

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	Germanium Tetrafluoride, Enriched Germanium
Synonyms	Germanium(IV) fluoride, Germane, Tetrafluoro-, germanium 72-enriched; F ₄ Ge
CAS No.	7783-58-6
Chemical Formula	GeF ₄
Molecular Weight:	148.6 g/mol
Supplier Address*	ISOFLEX USA PO Box 472615 San Francisco CA 94147 United States
Telephone	+1 415-440-4433
Fax	+1 415-563-4433
Emergency Phone Number (both supplier and manufacturer)	Infotrac/ +1 800-535-5053 *May include subsidiaries or affiliate companies/divisions
Email	iusa@isoflex.com
Website	www.isoflex.com
Preparation Information	ISOFLEX USA Product Safety +1 415-440-4433

2. HAZARDS IDENTIFICATION

Emergency Overview:

Color:	Colorless
Physical Form:	Gas
Odor:	Pungent odor, garlic odor
Major Health Hazards:	Toxic gas

Product reacts with water vapor in air to form other corrosive, toxic substances (hydrofluoric acid gas).

NFPA Ratings: (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health Hazard = 4 Flammability = 0 Reactivity = 1



4. FIRST AID MEASURES

General Advice

Remove victim to uncontaminated area wearing self-contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped. Use chemically protective clothing.

Eye Contact

Persons with potential exposure to germanium tetrafluoride should not wear contact lenses. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Keep eye wide open while rinsing.

Skin Contact

Flush with copious amounts of water until treatment is available. Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and badly.

Ingestion

Never give anything by mouth to an unconscious person. Do not induce vomiting. In all cases, notify physician and identify the nature of the hazard and the state of the victim. If conscious, have the victim rinse mouth liberally with water. Give water to drink ONLY if conscious and under advice of medical personnel. Call poison control center for advice. Have container handy to give information from label.

Inhalation

Move to fresh air. In case of shortness of breath, give oxygen. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. Mouth to mouth resuscitation is not recommended. Consult a doctor.

5. FIREFIGHTING MEASURES

Flammability

Not flammable

Hazardous Combustion Products

Combustion products: oxides of germanium, hydrogen fluoride.

Fire and Explosion Hazards

Reactions of hydrogen fluoride with metal piping and vessels generates hydrogen creating a potential explosion hazard. Cylinders may rupture violently from pressure when involved in a fire situation.

Suitable Extinguishing Media

Nonflammable. Will hydrolyze to corrosive hydrofluoric acid on contact with water.

Specific Hazards

Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Product is nonflammable and does not support combustion. Use of water may result in the formation of very toxic aqueous solutions. Move away from container and cool with water from a protected position. Do not allow runoff from firefighting to enter drains or water courses. Keep containers and surroundings cool with water spray. If possible, stop flow of product. Most cylinders are designed to vent contents when exposed to elevated temperatures.

Special Firefighting Procedures

Use self-contained breathing apparatus and chemically protective clothing. Water will cause hydrolysis to hydrofluoric acid. Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. Wear additional chemical protective clothing as necessary to prevent contact. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions

Evacuate personnel to safe areas. Approach suspected leak areas with caution. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ventilate the area.

Environmental Precautions

Should not be released into the environment. Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up

Ventilate the area. Reduce vapor with fog or fine water spray.

Additional Advice

If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the ISOFLEX USA emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Only experienced and properly instructed persons should handle compressed gases. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50 °C (122 °F). Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shocks which may cause damage to their valve or safety devices. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Keep container valve

outlets clean and free from contaminants particularly oil and water. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Avoid suckback of water, acid and alkalis. Installation of a cross purge assembly between the cylinder and the regulator is recommended. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50 °C (122 °F). Prolonged periods of cold temperature below -30 °C (-20 °F) should be avoided.

Storage

Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Full containers should be stored so that oldest stock is used first. Observe all regulations and local requirements regarding storage of containers. Stored containers should be periodically checked for general condition and leakage. Local codes may have special requirements for toxic gas storage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50 °C (122 °F). Return empty containers in a timely manner.

Technical Measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance with local regulations. Keep away from combustible material.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures

Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.

