

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

PRODUCT IDENTIFIER

Trade Name (As Labeled): MERCURY DISPLACEMENT RELAYS
Chemical Name/Class: Manufactured Article Containing Mercury
Synonyms: MDR
Product Use: Switching Resistive, Tungsten and Motor Loads for both AC and DC Applications

SUPPLIER OF THE SAFETY DATA SHEET

U.S. Manufacturer's Name: STRUTHERS-DUNN, INC
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Timmonsville, SC 29161 USA
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Email:
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Emergency Phone: (USA and Canada) 1-800-535-5053
(International) 1-352-323-3500

Date of Preparation: November 30, 2016
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This product has been classified in accordance with the hazard criteria of U.S. OSHA, Canadian WHMIS 2015 [HPR-GHS], European Union REACH and CLP. It is located in appropriate sections based on the Global Harmonization Standard format.

NOTE: This product is defined as an "Article" under all jurisdictions. Refer to Section 15 (Regulatory Information) for specific regulatory citations. As an article, this product presents negligible health and physical hazards under reasonably anticipated circumstances of use. Subsequently, a Safety Data Sheet is not required under Standards cited above. This document is prepared to provide persons using this product with additional safety information.

2. HAZARD IDENTIFICATION

GLOBAL HARMONIZATION, U.S. OSHA HAZARD COMMUNICATION STANDARD, CANADIAN WHMIS HPR-GHS 2015, EU REACH and CLP REGULATION (EC) 1272/2008 LABELING AND CLASSIFICATION, and SINGAPORE SPRING REGULATIONS: This product is an article and is not required to be classified under any jurisdiction.

The mercury is contained in a hermetically sealed tube, designed to withstand temperatures and pressures encountered during normal use. As a result, during use, the mercury is fully contained inside the relay. The relay should not be crushed, deformed, punctured, opened or exposed to excessive heat because exposure to the mercury contained within could be harmful. The following classification for mercury is provided for the user's information only, should an accident occur that results in the release of mercury.

CLASSIFICATION FOR MERCURY – This classification would apply only in the event of a release of the mercury contained in this product.

Classification: Reproductive Toxicity Cat. 1B, Acute Inhalation Toxicity Cat. 2, Specific Target Organ Toxicity (Neurological System, Other Organs) Repeated Exposure Cat. 1, Aquatic Acute Toxicity Cat. 1, Aquatic Chronic Toxicity Cat. 1

Signal Word: Danger

Hazard Statements: H360FD: May damage fertility. May damage the unborn child. H330: Fatal if inhaled. H372: Causes damages to multiple organs, including neurological system through prolonged or repeated exposure. H400: Very toxic to aquatic life. H410: Very toxic to aquatic life with long-lasting effects.

Hazards Not Otherwise Classified: The Mercury component may have adverse effects on the endocrine system, based on animal data.

Precautionary Statements:

Prevention: P203: Obtain, read and follow all safety instructions before use. P260: Do not breathe mercury vapors. P264: Wash contaminated tissues after handling. P270: Do not eat, drink or smoke when using this product. P271: Use only outdoors or in a well-ventilated area. P273: Avoid release to the environment. P280: Wear protective gloves, clothing, eye protection and face protection. P284: In case of inadequate ventilation, wear respiratory protection.

Response: P370 + P378: In case of fire: Use materials appropriate for surrounding fire for extinction. P304 + P340: If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. P316: Get emergency medical help immediately. P321: Specific treatment (remove from exposure and treat symptoms).

Storage: P403: Store in a well-ventilated place. P405: Store locked up.

Disposal: P501: Dispose of contents/containers in accordance with all local, regional, national and international regulations.

Hazard Symbols/Pictograms: GHS06, GHS08, GHS09



Percent of Unknown Toxicity By Route of Exposure: Not applicable to articles.

2. HAZARD IDENTIFICATION (Continued)

EMERGENCY OVERVIEW: Product Description: This product a manufactured article that consists of a plastic and metal coil assembly, copper terminals, high voltage plastic wrap, metal screws, a plastic molded tube, a metal and plastic plunger guide, a ceramic liner, a metal spring, and a sealed metal magnetic liner that contains mercury. **Health Hazards:** This product is considered a manufactured article and presents negligible health, or reactivity hazards under typical use conditions. If the product is punctured, exposed to destructive heating, crushed or destruction of product occurs, exposure with mercury may occur. Mercury is very toxic by inhalation, a known reproductive toxin and can cause adverse effects to the neurological, central and peripheral nervous systems, liver, kidneys and other organs. Dermal exposure to mercury may be irritating or corrosive, and may cause dermatitis or allergic reactions. **Flammability Hazards:** This product is not flammable; however, the product may rupture in fire conditions. If involved in a fire, this product can burn and produce toxic gases (e.g., mercury, metal oxides, hydrocarbons and harmful decomposition products from plastics). During a fire involving this product care should be taken to avoid inhalation of fumes. **Reactivity Hazards:** This product is not reactive under normal conditions of use and handling. See Section 10 for possible hazardous reactions of other compounds to Mercury. **Environmental Hazards:** This product is not expected to cause harm if released to the environment; however, release of the mercury from within the sealed tube can cause harm aquatic organisms. Mercury is highly acutely and chronically toxic to aquatic organisms. **Emergency Response Considerations:** Emergency responders must wear proper personal protective equipment (and have appropriate fire protection) suitable for the situation to which they are responding.

3. COMPOSITION and INFORMATION ON INGREDIENTS

Chemical Name	CAS #	EU EINECS #	% w/w	LABEL ELEMENTS GHS under U.S. OSHA, Canadian WHMIS HPR-GHS & EU Classification (1272/2008) and Singapore Spring Regulations Hazard Statement Codes
Formed product, consisting of metals and plastics.	Mixture	Mixture	Not Applicable	<u>Classification under All Jurisdictions:</u> Classification: Not Applicable
Mercury	7439-97-6	231-106-7	44 or 61 grams	EU ECHA HARMONISED CLASSIFICATION AND LABELLING (ATP01) CLASSIFICATION <u>Classification under All Jurisdictions:</u> Classification: Reproductive Toxicity Cat. 1B, Acute Inhalation Toxicity Cat. 2, Specific Target Organ Toxicity (Multiple Organs) Repeated Exposure Cat. 2, Aquatic Acute Toxicity Cat. 1, Aquatic Chronic Toxicity Cat. 1 Hazard Statements: H360D: May damage the unborn child. H330: Fatal if inhaled. H372: Causes damages to multiple organs, including neurological system through prolonged or repeated exposure. H400: Very toxic to aquatic life. H410: Very toxic to aquatic life with long-lasting effects. ADDITIONAL CLASSIFICATION UNDER ECHA IN REACH REGISTRATIONS Classification: Reproductive Toxicity Cat. 1B Hazard Statements: H360F: May damage fertility.

4. FIRST-AID MEASURES

PROTECTION OF FIRST AID RESPONDERS: Rescuers should be taken for medical attention, if necessary. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Avoid direct contact if mercury has been released and persons are contaminated with it. Wear chemical protective clothing, if necessary. Remove contaminated clothing, shoes and leather goods (e.g., watchbands, belts). Completely decontaminate clothing, shoes and leather goods before re-use or discard.

DESCRIPTION OF FIRST AID MEASURES: Persons using this product should consult a physician or other medical professional if an accident involving this product results in injury. Specific first-aid measures are as follows:

Inhalation: If any adverse effect occurs as a result of inhalation of fumes from mercury during fire or other destruction of product, remove individual to fresh air. Seek medical attention if adverse effect occurs after removal to fresh air.

GHS Precautionary Statements for Inhalation Exposure: None applicable for articles. For Mercury: P304 + P340: If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. P316: Get emergency medical help immediately.

Skin Exposure: If skin contact occurs to mercury, flush for 20 minutes. Contact physician or other medical health professional.

GHS Precautionary Statements for Skin Exposure: None applicable.

Eye Exposure: If eye contact occurs to mercury, flush for 20 minutes. Contact physician or other medical health professional.

GHS Precautionary Statements for Eye Exposure: None applicable.

Ingestion Exposure: Not a potential route of exposure.

GHS Precautionary Statements for Ingestion Exposure: None applicable.

Eye or Skin Contact: If skin or eye contact occurs to mercury, flush for 20 minutes. Contact physician or other medical health professional.

