Toro Flex Force Lithium Ion Battery (UN3480)

The Toro Company

Chemwatch Hazard Alert Code: **3**

Chemwatch: **5351-42**
Version No: **2.1.1.2**
Safety Data Sheet according to OSHA HazCom Standard (2012) requirements

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SECTION 1 IDENTIFICATION

Product Identifier

Product name	Toro Flex Force Lithium Ion Battery (UN3480)
Synonyms	Not Available
Proper shipping name	Lithium ion batteries including lithium ion polymer batteries
Other means of identification	Not Available

Recommended use of the chemical and restrictions on use

Relevant identified uses	Rechargeable battery. NOTE: Chemical materials are stored in sealed metal case. The toxic properties of the electrode materials are hazardous only if the materials are released by damaging the cell or if exposed to fire.The sealed battery is not hazardous in normal use.The chemical hazards are related to the leaked battery contents.

Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

Registered company name	**The Toro Company**
Address	8111 Lyndale Avenue South Bloomington MN 55420 United States
Telephone	+1 952 888 8801
Fax	Not Available
Website	Not Available
Email	Not Available

Emergency phone number

Association / Organisation	**Not Available**
Emergency telephone numbers	Not Available
Other emergency telephone numbers	Not Available

SECTION 2 HAZARD(S) IDENTIFICATION

Classification of the substance or mixture

CHEMWATCH HAZARD RATINGS

		Min	Max
Flammability	2		
Toxicity	1		
Body Contact	3		
Reactivity	0		
Chronic	2		

0 = Minimum
1 = Low
2 = Moderate
3 = High
4 = Extreme

NFPA 704 diamond



Note: The hazard category numbers found in GHS classification in section 2 of this SDSs are NOT to be used to fill in the NFPA 704 diamond. Blue = Health Red = Fire Yellow = Reactivity White = Special (Oxidizer or water reactive substances)

Classification	Flammable Solid Category 2, Skin Corrosion/Irritation Category 1B, Serious Eye Damage Category 1, Specific target organ toxicity - repeated exposure Category 2

Label elements

Hazard pictogram(s)	
SIGNAL WORD	**DANGER**

Hazard statement(s)

H228	Flammable solid.

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H314	Causes severe skin burns and eye damage.
H373	May cause damage to organs through prolonged or repeated exposure.

Hazard(s) not otherwise classified

Not Applicable

Precautionary statement(s) Prevention

P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/intrinsically safe equipment.

Precautionary statement(s) 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.
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 CENTER or doctor/physician.
P370+P378	In case of fire: Use alcohol resistant foam or normal protein foam for extinction.
P363	Wash contaminated clothing before reuse.
P304+P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

Precautionary statement(s) Storage

P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
Not Available		hermetically sealed case with
12190-79-3	50	lithium cobaltate
7782-42-5	30	graphite
21324-40-3	5	lithium fluorophosphate
Listed below		electrolyte solvent contents listed below*
96-49-1	1	ethylene carbonate*
108-32-7	1	propylene carbonate*
105-58-8	1	diethyl carbonate*
105-37-3	1	ethyl propionate*
7440-50-8	15	copper
7429-90-5	10	aluminium
24937-79-9	0.99	vinylidene fluoride homopolymer
12597-69-2	100	steel
7440-02-0	1	nickel

SECTION 4 FIRST-AID MEASURES

Description of first aid measures

Eye Contact	▸ Generally not applicable. If this product comes in contact with the eyes: ▸ Wash out immediately with fresh running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Seek medical attention without delay; if pain persists or recurs seek medical attention. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

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Skin Contact	If skin contact occurs: ▸ Immediately remove all contaminated clothing, including footwear. ▸ Flush skin and hair with running water (and soap if available). ▸ Seek medical attention in event of irritation.
Inhalation	Remove patient to fresh air and seek medical attention.
Ingestion	▸ Not considered a normal route of entry. ▸ If swallowed do **NOT** induce vomiting. ▸ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▸ Observe the patient carefully. ▸ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ▸ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▸ Seek medical advice.

