



BORON 11 TRIFLUORIDE

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	BORON 11 TRIFLUORIDE
Product Code(s)	G-87
UN-Number	UN1008
Recommended Use	Compressed gas.
Synonyms	Boron Trifluoride, Enriched (98.8 % Boron-11, 1.2% Boron-10)
Supplier Address*	Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC 575 Mountain Ave. Murray Hill, NJ 07974 Phone: 908-464-8100 www.lindeus.com Linde Gas Puerto Rico, Inc. Las Palmas Village Road No. 869, Street No. 7 Catano, Puerto Rico 00962 Phone: 787-641-7445 www.pr.lindegas.com Linde Canada Limited 5860 Chedworth Way Mississauga, Ontario L5R 0A2 Phone: 905-501-1700 www.lindecana.com * May include subsidiaries or affiliate companies/divisions. For additional product information contact your local customer service.
Chemical Emergency Phone Number	Chemtrec: 1-800-424-9300 for US/ 703-527-3887 outside US

2. HAZARDS IDENTIFICATION

DANGER!

Emergency Overview

Corrosive
Fatal if inhaled.
The product causes burns of eyes, skin and mucous membranes.
May adversely affect liver and kidney.
Contents under pressure
Keep at temperatures below 52°C / 125°F

Appearance Colorless

Physical State Gas.

Odor Acrid

OSHA Regulatory Status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
<u>Potential Health Effects</u>	
Principle Routes of Exposure	Eye contact. Skin contact. Inhalation.
Acute Toxicity	
Inhalation	Fatal if inhaled. Inhalation of corrosive fumes/gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate. Concentrations as low as 50 ppm may cause death from cardiac collapse and complications from fluid retention and swelling in the lung (edema) and chemical pneumonitis.
Eyes	Causes burns. Risk of serious damage to eyes. Persons with potential exposure to boron trifluoride should not wear contact lenses.
Skin	Causes burns. Symptoms may be delayed.
Skin Absorption Hazard	No known hazard by skin absorption.
Ingestion	Not an expected route of exposure. Ingestion causes burns of the upper digestive and respiratory tract.
Chronic Effects	May cause adverse liver and kidney effects.
Aggravated Medical Conditions	Pre-existing eye disorders. Skin disorders. Respiratory disorders. Kidney disorders.
Environmental Hazard	See Section 12 for additional Ecological Information.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Volume %	Chemical Formula
[¹¹ B]Boron trifluoride	20654-88-0	>99	¹¹ BF ₃

4. FIRST AID MEASURES

General Advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
Eye Contact	Immediate medical attention is required. In case of contact with substance, immediately flush eyes with running water for at least 30 minutes. Keep eye wide open while rinsing.
Skin Contact	Immediate medical attention is required. Wash off immediately with soap and plenty of water for at least 30 minutes while removing all contaminated clothing and shoes. Dermal burns may be treated with calcium gluconate gel or slurry in water or glycerine. This compound binds the active fluorides in an insoluble form and limits burn extension and pain.
Inhalation	PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF INHALATION OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious inhalation victims should be assisted to an uncontaminated area and inhale fresh air. If breathing is difficult, administer oxygen. Unconscious persons should be moved to an uncontaminated area and, as necessary, given artificial resuscitation and supplemental oxygen. Treatment should be symptomatic and supportive.
Ingestion	Not an expected route of exposure. Immediate medical attention is required. Do NOT induce vomiting. Drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician or Poison Control Center immediately.

Notes to Physician	For dermal exposure, the use of 2.5-33% calcium gluconate or carbonate gel or slurry has been recommended. The gel is either placed into a surgical glove into which the affected extremity is then placed or applied directly on the burn. This compound binds with the active fluorides in an insoluble form and limits burn extension and pain. Calcium chloride should not be used.
Protection of First-aiders	Use personal protective equipment. Avoid contact with skin, eyes and clothing.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Not flammable.
Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Boron trifluoride is water reactive. Use water cautiously as necessary to knock down vapors and cool fire exposed cylinders. Do not use water directly on boron trifluoride as contact can produce toxic hydrogen fluoride, fluoboric acid, boric acid and other similar compounds.
Hazardous Combustion Products	Fluorine compounds. Oxides of boron.
<u>Explosion Data</u>	
Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	None
Specific Hazards Arising from the Chemical	The product causes burns of eyes, skin and mucous membranes. In the event of fire and/or explosion do not breathe fumes. Do not allow run-off from fire fighting to enter drains or water courses. Runoff may pollute waterways. Cylinders may rupture under extreme heat. Continue to cool fire exposed cylinders until flames are extinguished. Damaged cylinders should be handled only by specialists.
Protective Equipment and Precautions for Firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Corrosive hazard. Wear protective gloves/clothing and eye/face protection.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Evacuate personnel to safe areas. Use personal protective equipment. Keep people away from and upwind of spill/leak. Do not get in eyes, on skin, or on clothing. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
Environmental Precautions	Do not allow material to contaminate ground water system. Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent product from entering drains.
Methods for Containment	Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.
Methods for Cleaning Up	Return cylinder to Linde or an authorized distributor.
Other Information	Refer to protective measures listed in Sections 7 and 8.