IMPORTANT SYMPTOMS AND EFFECTS, WHETHER ACUTE OR DELAYED: See Sections 2 (Hazard Identification) and 11 (Toxicological Information) for more detailed information.

Acute: No adverse effects are expected to occur by any route of exposure to undamaged product. If use or handling, including damage to the product results in a release of mercury, although unlikely, the following potential effects may occur.

Symptoms/Effects After Inhalation: Breathing difficulty, coughing, acute, and potentially fatal lung disorders.

Symptoms/Effects After Skin Contact: Contamination of the skin can be highly irritating or cause burns.

Symptoms/Effects After Eye Contact: Contamination of the eyes can be highly irritating or cause burns.

Symptoms/Effects After Ingestion: Ingestion is highly unlikely, as metallic mercury is not usually absorbed sufficiently from the gastrointestinal tract to induce an acute, toxic response. Rarely, a metallic taste in mouth, nausea, vomiting, central nervous system effects, and damage to the kidneys, damage to the tissues of the mouth, throat, esophagus, and other tissues of the digestive system. Ingestion of high concentration may be fatal, due to effects on gastrointestinal system and kidneys.

4. FIRST-AID MEASURES (Continued)

IMPORTANT SYMPTOMS AND EFFECTS, WHETHER ACUTE OR DELAYED (continued):

Chronic: No adverse effects are expected to occur by any route of exposure to undamaged product. If use or handling, including damage to the product results in a release of mercury, although unlikely, the following potential effects may occur.

Symptoms/Effects After Skin Contact: Dermatitis (dry, red skin, itching, cracking of the skin, skin rash/inflammation) and/or allergic skin reactions.

Symptoms/Effects After Inhalation: Chronic inhalation exposure may cause reduced lung function.

Symptoms/Effects After Ingestion/Injection: Potential damage to kidneys, central nervous, peripheral and neurological systems..

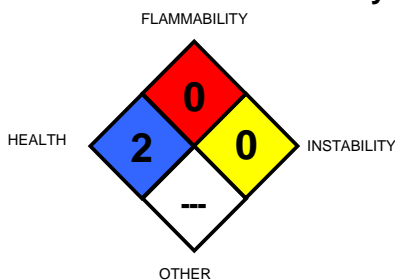
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: No medical conditions are known to be aggravated by this product as shipped. If mercury has been released, pre-existing skin, respiratory neurological, central or peripheral nervous system, kidney conditions may be exaggerated.

IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED: Treat symptoms and eliminate exposure.

NOTES TO PHYSICIANS IN EVENT OF EXPOSURE TO MERCURY: Many jurisdictions have specific regulations for mercury. These regulations may include requirements for medical surveillance programs, including pre- employment and pre-placement examinations, periodic medical examinations, clinical tests, health education and record keeping. Obtain detailed information from the appropriate government agency in relevant jurisdictions.

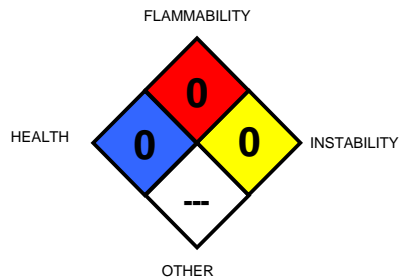
5. FIRE-FIGHTING MEASURES

NFPA RATING for Mercury



Hazard Scale: 0 = Minimal 1 = Slight
2 = Moderate 3 = Serious 4 = Severe

NFPA RATING for Product



FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %): Not applicable.

FIRE EXTINGUISHING MEDIA: Use extinguishing materials appropriate for surrounding materials in the fire area.

UNSUITABLE FIRE EXTINGUISHING MEDIA: None known.

SPECIAL HAZARDS ARISING FROM THE PRODUCT: This product is not flammable or combustible. Products of thermal decomposition can include produce toxic gases (e.g., mercury, metal oxides and toxic fumes from plastics). Damaged product may result in the release of toxic mercury vapors.

Explosion Sensitivity to Mechanical Impact or Static Discharge: Not applicable.

SPECIAL PROTECTIVE ACTIONS FOR FIRE-FIGHTERS: Mercury and its decomposition products are very hazardous to health. Do not enter without wearing specialized equipment suitable for the situation. Firefighter's normal protective clothing (Bunker Gear) will not provide adequate protection. Chemical protective clothing (e.g., chemical splash suit) and positive pressure self-contained breathing apparatus (NIOSH approved or equivalent) may be necessary.

GHS Statements for Fire-Fighters: P370 + P378: In case of fire: Use materials appropriate for surrounding fire for extinction.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: If a release of mercury has occurred, all personnel must evacuate area. All inhalation of mercury must be avoided.

PERSONAL PROTECTIVE EQUIPMENT: For clean-up of leaking mercury, proper protective equipment should be used.

Small Spills: Wear impervious gloves, splash goggles, respiratory protection and appropriate body protection.

Large Spills: Minimum Personal Protective Equipment should be impervious gloves, rubber boots, face shield, and Tyvek suit. Minimum level of personal protective equipment for releases in which the level of oxygen is less than 19.5% or is unknown must be **Level B: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard hat, and Self-Contained Breathing Apparatus.**

Large Spills: Minimum Personal Protective Equipment should be impervious gloves, rubber boots, face shield, and Tyvek suit. Minimum level of personal protective equipment for releases in which the level of oxygen is less than 19.5% or is unknown must be **Level B: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard hat, and Self-Contained Breathing Apparatus.**

METHODS FOR CLEAN-UP AND CONTAINMENT: No special accidental release measures are required for non-damaged relays. Damaged relays should be placed in a sealed container and disposed of according to all disposal regulations for mercury. Mercury spills of any quantity should be cleaned-up spill immediately. The following are spill response procedures in the event of a release of mercury has occurred.

Small Spills: Dust spill with calcium polysulfide to reduce mercury vapor loss during cleanup. A special mercury vacuum can be used to remove the mercury. Collect and store using a suction pump with a capillary tube. Calcium polysulfide with excess sulfur should be sprinkled into cracks or inaccessible sites. Keep collected mercury in a tightly closed bottle for recovery or disposal. Flush area with water.

Large Spills: Trained personnel following pre-planned procedures should handle non-incident releases. Only persons trained in specific procedures should attempt to respond to spills that involve a large amount of relays and the mercury contained within them.

6. ACCIDENTAL RELEASE MEASURES (Continued)

METHODS FOR CLEAN-UP AND CONTAINMENT (continued):

All Spills: Place all spill residue in an appropriate container and seal. Decontaminate the area thoroughly. Discard all contaminated response equipment or decontaminate before returning such equipment to service. Do not mix with wastes from other materials. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations). For spills on water, contain, minimize dispersion and collect. Dispose of recovered material and report spill per regulatory requirements. Notify government occupational health and safety and environmental authorities after release of any amount of mercury.

ENVIRONMENTAL PRECAUTIONS: Avoid release to the environment; prevent any spill residue from entering sewer or confined spaces. Run-off water may be contaminated by other materials and should be contained to prevent possible environmental damage.

REFERENCE TO OTHER SECTIONS: See information in Section 8 (Exposure Controls – Personal Protection) and Section 13 (Disposal Considerations) for additional information.

7. HANDLING and STORAGE

PRECAUTIONS FOR SAFE HANDLING: This product, as shipped, presents minimal hazards. Avoid damage to the relays to prevent possibility of release of mercury. If a release of mercury occurs, avoid all inhalation or skin contact. Evacuate personnel in area and contact spill response personnel.

GHS Statements for Safe Handling (related to presence of mercury): P260: Do not breathe gas/mist/vapors/spray. P264: Wash contaminated tissues after handling. P270: Do not eat, drink or smoke when using this product. P271: Use only outdoors or in a well-ventilated area. P280: Wear protective gloves, clothing, eye protection and face protection. P284: In case of inadequate ventilation, wear respiratory protection.

SPECIAL INSTALLATION INFORMATION: It is very important that the correct, required wire size and screw connection torque be used for the relays be used for mounting (vertical position with 10 degrees). For the M35 Series #6 copper wire should be used with a minimum torque on power terminals of 36 in./lbs. For the M60 Series #4 copper wire should be used with a minimum torque on power terminals of 50 in./lbs. Failure to use the correct wire and torque can result in a ruptured relay, which could then cause a spill of the mercury contained within the sealed metal tube. Refer to the following specification document for complete information: http://relays.struthers-dunn.com/Asset/35-60_Series.pdf.

