

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Chlorine trifluoride (MSDS No. P-4581-B)	Trade Name: Chlorine Trifluoride
Chemical Name: Chlorine trifluoride	Synonyms: Chlorotrifluoride
Formula: ClF ₃	Chemical Family: Halogen
Telephone:	Company Name: Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113
Emergencies: 1-800-645-4633*	
CHEMTREC: 1-800-424-9300*	
Routine: 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 (2004)
Chlorine Trifluoride	7790-91-2	>99%*	0.1 ppm (ceiling)**	0.1 ppm (ceiling)**

* The symbol > means "greater than."

**Ceiling values are not time-weighted average.

3. Hazards Identification



EMERGENCY OVERVIEW



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

Can cause severe eye, skin, and respiratory tract burns.

Extremely reactive; reacts violently with water; reacts with most other substances including rare gases and some metals.

Vigorously accelerates combustion.

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

Odor: Sharp, pungent

THRESHOLD LIMIT VALUE: TLV-Ceiling, 0.1 ppm (ACGIH, 2004). TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION—Chlorine trifluoride is corrosive and extremely irritating to the upper and lower respiratory tracts. Prolonged exposure to concentrations of as little as 5-10 ppm can irritate the inner passages of the nose and mouth (nasal and buccal mucosa). Higher concentrations can cause deep lung inflammation (chemical pneumonitis) and abnormal fluid build up in the lungs (pulmonary edema). Symptoms include coughing, wheezing, and severe salivation with abnormal fluid buildup in the throat, mouth, and nose. Acute respiratory distress (victim is gasping for breath) is followed by convulsions and death.

SKIN CONTACT—Can cause extremely severe burns in less than 1 second, but redness and burns may be delayed. Hydrofluoric acid formed by reaction with moisture can cause additional tissue damage.

SWALLOWING—An unlikely route of exposure. This product is a gas at normal temperature and pressure, but burns of the mouth, esophagus, and stomach may result.

EYE CONTACT—Chlorine trifluoride is irritating and corrosive to eye tissue. Symptoms are burning, tearing, and swelling of the eyes and eyelids, followed by cloudiness of the cornea. Burns resulting from exposure to higher concentrations can cause blindness.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: No information available.

OTHER EFFECTS OF OVEREXPOSURE: None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Inhalation may aggravate asthma, emphysema, and other conditions involving respiratory distress.

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

CARCINOGENICITY: This product is not listed by NTP, OSHA, or IARC.

4. First Aid Measures

NOTE: *In case of contact or suspicion of contact with chlorine trifluoride, prompt medical attention is absolutely necessary.*

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. **Rescuer should avoid breathing any exhaled air from victim.** If breathing is difficult, qualified personnel may give oxygen. Trained personnel may administer 2.5% calcium gluconate by nebulizer with patient in sitting position. Call a physician.

SKIN CONTACT:

Avoid breathing vapor. Immediately flush skin with large quantities of cool water while removing contaminated clothing and shoes. Continue until all acid is removed, paying particular attention to skin under nails. Follow by applying iced alcoholic or aqueous zephiran chloride solution or Hyamine 1622 solution. If not available, continue washing in cool water for two to four hours or until medical attention arrives. Discard contaminated clothing and shoes.

NOTE: *Burns covering an area greater than 8 in² (52 cm²) require immediate treatment by a physician. If immersion is impractical, soaked compresses of one of the recommended solutions should be applied to the area. Continue immersion or compresses for two hours. With gloved hand apply 2.5% calcium gluconate gel to the burn area. Immediate medical treatment is necessary to promote healing—untreated wounds from corrosion of the skin heal slowly and poorly.*

SWALLOWING: An unlikely route of exposure. This product 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. Trained personnel may administer 1% calcium gluconate solution by continuous drip. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *If pain persists after topical treatments, it may be necessary to inject 5% aqueous calcium gluconate beneath, around, and into the burn area. Extensive burns, small burns with concentrated material, or burns that have been neglected may result in systemic absorption of fluoride causing serious depletion of calcium and electrolyte imbalance. Electrocardiographic monitoring and appropriate laboratory tests are essential. Do not use local anesthetics. Resolution of pain is a means to determine effective medical treatment. The patient should be observed for clinical symptoms of hypocalcemia following ingestion or inhalation. Serum calcium, potassium, and magnesium determinations must be performed immediately and periodically to monitor for hypocalcemia and electrolyte imbalance. EKGs should be done immediately and periodically to monitor for arrhythmias, hypocalcemia and hyperkalemia. Keep victims of exposure under medical observation for at least 24 hours.*

5. Fire Fighting Measures

FLASH POINT (test method):	Not applicable	
AUTOIGNITION TEMPERATURE:	Not applicable	
FLAMMABLE LIMITS IN AIR, % by volume:	LOWER: Not applicable	UPPER: Not applicable

EXTINGUISHING MEDIA: Chlorine trifluoride cannot catch fire. Use media appropriate for surrounding fire. Contact with water causes violent reaction.