Most important symptoms and effects, both acute and delayed

See Section 11

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5 FIRE-FIGHTING MEASURES

Extinguishing media

- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Special protective equipment and precautions for fire-fighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves in the event of a fire. ▸ Prevent, by any means available, spillage from entering drains or water courses. ▸ Use fire fighting procedures suitable for surrounding area. ▸ **DO NOT** approach containers suspected to be hot. ▸ Cool fire exposed containers with water spray from a protected location. ▸ If safe to do so, remove containers from path of fire. ▸ Equipment should be thoroughly decontaminated after use.
Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered to be a significant fire risk. ▸ Heating may cause expansion or decomposition leading to violent rupture of containers. ▸ May emit acrid smoke. May emit corrosive and poisonous fumes.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	Clean up all spills immediately. Avoid contact with skin and eyes. Place in suitable containers for disposal.
Major Spills	▸ Clean up all spills immediately. ▸ Wear protective clothing, safety glasses, dust mask, gloves. ▸ Secure load if safe to do so. Bundle/collect recoverable product. ▸ Use dry clean up procedures and avoid generating dust. ▸ Vacuum up (consider explosion-proof machines designed to be grounded during storage and use). ▸ Water may be used to prevent dusting. ▸ Collect remaining material in containers with covers for disposal. ▸ Flush spill area with water.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	Use good occupational work practice. Observe manufacturer's storage and handling recommendations contained within this SDS. Avoid physical damage to containers. |Do not connect the positive terminal to the negative terminal with electrical wire or chain.|Avoid polarity reverse connection when installing the battery to an instrument.|Do not wet the battery with water, seawater or acid; or expose to strong oxidizer.|Do not damage or remove the external tube.|Keep the battery away from heat and fire.|Do not disassemble or reconstruct the battery; or solder the battery directly.|Do not give a mechanical shock or deform.|Do not use

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	unauthorized charger or other charging method. Terminate charging when the charging|process does not end within specified time.
Other information	▸ Keep dry. ▸ Store under cover. ▸ Protect containers against physical damage. ▸ Observe manufacturer's storage and handling recommendations contained within this SDS. Keep out of reach of children. Store out of direct sunlight ▸ Store away from incompatible materials.

Conditions for safe storage, including any incompatibilities

Suitable container	Store in original containers.
Storage incompatibility	▸ Avoid reaction with oxidising agents

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
US ACGIH Threshold Limit Values (TLV)	lithium cobaltate	Cobalt and inorganic compounds, as Co	0.02 mg/m3	Not Available	Not Available	TLV® Basis: Asthma; pulm tunc; myocardial eff; BEI
US NIOSH Recommended Exposure Limits (RELs)	graphite	Black lead, Mineral carbon, Plumbago, Silver graphite, Stove black [Note: Also see specific listing for Graphite (synthetic).]	2.5 (resp) mg/m3	Not Available	Not Available	Not Available
US OSHA Permissible Exposure Levels (PELs) - Table Z3	graphite	Graphite	15 mppcf	Not Available	Not Available	(Name ((Natural)))
US ACGIH Threshold Limit Values (TLV)	graphite	Graphite (all forms except graphite fibers)	2 mg/m3	Not Available	Not Available	TLV® Basis: Pneumoconiosis
US OSHA Permissible Exposure Levels (PELs) - Table Z1	graphite	Graphite, natural, respirable dust	Not Available	Not Available	Not Available	See Table Z-3
US NIOSH Recommended Exposure Limits (RELs)	copper	Copper metal dusts, Copper metal fumes	1 mg/m3	Not Available	Not Available	[*Note: The REL also applies to other copper compounds (as Cu) except Copper fume.]
US ACGIH Threshold Limit Values (TLV)	copper	Copper - Dusts and mists, as Cu	1 mg/m3	Not Available	Not Available	TLV® Basis: Irr; GI; metal fume fever; BEI
US ACGIH Threshold Limit Values (TLV)	copper	Copper - Fume, as Cu	0.2 mg/m3	Not Available	Not Available	TLV® Basis: Irr; GI; metal fume fever; BEI
US OSHA Permissible Exposure Levels (PELs) - Table Z1	copper	Copper: Dusts and mists (as Cu)	1 mg/m3	Not Available	Not Available	Not Available
US OSHA Permissible Exposure Levels (PELs) - Table Z1	copper	Copper: Fume (as Cu)	0.1 mg/m3	Not Available	Not Available	Not Available
US NIOSH Recommended Exposure Limits (RELs)	aluminium	Aluminium, Aluminum metal, Aluminum powder, Elemental aluminum	10 (total), 5 (resp) mg/m3	Not Available	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	aluminium	Aluminum metal and insoluble compounds	1 mg/m3	Not Available	Not Available	TLV® Basis: Pneumoconiosis; LRT irr; neurotoxicity
US OSHA Permissible Exposure Levels (PELs) - Table Z1	aluminium	Aluminum, metal (as Al): Total dust	15 mg/m3	Not Available	Not Available	Not Available
US OSHA Permissible Exposure Levels (PELs) - Table Z1	aluminium	Aluminum, metal (as Al): Respirable fraction	5 mg/m3	Not Available	Not Available	Not Available
US NIOSH Recommended Exposure Limits (RELs)	nickel	Nickel metal: Elemental nickel, Nickel catalyst	0.015 mg/m3	Not Available	Not Available	Ca See Appendix A [*Note: The REL does not apply to Nickel carbonyl.]
US ACGIH Threshold Limit Values (TLV)	nickel	Nickel and inorganic compounds including Nickel subsulfide, as Ni - Elemental	1.5 mg/m3	Not Available	Not Available	TLV® Basis: Dermatitis; pneumoconiosis
US OSHA Permissible Exposure Levels (PELs) - Table Z1	nickel	Nickel, metal and insoluble compounds (as Ni)	1 mg/m3	Not Available	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
graphite	Graphite; (Mineral carbon)	6 mg/m3	16 mg/m3	95 mg/m3
lithium fluorophosphate	Lithium hexafluorophosphate	7.5 mg/m3	83 mg/m3	500 mg/m3
ethylene carbonate	Glycol carbonate; (Ethylene carbonate)	30 mg/m3	330 mg/m3	2,000 mg/m3
propylene carbonate	Propylene carbonate, 1,2-	3.3 mg/m3	37 mg/m3	220 mg/m3
diethyl carbonate	Diethyl carbonate	12 ppm	140 ppm	810 ppm
ethyl propionate	Ethyl propionate	6.3 ppm	69 ppm	410 ppm
copper	Copper	3 mg/m3	33 mg/m3	200 mg/m3
nickel	Nickel	4.5 mg/m3	50 mg/m3	99 mg/m3