CONDITIONS FOR SAFE STORAGE INCLUDING ANY INCOMPATIBILITIES: Recommended storage temperature is -40 to 105°C (-40 to 221°F). Inspect all incoming containers before storage, to ensure containers are properly labeled and product is not damaged. Post warning and “NO SMOKING” signs in storage and use areas, as appropriate. Have appropriate extinguishing equipment in the storage area (such as sprinkler systems or portable fire extinguishers).

Incompatibilities: Mercury is incompatible with acetylene compounds, ammonia, strong oxidizing agents, metals (e.g., aluminum, lithium, potassium, sodium, calcium and rubidium) - form amalgams, which are violently exothermic and may explode if too much metal is added at once, ethylene oxide, methyl silane or tetracarbonyl nickel, methyl azide or hot sulfuric acid, silver perchlorate, dry bromine, chlorine, boron diiodophosphide, sodium carbide. Mercury readily amalgamates with most metals. Mercury can attack copper alloys.

GHS Statements for Safe Storage: P403 + P233: Store in a well-ventilated place. Keep container tightly closed. P405: Store locked up.

SPECIFIC END USE(S): Indicated in Section 1.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

CONTROL PARAMETERS, INCLUDING OCCUPATIONAL EXPOSURE GUIDELINES OR BIOLOGICAL EXPOSURE LIMITS AND THE SOURCE OF THOSE VALUES:

Ventilation and Engineering Controls: No engineering controls are required for handling relays that have not been damaged.

Occupational/Workplace Exposure Limits/Guidelines: The following limits are for mercury only.

CHEMICAL NAME	CAS #	EXPOSURE LIMITS IN AIR							
		ACGIH-TLVs		OSHA-PELs		NIOSH-RELS		NIOSH	OTHER
		TWA mg/m ³	STEL mg/m ³	TWA mg/m ³	STEL mg/m ³	TWA mg/m ³	STEL mg/m ³	IDLH mg/m ³	
Mercury Limits given are for mercury elemental & inorganic compounds as Hg	7439-97-6	0.025 (skin)	Skin	0.1 Hg Vapor: Vacated 1989 PEL: 0.05 (skin) See OSHA Standard Interpretation Memo	Vacated 1989 PEL: 0.1, ceiling (skin)	0.05, Vapor (skin)	0.1, ceiling (skin)	10 (as Mg)	DFG MAKs: TWA: 0.02 (Inhalable fraction) PEAK: 8•MAK 15 min. average value, 15 min. interval, 4 per shift Danger of Sensitization of the Skin DFG MAK Pregnancy Risk Classification: C Carcinogen: EPA-D, IARC-3, MAK-3B, TLV-A4

NE = Not Established. See Section 16 for Definitions of Other Terms Used

International Exposure Limits: Currently, the following international limits established for components of these products. New exposure limits can come into effect or existing limits may change. These limits may not be the most current; appropriate government agencies in each jurisdiction should be consulted to determine which regulations apply.

MERCURY and its COMPOUNDS

	<u>Limit Value - Eight Hours</u>	<u>Limit Value - Short Term</u>
Norway	0.02 mg/m ³ (1)	
	<u>Remarks</u>	
Norway	(1) Except mercury alkyl compounds	

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

CONTROL PARAMETERS, INCLUDING OCCUPATIONAL EXPOSURE GUIDELINES OR BIOLOGICAL EXPOSURE LIMITS AND THE SOURCE OF THOSE VALUES (continued):

International Exposure Limits (continued):

MERCURY VAPOR

	<u>Limit Value - Eight Hours</u>	<u>Limit Value - Short Term</u>
Austria	0.02 mg/m ³	0.08 mg/m ³
Canada (Ontario)	0.025 mg/m ³	
Canada-Québec	0.025 mg/m ³ (1)	
Finland	0.02 mg/m ³ (1)	
Germany(AGS)	0.02 mg/m ³ (1)	0.16 mg/m ³ (1)(2)
Germany (DFG)	0.02 mg/m ³ (1)(2)	0.16 mg/m ³ (1)(2)(3)
Poland	0.02 mg/m ³	
Romania	0.02 mg/m ³	
Singapore	0.025 mg/m ³	
Sweden	0.02 mg/m ³	
Switzerland	0.005 ppm (1), 0.05 mg/m ³	0.04 (1) ppm, 0.4 mg/m ³ (1)
	<u>Remarks</u>	
Canada-Québec	(1) Skin	
Finland	(1) Calculated as Hg.	
Germany(AGS)	(1) Inhalable fraction. (2) 15 minutes average value.	
Germany (DFG)	1) Inhalable fraction.. (2) Skin (3) 15 minutes average value.	
Ireland	(1) 15 minutes average value	
Italy	Skin	
Latvia	(1) 15 minutes average value	
Romania	(1) 15 minutes average value	

ACGIH Biological Exposure Indices: Currently, the following ACGIH Biological Exposure Indices (BEIs) determined for some components.

CHEMICAL: DETERMINANT	SAMPLING TIME	BEI
Mercury, Elemental • Mercury in Urine	• Prior to Shift	• 20 µ/g Creatinine

INDIVIDUAL PROTECTION MEASURES, SUCH AS PERSONAL PROTECTIVE EQUIPMENT: The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132), equivalent standards of Canada (including CSA Standard Z94.4-02 and CSA Standard Z94.3-02, U.S. OSHA 29 CFR 1910.136 and the Canadian CSA Standard Z195-02, *Protective Footwear*), standards of EU member states (including EN 529:2005 for respiratory PPE, CEN/TR 15419:2006 for hand protection, and CR 13464:1999 for face/eye protection) and Singapore Standards. Please reference applicable regulations and standards for relevant details.

Respiratory Protection: No special respiratory protection is required for use of this product during normal use. If relays are damaged and mercury has been released, Self-Contained Breathing Apparatus must be used. The following are NIOSH respiratory protective equipment recommendations for potential exposure to mercury and are provided in the event of accidental release of mercury.

MERCURY COMPOUNDS [except (organo) alkyls], as Hg

CONCENTRATION RESPIRATORY PROTECTION

Up to 1 mg/m ³ :	Any chemical cartridge respirator with cartridge(s) providing protection against mercury compounds (except (organo) alkyls)†; or any Supplied-Air Respirator (SAR).
Up to 2.5 mg/m ³ :	Any SAR operated in a continuous-flow mode; or Any powered, air-purifying respirator with cartridge(s) providing protection against mercury compounds (except (organo) alkyls)†(canister).
Up to 5 mg/m ³ :	Any Chemical Cartridge Respirator with a full facepiece and cartridge(s) providing protection against mercury compounds (except (organo) alkyls)†; or Any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against mercury compounds (except (organo) alkyls)†; or any SAR that has a tight-fitting facepiece and is operated in a continuous-flow mode; or Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against mercury compounds (except (organo) alkyls) (canister); or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece; or any SAR with a full facepiece.
Up to 10 mg/m ³ :	Any SAR operated in a pressure-demand or other positive-pressure mode.
Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions:	Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode; or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary Self-Contained Positive-Pressure Breathing Apparatus.
Escape:	Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against mercury compounds (except (organo) alkyls); or; any appropriate escape-type, SCBA.
	† End of service life indicator (ESLI) required. These recommendations are based on the NIOSH exposure limit of 0.05 mg/m ³ (time-weighted average).

Eye Protection: No special eye protection is required for use of this product. If relays are damaged or leaking use safety goggles when handling the relays.

Hand Protection: No special hand protection is normally required for use of this product. If relays are damaged or leaking use wear butyl rubber, polyvinyl alcohol gloves or other appropriate glove.

Body/Skin Protection: No special body or skin protection is normally required for use of this product. If a hazard of injury to the feet exists due to falling objects or rolling objects use foot protection, as described in U.S. OSHA 29 CFR 1910.136 and the Canadian CSA Standard Z195-02, *Protective Footwear*.

9. PHYSICAL and CHEMICAL PROPERTIES

FORM: Manufactured article containing mercury.

MOLECULAR FORMULA: Mixture.

ODOR: Not applicable.

COLOR: Various parts have different colors.

MOLECULAR WEIGHT: Mixture.

ODOR THRESHOLD: Not applicable.

