



CHEMICAL INDUSTRIES (FAR EAST) LIMITED.

化学工业(远东)有限公司

Title SDS – Chlorine	Doc. No.	TDC-SDS- Lab-C005
	Revision	K
	Date of issue	27 February 2023
Supersedes Revision I dated 19 February 2020	Page	1 of 8

SAFETY DATA SHEET (SDS)

CHLORINE

Preface

Chlorine is a greenish-yellow gas, which is readily compressed and liquefied into a clear, amber-colored liquid. Liquid chlorine is 1 ½ times as heavy as water, and is packed in steel containers. Chlorine has a characteristic pungent odor and irritates the respiratory tract. Chlorine is neither flammable nor combustible but is a highly reactive material.

Liquid chlorine is a skin irritant and cause severe damage to body tissues. It vaporizes rapidly to gas at normal atmospheric pressure and temperature conditions. In low concentration, irritates the mucous membranes, the respiratory system and the skin. In extreme cases, the difficulty of breathing may increase to the point where death can result from suffocation.

Chlorine produces no cumulative effects and complete recovery occurs after mild exposure. As chlorine is particularly irritating to persons afflicted with asthma and certain types of chronic bronchitis, such persons should avoid exposure to chlorine at all times.

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1	CHEMICAL PRODUCT & COMPANY IDENTIFICATION
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Product name : Chlorine (Liquid), Chlorine (gas)
 Chemical name : Chlorine
 Chemical formula : Cl₂
 Other names : Liquefied chlorine
 Company's name & address : Chemical Industries (Far East) Limited
 (Head office) : 3, Jalan Samulun, Jurong Town, Singapore 629127
 Tel: 6265 0411 Fax: 6265 6690 Email: chemical.ind@cil.sg
 (Manufacturing plant) : 91, Sakra Avenue, Jurong Island, Singapore 627882
 Tel: 6867 6977 Fax: 6867 6972 Email: sakraplant@cil.sg
Emergency telephone number : **6265 0411 (Head Office) or 6867 7433 (Manufacturing plant's control room)**

2	HAZARD IDENTIFICATION
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GHS CLASSIFICATION :

Toxic & Oxidizing gas	Category 1
Acute Toxicity :	
Oral :	Category 2
Dermal:	Category 2
Inhalation :	Category 2- Fatal if inhaled
Skin corrosion/irritation:	Category 1
Serious eye damage/irritation :	Category 1
Skin sensitization:	Category 1
Carcinogenicity	Not classified
Reproductive toxicity :	Not classified
Specific target organ toxicity (single exposure)	Category 3 – respiratory tract irritation
Acute aquatic toxicity	Category 1

GHS label elements
Pictograms:

Signal word:

Danger

Hazard Statement(s):

H270: May cause or intensify fire; oxidizer
 H280: Contains gas under pressure; may explode if heated.
 H300 + H330: Fatal if swallowed or inhaled
 H315: May cause skin irritation
 H319: May cause serious eye irritation
 H335: May cause respiratory irritation
 H400: Very toxic to aquatic life

Precautionary Statement(s):
Prevention:

P202: Do not handle until all safety precautions have been read and understood.
 P220: Keep away from combustible materials
 P244: Keep reduction valves/valves and fittings free from oil and grease.
 P260: Do not breathe gas/vapours/mist/fume.
 P264: Wash hands thoroughly after handling.
 P271: Use only outdoors or a well-ventilated area.

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P273: Avoid release into the environment

P280 + P284: Wear protective gloves, clothing, eye protection and/or face protection and respiratory protection.

Response:

P311: Immediately call a POISON CENTRE or doctor/physician

P303 + P361 + P353: IF ON SKIN: Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.

P304 + P340: IF INHALED: Remove person to fresh air and keep 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.

P370 + P376: In case of fire: Stop leak if safe to do so.

Storage and disposal:

P233: Keep container closed.

P403: Store in a well-ventilated place.

P501: Dispose of content/container in accordance with local/regional/national/international regulations.