Ingredient	Original IDLH	Revised IDLH
lithium cobaltate	Not Available	Not Available

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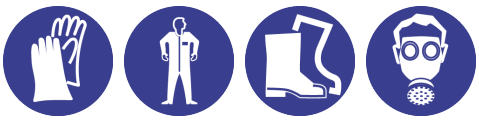
graphite	1,250 mg/m3	Not Available
lithium fluorophosphate	Not Available	Not Available
ethylene carbonate	Not Available	Not Available
propylene carbonate	Not Available	Not Available
diethyl carbonate	Not Available	Not Available
ethyl propionate	Not Available	Not Available
copper	100 mg/m3	Not Available
aluminium	Not Available	Not Available
vinylidene fluoride homopolymer	Not Available	Not Available
steel	Not Available	Not Available
nickel	Not Available	Not Available

MATERIAL DATA

Exposure controls

Appropriate engineering controls	General exhaust is adequate under normal operating conditions.
Personal protection	
Eye and face protection	None under normal operating conditions. **OTHERWISE:** ▸ Safety glasses.
Skin protection	See Hand protection below
Hands/feet protection	None under normal operating conditions. **OTHERWISE:** ▸ Rubber Gloves
Body protection	See Other protection below
Other protection	No special equipment needed when handling small quantities

Respiratory protection

Type A-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required.
Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	A-AUS P2	-	A-PAPR-AUS / Class 1 P2
up to 50 x ES	-	A-AUS / Class 1 P2	-
up to 100 x ES	-	A-2 P2	A-PAPR-2 P2 ^

^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory protection. These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Coloured solid article with no odour; insoluble in water.

Physical state	Manufactured	**Relative density (Water = 1)**	Not Applicable
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Applicable
pH (as supplied)	Not Applicable	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Applicable	**Viscosity (cSt)**	Not Applicable
Initial boiling point and boiling range (°C)	Not Applicable	**Molecular weight (g/mol)**	Not Applicable

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Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Applicable	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Applicable
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Applicable
Vapour pressure (kPa)	Not Applicable	**Gas group**	Not Available
Solubility in water	Immiscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	Not Applicable	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Unstable in the presence of incompatible materials. ▸ Product is considered stable. ▸ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Not normally a hazard due to physical form of product. |Vapors or fumes may cause respiratory tract irritation.
Ingestion	Considered an unlikely route of entry in commercial/industrial environments Ingestion may result in nausea, abdominal irritation, pain and vomiting
Skin Contact	Not normally a hazard due to physical form of product. |The electrolyte causes severe skin burns and irritation.
Eye	Not normally a hazard due to physical form of product. |The electrolyte causes eye irritation and damage.
Chronic	Not normally a hazard due to physical form of product. |The chemicals in this product are contained in a sealed case and exposure does not occur during normal handling and use.