9. PHYSICAL and CHEMICAL PROPERTIES (Continued)

SPECIFIC GRAVITY (water = 1): Not available.

SOLUBILITY IN WATER: Insoluble.

VAPOR PRESSURE: Not applicable.

HEAT OF COMBUSTION: Not available.

OXIDIZING PROPERTIES: Not an oxidizer.

EXPLOSIVE PROPERTIES: Heating or water contact may cause overpressure of outside casing and possible explosive result.

COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT): Not applicable.

MELTING/FREEZING POINT: Not available.

BOILING POINT: Not applicable.

pH: Not applicable.

THERMAL CONDUCTIVITY: Not available.

FLASH POINT: Not applicable.

10. STABILITY and REACTIVITY

CHEMICAL STABILITY: Stable.

DECOMPOSITION PRODUCTS:

Combustion: Mercury, metal oxides and other toxic compounds from plastics.

Hydrolysis: None known.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Mercury is incompatible with acetylene compounds, ammonia, strong oxidizing agents, metals (e.g., aluminum, lithium, potassium, sodium, calcium and rubidium) - form amalgams, which are violently exothermic and may explode if too much metal is added at once, ethylene oxide, methyl silane or tetracarbonyl nickel, methyl azide or hot sulfuric acid, silver perchlorate, dry bromine, chlorine, boron diiodophosphide, sodium carbide. Mercury readily amalgamates with most metals. Mercury can attack copper alloys.

POSSIBILITY OF HAZARDOUS REACTION/POLYMERIZATION:

Hazardous Reactions: Intact relays are not reactive. Mixtures of mercury with acetylene, ammonia, chlorine dioxide, methyl azide, chlorates, nitrates, or hot sulfuric acid can be explosive.

Hazardous Polymerization: Will not polymerize.

CONDITIONS TO AVOID: Avoid damaging relays in any way that could release mercury. Avoid exposure to heat, flame, or other ignition source. Avoid other conditions as described in Section 7 (Handling or Storage).

11. TOXICOLOGICAL INFORMATION

SYMPTOMS OF EXPOSURE BY ROUTE OF EXPOSURE: Under normal handling and use, this product does not pose a hazard by any route of exposure. If the relay has been damaged and the mercury contained in a sealed compartment occurs, exposure to mercury can occur. The following information is for possible health effects from Mercury by route of exposure.

Inhalation: Under normal conditions of use and handling, no inhalation hazard is present. When inhaled, Mercury is rapidly distributed throughout the body. Mercury crosses the blood-brain barrier, and become oxidized to the Hg (II) oxidation state. Short-term exposure to high concentrations of mercury vapors can lead to breathing difficulty, coughing, acute, and potentially fatal lung disorders.

Depending on the concentration of inhalation exposure, heart problems, damage to the kidney, liver or nerves and effects on the brain may occur. Long-term inhalation exposure can cause the development of a wide variety of symptoms, including excessive salivation, gingivitis, anorexia, chills, fever, cardiac abnormalities, anemia, digestive problems, abdominal pains, frequent urination, an inability to urinate, diarrhea, peripheral neuropathy (numbness, weakness, or burning sensations in the hands or feet), tremors (especially in the hands, fingers, eyelids, lips, cheeks, tongue, or legs), alteration of tendon reflexes, slurred speech, visual disturbances, and deafness. Allergic reactions (e.g., breathing difficulty) may also occur in sensitive individuals. Limited information suggests that long-term exposure to mercury vapor can cause inflammation and ulceration of the inside of the mouth, sore gums, drooling, diarrhea, and other effects on the digestive system.

Eye Contact: Under normal conditions of use and handling, eye hazard is present. If the relay is punctured or otherwise damaged so that contact with mercury occurs, contamination of the eyes can be highly irritating or cause burns. Long-term occupational exposure to mercury has caused a grayish-brown or yellow discoloration in the eyes of some people. This haze is not thought to affect vision. A gray band through the cornea (band keratopathy) has also been reported in a few people.

Skin Contact: Under normal conditions of use and handling, no skin hazard is present. If the relay is punctured or otherwise damaged so that contact with mercury occurs, contamination of the skin can be highly irritating or cause burns. Prolonged contact may lead to ulceration of the skin. Allergic reactions (e.g., rashes, welts) may occur in sensitive individuals.

Skin Absorption: Mercury may be absorbed via intact skin. Symptoms may include those described under 'Skin or Eye Contact'.

Ingestion: Ingestion is not a likely route of exposure for this product under normal handling and use. If Mercury is swallowed, symptoms of such over-exposure can include metallic taste in mouth, nausea, vomiting, central nervous system effects, and damage to the kidneys. Metallic mercury is not usually absorbed sufficiently from the gastrointestinal tract to induce an acute, toxic response. Damage to the tissues of the mouth, throat, esophagus, and other tissues of the digestive system may occur. Ingestion may be fatal, due to effects on gastrointestinal system and kidneys.

Injection: Injection is not a likely route of exposure for this product under normal handling and use.

Other: Exposure to mercury may cause adverse reproductive effects. Mercury may cause adverse effects on the endocrine system. See further in this section for more information.

DELAYED AND IMMEDIATE EFFECTS AND CHRONIC EFFECTS FROM SHORT AND LONG-TERM EXPOSURE:

Acute: There is no health hazard anticipated to occur during routine use of this product. If damage or heating of the relay occurs, contact with mercury may occur and may cause moderate to severe irritation of skin, eyes and respiratory system. Mercury is highly toxic by inhalation. Mercury can be absorbed via intact skin and cause systemic toxicity effects.

Chronic: In the unlikely event of exposure to mercury occurs, chronic toxic effects may include adverse effects on the neurological, central nervous and peripheral nervous systems, cardiovascular system, kidneys and liver. Studies have shown repeated dose toxicity via the oral route with systemic effects (target organs) urogenital: kidneys. Repeated exposure to some mercury compounds may cause allergic skin reaction. Mercury is a known human reproductive toxin and is a suspect carcinogen.

11. TOXICOLOGICAL INFORMATION (Continued)

TARGET ORGANS: None for the finished product. The following are potential target organs for exposure to mercury.

Acute: Respiratory system, skin, eyes (fumes from thermal decomposition).

Chronic: Skin, respiratory system, central nervous, peripheral, neurological systems, kidneys, reproductive toxicity.

TOXICITY DATA FOR PRODUCT: Testing has not been performed on this product to determine toxicity by any route of exposure due to the form of the product.

Acute Toxicity Estimates (ATE): ATEs are not applicable to articles.

TOXICITY DATA: The following toxicity data are available for mercury. Only available human data are given in this SDS.

MERCURY:

Open Irritation Test (Skin-Woman) 0.5%/1 day

LDLo (Oral-Human) 0.043 mL/kg: Gastrointestinal: other changes

TDLo (Oral-Man) 43 mg/kg: Behavioral: tremor; Liver: jaundice, other or unclassified, other changes

TDLo (Skin-Man) 129 mg/kg/5 hours-continuous: Sense Organs and Special Senses (Ear): tinnitus; Behavioral: headache; Skin and Appendages: dermatitis, allergic (after systemic exposure)

TDLo (Subcutaneous-Woman) 120 mg/kg: Musculoskeletal: other changes; Skin and Appendages: dermatitis, other (after systemic exposure)

TDLo (Subcutaneous-Man) 254 mg/kg: Skin and Appendages: dermatitis, other (after systemic exposure)

TDLo (Subcutaneous-Man) 714 µL/kg: Skin and Appendages: dermatitis, other (after systemic exposure)

TDLo (Intravenous-Man) 571 µL/kg: Peripheral Nerve and Sensation: paresthesia; Lungs, Thorax, or Respiration: dyspnea; Skin and Appendages: sweating

TDLo (Intravenous-Man) 0.023 mL/kg: Cardiac: pulse rate increase, without fall in BP; Lungs, Thorax, or Respiration: dyspnea; Nutritional and Gross Metabolic: body temperature increase

TDLo (Multiple Routes-Man) 86 µL/kg: Cardiac: pulse rate increase, without fall in BP; Lungs, Thorax, or Respiration: pulmonary emboli; Skin and Appendages: dermatitis, other (after systemic exposure)

MERCURY (continued):

