1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	**Silane, Enriched in Silicon-28**
Chemical Formula	H_4Si^{28}
Molecular Weight	32 g/mol
CA Index Name	Silane-^{28}Si
Synonyms	Silane, Silicon tetrahydride, Monosilane, Silicane
Product Use	For general analytical/synthetic chemical uses
CAS No.	7803-62-5
Concentration (Volume)	100%
Supplier Address*	ISOFLEX USA PO Box 472615 San Francisco CA 94147 United States
Telephone	+1 415-440-4433
Fax	+1 415-563-4433
Email	iusa@isoflex.com
Website	www.isoflex.com
Preparation Information	ISOFLEX USA Product Safety +1 415-440-4433

2. HAZARDS IDENTIFICATION

Emergency Overview:

PYROPHORIC GAS! This product is a colorless, air-reactive gas, with a choking effect. This gas usually ignites upon contact with air, releasing a dense white cloud of amorphous silicon dioxide. Silane can react with water to form corrosive silicic acid. The primary health hazard associated with Silane is the potential for severe thermal burns from contact with flames resulting from the spontaneous ignition of this gas. Depending on the severity of the burns, such exposures can be fatal. Flame or high temperature impinging on a localized area of the cylinder of this product can cause the cylinder to burst without activating the cylinder's relief devices. If Silane is released at high pressure or high flow velocity, a delayed detonation may occur. Silane releases which have not spontaneously ignited must be considered extremely dangerous and should not be approached. Emergency responders must have personal protective equipment and fire protection appropriate for the situation to which they are responding.

Classification of Substance

GHS US Classification

Flammable Gas 1	H220
Liquefied Gas	H280
Acute Tox. 4 (Inhalation: gas)	H232

GHS US Labeling

Hazard Pictograms

Signal word (GHS US)	**DANGER**

Hazard statement(s)

H220	**EXTREMELY FLAMMABLE GAS**
H250	**CATCHES FIRE SPONTANEOUSLY IF EXPOSED TO AIR**
H280	CONTAINS GAS UNDER PRESSURE, MAY EXPLODE IF HEATED
H332	HARMFUL IF INHALED

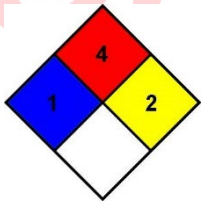
Precautionary statements

P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat, open flames, sparks, hot surfaces – No Smoking
P222	Do not allow contact with air
P261	Avoid breathing gas.
P271+P403	Use and store only outdoors or in a well-ventilated place.
P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely
P381	Eliminate all ignition sources if safe to do so
CGA-PG05	Use a back flow preventive device in the piping
CGA-PG06	Close valve after each use and when empty.
CGA-PG10	Use only with equipment rated for cylinder pressure
CGA-PG17	Use only with equipment purged with inert gas or evacuated prior to discharge from cylinder.
CGA-PG12	Do not open valve until connected to equipment prepared for use
CGA-PG18	When returning cylinder, install leak tight valve outlet cap or plug
CGA-PG02	Protect from sunlight when ambient temperature exceeds 52°C (125°F).

Unknown Acute Toxicity: No Data Available

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

Health Hazard = 1 **Flammability = 4** **Reactivity = 2**



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

Health Hazard = 1 **Flammability = 4** **Physical Hazard = 3**

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3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name:	Silane
CAS No.:	7803-62-5
Chemical Formula:	H_4Si
Molecular Weight:	32 g/mol
Other Names:	Silicon tetrahydride; Silicane; Monosilane; silicon hydride; Silicomethane

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4. FIRST AID MEASURES

General Advice	Rescuers should not attempt to retrieve victims of exposure to this product without adequate personal protective equipment. At a minimum, self-contained breathing apparatus and fire-retardant equipment should be worn. Adequate fire protection must be provided during rescue situations. Remove victim to uncontaminated area wearing self-contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stops.
Eye Exposure	Rinse immediately with plenty of water for at least 15 minutes.
Dermal Exposure	Wash with water and soap for at least 15 minutes as a precaution.
Oral Exposure	Ingestion is not considered a potential route of exposure.
Inhalation Exposure	In case of shortness of breath, give oxygen. Move to fresh air. 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. Seek medical advice.
Notes to Physician	Treatment: Be observant for initial signs of pulmonary edema.