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Toxic, oxidizing, corrosive liquid and gas under pressure. Immediately evacuate all personnel from danger area. If product is leaking or suspected of leaking, evacuate beyond the distances prescribed in section 6. 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. If cylinders are leaking, reduce toxic vapors with water spray or fog. Shut off leak if without risk. Reverse flow into cylinders may cause violent rupture. (See section 16.) On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Nonflammable, poisonous, oxidizing, corrosive liquid and gas. Contact with flammables may cause fire or explosion. Ignites many metals at elevated temperatures. Chlorine trifluoride will attack many types of clothing, including firefighter's ordinary protective clothing. Heat of fire can build pressure in cylinder and cause it to rupture. To provide maximum containment up to cylinder burst pressure, chlorine trifluoride cylinders are not equipped with a pressure relief device. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Vapors are extremely irritating and may burn skin and eyes on contact (see section 4).

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Toxic, oxidizing, corrosive liquid and gas under pressure. Immediately evacuate all personnel from danger area. Suggested evacuation distances (DOT 2000 *Emergency Response Guidebook*):

Initial: Small spill or leak—200 ft (60 m) in all directions
Large spill or leak—1100 ft (335 m) in all directions

Downwind protection: Small spill or leak—0.3 mi (0.5 km), day; 1 mi (1.6 km), night
Large spill or leak—2.1 mi (3.4 km), day; 4.8 mi (7.7 km), night.

Do not approach area without self-contained breathing apparatus and protective clothing. Avoid spilled product. Reduce vapors with fog or fine water spray. Shut off flow if without risk. Releases of liquid chlorine trifluoride are extremely dangerous; chlorine trifluoride can react violently with most materials including sand, concrete, asphalt, and water. Reverse flow into cylinder may cause violent rupture. Ventilate area or move cylinder to a well-ventilated area. Prevent runoff from contaminating surrounding environment. Toxic, corrosive vapors may spread from spill. Before entering area, especially a confined area, check atmosphere with an appropriate device.

WASTE DISPOSAL METHOD: Prevent waste from contaminating the surrounding environment. Keep personnel away. Call your local Praxair supplier for disposal information, or call one of the emergency numbers listed in section 1.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation, away from oil, grease, and other flammable materials. Firmly secure cylinders upright to keep them from falling or being knocked over. Store cylinders with valve outlet cap in place. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods. Visually inspect stored cylinders at least once a week for indications of leaks or other problems.

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. 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 chlorine trifluoride, see section 16.

For additional information on storage and handling, refer to Compressed Gas Association (CGA) pamphlet P-1, *Safe Handling of Compressed Gases in Containers*, available from the CGA. Refer to section 16 for the address and phone number along with a list of other available publications.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST—A metallic corrosion-resistant system is acceptable.

MECHANICAL (general)—Inadequate. See SPECIAL, below.

SPECIAL—Use only in a closed system. A corrosion-resistant, forced-draft fume hood is preferred.

OTHER— See special.

RESPIRATORY PROTECTION: Select per OSHA 29 CFR 1910.134 and ANSI Z88.2. No NIOSH-approved respirator is available for this product. Where product concentration may exceed 0.1 ppm, Praxair recommends an SCBA or positive-pressure airline respirator with a full face mask and escape pack worn with a full-protection, chemical resistant suit.

SKIN PROTECTION: Wear work gloves for cylinder handling; Where contact with product is possible, such as when changing out cylinders, wear two pairs of gloves—inner gloves of smooth leather and outer gloves of 17 mil nitrile. The breakthrough time of the selected gloves must be greater than the intended use period.

EYE PROTECTION: Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Protective clothing consisting of a PVC splash suit and double glove as described above should be worn wherever contact with product is possible, such as during cylinder changeout. Emergency protective clothing should consist of the recommended double gloves and a totally encapsulating chemical protective suit worn over natural fiber clothing. Select per OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

NOTE: *Protective clothing and equipment that has been in contact with the product or is suspected of contact must be decontaminated or discarded using an approved method. This clothing should not be worn or carried outside the area where the product is used. Clothing, including chemical protective suits, may react and burn on contact with liquid product.*

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	92.45
SPECIFIC GRAVITY (H ₂ O = 1) at 32°F (0°C)	1.88
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	3.192
VAPOR PRESSURE at 70°F (21.1°C):	21.5 psia (148 kPa abs)
SOLUBILITY IN WATER:	Reacts violently.
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE:	High
BOILING POINT at 1 atm:	52.7°F (11.5°C)
FREEZING POINT at 1 atm:	-105.4°F (-76.3°C)

APPEARANCE, ODOR, AND STATE: Colorless gas at normal temperature and pressure; yellow-green liquid, sweet, highly irritating odor.