Toro Flex Force Lithium Ion Battery (UN3480)	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
lithium cobaltate	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: >2000 mg/kg[1]	Not Available
	Oral (rat) LD50: >5000 mg/kg[1]	
graphite	**TOXICITY**	**IRRITATION**
	Inhalation (rat) LC50: >2 mg/l4 h[1]	Not Available
	Oral (rat) LD50: >2000 mg/kg[2]	
lithium fluorophosphate	**TOXICITY**	**IRRITATION**
	Oral (rat) LD50: 50-300 mg/kg[1]	Not Available
ethylene carbonate	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: >2000 mg/kg[1]	Eye (rabbit): 20 mg - mild
	Oral (rat) LD50: >2000 mg/kg[1]	Eye: adverse effect observed (irritating)[1]
		Skin (rabbit): 660 mg - moderate
		Skin: no adverse effect observed (not irritating)[1]
propylene carbonate	**TOXICITY**	**IRRITATION**
	Dermal (rabbit) LD50: >2000 mg/kg[2]	Eye (rabbit): 60 mg - moderate
	Oral (rat) LD50: >5000 mg/kg[2]	Eye: adverse effect observed (irritating)[1]
		Skin (human): 100 mg/3d-I moderate
		Skin (rabbit): 500 mg moderate
		Skin: no adverse effect observed (not irritating)[1]

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diethyl carbonate	**TOXICITY**	**IRRITATION**
	Not Available	Eye: no adverse effect observed (not irritating)[1]
		Skin: no adverse effect observed (not irritating)[1]
ethyl propionate	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: >2000 mg/kg[1]	Eye: adverse effect observed (irritating)[1]
	Oral (rat) LD50: >5000 mg/kg[1]	Skin (rabbit):500 mg/24h-moderate
		Skin: adverse effect observed (irritating)[1]
copper	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: >2000 mg/kg[1]	Eye: no adverse effect observed (not irritating)[1]
	Inhalation (rat) LC50: 0.733 mg/l4 h[1]	Skin: no adverse effect observed (not irritating)[1]
	Oral (rat) LD50: 300-500 mg/kg[1]	
aluminium	**TOXICITY**	**IRRITATION**
	Oral (rat) LD50: >2000 mg/kg[1]	Eye: no adverse effect observed (not irritating)[1]
		Skin: no adverse effect observed (not irritating)[1]
vinylidene fluoride homopolymer	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
steel	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
nickel	**TOXICITY**	**IRRITATION**
	Oral (rat) LD50: 5000 mg/kg[2]	Eye: no adverse effect observed (not irritating)[1]
		Skin: no adverse effect observed (not irritating)[1]

