup>3</sup> (421kg/m <sup>3</sup> )
VAPOR PRESSURE @ 70°F (21.1°C): Above the critical temp. of 62°F (16.7°C)	GAS DENSITY AT 70°F. 1 atm .0711 lg/ft <sup>3</sup> (1.141 kg/m <sup>3</sup> )
SOLUBILITY IN WATER Hydrolyzes	FREEZING POINT -264.7°F (-164.9°C)
EVAPORATION RATE N/A (Gas)	SPECIFIC GRAVITY (AIR=1) @ 70°F (21.1°C) = 0.95
APPEARANCE AND ODOR Colorless gas with acharacteristic sickly sweet odor.	

## FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A (Gas)	AUTO IGNITION TEMPERATURE 100°F (38°)	FLAMMABLE LIMITS % BY VOLUME (See Page 4) LE 0.9 UEL 98
EXTINGUISHING MEDIA Only acceptable are protein based foams with a nitrogen carrier	ELECTRICAL CLASSIFICATION Class 1, Group not specified	
SPECIAL FIRE FIGHTING PROCEDURES Diborane reacts with most extinguishing media such as water, carbon dioxide, chemical powders and halogenated compounds. Attempting to stop the flow of gas and allow the fire to burn itself out. Use water spray to cool surrounding containers.		
UNUSUAL FIRE AND EXPLOSION HAZARDS ignites spontaneously in moist air. The heat of combustion from a diborane fire is greater than that from similar hydrocarbon such as an ethane fire		

## REACTIVITY DATA

STABILITY Unstable	X	CONDITIONS TO AVOID Elevated temperatures. Diborane mixture storage time should minimized. Higher borane decomposition products (typically tetraborane) may be ore shock sensitive that diborane
Stable		
INCOMPATIBILITY (Materials to avoid) None		
HAZARDOUS DECOMPOSITION PRODUCTS Carbon Monoxide		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID
Will Not Occur	X	None

## SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact your closest supplier location or call the emergency telephone number listed herein.
WASTE DISPOSAL METHOD Do not attempt to dispose of waste or unused quantities. Return in the shipping container <u>properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place</u> to your supplier. For emergency disposal assistance, contact your closest supplier location or call the emergency telephone number listed herein.

**SPECIAL PROTECTION INFORMATION**

<b>RESPIRATORY PROTECTION</b> (Specify type)	Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.		
<b>VENTILATION</b>  Hood with forced ventilation	<b>LOCAL EXHAUST</b> To prevent accumulation above the TWA	<b>SPECIAL</b>	N/A
	<b>MECHANICAL (Gen.)</b> In accordance with electrical codes	<b>OTHER</b>	N/A
<b>PROTECTIVE GLOVES</b> Plastic or rubber			
<b>EYE PROTECTION</b> Safety goggles or glasses			
<b>OTHER PROTECTIVE EQUIPMENT</b> Safety shoes, safety shower			

**SPECIAL PRECAUTIONS\***

<b>SPECIAL LABELING INFORMATION</b> DOT Shipping Name: Diborane Mixtures, compressed DOT Shipping Label: Flammable Gas	DOT Hazard Class: Division 2.2 I.D. No. NA 1911
<b>SPECIAL HANDLING RECOMMENDATIONS</b> Use only in well-ventilated areas. Valve protection caps 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 (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.  For additional handling recommendations, consult Compressed Gas Associations' Pamphlets P-1	
<b>SPECIAL STORAGE RECOMMENDATIONS</b> Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area  For additional storage recommendations, consult Compressed Gas Associations Pamphlets P-1	
<b>SPECIAL PACKAGING RECOMMENDATIONS</b> Diborane is non-corrosive and most common structural materials (except aluminum) may be used. It is also compatible with ordinary glass, pyrex and quartz. Kel-F and Teflon are preferred gasketing materials.	
<b>OTHER RECOMMENDATIONS OR PRECAUTIONS</b> Earth-ground and bond all lines and equipment associated with the diboran system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers or compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of federal law.  (Continued on Page 4)	

\*Various Government Agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.

### DIBORAN STABILITY:

At room temperature diborane decomposes to produce hydrogen and higher boranes. Decomposition rate increasing temperature. Non-volatile boranes such as pentaborane are produced in greater quantities at higher temperatures. Above approximately 570°F (300°C) it dissociates into its elements boron and hydrogen.

Because of its instability, your supplier only offers diborane in mixtures with other gases which act as diluents and retard its decomposition. The data in this document are for pure diborane where indicated the remaining data are for diborane in mixtures with other gases.

Not re DOT I.D. No.: Pure diborane (UN 1911) has an EHS RQ of 100(45.4).

### HEALTH HAZARD DATA

#### TOXICOLOGICAL PROPERTIES: (Continued)

Diborane is not listed in the IARCm NTP or by OSHA as a carcinogen or potential carcinogen

Persons in ill health where such illness would be aggravated by exposure to diborane should not be allowed to work with or handel this product.

### SPECIAL PRECAUTIONS

#### OTHER RECOMMENDATIONS OR PRECAUTIONS: (Continued)

Always secure cylinders in an upright position before transporting them. NEVER transport cylinders in trunks of vehicles, enclosed vans, truck cabs or in passenger compartments. Transport cylinders secured in open flatbed or in open pick-up type vehicles.

Reporting Under SARA, Title III, section 313 not required

NFPA 704 No. for diborane = 3 4 3 W(also reacts violently with halogenated extinguishing agents)