

Safety Data Sheet

Version 2.4

Revision Date 02/08/2017

SDS Number 300000000026

Print Date 03/04/2017

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Chlorine

Chemical formula : Cl₂

Synonyms : Chlorine

Product Use Description : General Industrial

Manufacturer/Importer/Distributor : Versum Materials US, LLC
7201 Hamilton Blvd.
Allentown, PA 18195-1501
Exporter EIN No.475632014
www.versummaterials.com

Telephone : (610)481-4911

Emergency telephone number (24h) : 800-523-9374 USA
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2. HAZARDS IDENTIFICATION

GHS classification

Oxidizing gases - Category 1
Gases under pressure - Liquefied gas.
Acute toxicity - Inhalation Category 2
Skin corrosion - Category 1
Serious Eye Damage - Category 1
Specific target organ toxicity - single exposure - Inhalation Category 3

GHS label elements

Hazard pictograms/symbols



Signal Word: Danger

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Hazard Statements:

H270:May cause or intensify fire; oxidiser.
H280:Contains gas under pressure; may explode if heated.
H314:Causes severe skin burns and eye damage.
H330:Fatal if inhaled.
H335:May cause respiratory irritation.
EUH071:Corrosive to the respiratory tract.

Precautionary Statements:

Prevention	: P220:Keep away from clothing and other combustible materials. P244:Keep valves and fittings free from oil and grease. P260:Do not breathe dust/fume/gas/mist/vapours/spray. P264:Wash hands thoroughly after handling. P271:Use only outdoors or in a well-ventilated area. P273:Avoid release to the environment. P280:Wear protective gloves/protective clothing/eye protection/face protection. P284:Wear respiratory protection.
Response	: P301+P330+P331 :IF SWALLOWED: rinse mouth. Do NOT induce vomiting. P303+P361+P353 :IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. P304+P340 :IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. P305+P351+P338 :IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P310 :Immediately call a POISON CENTRE/doctor. P363 :Wash contaminated clothing before reuse. P370+P376 :In case of fire: Stop leak if safe to do so. P391 :Collect spillage.
Storage	: P403+P233:Store in a well-ventilated place. Keep container tightly closed. P405:Store locked up. P410+P403:Protect from sunlight. Store in a well-ventilated place.
Disposal	: P501:Disposal of contents/container to be specified in accordance with regulations.

Hazards not otherwise classified

Reacts with water to form corrosive acids.
Vigorously accelerates combustion.
May react violently with combustible materials.
Keep oil, grease, and combustibles away.
Do not breathe gas.
Compressed liquefied gas.

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3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Concentration (Volume)
Chlorine	7782-50-5	100 %

Concentration is nominal. For the exact product composition, please refer to technical specifications.

4. FIRST AID MEASURES

- General advice : The potential for hydrogen chloride formation exists with every exposure, therefore its toxicity must be considered. Remove victim to uncontaminated area wearing self-contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
- Eye contact : In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Keep eye wide open while rinsing.
- Skin contact : Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and badly. Flush with copious amounts of water until treatment is available. Remove contaminated clothing. Drench affected area with water for at least 15 minutes.
- Ingestion : Ingestion is not considered a potential route of exposure.
- Inhalation : Move to fresh air. In case of shortness of breath, give oxygen. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. Mouth to mouth resuscitation is not recommended. If unconscious place in recovery position and seek medical advice. Consult a doctor.
- Most important symptoms/effects - acute and delayed : Irritating to eyes and respiratory system. Cough. Acute or chronic respiratory conditions.

Immediate Medical Attention and Special Treatment

- Treatment : Treat bronchospasm and laryngeal edema if present. Observe for delayed chemical pneumonitis, pulmonary hemorrhage or edema. If exposed or concerned: Get medical attention/advice.