TDLo (Multiple Routes-Man) 0.086 mL/kg: Cardiac: change in rate; Lungs, Thorax, or Respiration: pulmonary emboli; Kidney/Ureter/Bladder: other changes

TDLo (Multiple Routes-Man) 85,700 µL/kg: Cardiac: pulse rate; Lungs, Thorax, or Respiration: dyspnea; Kidney/Ureter/Bladder: renal function tests depressed

TCLo (Inhalation-Human) 0.2 mg/m³/26 weeks-intermittent: Behavioral: ataxia; Behavioral: irritability; Cardiac: pulse rate increase, without fall in BP

TCLo (Inhalation-Human) 0.035 mg/m³/3 years-intermittent: Behavioral: ataxia, irritability; Cardiac: pulse rate increase, without fall in BP

TCLo (Inhalation-Woman) 150 µg/m³/46 days: Behavioral: wakefulness; Behavioral: anorexia (human); Gastrointestinal: hypermotility, diarrhea

TCLo (Inhalation-Woman) 54,180 mg/kg: Behavioral: changes in psychophysiological tests

TCLo (Inhalation-Man) 44,300 µg/m³/8 hours: Behavioral: muscle weakness; Liver: other changes; Nutritional and Gross Metabolic: body temperature increase

TCLo (Inhalation-Man) 5 mg/m³/3 hours: Behavioral: tremor; Gastrointestinal: nausea or vomiting; Nutritional and Gross Metabolic: body temperature increase

TCLo (Inhalation-Child) 0.14 mg/m³/12 weeks-continuous: Behavioral: convulsions or effect on seizure threshold; Vascular: BP lowering not characterized in autonomic section; Lungs, Thorax, or Respiration: respiratory depression

Cytogenetic Analysis (Unreported-Man) 150 µg/m³

DNA Damage (Inhalation-Mouse) 2.71 µg/L/1 hour

CARCINOGENICITY: Due to the physical nature of this product, carcinogenicity is not a hazard for this product. The following information is for Mercury.

MERCURY: ACGIH TLV-4 (Not Classifiable as a Human Carcinogen); EPA-D (Not Classifiable as to Human Carcinogenicity); IARC-3 (Unclassifiable as to Carcinogenicity in Humans); MAK-3B (Substances for Which *in vitro* Tests or Animal Studies have yielded evidence of carcinogenic effects that is not sufficient for classification of the substance in one of the other categories. Further studies are required before a final classification can be made.)

IRRITANCY OF PRODUCT: This product is not irritating under normal circumstances of use or handling. Mercury can be irritating or corrosive depending on the duration and concentration of exposure to mercury.

SENSITIZATION TO THE PRODUCT:

Respiratory Sensitization: No data known.

Skin Sensitization: Dermal contact with Mercury may produce sensitization and allergic reactions in susceptible individuals.

ENDOCRINE TOXICITY: Mercury blocks thyroid hormone production by occupying iodine-binding sites and inhibiting or altering hormone action leading to the impairment of body temperature control, hypothyroidism, thyroid inflammation and depression. Like the thyroid, the pancreas is also susceptible to the toxic effects of mercury. Studies have shown there is sufficient evidence from animal studies supporting the disruptive effects of mercurials on the functions of the thyroid, adrenal, ovary, and testis, although several factors make it difficult to extrapolate the animal data to the human situation. However, the human studies performed so far, which focused mainly on serum hormone levels, failed to provide any conclusive data to confirm the findings from the animal studies. Therefore, further well-designed epidemiological studies are urgently needed.

REPRODUCTIVE TOXICITY INFORMATION: As an article, this product is not expected to cause mutagenic, embryotoxic, teratogenic, or reproductive effects in humans. The following information is available for mercury.

Mutagenicity: Aneuploidy and other chromosomal aberrations have been observed in lymphocytes from whole blood cultures of workers occupationally exposed to mercury, including people working with mercury amalgams.

Teratogenicity, Embryotoxicity and/or Fetotoxicity: Mercury is a developmental toxin. Two well-reported studies in rats have shown that inhalation exposure to mercury vapor during pregnancy can cause behavioral changes in the offspring at concentrations that do not cause maternal toxicity. Developmental toxicity has also been seen in other studies that did not report on maternal toxicity. In one study, rats were exposed by inhalation to 1.8 mg/m³ mercury from days 14-19 (1.5 hr/day) of pregnancy, while in the other study they were exposed to 1.8 mg/m³ from days 11-14 and 17-20 (1 or 3 hr/day) of pregnancy. In both studies, the offspring had altered responses in behavioral tests conducted at 3-14 months of age. The exposure concentrations were chosen to avoid toxicity in the mothers and the offspring. There was no decrease in maternal weight gain and no other signs of toxicity in the mothers. Behavioral changes were also seen in the offspring of squirrel monkeys exposed by inhalation during the last two thirds of pregnancy to 0.5 or 1.0 mg/m³ mercury vapor for just one week (4 or 7 hr/day 5 d/wk). Maternal toxicity was not reported. Squirrel monkeys were exposed to 0 or 1 mg/m³ mercury vapor starting at week 3-7 (5 d/week) of pregnancy and continuing throughout the pregnancy. Five monkeys were exposed for 4 hr/day, four monkeys for 7 hr/day, and one monkey for 24 hr/day. There was a decrease in birth weight in the offspring of mercury-exposed animals, a dose-related increase in abortion and in death shortly after birth. The incidence of abnormal pregnancies was 60% in the mercury-exposed animals in comparison with 5% in the untreated breeding colony. Examination of the brain showed several changes. Maternal toxicity was not reported. Rats were exposed by nose-only inhalation to 0 or 4 mg/m³ mercury from days 6-15 (2 hr/day) of pregnancy. The mothers gained 7% less weight than the controls (significance not reported). No treatment related differences in body-weight of the offspring were observed and all of the animals appeared healthy. In a series of tests on nerve function conducted on the offspring when they were adults (140-168 days of age), no changes in response were observed. (45) In a study which is not available in English, rats were exposed by inhalation to 0 or 2.5 mg/m³ mercury for 3 weeks (6 hr/day) before pregnancy and from day 7-20 of pregnancy. There was a significant decrease in the number of live fetuses at birth and all offspring from exposed mothers died by the age of 6 days. Maternal weight gain was reduced in the mercury-exposed group, but not significantly.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION (continued):

Reproductive Toxicity: The information located is not adequate to conclude that mercury causes reproductive toxicity. A study in female rats showed slight changes to the fertility cycle but no effects on functional fertility. Female rats were exposed by nose-only inhalation to 0, 1, 2 or 4 mg/m³ mercury for 11 consecutive days and allowed to breed. The exposure to 4 mg/m³ was found to be too toxic and the harmful effects on fertility observed at this dose level were not considered a reproductive effect. Exposure to 2 mg/m³ slightly increased the duration of the fertility (estrous) cycle but did not affect functional fertility as mating efficiency and implantations were not affected.(47) In a study which is not available in English, female rats were exposed by inhalation to 0 or 2.5 mg/m³ for 6-8 weeks (6 hr/day) before mating but not during pregnancy. There was no effect on the number of live pups at birth, however there was a significant increase in mortality of the offspring of treated mothers during the first 4 days of life. The exposed animals had longer fertility (estrous) cycles than controls. During the 2nd and 3rd weeks of exposure, exposed animals developed signs of mercury poisoning.

12. ECOLOGICAL INFORMATION

MOBILITY IN SOIL: Due to the form of this product, it is unlikely that it will be mobile in the soil.

PERSISTENCE AND BIODEGRADABILITY: This product has not been tested for persistence or biodegradability. The case of this product will not biodegrade. Mercury does not biodegrade. Atmospheric mercury exists as divalent mercury. Divalent mercury (also referred to as HgII or HG0), is formed when elemental mercury has undergone a chemical reaction of oxidation, losing electrons. Hg(0) lasts for a long time in the atmosphere (6 months to a year), meaning that it circulates around the globe and can travel long distances. Hg(II) can easily rain or settle out after only a few days in the atmosphere, which means it is more likely to enter the environment nearby its source.

BIO-ACCUMULATION POTENTIAL: This product has not been tested for bio-accumulation potential. Under normal conditions, this product is contained and pose no risk to persons or the surrounding environment. Mercury accumulates in the body.