5. FIREFIGHTING MEASURES

DANGER!	Pyrophoric, FLAMMABLE, high pressure gas. If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device.
Suitable Extinguishing Media	Extinguish Silane fires by shutting off the source of the gas. **Escaping gas cannot be extinguished.**
Unsuitable Extinguishing Media	Halocarbon type or water
Specific Hazards	Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Keep containers and surroundings cool with water spray. Extinguish fire only if gas flow can be stopped. If possible, shut off the source of gas and allow the fire to burn itself out. Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire. Move away from container and cool with water from a protected position. Keep adjacent cylinders cool by spraying with large amounts of water until fire burns itself out. If flames are accidentally extinguished, explosive re-ignition may occur; therefore, appropriate measures should be taken (e.g. total evacuation to protect persons from cylinder fragments and toxic fumes should a rupture occur). Most cylinders are designed to vent contents when exposed to elevated temperatures.
Unusual Fire and Explosion Hazards	This product is a colorless, air-reactive gas. This gas usually ignites upon contact with air, releasing a dense white cloud of amorphous silicon dioxide. The products of thermal decomposition of this material include amorphous silicon dioxide and hydrogen. Silane can react with water to

form corrosive silicic acid. The decomposition products of Silane can be irritating to exposed tissue. If Silane is released at high pressure or high flow velocity, a delayed detonation may occur. Silane releases which have not spontaneously ignited must be considered extremely dangerous and should not be approached.

Special Firefighting Procedures

Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best firefighting technique may be simply to let the burning gas escape from the leak. Stop the leak before extinguishing fire. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so. If the fire is extinguished before the leak is sealed, the still leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation to prevent flammable or explosive mixture formation.

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6. ACCIDENTAL RELEASE MEASURES

Personal Precautions

DANGER! Pyrophoric, FLAMMABLE, high pressure gas. May ignite spontaneously in contact with air.. May form explosive mixtures with air. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if safe to do so. Reduce vapors with fog or fine water spray, taking care not to spread liquid with water. Shut off flow if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device.

Environmental Precautions

Try to stop release. Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

Methods for Cleaning Up

Ventilate the area. Approach suspected leak areas with caution.

Additional Advice

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.

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7. HANDLING AND STORAGE

Handling

Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement. Use only non-sparking tools. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. This product should be handled using appropriate techniques that avoid exposure to atmospheric oxygen and moisture.

Storage

Store only where temperature will not exceed 125°F (52°C). Post "No

Smoking/No Open Flames" signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g, NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods.

OTHER PRECAUTIONS: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

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. Containers containing flammable gases should be stored away from other combustible materials. All electrical equipment in the storage areas should be compatible with stored flammable materials. Where necessary, containers containing oxygen and oxidants should be separated from flammable gases by a fire-resistant partition.

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8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures The product dispensing area should be monitored with the use of hydride monitors to detect leaks and releases and a UV/IR monitor to detect fires. Provide natural or explosion-proof ventilation that is adequate to ensure flammable gas does not reach its lower explosive limit.

EXPOSURE LIMITS IN AIR					
ACGIH-TLV (US 2019)		OSHA-PEL (US 2016		NIOSH IDLH ppm	OTHER ppm
TWA ppm	STEL ppm	TWA ppm	STEL ppm		
5 mg/m^3 8 hours.	Not Established	7 mg/m^3 10 hours	Not Established	Not Established	NIOSH REL: TWA - 5 ppm

Personal Protective Equipment

Appropriate engineering controls: Use an explosion-proof local exhaust system. Local exhaust and general ventilation must be adequate to meet exposure standards. MECHANICAL (GENERAL): Inadequate - Use only in a closed system. Use explosion proof equipment and lighting.