7. HANDLING AND STORAGE

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Handling

Dry Boron Trifluoride may be used with mild steel, copper, copper-zinc and copper-silicon alloys, nickel or Monel®. The moist (water) gas is best handled in Mondel®. Fluoride "passivation" is also recommended. Kel-F® and Teflon® are preferred gasketing materials. Use of polyvinyl chloride should be avoided. Mercury containing manometers should not be used since Boron Trifluoride is soluble in mercury.

Keep equipment scrupulously dry. Many of the metal fluorides are water soluble so that the passive film corrosion protection may be destroyed if wetted with water.

Wear personal protective equipment. Avoid contact with skin, eyes and clothing. "NO SMOKING" signs should be posted in storage and use areas.

Use only in ventilated areas. Never attempt to lift a cylinder by its valve protection cap. Protect cylinders from physical damage; do not drag, roll, slide or drop. Use equipment rated for cylinder pressure. Use backflow preventive device in piping. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing leak to occur.

Use an adjustable strap wrench to remove over-tight or rusted caps. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier.

Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.

Storage

Protect from physical damage. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Store in a cool, dry area away from potential sources of heat, open flames, sunlight or other chemicals. Keep at temperatures below 52°C / 125°F. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
[¹¹ B]Boron trifluoride 20654-88-0	TWA: 2.5 mg/m ³ F	TWA: 2.5 mg/m ³ F (vacated) TWA: 2.5 mg/m ³	IDLH: 25 ppm Ceiling: 1 ppm Ceiling: 3 mg/m ³

Immediately Dangerous to Life or Health.

Other Exposure Guidelines Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Engineering Measures Showers. Eyewash stations. Ventilation systems. Exhaust gas should be vented to a gas treatment system.

Ventilation Use ventilation adequate to keep exposures below recommended exposure limits.

Personal Protective Equipment

Eye/Face Protection Tightly fitting safety goggles. Face-shield.

Skin and Body Protection Appropriate protective and chemical resistant gloves, clothing and splash protection, or fully encapsulating vapor protective clothing to prevent exposure. For materials of construction consult protective clothing manufacturer's specifications.

Respiratory Protection

General Use	If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
Emergency Use	Use positive pressure airline respirator with escape cylinder or self contained breathing apparatus for oxygen-deficient atmospheres (<19.5%).
Hygiene Measures	When using, do not eat, drink or smoke. Remove and wash contaminated clothing before re-use. Keep away from food, drink and animal feeding stuffs. Contaminated work clothing should not be allowed out of the workplace. Provide regular cleaning of equipment, work area and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colorless.	Odor	Acrid.
Odor Threshold	1.5 ppm	Physical State	Gas
Flash Point	Not applicable.	Autoignition Temperature	No information available.
Upper	Not applicable		
Lower	Not applicable		

10. STABILITY AND REACTIVITY

Stability	Stable under recommended storage conditions.
Incompatible Products	Alkalis. Alkaline earth metals. Water. Calcium oxide. Alkyl nitrates.
Conditions to Avoid	Contact with water or moist air liberates irritating gas. Catalyst for many polymerization reactions.
Hazardous Decomposition Products	Boron compounds. Fluorine compounds.
Hazardous Polymerization	Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATIONAcute Toxicity

LD50 Oral:	No information available.
LD50 Dermal:	No information available.
LC50 Inhalation:	No information available.LC50: 806 ppm (Rat) (1 hr. time adjusted) Boron Trifluoride
Inhalation	The 4 hour LC50 for rats was reported to be 436 ppm for boron trifluoride dihydrate, a related compound formed via hydrolysis in moist air.

Repeated Dose Toxicity

Rats exposed to 67 ppm for 6 hours/day (two week study) died before the sixth daily exposure. Histopathology showed kidney damage. Depressed body weight, increased lung weight, and depressed liver weight were seen in rats exposed 6 hour/day at 24 ppm or 9 ppm for 2 weeks.