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

ETHYLENE CARBONATE

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.
for ethylene carbonate
Mammalian toxicity: Reliable acute toxicity tests are available on ethylene carbonate. Ethylene carbonate is practically nontoxic following acute oral exposure in a test that meets OECD and EPA test guidelines; the LD50 is >5000 mg/kg. The dermal LD50 is >2000 mg/kg, in a test that meets OECD and EPA test guidelines.
Ethylene carbonate is rapidly metabolized to ethylene glycol. Following gavage administration to rats, ethylene carbonate is rapidly converted into ethylene glycol; the half-life for disappearance of ethylene carbonate from blood was 0.25 hours. As a result, the mammalian toxicity of ethylene carbonate is nearly identical to that of ethylene glycol for endpoints where both have been tested
Ethylene carbonate was mixed in the diet of 26 male and 26 female Crl: CD(SD) rats for 18 months at concentrations of 25,000 ppm for males and females and 50,000 ppm for females; males were also fed 50,000 ppm for 42 weeks, and 40,000 ppm for 16 weeks. Survivors were observed to 24 months. Compound intake (mg/kg/day) was not reported, but is estimated to be approximately 250 and 500 mg/kg/day. No toxic effects were found in females, but increased mortality was seen in males at both dose levels. No high-dose males survived week 60 and only 10 low-dose males survived to week 78. Males had severe nephrotoxicity, characteristic of ethylene glycol toxicity.
The following *in vitro* genotoxicity tests were conducted on ethylene carbonate, without indications of genotoxicity: an Ames mutagenicity assay, an unscheduled DNA synthesis assay using rat hepatocytes, and a cell transformation assay using BALB/3T3 cells. No *in vivo* genotoxicity studies on ethylene carbonate were found; however, ethylene glycol has been tested and was negative in a rat dominant lethal assay.
Gavage administration of ethylene carbonate to pregnant rats days 6-15 of gestation resulted in systemic toxicity at doses of 3000 mg/kg/day, including post-dose salivation. The NOAEL for maternal toxicity was 1500 mg/kg/day. Similar to ethylene glycol, there were increased soft tissue (hydrocephalus, umbilical herniation, gastroschisis, cleft palate, misshapen and compressed stomach) and skeletal malformations at 3000 mg/kg/day, but not at 1500 mg/kg/day.
For ethylene glycol:
Ethylene glycol is quickly and extensively absorbed through the gastrointestinal tract. Limited information suggests that it is also absorbed through the respiratory tract; dermal absorption is apparently slow. Following absorption, ethylene glycol is distributed throughout the body according to total body water. In most mammalian species, including humans, ethylene glycol is initially metabolised by alcohol.
dehydrogenase to form glycolaldehyde, which is rapidly converted to glycolic acid and glyoxal by aldehyde oxidase and aldehyde dehydrogenase. These metabolites are oxidised to glyoxylate; glyoxylate may be further metabolised to formic acid, oxalic acid, and glycine. Breakdown of both glycine and formic acid can generate CO2, which is one of the major elimination products of ethylene glycol. In addition to exhaled CO2, ethylene glycol is eliminated in the urine as both the parent compound and glycolic acid. Elimination of ethylene glycol from the plasma in both humans and laboratory animals is rapid after oral exposure; elimination half-lives are in the range of 1-4 hours in most species tested.
Respiratory Effects. Respiratory system involvement occurs 12-24 hours after ingestion of sufficient amounts of ethylene glycol and is considered to be part of a second stage in ethylene glycol poisoning The symptoms include hyperventilation, shallow rapid breathing, and generalized pulmonary edema with calcium oxalate crystals occasionally present in the lung parenchyma. Respiratory system involvement appears to be dose-dependent and occurs concomitantly with cardiovascular changes. Pulmonary infiltrates and other changes compatible with adult respiratory distress syndrome (ARDS) may characterise the second stage of ethylene glycol poisoning Pulmonary oedema can be secondary to cardiac failure, ARDS, or aspiration of gastric contents. Symptoms related to acidosis such as hyperpnea and tachypnea are frequently observed; however, major respiratory morbidities such as pulmonary edema and bronchopneumonia are relatively rare and usually only observed with extreme poisoning (e.g., in only 5 of 36 severely poisoned