Personal Protective Equipment

Respiratory

Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits. Users of breathing apparatus must be trained.

Hand

Sturdy work gloves are recommended for handling cylinders. The breakthrough time of the selected glove(s) must be greater than the intended use period.

Eye protection

Safety glasses recommended when handling cylinders. A full face shield should be worn in addition to safety glasses when connecting, disconnecting or opening cylinders.

Skin and Body

Encapsulated chemical protective suit in emergency situations. Ensure adequate ventilation, especially in confined areas. Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits.

Exposure Limits

Germanium Fluoride:

Inorganic Fluorides (as F): 2.5 mg/m³ OSHA TWA
2.5 mg/m³ ACGIH TWA
2.5 mg/m³ NIOSH recommended TWA 10 hour(s)

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form Compressed gas
Color Colorless
Odor Pungent. Garlic-like.

Safety Data

Molecular Weight: 148.6 g/mol
Relative Vapor Density: 5.1 (air = 1)
Melting Point/Range: -34 °F (-36.5 °C)
Solubility (H₂O): Hydrolyzes
Vapor Pressure at 70 °F: 235 psia

10. STABILITY AND REACTIVITY

Stability Stable under normal conditions
Reactivity Germanium tetrafluoride is not known to decompose thermally.
Incompatible Materials / Conditions Rapidly reacts with water or water vapor to form hydrofluoric acid which reacts to most metals and organic materials with evolution of heat and hydrogen gas.
Hazardous Polymerization Will not occur
Hazardous Decomposition Products Hydrogen fluoride and germanium oxide on hydrolysis

11. TOXICOLOGICAL INFORMATION

Acute Health Hazard

Ingestion No data is available on the product itself.
Inhalation LC50 (1 h): ppm
Species: Rat
Skin No data is available on the product itself.
Toxicity Data Prolonged exposure to hydrogen fluoride produces system increase in fluoride, which may result in diseases of bones, liver and kidneys and in hypocalcemia.
Carcinogenicity This material is listed in the Registry of Toxic Effects of Chemical Substances (RTECS), but no information on it is available.

12. ECOLOGICAL INFORMATION

Does not contain Class I or Class II ozone-depleting substances

Ecotoxicity Effects

<i>Aquatic Toxicity</i>	May cause pH changes in aqueous ecological systems
<i>Toxicity to Other Organisms</i>	No data available
<i>Persistence and Degradability</i>	No data available
<i>Mobility in Soil</i>	No data available
<i>Bioaccumulation</i>	No data is available on the product itself.
<i>Results of PBT and vPvB assessment</i>	PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

13. DISPOSAL CONSIDERATIONS

<i>Product</i>	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 supplier or authorized distributor for proper disposal.
<i>Contaminated Packaging</i>	Return cylinder to supplier.

14. TRANSPORT INFORMATION**INTERNATIONAL U.S. DOT 49 CFR 172.101:**

<i>Proper Shipping Name</i>	Compressed gas, toxic, corrosive, n.o.s. (Germanium Tetrafluoride)
<i>Hazard Class Number</i>	2.3 (8) 2.3(8)
<i>UN Identification Number</i>	UN 3304
<i>Shipping Label</i>	POISON GAS, CORROSIVE
<i>Additional Marking Requirement</i>	"Inhalation Hazard"
<i>Additional Shipping Paper</i>	"Poison-Inhalation Hazard, Zone A"
<i>DOT Special Provisions</i>	(49 CFR 172.102): 2 - This material is poisonous by inhalation (see 171.8 of this subchapter) in Hazard Zone B (see 173.116(a) or 173.133(a) of this subchapter), and must be described as an inhalation hazard under the provisions of this subchapter. B9 - Bottom outlets are not authorized. B14 - Each bulk packaging, except a tank car or a multi-unit-tank car tank, must be insulated with an insulating material so that the overall thermal conductance at 15.5 C (60 F) is no more than 1.5333 kilojoules per hour per square meter per degree Celsius (0.075 Btu per hour per square foot per degree Fahrenheit) temperature differential. Insulating materials must not promote corrosion to steel when wet.