	In semiconductor process gas and other suitable applications, 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 is recommended.
Respiratory Protection	When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA). None necessary.
Skin & Body Protection	Wear shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.
Eye Protection	Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or whenever contact with product is possible. Select eye protection in accordance with OSHA 29 CFR 1910.133
Skin and Body Protection	Use fire-resistant gloves and clothing in emergency situations. Safety shoes are recommended when handling cylinders. Wear as appropriate: Flame-retardant protective clothing.
Ventilation	Ensure adequate ventilation, especially in confined areas.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	Compressed gas
Color	Colorless gas
Odor	No information available

Safety Data

Molecular Weight:	32 g/mol
Relative Vapor Density:	1.1 (air = 1)
Relative Density:	0.55 (water = 1)
Specific Volume:	11.98 ft^3/lb (0.7479 m^3/kg) at 70 °F (21 °C)
Boiling Point/Range:	-168 °F (-111 °C)
Critical Temperature:	26 °F (- 3.5 °C)
Melting Point/Range:	-303 °F (-186 °C)
Autoignition Temperature:	< 185 °F (< 85 °C)
Upper Flammability Limit:	96.0 % (V)
Lower Flammability Limit:	1.4 % (V)
Water Solubility:	No data available

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions; ignites spontaneously on exposure to air
Conditions to Avoid	Heat, flames and sparks. Contact with air. Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition..

Materials to Avoid	Air. Water, humidity. Bases. Oxidizing agents. Halogens. Chlorine. Halocarbons.
Hazardous Polymerization	Will not occur
Hazardous Decomposition Products	Silica dust (inert - but may irritate respiratory tract and eyes); amorphous silicon dioxide and hydrogen

11. TOXICOLOGICAL INFORMATION

Acute Health Hazard

Ingestion	No data is available on the product itself.
Inhalation LC50 Rat (1 h)	9500 ppm/4h or 19000 ppm/1 hour
Skin	No data is available on the product itself.
Chronic Health Hazard	Studies in mice showed that exposure to 10,000 ppm of Silane for 1 hour or exposure to 2500 ppm of Silane for 4 hours resulted in adverse kidney effects. Mice exposed to 1000 ppm, 6 hours/day, 5 days/week for 2 to 4 weeks only exhibited mild respiratory tract irritation. This material was mutagenic in a bacterial assay.

Carcinogenicity

Silane is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA or IARC, and therefore is not considered to be, nor suspected to be, a cancer-causing agent by these agencies.

Irritancy or Product	Decomposition products of Silane are irritating to the eyes, skin, and tissues of the respiratory system.

12. ECOLOGICAL INFORMATION

Environmental Stability	No known ecological damage caused by this product.
Effects on Plants and Animals	No known ecological damage caused by this product.
Effects on Aquatic Life	No known ecological damage caused by this product.
Ecology – Soil.	Because of its high volatility, the product is unlikely to cause ground or water pollution.

13. DISPOSAL CONSIDERATIONS

Waste disposal:	Do not attempt to dispose of residual or unused quantities. Return container to supplier.

14. TRANSPORT INFORMATION

This gas is hazardous as defined by 49 CFR 172.101 by The U.S. Department of Transportation. Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure that the 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.

CFR / IATA / IMDG / CTC:

Proper Shipping Name	Silane
Hazard Class (Number and Description)	2.1 (Flammable Gas)
UN No.	UN 2203

Packing Group	Not applicable
DOT Label(s) Required	Flammable Gas
North American Emergency Response Guidebook Number (2000)	116
Marine Pollutant	Silane is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).
Special Transport precautions:	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. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

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15. REGULATORY INFORMATION

U.S. Federal

SARA Reporting: Silane is not subject to the reporting requirements of Sections 311/312 of of the Superfund Amendments and Reauthorization Act (SARA).