3	COMPOSITION / INFORMATION ON INGREDIENTS
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Ingredients	CAS No. ¹	EC-No. ²	EC-Index-No. ³	Symbol / R-phrases	Content
Chlorine (Cl ₂)	: 7782-50-5	231-959-5	Data not available	T, N, R 23 R36/37/38 R 50	> 99 %

(Please refer to section 15 for meaning of risk phrases used above)

4	FIRST-AID MEASURES
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Types of contact	First aid measures
Eye contact	Wash eyes thoroughly with water for at least 15 minutes with eyelids held widely open. Immediately consult eye doctor or specialist. DO NOT WEAR CONTACT LENSES WHEN WORKING WITH CHLORINE.
Skin contact	Avoid breathing vapors. In case of contact, immediately wash off with plenty of water while removing contaminated clothing and shoes. Wash clothing before reuse. Discard contaminated shoes. Consult or seek medical attention for serious exposure.
Inhalation of process emissions	Take proper precautions to ensure rescuer safety before attempting rescue (wear appropriate protective equipments and utilize the "buddy system"). Remove source of chlorine or move victim to fresh air and obtain medical attention immediately. If breathing has not ceased, the patient should be placed in a comfortable position. Firmness and assurance will help alleviate patient anxiety. Slow deep breathing should be encouraged. Trained personnel should administer oxygen as soon as possible. The victim should be kept warm and remain at rest until medical help arrives. If breathing has stopped, trained personnel should immediately begin artificial respiration. If the heart has stopped, administer cardiopulmonary resuscitation (CPR). Avoid mouth-to-mouth contact.
Ingestion	IF SWALLOWED, DO NOT INDUCE VOMITING. Immediately rinse mouth with water. If victim is conscious give plenty of water. Spontaneous vomiting may occur. Never give anything to an unconscious victim. Immediately seek medical attention.

Note: Speed in removing victim from contaminated area is of primary importance.

5	FIRE-FIGHTING MEASURES
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Extinguishing media : Not combustible. However, if material is involved in fire, use water spray. Do not use dry chemicals, carbon dioxide or halogenated extinguishing agents.

¹ CAS – Chemical Abstract Service

² EC No. – No. given by European Community Commission

³ EC Index No. – as per appendix 1 of the regulation 67/548/EC

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- Protective equipment for fire-fighting : Fire fighters should use full protective clothing and full-face positive pressure self-contained breathing apparatus.
- Special risks : *
- * Chlorine is a strong oxidizer. Non-combustible but may ignite or explode on contact with combustible material. Containers may rupture or explode if exposed to heat.
 - * If chlorine is not leaking, apply water spray to keep fire-exposed containers cool. DO NOT APPLY WATER TO LEAKING CONTAINERS.
 - * Chlorine containers may explode from pressure when involved in fire. Remove containers away from fire zone if possible.
 - * Intense heat from fire can melt the safety fusible plugs of containers / cylinders at about 75 – 78°C, thus releasing chlorine.

6	ACCIDENTAL RELEASE MEASURES
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- Personal protective equipment : Avoid contact with skin / eye. Do not inhale vapor / fume. Ensure supply of fresh air in enclosed room.
Use full protective clothing and full-face positive pressure self-contained breathing apparatus.
- Procedure to stop / minimize : 1. Restrict entry to affected area except trained personnel equipped with the approved protective equipment mentioned above.
2. Evacuate unprotected personnel from affected area, if required, Stay upwind / crosswind.
3. Locate the leak point with dilute ammonia solution (about 10%) in a polyethylene squeeze bottle. If chlorine is escaping, a white cloud will be observed.
4. Attempt to stop leak from valves by tightening the valve nut or outlet cap. If it fails, use the appropriate emergency kit A (for cylinders) / B (for containers).
5. If leak is from the cylinder / container body, position it such that gas is released and not liquid. Use a body clamp if appropriate.
6. Extinguish all surrounding source of ignition.
7. For leaks, immediately implement pre-determined emergency response plans.
8. If spill / leak is not under control, inform SCDF / PCD / police / supplier / neighboring companies.
- Method to clean up : Unload remaining chlorine from a leaking container or cylinder by discharging into an absorption tower circulating with alkaline solution (e.g. 20 – 25% sodium hydroxide solution, soda ash or hydrated lime solutions).
Collect the absorbing solution thereafter for disposal in accordance to current local disposal regulations. *In Singapore, The Environmental Public Health (Toxic industrial waste) Regulations.*
Repair or dispose the leaking container / cylinder in accordance to current local disposal regulations.
- Environmental precautions : Contain the leak gas in isolated area, where possible and try to stop the release. Prevent used absorbing solution from entering sewer, surface water, ground water and soil. Report to authorities if substance has entered a watercourse / drain / soil.