5. FIRE-FIGHTING MEASURES

- Suitable extinguishing media : All known extinguishing media can be used.
- Specific hazards : Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Oxidant. Strongly supports combustion. May react violently with combustible materials. Some materials which are noncombustible in air may burn in the presence of an oxidizer. Use of water may result in the formation of very toxic aqueous solutions. Move away from container and cool with water

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from a protected position. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out. Keep containers and surroundings cool with water spray. Do not allow run-off from firefighting to enter drains or water courses. Gas is heavier than air and may collect in low areas or travel along the ground where there may be an ignition source present.

Special protective equipment for fire-fighters : Use self-contained breathing apparatus and chemically protective clothing.

6. ACCIDENTAL RELEASE MEASURES

- Personal Precautions, Protective Equipment, and Emergency Procedures : Evacuate personnel to safe areas. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Use chemically protective clothing. Ventilate the area.
- Environmental precautions : Reduce vapor with fog or fine water spray. Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
- Methods for cleaning up : Ventilate the area. Approach suspected leak areas with caution.
- Additional advice : Large releases may require considerable downwind evacuation. If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Carbon steel, stainless steel, Monel or copper are suitable materials of construction when no moisture is present. Hastelloy, platinum or gold offer good resistance to corrosion when moisture is present. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Only experienced and properly instructed persons should handle compressed gases/cryogenic liquids. Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g.

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wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shock. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Keep container valve outlets clean and free from contaminants particularly oil and water. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Avoid suckback of water, acid and alkalis. Installation of a cross purge assembly between the cylinder and the regulator is recommended. When returning cylinder install valve outlet cap or plug leak tight. Never permit oil, grease, or other readily combustible substances to come into contact with valves or containers containing oxygen or other oxidants. Do not use rapidly opening valves (e.g. ball valves). Open valve slowly to avoid pressure shock. Never pressurize the entire system at once. Use only with equipment cleaned for oxygen service and rated for cylinder pressure. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F). Never attempt to increase liquid withdrawal rate by pressurizing the container without first checking with the supplier. Never permit liquefied gas to become trapped in parts of the system as this may result in hydraulic rupture.

Storage

Open/close valve slowly. Close when not in use. Wear Safety Eye Protection. Check Safety Data Sheet before use. Use a back flow preventative device in the piping. Use only with equipment of compatible materials of construction, rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. When returning cylinder install valve outlet cap or plug leak tight. Close valve after each use and when empty. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Full containers should be stored so that oldest stock is used first. Keep containers tightly closed in a cool, well-ventilated place. Stored containers should be periodically checked for general condition and leakage. Observe all regulations and local requirements regarding storage of containers. Local codes may have special requirements for toxic gas storage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Keep container tightly closed in a dry and well-ventilated place. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Display "No Smoking or Open Flames" signs in the storage areas. Return empty containers in a timely manner. Flammable storage areas should be separated from oxygen and other oxidizers by a minimum distance of 20 ft. (6.1 m.) or by a barrier of non-combustible material at least 5 ft. (1.5 m.) high, having a fire resistance rating of at least 1/2 hour.

Technical measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance with local regulations. Keep away from combustible material. Where necessary containers containing oxygen and oxidants should be separated from flammable gases by a fire resistant partition. Segregate from flammable gases and other flammable materials in store.

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8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.
Provide readily accessible eye wash stations and safety showers.

Personal protective equipment

- | | | |
|---|---|---|
| Respiratory protection | : | Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits. Users of breathing apparatus must be trained. |
| Hand protection | : | Acid resistant gloves.
Sturdy work gloves are recommended for handling cylinders.
Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. |
| Eye protection | : | Safety glasses recommended when handling cylinders.
A full faceshield should be worn in addition to safety glasses when connecting, disconnecting or opening cylinders. |
| Skin and body protection | : | Acid resistant gloves (e.g. butyl rubber, neoprene, polyethylene) and splash suit when connecting, disconnecting or opening cylinders.
Cold temperatures may cause embrittlement of protective material resulting in breakage and exposure.
Contact with cold evaporating liquid on gloves or suit may cause cryogenic burns or frostbite.
Safety shoes are recommended when handling cylinders. |
| Environmental exposure controls | : | Reduce vapor with fog or fine water spray. |
| Special instructions for protection and hygiene | : | Ensure adequate ventilation, especially in confined areas. Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits. Gloves must be clean and free of oil and grease. |