PASSENGER AIRCRAFT OR RAILCAR: Forbidden

CARGO AIRCRAFT ONLY: Forbidden

Further Information Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.

15. REGULATORY INFORMATION

SARA Title III SARA Sections 311/312 Hazardous Categories (40 CFR 370.21):

Acute: Yes
Chronic: No
Fire: No
Reactive: Yes
Sudden Release: Yes

SARA Title III - Section 313 Supplier Notification:

This product does not contain toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372.

U.S. TSCA/Canadian DSL:

All ingredients are listed on the U.S. Toxic Substances Control Act (TSCA) inventory or exempt from listing and on the Canadian Domestic Substance List (DSL).

California Proposition 65:

This product does not contain ingredient(s) known to the State of California to cause cancer or reproductive toxicity.

Canadian Controlled Products Regulations (CPR):

This product has been classified in accordance with the hazard criteria of the CPR and the SDS contains all the information required by the CPR.

16. OTHER INFORMATION

Prepared By ISOFLEX USA
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San Francisco CA 94147
United States

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ISOFLEX USA's Commonly Used Abbreviations and Acronyms*

ACGIH	American Conference of Governmental Industrial Hygienists
ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Road
ALARA	As Low As Is Reasonably Achievable
AMU	Atomic Mass Unit
ANSI	American National Standards Institute
BLS	Basic Life Support
CAM	Continuous Air Monitor
CAS	Chemical Abstracts Service (division of the American Chemical Society)
CEN	European Committee for Standardization
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Classification, Labelling and Packaging (European Union)
CPR	Controlled Products Regulations (Canada)
CWA	Clean Water Act (USA)
DAC	Derived Air Concentration (USA)

DOE	United States Department of Energy (USA)
DOT	United States Department of Transportation (USA)
DSL	Domestic Substances List (Canada)
EC50	Half Maximal Effective Concentration
EINECS	European Inventory of Existing Commercial Chemical Substances
EHS	Environmentally Hazardous Substance
ELINCS	European List of Notified Chemical Substances
EMS	Emergency Response Procedures for Ships Carrying Dangerous Goods
EPA	Environmental Protection Agency (USA)
EPCRA	Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986
GHS	Globally Harmonized System
HMIS	Hazardous Materials Identification System (USA)
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association
IBC	Intermediate Bulk Containers
ICAO	International Civil Aviation Organization
IDLH	Immediately Dangerous to Life or Health
IMDG	International Maritime Code for Dangerous Goods
LC50	Lethal concentration, 50 percent
LD50	Lethal dose, 50 percent
LOEC	Lowest-Observed-Effective Concentration
MARPOL	International Convention for the Prevention of Pollution from Ships
MSHA	Mine Safety and Health Administration (USA)
NCRP	National Council on Radiation Protection & Measurements (USA)
NDSL	Non-Domestic Substances List (Canada)
NFPA	National Fire Protection Association (USA)
NIOSH	National Institute for Occupational Safety and Health (USA)
NOEC	No Observed Effect Concentration
N.O.S.	Not Otherwise Specified
NRC	Nuclear Regulatory Commission (USA)
NTP	National Toxicology Program (USA)
OSHA	Occupational Safety and Health Administration (USA)
PBT	Persistent Bioaccumulative and Toxic Chemical
PEL	Permissible Exposure Limit
PIH	Poisonous by Inhalation Hazard
RCRA	Resource Conservation and Recovery Act (USA)
RCT	Radiation Control Technician
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (Europe)
RID	Regulations Concerning the International Transport of Dangerous Goods by Rail
RTECS	Registry of Toxic Effects of Chemical Substances
SARA	Superfund Amendments and Reauthorization Act (USA)
TDG	Transportation of Dangerous Goods (Canada)
TIH	Toxic by Inhalation Hazard
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UN	United Nations (Number)
VOC	Volatile Organic Compound
vPvB	Very Persistent Very Bioaccumulative Chemical
WGK	Wassergefährdungsklassen (Germany: Water Hazard Classes)
WHMIS	Workplace Hazardous Materials Information System

*One or more of the above-listed items may not appear in this document.

General Disclaimer

For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between ISOFLEX USA (or any of its affiliates and subsidiaries) and the purchaser.

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