10. Stability and Reactivity

STABILITY: Unstable Stable

INCOMPATIBILITY (materials to avoid): Reacts with most substances, including the rare gases and a few metals. May react violently with organic materials. Refer to NFPA 49 and NFPA 491M for more complete listings.

HAZARDOUS DECOMPOSITION PRODUCTS: Chlorine, fluorine

HAZARDOUS POLYMERIZATION: May Occur Will Not Occur

CONDITIONS TO AVOID: None known.

11. Toxicological Information

See section 3. LC₅₀, 1 hour, rat = 299 ppm.

12. Ecological Information

Chlorine trifluoride does not contain any Class I or Class II ozone-depleting chemicals. Chlorine trifluoride 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. See section 6 for emergency leak or spill instructions.

14. Transport Information**DOT/IMO SHIPPING NAME:** Chlorine trifluoride**HAZARD CLASS:** 2.3 | **IDENTIFICATION NUMBER:** UN 1749 | **PRODUCT RQ:** None**SHIPPING LABEL(s):** POISON GAS, OXIDIZER, CORROSIVE***PLACARD (when required):** POISON GAS, OXIDIZER, CORROSIVE***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 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

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:** None**EHS RQ:** None**SECTIONS 311/312:** Require submission of MSDSs and chemical inventory reporting with identification of EPA hazard categories. The hazard categories for this product are as follows:**IMMEDIATE:** Yes**PRESSURE:** Yes**DELAYED:** Yes**REACTIVITY:** Yes**FIRE:** Yes**SECTION 313:** Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Chlorine trifluoride 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.

Chlorine trifluoride is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: This product 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.

Chlorine trifluoride is listed in Appendix A as a highly hazardous chemical in quantities of 1000 pounds (454 kg) or greater.

STATE REGULATIONS:

CALIFORNIA: This product is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: This product 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.

SPECIAL HANDLING PROCEDURE—SYSTEM PASSIVATION: Praxair strongly recommends that you passivate the supply system prior to use. The passivation process, which is often used with systems handling reactive fluorides such as fluorine and chlorine trifluoride, forms a fluoride layer on the inner surfaces of metallic components. This protective layer prevents corrosion and resultant system failure.

See your Praxair sales representative or local Praxair distributor or supplier for information about passivating your system. Obtain Praxair publication P-15-168, *Equipment Passivation for Reactive Fluoride Service*.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Toxic, oxidizing, corrosive liquid and gas under pressure.* Do not breathe gas. Do not get vapors or liquid in eyes, on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. *Use behind barricades with remote extensions on valves and regulators as a minimum* or as specified under "Recommended Equipment" below. *Use piping and equipment adequately designed to withstand pressures to be encountered.* Use only in a closed, leak-tight system constructed of corrosion-resistant materials conditioned for chlorine trifluoride service. Passivated carbon steel, stainless steel, and copper of greater than 99.9% purity have been found suitable at ambient temperatures. At high temperatures, Monel and nickel are preferred. Lead or pure nickel gaskets are recommended. *Distribution systems must be thoroughly cleaned and passivated prior to use as described earlier in this section.* Once the system is passivated, do not expose to it air—severe corrosion may result. *Water or organic contamination may cause violent reaction.* Maintain original service atmosphere or purge system with dry inert gas when out of service. *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. *Store and use with adequate ventilation at all times.* Close valve after each use; keep closed even when empty. *Never work*

on a pressurized system. If there is a leak, close the cylinder valve. Blow the system down in an environmentally safe manner in compliance with all federal, state, and local laws; inert the system; then repair the leak. When opening distribution system, wear acid resistant gloves and dust mask since corrosive dust may be present. **Follow safe practices when returning cylinder to supplier.** Make sure valve is closed and valve outlet plug tightly installed **Never place a compressed gas cylinder where it may become part of an electrical circuit.**

Recommended Equipment: 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. Control temperature throughout distribution system to be at or above cylinder temperature to avoid condensation.

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 = 4
 FLAMMABILITY = 0
 INSTABILITY = 3
 SPECIAL = W

HMIS RATINGS:

HEALTH = 3
 FLAMMABILITY = 0
 PHYSICAL HAZARD = 3

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: CGA-670 (lead gasket)

PIN-INDEXED YOKE: Not applicable

ULTRA-HIGH-INTEGRITY CONNECTION: CGA-728 (nickel gasket)

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, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, <http://www.cganet.com/Publication.asp>.

G-4.1 *Cleaning Equipment for Oxygen Service*
 P-1 *Safe Handling of Compressed Gases in Containers*
 V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections*
 — *Handbook of Compressed Gases, Fourth Edition*

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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