ECOTOXICITY: This product is not expected to cause significant harm to plant and animal-life; however, all disposal should be according to current regulations. This product has not been tested for aquatic toxicity. All release of this product into an aquatic or terrestrial environment should be prevented. In the event of breach of the portion of the product that contains mercury, an acute and chronic toxicity hazard to aquatic organisms will be present as methylmercury is formed in aquatic environments (Mercury is converted to methylmercury in aquatic systems by sulfate- and iron-reducing bacteria) and is highly toxic to aquatic organisms. The following are aquatic toxicity data for mercury.

MERCURY:

EC₅₀ (*Daphnia* water flea) 96 hours = 5.0 mg/L

LC₅₀ (*Cyprinus carpio*) 96 hours = 0.5 mg/L

LC₅₀ (*Cyprinus carpio*) 96 hours = 0.16 mg/L (semi-static)

MERCURY (continued):

LC₅₀ (Rainbow trout) 96 hours = 0.16-0.90 mg/L

LC₅₀ (Bluegill/Sunfish) 96 hours = 0.16-0.90 mg/L

LC₅₀ (Channel catfish) 96 hours = 0.35 mg/L

RESULTS OF PBT and vPvB ASSESSMENT: No data available. PBT and vPvB assessments are part of the chemical safety report required for some substances in European Union Regulation (EC) 1907/2006, Article 14.

ENVIRONMENTAL EXPOSURE CONTROLS: Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

13. DISPOSAL CONSIDERATIONS

WASTE TREATMENT AND DISPOSAL METHODS: Dispose of in accordance with applicable International, Federal, State, and local procedures and standards.

PRECAUTIONS TO BE FOLLOWED DURING WASTE HANDLING: Do not mix with wastes of other materials.

U.S. EPA WASTE NUMBER: Not applicable.

EWC WASTE CODE: 06 04: metal-containing wastes other than those mentioned in 06 03: 06 04 04* wastes containing mercury

14. TRANSPORTATION INFORMATION

This product is shipped according to the applicable transportation regulations listed on this SDS:

- ❖ U.S. Department of Transportation (DOT) Subchapter C of the Hazardous Materials Regulations,
- ❖ UN Recommendations on the Transport of Dangerous Goods,
- ❖ International Civil Aviation Organization (ICAO) Technical Instruction for the Safe Transport of Dangerous Goods by Air,
- ❖ International Aviation Transportation Association (IATA) Dangerous Goods Regulations,
- ❖ International Maritime Organization (IMO),
- ❖ Transport Canada Transportation of Dangerous Goods Regulations (TDG),
- ❖ European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR),
- ❖ Singapore Standard 286: Part A, and

This product may be shipped according to the special provisions, exceptions and exemptions specified in the regulations listed in the following sections are met. Always refer to the latest transportation regulations prior to shipping this product as regulations may have changed.

U.S. DEPARTMENT OF TRANSPORTATION 49 CFR 172.101: This product is exempted from classification as Dangerous Goods, per regulations of the DOT unless shipped by air or vessel and as long as all provisions of Special Provision A191 are met (see below) and provisions of 49 CFR 173.164.

Special Provisions A191: Notwithstanding the Division 6.1 subsidiary risk for this description, the toxic subsidiary risk label and the requirement to indicate the subsidiary risk on the shipping paper are not required for manufactured articles containing less than 5 kg (11 pounds) of mercury.

14. TRANSPORTATION INFORMATION (Continued)

U.S. DEPARTMENT OF TRANSPORTATION 49 CFR 172.101 (continued): When shipped by air, the following classification is applicable.

UN Identification Number: UN 3506
Hazard Materials Description and Proper Shipping Name: Mercury contained in manufactured articles
Hazard Class or Division: 8 (Corrosive)
Packing Group: None
Label Codes: Class 8 (Corrosive); Class 6.1 (Toxic)
Special Provisions: A191
Exceptions: 164
Packaging: None
Quantity Limitations: No Limit
Vessel Storage: Location: B; Other: 40, 97
Emergency Response Guidebook Number (2020): 172

Marine Pollutant: The mercury component meets the criteria of Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is classified as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. Under Canadian TDG Provision 127, shipments need not be classified if the mercury contained within the article is less than 1 kg.

UN Number: UN 3506
Proper Shipping Name: Mercury contained in manufactured articles
Class: 8; 6.1
Packing Group: None
Special Provisions: 127
Hazard Label(s) Required: Class 8 (Corrosive); Class 6.1 (Toxic)
Explosive Limit and Limited Quantity Index: 5 kg
Excepted Quantities: E0
ERAP Index: None
Passenger Carrying Ship Index: None
Passenger Carrying Road or Rail Vehicle Index: None

Marine Pollutant: The mercury component meet the criteria of Marine Pollutant under Transport Canada regulations, as per TDG 2.7.

INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA): This product is classified as Dangerous Goods, per rules of IATA:

UN Identification Number: UN 3506
Proper Shipping Name: Mercury contained in manufactured articles
Hazard Class or Division (Subsidiary Hazard): 8 (6.1)
Hazard Label(s) Required: Class 8 (Corrosive); Class 6.1 (Toxic)
Packing Group: None
Excepted Quantities: E0
Passenger and Cargo Aircraft Packing Limited Quantity Packing Instruction: Forbidden
Passenger and Cargo Aircraft Packing Limited Quantity Maximum Net Quantity per Pkg.: Forbidden
Passenger and Cargo Aircraft Packing Instruction: 869
Passenger and Cargo Aircraft Packing Maximum Net Quantity per Pkg.: No Limit
Cargo Aircraft Only Packing Instruction: 869
Cargo Aircraft Only Maximum Net Quantity per Pkg.: No Limit
Special Provisions: A48, A69, A191
ERG Code: 8L

INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO): This product is classified as dangerous goods, per the International Maritime Organization.

UN No.: 3506
Proper Shipping Name: Mercury contained in manufactured articles
Hazard Class Number: 8 (Corrosive)
Subsidiary Class Number: 6.1 (Toxic)
Hazard Labels: Class 8 (Corrosive); Class 6.1 (Toxic)
Packing Group: None
Special Provisions: 366
Limited Quantities: 5 kg
Excepted Quantities: E0
Packing Instructions: Instructions: P003, Provisions: PP90
IBC Information: Instructions: None, Provisions: None
Tanks: Instructions: None, Provisions: None
EmS: F-A, S-B
Stowage Category: Category B, SW2
Segregation: SG24

Marine Pollutant: The mercury component meet the criteria of Marine Pollutant under UN criteria.

Properties and Observations: Articles containing mercury (UN 2809). Carriage should be prohibited in hovercraft and other ships constructed with aluminum.

14. TRANSPORTATION INFORMATION (Continued)

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD

(ADR): This product is classified by the Economic Commission for Europe to be dangerous goods.

UN No.:	3506
Name and Description:	Mercury contained in manufactured articles
Class:	8
Classification Code:	CT3
Packing Group:	Not Applicable
Labels:	8 + 6.1
Special Provisions:	366
Limited Quantities:	5 kg
Excepted Quantities:	E0
Packing Instructions:	Instructions: P003
Special Packing Provisions:	PP90
Mixed Packing Provisions:	MP15
Portable Tanks and Bulk Containers:	Instructions: None; Provisions: None
Transport Category:	3
Tunnel Restriction Code:	(E)
Loading, Unloading and Handling:	CV13, CV28
Hazard Identification No.:	None

TRANSPORT IN BULK ACCORDING TO THE IBC CODE: See the information under the individual jurisdiction listings for IBC information.

ENVIRONMENTAL HAZARDS: Mercury meets the criteria of environmentally hazardous according to the criteria of the UN Model Regulations (as reflected in the IMDG Code, ADR, RID, and ADN) as indicated in this Section.

15. REGULATORY INFORMATION

U.S. REGULATIONS:

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65): The Mercury component is listed on the California Proposition Lists as a compound known to the State of California to cause cancer and/or developmental. This product may expose you to chemicals including Mercury, which is known to the State of California to cause cancer, birth defects or other reproductive harm. For more information go to P65Warnings.ca.gov. In addition, to the warning text provided above, the following symbol must be displayed. Where the sign, label or shelf tag for the product is not printed using the color yellow, the symbol may be printed in black and white. The symbol shall be placed to the left of the text of the warning, in a size no smaller than the height of the word "WARNING".