Renal toxicity was observed in 2 of 40 rats exposed to 6 ppm boron trifluoride, 6 H/day, 5 days/week for 13 weeks. Fluorosis and pneumonitis was seen in rats, rabbits and guinea pigs exposed 5 days/week for up to 6 months to 12.8 ppm and 3.4 ppm. Marginal evidence of pneumonitis was seen in animals exposed to 1.5 ppm concentrations in this study.

Component Information

No information available.

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
[¹¹ B]Boron trifluoride			1.18 mg/L (Rat) 4 h

Chronic Toxicity**Chronic Toxicity**

May cause adverse liver and kidney effects.

Carcinogenicity

Contains no ingredient listed as a carcinogen.

Irritation

No information available.

Sensitization

No information available.

Reproductive Toxicity

No information available.

Developmental Toxicity

No information available.

Synergistic Materials

None known.

Target Organ Effects

Eyes. Kidney. Respiratory system. Skin.

12. ECOLOGICAL INFORMATION**Ecotoxicity**

The environmental impact of this product has not been fully investigated.

Ozone depletion potential; ODP; (R-11 = 1): Does not contain ozone depleting chemical (40 CFR Part 82).

13. DISPOSAL CONSIDERATIONS**Waste Disposal Methods**

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Linde for proper disposal.

Contaminated Packaging

Do not re-use empty containers.

14. TRANSPORT INFORMATION**DOT**

Proper shipping name	Boron trifluoride
Hazard Class	2.3
Subsidiary Class	8
UN-Number	UN1008
Description	UN1008,Boron trifluoride,2.3,(8),PG None
Additional Description:	"Toxic-Inhalation Hazard Zone B".
Additional Marking Requirements:	"Inhalation Hazard".
Emergency Response Guide Number	125

TDG

Proper Shipping Name	Boron trifluoride, compressed
Hazard Class	2.3
Subsidiary Class	(8)
UN-Number	UN1008
Description	UN1008,BORON TRIFLUORIDE, COMPRESSED,2.3(8)

MEX

Proper Shipping Name	Boron trifluoride
Hazard Class	2.3
Subsidiary Class	8
UN-Number	UN1008
Description	UN1008 Boron trifluoride,2.3(8)

IATA

UN-Number	UN1008
Proper Shipping Name	Boron trifluoride
Hazard Class	2.3
Subsidiary Class	8
ERG Code	2CP
Description	UN1008,Boron trifluoride,2.3(8)
Maximum Quantity for Passenger	Forbidden
Maximum Quantity for Cargo Only	Forbidden
Limited Quantity	No information available.

IMDG/IMO

Proper Shipping Name	Boron trifluoride
Hazard Class	2.3
Subsidiary Class	8
UN-Number	UN1008
EmS No.	F-C, S-U
Description	UN1008, Boron trifluoride,2.3(8)

ADR

Proper Shipping Name	Boron trifluoride, compressed
Hazard Class	2.3
UN-Number	UN1008
Classification Code	2TC
Description	UN1008 Boron trifluoride, compressed,2.3(8),
ADR/RID-Labels	8

15. REGULATORY INFORMATION

International Inventories

15. REGULATORY INFORMATION

TSCA	Complies
DSL	Does not Comply
NDSL	Complies
EINECS/ELINCS	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	No

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Risk and Process Safety Management Programs

This material, as supplied, contains one or more regulated substances with specified thresholds under 40 CFR Part 68 or regulated as a highly hazardous chemical pursuant to the 29 CFR Part 1910.110 with specified thresholds:

Chemical Name	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Toxic Substances	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Flammable Substances	U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals
[¹¹ B]Boron trifluoride			250 lb

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CERCLA/SARA

This material, as supplied, contains one or more substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355):

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	TPQ
[¹¹ B]Boron trifluoride		500 lb	500 lb TPQ

U.S. State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
[11b]Boron trifluoride		X			X

International Regulations**Canada**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

A Compressed gases

D1A Very toxic materials

E Corrosive material

**16. OTHER INFORMATION**

Prepared By Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Issuing Date 10-Feb-2011

Revision Date

Revision Number 0

Revision Note Initial Release.

<u>NFPA</u>	Health Hazard 4	Flammability 0	Stability 0	Physical and Chemical Hazards -
<u>HMIS</u>	Health Hazard 3	Flammability 0	Physical Hazard 3	Personal Protection -

Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.

General Disclaimer

For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

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End of Safety Data Sheet