



NITROGEN TRIFLUORIDE

Safety Data Sheet

1. IDENTIFICATION

Product identifier

Product Name NITROGEN TRIFLUORIDE

Other means of identification

Safety data sheet number LIND-P089
UN / ID no. UN2451
Synonyms Nitrogen Fluoride; Trifluoramine; Trifluorammonia

Recommended use of the chemical and restrictions on use

Recommended Use Industrial and professional use.
Uses advised against Consumer use

Details of the supplier of the safety data sheet

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.
Road 869, Km 1.8
Barrio Palmas, Catano, PR 00962
Phone: 787-641-7445
www.pr.lindegas.com

Linde Canada Limited
5860 Chedworth Way
Mississauga, Ontario L5R 0A2
Phone: 905-501-1700
www.lindecanada.com

* May include subsidiaries or affiliate companies / divisions.

For additional product information contact your local customer service.

Emergency telephone number

Company Phone Number 800-232-4726 (Linde National Operations Center, US)
905-501-0802 (Canada)

CHEMTREC: 1-800-424-9300 (North America) +1-703-527-3887 (International)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Acute toxicity - Inhalation (Gases)	Category 4
Specific target organ toxicity (repeated exposure)	Category 2
Oxidizing gases	Category 1
Gases under pressure	Compressed gas

Label elements



Signal word

Danger

Hazard Statements

May cause or intensify fire; oxidizer

Contains gas under pressure; may explode if heated

Harmful if inhaled

May cause damage to kidney, liver, spleen, and central nervous system

Asphyxiating even with adequate oxygen

Precautionary Statements - Prevention

Do not handle until all safety precautions have been read and understood

Keep and store away from clothing and other combustible materials

Keep valves and fittings free from oil and grease

Do not breathe gas.

Use and store only outdoors or in a well ventilated place

Use backflow preventive device in piping

Use only equipment of compatible materials of construction and rated for cylinder pressure

Use only with equipment cleaned for oxygen service

Open valve slowly

Close valve after each use and when empty

Precautionary Statements - Response

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor / physician if you feel unwell.

In case of fire: Stop leak if safe to do so

Precautionary Statements - Storage

Protect from sunlight when ambient temperature exceeds 52°C / 125°F

Hazards not otherwise classified (HNOC)

Not applicable

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Volume %	Chemical Formula
Nitrogen Trifluoride	7783-54-2	100	NF ₃

4. FIRST AID MEASURESDescription of first aid measures

General advice	Show this safety data sheet to the doctor in attendance.
Inhalation	Remove to fresh air and keep comfortable for breathing. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately.
Skin contact	None under normal use. Get medical attention if symptoms occur.
Eye contact	None under normal use. Get medical attention if symptoms occur.
Ingestion	Not an expected route of exposure.
Self-protection of the first aider	RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Most important symptoms and effects, both acute and delayed

Symptoms	Chemical Asphyxiant-interferes with oxygen transport. Reacts with hemoglobin in the blood to form a hemoglobin complex, similar to carbon monoxide. The altered hemoglobin cannot take part in oxygen transport. Suffocation from exposure to this may occur in the presence of sufficient oxygen to support respiration.
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Indication of any immediate medical attention and special treatment needed

Note to physicians	Human data on nitrogen trifluoride are limited. Methemoglobin production and hemolysis are non-specific effects which require monitoring and appropriate supportive measures. Close observation for pulmonary and renal impairment is indicated.
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5. FIRE-FIGHTING MEASURESSuitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Specific extinguishing methods

Continue to cool fire exposed cylinders until flames are extinguished. Damaged cylinders should be handled only by specialists.

Specific hazards arising from the chemical

May cause or intensify fire; oxidizer. Will support and accelerate combustion of combustible materials (wood, paper, oil, debris, etc). This is a strong oxidizer and will react vigorously or explosively with many materials including fuels. Above 1830°F (1000°C) it should ignite most materials on contact. Cylinders may rupture under extreme heat.

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. Additional chemical protective clothing may be required to protect from toxic decomposition products.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Evacuate personnel to safe areas. Ensure adequate ventilation, especially in confined areas. Keep people away from and upwind of spill / leak. Monitor concentration of released product. Eliminate all ignition sources if safe to do so. Use personal protection recommended in Section 8. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Other Information	Gas / vapor is heavier than air. Prevent from entering sewers, basements and workpits, or any place where accumulation may be dangerous.