7	HANDLING & STORAGE
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- Usual shipping containers : Steel cylinders (100 kg), steel containers (1000 kg)
- Handling : *
- * Protect container / cylinder from physical damage.
 - * Do not drop.
 - * Do not temper with valve or fusible plugs. Keep valve protection hood in place when not in use.
 - * Do not heat container / cylinder by any means to increase flowrate of product from container.
 - * Use suitable pressure regulator and / or check valve, if required.
 - * Do not lift cylinder by hooking on the valve caps.
- Storage : *
- * Store in well ventilated area away from heat source, emergency exits, heavy traffic areas, flammable and other incompatible materials.

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- * Cylinders should be upright and secured to prevent falling; containers should be on their side and secured to prevent rolling.
- * Mark clearly and separate full containers / cylinders from empty ones.
- * Practice "first-in-first-out" inventory system to prevent full cylinders / containers to be stored for excessive period of time (not more than 6 months).

Other precautions

- * Ensure only trained personnel handle the container / cylinder.
- * Provide emergency equipment such as self-contained breathing apparatus, ammonia solution in squeeze bottle and Emergency Kit A (for cylinder) and / or B (for container) at storage and use area.
- * Train personnel to be familiar in using the emergency equipment and emergency response plans (through regular drills).
- * Regularly inspect and test piping and equipment used in chlorine service.

8	EXPOSURE CONTROLS / PERSONAL PROTECTION
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Engineering controls : Provide adequate, general and local exhaust ventilation in areas of storage and use where chlorine gas leakage is present to meet PEL (permissible exposure limit) requirements of 0.5 ppm (1.47 mg/m³).
Provide water supply / emergency eyewash / shower near area of handling.

Safe work practices / industrial hygiene : Do not eat, drink and smoke in work area. Maintain good housekeeping.
Wash hands and face after working with the substance, and before eating / drinking.
Immediately remove contaminated clothing. Wash before re-using.

Personal protection

1. Eye protection : Use non-ventilated chemical safety goggles / full-face shield. Do not wear contact lens.
2. Skin protection : Use impervious gloves, coveralls, boots and/or other resistance protective clothing. Some operations may require the use of an impervious full-body encapsulating suit and respiratory protection.
3. Respiratory protection : Use approved half-face acid gas cartridge respirator suitable for the substance to be worn when concentrations are above the permissible exposure limits but less than 5 ppm. Use self-contained breathing apparatus with a full-face piece respirator when the concentration is greater than 5 ppm.
4. Other protective equipment : Uniform, apron, long-sleeved lab coat

Occupational exposure standards : PEL/TWA = 1.47 mg/m³ (0.5 ppm)
STEL = 3 mg/m³ (1 ppm)
TLV = 3 mg/m³ (1 ppm)
(PEL – Permissible exposure limits, TWA – time weighted average, STEL – Short term exposure limit, TLV – Threshold limit value)

9	PHYSICAL & CHEMICAL PROPERTIES
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Appearance : Greenish-yellow gas or amber liquid

Odor : Pungent, suffocating bleach like odor

Boiling point (at 1013 hPa) : -34 °C

Melting point : -101 °C

Specific gravity (at 20°C) : Dry Gas (2.48 @ 0 °C) (air = 1)
Liquid (1.47 @ 0/4 °C) (water = 1)

Solubility in water (at 20°C) : 8620 mg/l

Vapor density : 2.5 (Air=1)

Vapor pressure (at 20°C) : 6.8 bar

Corrosiveness : Material is highly corrosive to most metals in presence of water moisture.

Flash point : Not applicable

Explosive limits : lower : Not applicable
upper : Not applicable

Auto-ignition temperature : Not applicable

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Molecular weight : 70.9

10	STABILITY & REACTIVITY
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Stability	Stable.
Conditions to avoid instability	Heat
Hazardous decomposition products	Hydrochloric acid and Hypochlorous acid may form from chlorine in the presence of water vapor.
Conditions to avoid polymerization	No information available
Materials & conditions to avoid (incompatibility)	Liquid or gaseous chlorine can react violently with many combustible materials and other chemicals, including water. Metal halides, carbon, finely divided metals and sulfides can accelerate the rate of chlorine reactions. Hydrocarbon gases, e.g., methane, acetylene, ethylene or ethane, can react explosively if initiated by sunlight or a catalyst. Liquid or solid hydrocarbons, e.g., natural or synthetic rubbers, naphtha, turpentine, gasoline, fuel gas, lubricating oils, greases or waxes, can react violently. Metals, e.g., finely powdered aluminum, brass, copper, and manganese, tin, steel and iron, can react vigorously or explosively with chlorine. Nitrogen compounds, e.g., ammonia and other nitrogen compounds, can react with chlorine to form highly explosive nitrogen trichloride. Non-metals, e.g., phosphorous, boron, activated carbon and silicon can ignite on contact with gaseous chlorine at room temperature. Certain concentrations of chlorine-hydrogen can explode by spark ignition. Copper may burn spontaneously. Chlorine reacts with most metals at high temperatures. Titanium will burn at ambient temperature in the presence of dry chlorine.
Further information	Oxidizer. Extremely reactive.