INTERNATIONAL CHEMICAL INVENTORIES: This product is considered an article under the chemical inventories listed below and consequently is exempt from listing on these inventories:

- U.S. EPA Toxic Substance Control Act (TSCA)
- Canadian DSL Inventory
- Canadian Chemical Registration Regulations (NDSL/DSL)
- European Inventory of Existing Chemical Substances (EINECS/ELINCS)
- Singapore Code of Practice on Pollution Control Requirements

However, based on the rules enforced with regards to the marketing and use of chemicals to manufacture this product, each chemical component of this finished product has been listed or exempt from the listed chemical inventories.

OTHER INTERNATIONAL REGULATIONS: As an article this product has no requirements under the following U.S. and International regulations:

- U.S. SARA Reporting & Threshold Planning Quantity (TPQ) Requirements
- U.S. CERCLA Reportable Quantity (RQ)
- California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)
- Canadian WHMIS Regulations (Hazardous Products Act, 6&7, Part II (Sections 11 and 12)).
- Canadian Environmental Protection Agency (CEPA) Priorities Substances Lists
- Singapore Code of Practice on Pollution Control Requirements

EUROPEAN UNION REGULATIONS:

Chemical Safety Assessment: No Data Available. The chemical safety assessment is required for some substances according to European Union Regulation (EC) 1907/2006, Article 14.

Substances of Very High Concern (SVHC) Status: Mercury is not listed. Undetermined for other components of the relays.

Directive 2012/18/EU, SEVESO III Data: Mercury is a SEVESO Substance, Categories Health Hazards H2: Acutely Toxic; Environmental Hazards E1: Hazardous to the Aquatic Environment in Category Acute 1 or Chronic 1.

Category H2: Qualifying Quantity (Tonnes) of Dangerous Substances, as referred to in Article 3(10) for the application of:
Lower Tier Requirements: 5 tonnes Higher Tier Requirements: 20 tonnes

Category E1: Qualifying Quantity (Tonnes) of Dangerous Substances, as referred to in Article 3(10) for the application of:
Lower Tier Requirements: 100 tonnes Higher Tier Requirements: 200 tonnes

16. OTHER INFORMATION

REFERENCES AND DATA SOURCES: Contact the supplier for information.

METHODS OF EVALUATING INFORMATION FOR THE PURPOSE OF CLASSIFICATION: Bridging principles were used to classify this product.

REVISION DETAILS:

January 2018: Review and up-date of SDS to current regulations as of January 2, 2018. Up-date of GHS classification in Sections 3 and 15; Inclusion of California Proposition 65 warnings related to Mercury in Section 15.

November 2021: Review and up-date entire SDS to current classification and format, including GHS classification and SDS format under GHS, exposure limits and transportation.

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc. • PO Box 1961, Hilo, HI 96721 • (800) 441-3365 • (808) 969-4846

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Struthers-Dunn products are sold with the understanding that the buyers will test them in actual use and determine for themselves their adaptability to their intended uses. Struthers-Dunn warrants to the buyers that its products are free from defects in material and workmanship, but limits its obligation under this warranty to replacement of the product shown to Struthers-Dunn's satisfaction to have been defective at the time Struthers-Dunn sold it. This warranty does not extend to any persons obtaining the product from the buyers. This warranty is in lieu of any other warranty, express or implied, including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liability on Struthers-Dunn's part. Under no circumstances will Struthers-Dunn be liable for any loss, damage, expense, or consequential damages of any kind arising in connection with the use, or inability to use, Struthers-Dunn's products. Struthers-Dunn assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, Struthers-Dunn assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

16. OTHER INFORMATION (Continued)

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on an SDS. Some of these, which are commonly used, include the following:

CAS #: This is the Chemical Abstract Service Number that uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

CEILING LEVEL: The concentration that shall not be exceeded during any part of the working exposure.

DFG MAK Germ Cell Mutagen Categories: **1:** Germ cell mutagens which have been shown to increase the mutant frequency in the progeny of exposed humans. **2:** Germ cell mutagens which have been shown to increase the mutant frequency in the progeny of exposed mammals. **3A:** Substances which have been shown to induce genetic damage in germ cells of human of animals, or which produce mutagenic effects in somatic cells of mammals *in vivo* and have been shown to reach the germ cells in an active form. **B:** Substances which are suspected of being germ cell mutagens because of their genotoxic effects in mammalian somatic cell *in vivo*; in exceptional cases, substances for which there are *no in vivo* data, but which are clearly mutagenic *in vitro* and structurally related to known *in vivo* mutagens. **4:** Not applicable (Category 4 carcinogenic substances are those with non-genotoxic mechanisms of action. By definition, germ cell mutagens are genotoxic. Therefore, a Category 4 for germ cell mutagens cannot apply. At some time in the future, it is conceivable that a Category 4 could be established for genotoxic substances with primary targets other than DNA [e.g., purely aneugenic substances] if research results make this seem sensible.) **5:** Germ cell mutagens, the potency of which is considered to be so low that, provided the MAK value is observed, their contribution to genetic risk for humans is expected not to be significant.

DFG MAK Pregnancy Risk Group Classification: Group A: A risk of damage to the developing embryo or fetus has been unequivocally demonstrated. Exposure of pregnant women can lead to damage of the developing organism, even when MAK and BAT (Biological Tolerance Value for Working Materials) values are observed. **Group B:** Currently available information indicates a risk of damage to the developing embryo or fetus must be considered to be probable. Damage to the developing organism cannot be excluded when pregnant women are exposed, even when MAK and BAT values are observed. **Group C:** There is no reason to fear a risk of damage to the developing embryo or fetus when MAK and BAT values are observed. **Group D:** Classification in one of the groups A-C is not yet possible because, although the data available may indicate a trend, they are not sufficient for final evaluation.

IDLH-Immediately Dangerous to Life and Health: This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.

LQ: Limit of Quantitation.

MAK: Federal Republic of Germany Maximum Concentration Values in the workplace.

NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference.

NIC: Notice of Intended Change.

NIOSH CEILING: The exposure that shall not be exceeded during any part of the workday. If instantaneous monitoring is not feasible, the ceiling shall be assumed as a 15-minute TWA exposure (unless otherwise specified) that shall not be exceeded at any time during a workday.

PEL-Permissible Exposure Limit: OSHA's Permissible Exposure Limits. This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register, 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "vacated 1989 PEL" is placed next to the PEL that was vacated by Court Order.

SKIN: Used when there is a danger of cutaneous absorption.

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

TLV-Threshold Limit Value: An airborne concentration of a substance that represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour.

TWA-Time Weighted Average: Time Weighted Average exposure concentration for a conventional 8-hr (TLV, PEL) or up to a 10-hr (REL) workday and a 40-hr workweek.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS:

This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards.

HEALTH HAZARD: 0 (Minimal Hazard): No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. PII or Draize = "0". *Eye Irritation:* Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g., mechanical irritation]. Draize = "0". *Oral Toxicity LD₅₀ Rat:* < 5000 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* < 2000 mg/kg. *Inhalation Toxicity 4-hrs LC₅₀ Rat:* < 20 mg/L.; **1 (Slight Hazard):** Minor reversible injury may occur; slightly or mildly irritating. *Skin Irritation:* Slightly or mildly irritating. *Eye Irritation:* Slightly or mildly irritating. *Oral Toxicity LD₅₀ Rat:* > 500-5000 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 1000-2000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 2-20 mg/L.; **2 (Moderate Hazard):** Temporary or transitory injury may occur. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation:* Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, ≤ 25. *Oral Toxicity LD₅₀ Rat:* > 50-500 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 200-1000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.5-2 mg/L.; **3 (Serious Hazard):** Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation:* Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns, dermal necrosis. PII or Draize > 5-8 with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD₅₀ Rat:* > 1-50 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 20-200 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.05-0.5 mg/L.; **4 (Severe Hazard):** Life-threatening; major or permanent damage may result from single or repeated exposure. *Skin Irritation:* Not appropriate. Do not rate as a "4", based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a "4", based on eye irritation alone. *Oral Toxicity LD₅₀ Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* ≤ 0.05 mg/L.