SARA TPQ: There are no specific Threshold Planning Quantities for this material. The default Federal SDS submission and inventory requirement filing threshold of 10,000 lb (4544 kg) may apply, per 40 CFR 370.20.

CERCLA RQ: Not applicable.

TSCA Inventory Status: Silane is listed on the TSCA Inventory.

Other U.S. Federal Regulations: Depending on specific operations involving the use of Silane, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Silane is not listed in Appendix A of this regulation; however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lbs (4544 kg) or greater is covered under this regulation unless it is used as a fuel. Silane is listed under Table 3 as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Release Prevention, as a flammable substance. The threshold quantity for Silane under this regulation is 10,000 lbs. Silane is listed under Section 112(r) of the Clean Air Act. The threshold quantity for Silane under this regulation is 10,000 lb (4544 kg).

U.S. State

Silane is covered under specific state regulations, as denoted below:

Alaska:	Designated Toxic and Hazardous Substances: Silane
California:	Permissible Exposure Limits for Chemical Contaminants: Silane
Florida:	Substance List: Silane
Illinois:	Toxic Substance List: Silane
Kansas:	Section 302/313 List: None
Massachusetts:	Substance List: Silane
Michigan:	Critical Materials Register: None
Minnesota:	List of Hazardous Substances: Silane
Missouri:	Employer Information/Toxic Substance List: Silane
New Jersey:	Right to Know Hazardous Substance List: Silane
North Dakota:	List of Hazardous Chemicals, Reportable Quantities: None
Pennsylvania:	Hazardous Substance List: Silane

Rhode Island:	Hazardous Substance List: Silane
Texas:	Hazardous Substance List: Silane
West Virginia:	Hazardous Substance List: None
Wisconsin:	Toxic and Hazardous Substances: None

California Prop. 65 Components Silane is not on the California Proposition 65 lists.

CGA Labeling (For Compressed Gas):

DANGER: PYROPHORIC, FLAMMABLE, HIGH PRESSURE GAS.
CAN IGNITE ON CONTACT WITH AIR.
MAY FORM EXPLOSIVE MIXTURE WITH AIR.
Keep away from heat, flames, and sparks.
Use only with equipment purged with inert gas or evacuated prior to discharge from cylinder.
Use equipment rated for cylinder pressure.
Store and use with adequate ventilation.
Close valve after each use and when empty.
WHEN RETURNING CYLINDER, INSTALL VALVE OUTLET CAP OR PLUG, LEAK TIGHT.
Use in accordance with the Safety Data Sheet.
DO NOT REMOVE THIS PRODUCT LABEL.

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16. OTHER INFORMATION

Prepared By	ISOFLEX USA PO Box 472615 San Francisco CA 94127 United States
Issuing Date	January 12, 2014
Revision Date	July 26, 2024
Revision Number	3
Revision Note	Required review and update

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
AICS	Australian Inventory of Chemical Substances
ALARA	As Low As Is Reasonably Achievable
AMU	Atomic Mass Unit
ANSI	American National Standards Institute
BLS	Basic Life Support
BOD5	Biochemical Oxygen Demand
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)

COD	Chemical Oxygen Demand
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
ECL	Korean Existing Chemicals List
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
IECSC	Inventory of Existing Chemical Substances Produced or Imported in China
IMDG	International Maritime Code for Dangerous Goods
LC50	Lethal concentration, 50 percent
LD50	Lethal dose, 50 percent
LDLO	Lethal Dose Low
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
PICCS	Philippines Inventory of Chemicals and Chemical Substances
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
RQ	Reportable Quantity
RTECS	Registry of Toxic Effects of Chemical Substances
SARA	Superfund Amendments and Reauthorization Act (USA)
SNUR	Significant New Use Rule (TSCA)
TDG	Transportation of Dangerous Goods (Canada)
TIH	Toxic by Inhalation Hazard
TLV	Threshold Limit Value
TPQ	Threshold Planning Quantity
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.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

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