11	TOXICOLOGICAL INFORMATION
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Acute toxicity : LC₅₀ (inhalation, rat) – 293 ppm vol / 1 hour
Further data : Delayed fatal pulmonary oedema possible. Severe corrosion to skin, eyes and respiratory tract at high concentrations. May cause inflammation of the respiratory system and skin. See also section 2 on effects on health.
(LC₅₀ - Lethal Concentration 50)

12	ECOLOGICAL INFORMATION
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Ecotoxicity : May cause pH changes in aqueous ecological system.
Toxic to water organisms.

Ecological information : Chlorine facilities should be designed and operated so that chlorine is not released to the environment. If accidental release should occur, the environment effects, as well as all relevant reporting requirements, must be considered.

13	DISPOSAL CONSIDERATIONS
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Considerations : Waste gas should scrub through an absorption tower, circulated with alkaline solution of caustic soda, soda ash, or hydrated lime before discharging to the atmosphere. Liquid or solid residues must be disposed off in a permitted waste treatment facility. **Consult approved waste collectors or chlorine suppliers for disposal.**

Singapore regulations : Dispose in accordance to current local disposal regulations.
In Singapore, The Environmental Public Health (Toxic industrial waste) Regulations

14	TRANSPORT INFORMATION
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Proper shipping name : Chlorine
(For land / sea / air)

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	UN No. ⁴	Hazard class	PSA Group ⁵
<u>Land</u> [The Environmental Pollution Control (Hazardous substances) Regulations]	1017	2.3	II
<u>Sea</u> (IMDG ⁶ / IMO ⁷)	1017	2.3	II
<u>Air</u> (ICAO ⁸ / IATA ⁹)	1017	2.3	II

15	REGULATORY INFORMATION
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In Singapore:

Import & sale of hazardous substances : Environmental Protection and Management (Hazardous Substances) Regulations
Disposal of obsolete / expired chemicals / waste : Environmental Public Health (Toxic Industrial Waste) Regulations

Symbol : T, N Toxic, Dangerous for the environment
R-phases : R23, R36/37/38, R50 Toxic by inhalation. Irritating to eyes, respiratory system and skin. Very toxic to aquatic organisms.
S-phases : S9, S45, S61 Keep container in well-ventilated place. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions/ Safety data sheets.

	Hazard type	Hazard class.	UN No.	Hazchem code
Chlorine (Cl ₂)	Poison Gas	2.3	1017	2XE

NFPA rating ¹⁰	Health	Reactivity	Flammability	Other
	4	0	0	OXY

"OXY" = Oxidizing agent

16	OTHER INFORMATION
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Revision No.	Date of issue	Description of changes
K	27 February 2023	Overall review
J	19 February 2020	Overall reviewed
I	10 September 2019	Complete review
H	20 October 2015	Amendment of company contact details. Addition of Response hazard statements
G	03 July 2014	Complete review
F	January 2011	Add GHS Classification, GHS labels and overall reviewed and updated according to SS 586 : Part 3 : 2008
E	May 2008	Document Title change to Safety Data Sheet, Section No.2 to 3 and 3 to 2. Changed Section 15 "Environmental Pollution Control (Hazardous Substances) Regulations" to "Environmental Protection and Management (Hazardous Substances) Regulations. Reviewed on section 16 according to guideline on preparation.(S134/2006)
D	Sept 2005	Complete review and deleted ISO logo
C	Nov 2003	Complete review; re-format to guidelines in The Code Of Practice for preparation and use of MSDS; up-date of manufacturer & supplier's contacts; included NFPA ratings; MSDS revision identification changed from "number" to "alphabet" format.

⁴ UN No. – No. issued by United Nations Subcommittee Experts

⁵ PSA Group – Grouping of dangerous goods by Port Of Singapore Authority

⁶ IMDG – International Maritime Dangerous Goods

⁷ IMO – International Maritime Organisation

⁸ ICAO – International Civil Aviation Organisation

⁹ IATA – International Air Transport Association

¹⁰ NFPA rating – rating according to National Fire Protection Agency

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B	July 1999	Up-dating of manufacturer & supplier's contacts
A	July 1997	Initial release