Exposure limit(s)

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Chlorine	Time Weighted Average (TWA): ACGIH	0.5 ppm	-
Chlorine	Short Term Exposure Limit (STEL): ACGIH	1 ppm	-
Chlorine	Ceiling Limit Value and Time Period (if specified): NIOSH	0.5 ppm	1.45 mg/m3
Chlorine	Ceiling Limit Value: OSHA Z1	1 ppm	3 mg/m3
Chlorine	Time Weighted Average (TWA): OSHA Z1A	0.5 ppm	1.5 mg/m3
Chlorine	Short Term Exposure Limit (STEL): OSHA Z1A	1 ppm	3 mg/m3
Chlorine	Time Weighted Average (TWA) Permissible Exposure Limit (PEL): US CA OEL	0.5 ppm	1.5 mg/m3
Chlorine	Short Term Exposure Limit (STEL): US CA OEL	1 ppm	3 mg/m3
Chlorine	Time Weighted Average (TWA): TN OEL	0.5 ppm	1.5 mg/m3
Chlorine	Short Term Exposure Limit (STEL): TN OEL	1 ppm	3 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	: Liquefied gas. Greenish-yellow.
Odor	: Pungent.
Odor	: Mixture contains one or more component(s) which have the following odor: Pungent.
Odor threshold	: No data available.
pH	: Not applicable.
Melting point/range	: -150 °F (-101 °C)
Boiling point/range	: -29 °F (-33.8 °C)
Flash point	: Not applicable.
Evaporation rate	: Not applicable.
Flammability (solid, gas)	: Refer to product classification in Section 2
Upper/lower explosion/flammability limit	: No data available.
Vapor pressure	: 98.62 psia (6.80 bara) at 68 °F (20 °C)
Water solubility	: 8.620 g/l
Relative vapor density	: 2.448 (air = 1)
Relative density	: 1.6 (water = 1)
Partition coefficient (n-octanol/water)	: Not applicable.

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octanol/water)

Auto-ignition temperature : No data available.

Decomposition temperature : No data available.

Viscosity : Not applicable.

Molecular Weight : 70.91 g/mol

Density : 0.187 lb/ft³ (0.0030 g/cm³) at 70 °F (21 °C) Note: (as vapor)

Specific Volume : 5.39 ft³/lb (0.3365 m³/kg) at 70 °F (21 °C)

10. STABILITY AND REACTIVITY

Chemical Stability : Stable under normal conditions.

Conditions to avoid : No data available.

Materials to avoid : Water.
Aluminium.
Strong bases.
Brass.
May react violently with combustible materials.
May react violently with reducing agents.
Violently oxidises organic material.
Reacts with water to form corrosive acids.
May react violently with alkalis.
With water causes rapid corrosion of some metals.
Avoid oil, grease and all other combustible materials.
Organic materials.
Flammable materials.

Hazardous decomposition products : No data available.

Possibility of hazardous Reactions/Reactivity : No data available.

11. TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Likely routes of exposure

Effects on Eye : May cause eye irritation. May cause permanent eye injury. May cause blindness.

Effects on Skin : Causes skin irritation. Causes skin burns. Contact with liquid may cause cold burns/frostbite.

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- Inhalation Effects : May be fatal if inhaled. Corrosive to respiratory tract If inhaled, remove to fresh air.
- Ingestion Effects : No data available.
- Symptoms : Irritating to eyes and respiratory system. Cough. Acute or chronic respiratory conditions.

