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MATERIAL  
SAFETY  
DATA SHEET

No. 27

PRODUCT NAME Fluorine	CAS # 7782-41-4
TRADE NAME AND SYNONYMS Fluorine, compressed (D.O.T.)	DOT I.D. No.: UN 1045 RQ 10(4.54)
CHEMICAL NAME AND SYNONYMS Fluorine	DOT Hazard Class: Division 2.3
ISSUE DATES AND REVISIONS Revised April 1998	Formula F <sub>2</sub>
	Chemical Family: Halogen

### HEALTH HAZARD DATA

#### TIME WEIGHTED AVERAGE EXPOSURE LIMIT

1.0 Molar PPM; STEL = 2.0 Molar PPM (ACGIH 1997). OSHA 1996 PEL (8 Hr. TWA) = 0.1 Molar PPM.

#### SYMPTOMS OF EXPOSURE

Corrosive and irritating to the upper and lower respiratory tracts, skin and eyes. It hydrolyzes very rapidly yielding hydrofluoric acid so that skin burns- and mucosal irritation are like that from exposure to that acid. Symptoms include lacrymation, cough, labored breathing and excessive salivary and sputum formation. Excessive irritation of the lungs causes acute pneumonitis and pulmonary edema which could be fatal. (Continued on Page 4)

#### TOXICOLOGICAL PROPERTIES

As a narcotic gas or intoxicant causes hypercapnia (an excessive amount of carbon dioxide in the blood). Repeated exposures to tolerable levels have not shown deleterious effects. The major property is the exclusion of an adequate supply of oxygen to the lungs.

Acetylene is not listed in the IARC, NTP or by OSHA as a carcinogen or potential carcinogen.

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

#### RECOMMENDED FIRST AID TREATMENT

**PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO FLUORINE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.**

**Inhalation:** Unconscious persons should be moved to an uncontaminated area and given assisted respiration and supplemental oxygen. Keep the victim warm and quiet. Assure that mucous or vomited material does not obstruct the airway by use of positional drainage. Delayed pulmonary edema may occur. Keep patient under medical observation for at least 24 hours.

**Eye Contact:** PERSONS WITH POTENTIAL EXPOSURE TO FLUORINE SHOULD NOT WEAR CONTACT LENSES. (Continued on Page 4)

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# FLUORINE

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

Fluorine is the most powerful oxidizing agent known. It reacts with virtually all inorganic and organic substances. Some of the inert gases and some perfluorinated organic compounds in their pure form are not (Continued on last page)

## PHYSICAL DATA

BOILING POINT -306.6°F (-188.1°C)	LIQUID DENSITY AT BOILING POINT 93.8 lb/ft <sup>3</sup> (1502 kg/m <sup>3</sup> )
VAPOR PRESSURE @ 70°F (21.1°C) Above the critical temp. of -200.9°F (-129.4°C)	GAS DENSITY AT 70°F, 1 atm 0.098 lb/ft <sup>3</sup> (1.57 kg/m <sup>3</sup> )
SOLUBILITY IN WATER Reacts violently	FREEZING POINT -363.5°F (-219.7°C)
EVAPORATION RATE N/A (Gas)	SPECIFIC GRAVITY (AIR=1) @ 70° (21.1°C) = 1.31
APPEARANCE AND ODOR Pale yellow gas, choking ozone-like odor.	

## FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMABLE LIMITS % BY VOLUME (See Page 4) LEL N/A UEL N/A
EXTINGUISHING MEDIA N/A	ELECTRICAL CLASSIFICATION Non-hazardous.	
SPECIAL FIRE FIGHTING PROCEDURES Fires with fluorine as the oxidizer can only be extinguished by shutting off the source of fluorine. Do not use water, chemicals, carbon dioxide or other extinguishing media; these will only add more fuel to the fire.		
UNUSUAL FIRE AND EXPLOSION HAZARDS Combustion products from a fire with fluorine as an oxidizer are generally extremely toxic and reactive. These products usually include hydrogen fluoride and oxygen difluoride.		

## REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID None
Stable	X	
INCOMPATIBILITY (Materials to avoid) Incompatible with all materials except certain perfluorinated hydrocarbons and some metals which have been "passivated".		
HAZARDOUS DECOMPOSITION PRODUCTS N/A		
HAZARDOUS POLYMERIZATION May Occur		CONDITIONS TO AVOID None
Will Not Occur	X	

## 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 properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place 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> N/A	<b>OTHER</b> N/A
<b>PROTECTIVE GLOVES</b> Plastic or rubber		
<b>EYE PROTECTION</b> Safety goggles or glasses, face shield		
<b>OTHER PROTECTIVE EQUIPMENT</b> Safety shoes, safety shower, eyewash "fountain," neoprene apron		

**SPECIAL PRECAUTIONS\***

<b>SPECIAL LABELING INFORMATION</b> DOT Shipping Name: Fluorine, Compressed DOT Shipping Label: Toxic Gas; Oxidizer; Corrosive DOT Hazard Class: Division 2.3 I.D. No.: UN 1045 (RQ 10/4.54)
<b>SPECIAL HANDLING RECOMMENDATIONS</b> Use only in well-ventilated areas. Valve protection caps must remain in place unless cylinder 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 (<500 psig) piping or systems. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.  Cylinder valve should be opened and closed with remote controlled extensions passing through a suitable barricade for additional protection. Double valving should be employed to facilitate the reduction in pressure from high pressure sources of fluorine. (Continued on Page 4)
<b>SPECIAL STORAGE RECOMMENDATIONS</b> Protect cylinders from physical damage. Store in cool, dry, well-ventilated area. Do not allow 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. Isolate fluorine from other flammable products.  For additional storage recommendations, consult Compressed Gas Association's Pamphlet P-1.
<b>SPECIAL PACKAGING RECOMMENDATIONS</b> Most metals form a passive fluoride film with low pressure fluorine that protects the metals from further corrosion. Monel® and nickel are preferred for higher temperature applications. Teflon® is the preferred gasket material.
<b>OTHER RECOMMENDATIONS OR PRECAUTIONS</b> 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. Compressed gas cylinders should not be refilled except by qualified producers of 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 (49CFR). (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.

## FLUORINE

### HEALTH HAZARD DATA

#### SYMPTOMS OF EXPOSURE: (Continued)

Hydrofluoric acid dermal burns exhibit severe pain, redness, possible swelling and early necrosis.

#### TOXICOLOGICAL PROPERTIES: (Continued)

Fluorine is not listed in the IARC, NTP or by OSHA as a carcinogen or potential carcinogen.

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

#### RECOMMENDED FIRST AID TREATMENT: (Continued)

Flush contaminated eye(s) with copious quantities of water. Part eyelids with fingers to assure complete flushing. Continue for minimum of 30 minutes.

Skin Contact: Flush affected area with copious quantities of water. Remove affected clothing as rapidly as possible. Dermal burns may be treated with a calcium gluconate gel or slurry in water or glycerine. This compound binds the active fluorides in an insoluble form and limits burn extension and relieves pain.

#### HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES: (Continued)

Oxidized by fluorine. The reaction of metals with fluorine is relatively slow at room temperature, but becomes vigorous and self-sustaining if the temperature is elevated.

### SPECIAL PRECAUTIONS

#### SPECIAL HANDLING RECOMMENDATIONS: (Continued)

For additional handling recommendations, consult Compressed Gas Association's Pamphlet P-1.

#### 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.

Fluorine is considered a toxic chemical and is subject to the reporting requirements of SARA, Title III, Section 313.

NFPA 704 No. for fluorine = 4 0 3 OX