Environmental precautions

Environmental precautions	Prevent spreading of vapors through sewers, ventilation systems and confined areas.
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Methods and material for containment and cleaning up

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.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling	Most metals are satisfactory for handling nitrogen trifluoride up to temperatures of ~ 160°F (70°). Nickel and Monel® are recommended for higher temperatures. Wetted surfaces should be passivated with an "active" fluorine compound to establish a metal fluoride coating for additional protection. Teflon® and Kel-F® are the preferred gasket materials. Keep equipment scrupulously dry. Many metal fluorides are water soluble so that the passive film corrosion protection may be destroyed if wetted with water. Keep valves and fittings free from oil and grease. Use only equipment of compatible materials of construction. Use only with equipment cleaned for oxygen service. Open valve slowly. "NO SMOKING" signs should be posted in storage and use areas. Separate flammable gas cylinders from oxygen and other oxidizers by a minimum distance of 20 ft. or by a 5 ft. high barrier with a minimum fire resistance rating of a half an hour. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Never attempt to lift a cylinder by its valve protection cap. 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. Use only with adequate ventilation. Use backflow preventive device in piping. Use only with equipment rated for cylinder pressure. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Ensure the complete gas system has been checked for leaks before use. 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. Only experienced and properly instructed persons should handle gases under pressure. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.
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Conditions for safe storage, including any incompatibilities

Storage Conditions	Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Full and empty cylinders should be segregated. Stored containers should be periodically checked for general condition and leakage. Do not store near combustible materials
Incompatible materials	Ammonia. Carbon monoxide. Hydrogen sulfide. Methane. Grease. Oil. Diborane. Plastics. Oxidizing or reducing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nitrogen Trifluoride 7783-54-2	TWA: 10 ppm	TWA: 10 ppm TWA: 29 mg / m ³ TWA: 2.5 mg / m ³ F TWA: 2.5 mg / m ³ dust (vacated) TWA: 10 ppm (vacated) TWA: 29 mg / m ³ (vacated) TWA: 2.5 mg / m ³	IDLH: 1000 ppm TWA: 10 ppm TWA: 29 mg / m ³

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health. Immediately Dangerous to Life or Health

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

Engineering Controls	Ventilation systems. Consider installation of leak detection systems in areas of use and storage. Systems under pressure should be regularly checked for leakages.
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Individual protection measures, such as personal protective equipment

Eye / face protection	Wear safety glasses with side shields (or goggles).
Skin and body protection	Work gloves and safety shoes are recommended when handling cylinders. Gloves must be clean and free from grease or oil.
Respiratory protection	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.
General Hygiene Considerations	Handle in accordance with good industrial hygiene and safety practice. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Compressed gas
Appearance	No information available.
Odor	No information available.
Odor threshold	No information available
pH	No data available
Melting point	-206.8 °C / -340.2 °F
Evaporation rate	Not applicable
Fire Hazard	Yes

Lower flammability limit:	Not applicable
Upper flammability limit:	Not applicable
Flash point	No information available
Autoignition temperature	No data available
Decomposition temperature	No data available
Oxidizing properties	Oxidizer
Partition coefficient	No data available
Kinematic viscosity	Not applicable

Chemical Name	Molecular weight	Boiling point	Vapor Pressure	Vapor density (air =1)	Gas Density kg / m ³ @20°C	Critical Temperature
Nitrogen Trifluoride	71.00	-120.1 °C	Above critical temperature	2.48	2.95	-39.2 °C

10. STABILITY AND REACTIVITY

Reactivity

Reactivity increases at increased temperature and pressure.

Chemical stability

Stable below 260°C / 560°F.

Explosion data

Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	None.

Possibility of Hazardous Reactions

Absorption on to activated granular charcoal at -100°C (-148°F) has caused an explosion.

Conditions to avoid

Heat, flames and sparks. High temperature from adiabatic compression. Avoid high gas velocity.

Incompatible materials

Ammonia. Carbon monoxide. Hydrogen sulfide. Methane. Grease. Oil. Diborane. Plastics. Oxidizing or reducing agents.

Hazardous Decomposition Products

Tetrafluorohydrazine (N₂F₄) and active fluoride radicals.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation	Reacts with hemoglobin in the blood to form a hemoglobin complex, similar to carbon monoxide. The altered hemoglobin cannot take part in oxygen transport. Suffocation from exposure to this may occur in the presence of sufficient oxygen to support respiration.
Skin contact	No data available.
Eye contact	Dogs exposed to 9600 ppm for 1 hour exhibited slight eye irritation.
Ingestion	Not an expected route of exposure.