Acute toxicity

- Acute Oral Toxicity : No data is available on the product itself.
- Inhalation : LC50 (1 h) : 293 ppm Species : Rat.
- Acute Dermal Toxicity : No data is available on the product itself.
- Skin corrosion/irritation : No data available.
- Serious eye damage/eye irritation : No data available.
- Sensitization. : No data available.

Chronic toxicity or effects from long term exposures

- Carcinogenicity : No data available.
- Reproductive toxicity : Pregnant rats exposed for one hour to 300 ppm hydrochloric acid had a five-fold higher incidence of fetal death than control rats. In addition, the surviving rat pups showed disturbances in kidney function.
- Germ cell mutagenicity : No data is available on the product itself.
- Specific target organ systemic toxicity (single exposure) : No data available.
- Specific target organ systemic toxicity (repeated exposure) : No data available.
- Aspiration hazard : No data available.

Delayed and Immediate Effects and Chronic Effects from Short and Long Term Exposure

Acute or chronic respiratory conditions.

Rats exposed 6 hours/day, 5 days/week for 6 weeks to Chlorine at a concentration of 1, 3, or 9 ppm exhibited respiratory tract effects and gained less weight than control animals. The severity of these effects was dose-related. In addition, liver and kidney effects were observed in the rats treated at > 3 ppm. Pregnant rats exposed for one hour to 300 ppm

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12. ECOLOGICAL INFORMATION

Ecotoxicity effects

- Aquatic toxicity : Toxic to aquatic organisms.May cause pH changes in aqueous ecological systems.
- Toxicity to other organisms : No data available.

Persistence and degradability

- Biodegradability : No data is available on the product itself.
- Mobility : Because of its high volatility, the product is unlikely to cause ground pollution.
- Bioaccumulation : Refer to Section 9 "Partition Coefficient (n-octanol/water)".

Further information

Toxic to aquatic organisms.

13. DISPOSAL CONSIDERATIONS

- Waste from residues / unused products : In accordance with local and national regulations. Return unused product in original cylinder to supplier. Contact supplier if guidance is required. Must not be discharged to atmosphere.
- Contaminated packaging : Return cylinder to supplier.

14. TRANSPORT INFORMATION

DOT

- UN/ID No. : UN1017
- Proper shipping name : Chlorine
- Class or Division : 2.3
- Label(s) : 2.3 (5.1, 8)
- PIH Zone : B
- RQ Substance : Yes
- Marine Pollutant : Yes

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* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.

** NOTE: This product contains a substance that is regulated as a Marine Pollutant when transported in bulk packages (liquid – volume exceeding 450 liters, gas – water capacity exceeding 454 kilograms).

IATA

Transport Forbidden

IMDG

UN/ID No. : UN1017
Proper shipping name : CHLORINE
Class or Division : 2.3
Label(s) : 2.3 (5.1, 8)
RQ Substance : Yes
Marine Pollutant : Yes

* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.

** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

TDG

UN/ID No. : UN1017
Proper shipping name : CHLORINE
Class or Division : 2.3
Label(s) : 2.3 (8)
RQ Substance : Yes
Marine Pollutant : Yes

* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.

** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

Further Information

Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact customer

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service.

15. REGULATORY INFORMATION

Toxic Substance Control Act (TSCA) 12(b) Component(s):

None.

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on Inventory.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification

Acute Health Hazard

Fire Hazard. Sudden Release of Pressure Hazard.

EPA SARA Title III Section 313 (40 CFR 372) Component(s) above 'de minimus' level

Chlorine

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

This product does not contain any chemicals known to State of California to cause cancer, birth defects or any other harm.

16. OTHER INFORMATION

NFPA Rating

Health : 4
Fire : 0
Instability : 0
Special : OX

HMIS Rating

Health : 3
Flammability : 0
Physical hazard : 2

Prepared by : Versum Materials, Product Regulatory Department

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Telephone : (610)481-4911

Preparation Date : 03/04/2017

For additional information, please visit Versum Materials' Product Stewardship web site.
<http://www.versummaterials.com/productstewardship/>