FLAMMABILITY HAZARD: 0 (Minimal Hazard-Materials) that will not burn in air when exposure to a temperature of 815.5°C [1500°F] for a period of 5 minutes; **1 (Slight Hazard-Materials)** that must be pre-heated before ignition can occur. Material require considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur, including: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C [200°F] (e.g., OSHA Class IIIB, or; Most ordinary combustible materials [e.g., wood, paper, etc.];

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued): 2 (Moderate Hazard-Materials) that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres in air, including: Liquids having a flash-point at or above 37.8°C [100°F]; Solid materials in the form of coarse dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g., cotton, sisal, hemp; Solids and semisolids that readily give off flammable vapors.); **3 (Serious Hazard-Liquids and solids)** that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions, including: Liquids having a flash point below 22.8°C [73°F] and having a boiling point at or above 38°C [100°F] and below 37.8°C [100°F] [e.g. OSHA Class IB and IC]; Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air [e.g., dusts of combustible solids, mists or droplets of flammable liquids]; Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides]; **4 (Severe Hazard-Materials)** that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] [e.g. OSHA Class IA; Material that ignite spontaneously when exposed to air at a temperature of 54.4°C [130°F] or below [e.g. pyrophoric].

PHYSICAL HAZARD: 0 (Water Reactivity): Materials that do not react with water. *Organic Peroxides:* Materials that are normally stable, even under fire conditions and will not react with water. *Explosives:* Substances that are Non-Explosive. *Unstable Compressed Gases:* No Rating. *Pyrophorics:* No Rating. *Oxidizers:* No "0" rating allowed. *Unstable Reactives:* Substances that will not polymerize, decompose, condense or self-react; **1 (Water Reactivity):** Materials that change or decompose upon exposure to moisture. *Organic Peroxides:* Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy. *Explosives:* Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases:* Pressure below OSHA definition. *Pyrophorics:* No Rating. *Oxidizers:* Packaging Group III; *Solids:* any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%) cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives:* Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.; **2 (Water Reactivity):** Materials that may react violently with water. *Organic Peroxides:* Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives:* Division 1.4 – Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. *Compressed Gases:* Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group II *Solids:* any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 aqueous sodium chlorate solution (40%) cellulose mixture and the criteria for Packing Group I are not met. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature; **3 (Water Reactivity):** Materials that may form explosive reactions with water. *Organic Peroxides:* Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives:* Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases:* Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group I *Solids:* any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. *Oxidizers:* *Liquids:* Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%) cellulose mixture. *Unstable Reactives:* Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion.; **4 (Water Reactivity):** Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides:* Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives:* Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases:* No Rating. *Pyrophorics:* Add to the definition of Flammability "4". *Oxidizers:* No "4" rating. *Unstable Reactives:* Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion.)

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

HEALTH HAZARD: 0 (materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 10,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 200 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 2000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 2000 mg/kg. Materials that are essentially non-irritating to the respiratory tract, eyes and skin. **1 (materials that, under emergency conditions, can cause significant irritation):** Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 10 mg/L but less than or equal to 200 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 1000 mg/kg but less than or equal to 2000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 500 mg/kg but less than or equal to 2000 mg/kg. Materials that cause slight to moderate irritation to the respiratory tract, eyes and skin.

16. OTHER INFORMATION (Continued)

DEFINITIONS OF TERMS (continued)

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

HEALTH HAZARD (continued): 2 (materials that, under emergency conditions, can cause temporary incapacitation or residual injury): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 3,000 ppm but less than or equal to 5,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 2 mg/L but less than or equal to 10 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 200 mg/kg but less than or equal to 1000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 50 mg/kg but less than or equal to 500 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 5000 ppm and that does not meet the criteria for either degree of hazard 3 or degree of hazard 4. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause severe tissue damage, depending on duration of exposure. Materials that are respiratory irritants. Materials that cause severe, but reversible irritation to the eyes or are lachrymators. Materials that are primary skin irritants or sensitizers. **3** (materials that, under emergency conditions, can cause serious or permanent injury): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 1,000 ppm but less than or equal to 3,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 40 mg/kg but less than or equal to 200 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 5 mg/kg but less than or equal to 50 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 3000 ppm and that does not meet the criteria for degree of hazard 4. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause frostbite and irreversible tissue damage. Materials that are respiratory irritants. Cryogenic gases that cause frostbite and irreversible tissue damage. Materials that are corrosive to the respiratory tract. Materials that are corrosive to the eyes or cause irreversible corneal opacity. Materials that are corrosive to the skin. **4** (materials that, under emergency conditions, can be lethal): Gases and vapors whose LC₅₀ for acute inhalation toxicity less than or equal to 1,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is less than or equal to 0.5 mg/L. Materials whose LD₅₀ for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD₅₀ for acute oral toxicity is less than or equal to 5 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 1000 ppm.

FLAMMABILITY HAZARD: 0 Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand: Materials that will not burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with Annex D. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur. Materials that will burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with Annex D. Liquids, solids and semisolids having a flash point at or above 93.4°C (200°F) (e.g., Class IIIB liquids). Liquids with a flash point greater than 35°C (95°F) that do not sustain combustion when tested using the *Method of Testing for Sustained Combustibility*, per 49 CFR 173, Appendix H or the *UN Recommendation on the Transport of Dangerous Goods, Model Regulations* (current edition) and the related *Manual of Tests and Criteria* (current edition). Liquids with a flash point greater than 35°C (95°F) in a water-miscible solution or dispersion with a water non-combustible liquid/solid content of more than 85 percent by weight. Liquids that have no fire point when tested by ASTM D 92 Standard Test Method for Flash and Fire Points by Cleveland Open Cup, up to a boiling point of the liquid or up to a temperature at which the sample being tested shows an obvious physical change. Combustible pellets with a representative diameter of greater than 2 mm (10 mesh). Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. Most ordinary combustible materials. **2** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air: Liquids having a flash point at or above 37.8°C (100°F) and below 93.4°C (200°F) (e.g., Class II and Class IIIA liquids.) Solid materials in the form of powders or coarse dusts of representative diameter between 420 microns (40 mesh) and 2 mm (10 mesh) that burn rapidly but that generally do not form explosive mixtures in air. Solid materials in fibrous or shredded form that burn rapidly and create flash fire hazards, such as cotton, sisal and hemp. Solids and semisolids that readily give off flammable vapors. Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **3** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions: Liquids having a flash point below 22.8°C (73°F) and having a boiling point at or above 37.8°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (73°F) and below 37.8°C (100°F) (e.g., Class IB and IC liquids). Materials that, on account of their physical form or environmental conditions, can form explosive mixtures with air and are readily dispersed in air. Flammable or combustible dusts with a representative diameter less than 420 microns (40 mesh). Materials that burn with extreme rapidity, usually by reason of self-contained oxygen (e.g., dry nitrocellulose and many organic peroxides). Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued): 4 Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily: Flammable gases. Flammable cryogenic materials. Any liquid or gaseous materials that is liquid while under pressure and has a flash point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F) (e.g., Class IA liquids). Materials that ignite when exposed to air, Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

INSTABILITY HAZARD: 0 Materials that in themselves are normally stable, even under fire conditions: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) below 0.01 W/mL. Materials that do not exhibit an exotherm at temperatures less than or equal to 500°C (932°F) when tested by differential scanning calorimetry. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 0.01 W/mL and below 10 W/mL. **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 10 W/mL and below 100 W/mL. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 100 W/mL and below 1000 W/mL. Materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) of 1000 W/mL or greater. Materials that are sensitive to localized thermal or mechanical shock at normal temperatures and pressures.

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). **Flash Point** - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. **Autoignition Temperature**: The minimum temperature required to initiate combustion in air with no other source of ignition. **LEL** - the lowest percent of vapor in air, by volume, which will explode or ignite in the presence of an ignition source. **UEL** - the highest percent of vapor in air, by volume, which will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LD₀**, or **TC**, **TCLo**, **LCLo**, and **LC₀**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information**: The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program. **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. **IARC** and **NTP** rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used.

Other Information: **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

REPRODUCTIVE TOXICITY INFORMATION:

A **mutagen** is a chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryo toxin** is a chemical that causes damage to a developing embryo (e.g., within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical that causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance that interferes in any way with the reproductive process.

ECOLOGICAL INFORMATION:

EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. $TL_{50} = \text{median threshold limit}$; *Coefficient of Oil/Water Distribution is represented by log K_{ow} or log K_{oc} and is used to assess a substance's behavior in the environment.*

REGULATORY INFORMATION:

U.S. and CANADA: **ACGIH**: American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDSL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label. **OSHA** - U.S. Occupational Safety and Health Administration.