Information on toxicological effects

Symptoms	No information available.
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Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	Not classified.
Sensitization	Not classified.
Germ cell mutagenicity	The results of the Ames tests conducted on NF ₃ are reported as negative, without metabolic activation; weakly positive, with metabolic activation. Examination of these results and those of previously conducted tests suggests that the activity shown is attributable to N ₂ F ₂ a recognized contaminant of NF ₃ . NF ₃ is currently manufactured with a minimal N ₂ F ₂ content.
Carcinogenicity	This product does not contain any carcinogens or potential carcinogens listed by OSHA, IARC or NTP.
Reproductive toxicity	Not classified.
STOT - single exposure	Not classified.
STOT - repeated exposure	Category 2.
Chronic toxicity	May cause adverse liver and kidney effects. Extended low level systemic absorption of fluorides may cause fluorosis, an abnormal calcification pattern of the skeletal system.
Subchronic toxicity	Subchronic studies in animals at 100 ppm or greater indicate that repeated exposure may affect the kidney, spleen, liver, and myocardium.
Target Organ Effects	Blood, Kidney, Liver.
Aspiration hazard	Not applicable.

Numerical measures of toxicity

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50	Inhalation LC50 (CGA P-20)
Nitrogen Trifluoride 7783-54-2	-	-	6700 ppm (Rat) 1 h	6700 ppm (Rat) 1hr - CGA

Product Information

Oral LD50	No information available
Dermal LD50	No information available
Inhalation LC50	No information available

12. ECOLOGICAL INFORMATIONEcotoxicity

No known acute aquatic toxicity.

Persistence and degradability

Not applicable.

Bioaccumulation

No information available.

Other adverse effects

Contains fluorinated greenhouse gas.

Global warming potential (GWP) 17,200

13. DISPOSAL CONSIDERATIONSWaste treatment methods

Disposal of wastes 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.

14. TRANSPORT INFORMATIONDOT

UN / ID no. UN2451

Proper shipping name	Nitrogen trifluoride
Hazard Class	2.2
Subsidiary class	5.1
Description	UN2451, Nitrogen trifluoride, 2.2 (5.1)
Emergency Response Guide Number	122

TDG

UN / ID no.	UN2451
Proper shipping name	Nitrogen trifluoride
Hazard Class	2.2
Subsidiary class	5.1
Description	UN2451, Nitrogen trifluoride, 2.2 (5.1)

MEX

UN / ID no.	UN2451
Proper shipping name	Nitrogen trifluoride
Hazard Class	2.2
Subsidiary class	5.1
Description	UN2451, Nitrogen trifluoride, 2.2 (5.1)

IATA

UN / ID no.	UN2451
Proper shipping name	Nitrogen trifluoride
Hazard Class	2.2
Subsidiary hazard class	5.1
ERG Code	2X
Description	UN2451, Nitrogen trifluoride, 2.2 (5.1)

IMDG

UN / ID no.	UN2451
Proper shipping name	Nitrogen trifluoride
Hazard Class	2.2
Subsidiary hazard class	5.1
EmS-No.	F-C, S-W
Description	UN2451, Nitrogen trifluoride, 2.2 (5.1)

ADR

UN / ID no.	UN2451
Proper shipping name	Nitrogen trifluoride
Hazard Class	2.2
Classification code	20
Tunnel restriction code	(C/E)
Description	UN2451, Nitrogen trifluoride, 2.2 (5.1), (C/E)
Labels	5.1

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	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 Chemical Substances / European List of Notified Chemical Substances

US 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	Yes
Sudden release of pressure hazard	Yes
Reactive Hazard	No

CERCLA

This material, as supplied, does not contain any 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). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

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.

CWA (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, does not contain any regulated substances with specified thresholds under 40 CFR Part 68. This product does not contain any substances regulated as Highly Hazardous Chemicals pursuant to the 29 CFR Part 1910.110.

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
Nitrogen Trifluoride	-	-	5000 lb

US State RegulationsCalifornia Proposition 65

This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Nitrogen Trifluoride 7783-54-2	X	X	X

International Regulations

Chemical Name	Carcinogenicity	Exposure Limits
Nitrogen Trifluoride	-	Mexico: TWA 10 ppm Mexico: TWA 30 mg / m ³ Mexico: TWA 2.5 mg / m ³ Mexico: STEL 15 ppm Mexico: STEL 45 mg / m ³

16. OTHER INFORMATION

NFPA Health hazards 1 Flammability 0 Instability 0 Physical and Chemical Properties OX

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.

Issue Date 16-Mar-2015
Revision Date 16-Mar-2015
Revision Note Initial Release.

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