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	cases). **Cardiovascular Effects.** Cardiovascular system involvement in humans occurs at the same time as respiratory system involvement, during the second phase of oral ethylene glycol poisoning, which is 12- 24 hours after acute exposure. The symptoms of cardiac involvement include tachycardia, ventricular gallop and cardiac enlargement. Ingestion of ethylene glycol may also cause hypertension or hypotension, which may progress to cardiogenic shock. Myocarditis has been observed at autopsy in cases of people who died following acute ingestion of ethylene glycol. As in the case of respiratory effects, cardiovascular involvement occurs with ingestion of relatively high doses of ethylene glycol. Nevertheless, circulatory disturbances are a rare occurrence, having been reported in only 8 of 36 severely poisoned cases.Therefore, it appears that acute exposure to high levels of ethylene glycol can cause serious cardiovascular effects in humans. The effects of a long-term, low-dose exposure are unknown. **Gastrointestinal Effects.** Nausea, vomiting with or without blood, pyrosis, and abdominal cramping and pain are common early effects of acute ethylene glycol ingestion. Acute effects of ethylene glycol ingestion in one patient included intermittent diarrhea and abdominal pain, which were attributed to mild colonic ischaemia; severe abdominal pain secondary to colonic stricture and perforation developed 3 months after ingestion, and histology of the resected colon showed birefringent crystals highly suggestive of oxalate deposition. **Musculoskeletal Effects.** Reported musculoskeletal effects in cases of acute ethylene glycol poisoning have included diffuse muscle tenderness and myalgias associated with elevated serum creatinine phosphokinase levels, and myoclonic jerks and tetanic contractions associated with hypocalcaemia. **Hepatic Effects.** Central hydropic or fatty degeneration, parenchymal necrosis, and calcium oxalate crystals in the liver have been observed at autopsy in cases of people who died following acute ingestion of ethylene glycol. **Renal Effects.** Adverse renal effects after ethylene glycol ingestion in humans can be observed during the third stage of ethylene glycol toxicity 24-72 hours after acute exposure. The hallmark of renal toxicity is the presence of birefringent calcium oxalate monohydrate crystals deposited in renal tubules and their presence in urine after ingestion of relatively high amounts of ethylene glycol. Other signs of nephrotoxicity can include tubular cell degeneration and necrosis and tubular interstitial inflammation. If untreated, the degree of renal damage caused by high doses of ethylene glycol progresses and leads to haematuria, proteinuria, decreased renal function, oliguria, anuria , and ultimately renal failure. These changes in the kidney are linked to acute tubular necrosis but normal or near normal renal function can return with adequate supportive therapy. **Metabolic Effects.** One of the major adverse effects following acute oral exposure of humans to ethylene glycol involves metabolic changes. These changes occur as early as 12 hours after ethylene glycol exposure. Ethylene glycol intoxication is accompanied by metabolic acidosis which is manifested by decreased pH and bicarbonate content of serum and other bodily fluids caused by accumulation of excess glycolic acid. Other characteristic metabolic effects of ethylene glycol poisoning are increased serum anion gap, increased osmolal gap, and hypocalcaemia. Serum anion gap is calculated from concentrations of sodium, chloride, and bicarbonate, is normally 12-16 mM, and is typically elevated after ethylene glycol ingestion due to increases in unmeasured metabolite anions (mainly glycolate). **Neurological Effects:** Adverse neurological reactions are among the first symptoms to appear in humans after ethylene glycol ingestion. These early neurotoxic effects are also the only symptoms attributed to unmetabolised ethylene glycol. Together with metabolic changes, they occur during the period of 30 minutes to 12 hours after exposure and are considered to be part of the first stage in ethylene glycol intoxication. In cases of acute intoxication, in which a large amount of ethylene glycol is ingested over a very short time period, there is a progression of neurological manifestations which, if not treated, may lead to generalized seizures and coma. Ataxia, slurred speech, confusion, and somnolence are common during the initial phase of ethylene glycol intoxication as are irritation, restlessness, and disorientation. Cerebral edema and crystalline deposits of calcium oxalate in the walls of small blood vessels in the brain were found at autopsy in people who died after acute ethylene glycol ingestion. Effects on cranial nerves appear late (generally 5-20 days post-ingestion), are relatively rare, and according to some investigators constitute a fourth, late cerebral phase in ethylene glycol intoxication. Clinical manifestations of the cranial neuropathy commonly involve lower motor neurons of the facial and bulbar nerves and are reversible over many months. **Reproductive Effects:** Reproductive function after intermediate-duration oral exposure to ethylene glycol has been tested in three multi-generation studies (one in rats and two in mice) and several shorter studies (15-20 days in rats and mice). In these studies, effects on fertility, foetal viability, and male reproductive organs were observed in mice, while the only effect in rats was an increase in gestational duration. **Developmental Effects:** The developmental toxicity of ethylene glycol has been assessed in several acute-duration studies using mice, rats, and rabbits. Available studies indicate that malformations, especially skeletal malformations occur in both mice and rats exposed during gestation; mice are apparently more sensitive to the developmental effects of ethylene glycol. Other evidence of embyrotoxicity in laboratory animals exposed to ethylene glycol exposure includes reduction in foetal body weight. **Cancer:** No studies were located regarding cancer effects in humans or animals after dermal exposure to ethylene glycol. **Genotoxic Effects**: Studies in humans have not addressed the genotoxic effects of ethylene glycol. However, available *in vivo* and *in vitro* laboratory studies provide consistently negative genotoxicity results for ethylene glycol.
PROPYLENE CARBONATE	for propylene carbonate: Numerous adequate and reliable acute toxicity tests are available on propylene carbonate. Oral and dermal tests meet OECD and EPA test guidelines. Propylene carbonate is practically nontoxic following acute exposures; the oral LD50 is >.5000 mg/kg and the dermal LD50 is >3000 mg/kg. No further testing is recommended. Subchronic studies (13- 14 weeks) of propylene carbonate by inhalation (aerosol) and oral (gavage) routes were conducted in rats according to current guidelines. The oral study indicated low systemic toxicity from propylene carbonate (NOAEL = 5000 mg/kg/day). In the inhalation study, no systemic toxicity was seen at concentrations up to 1000 mg/m"; however, there was periocular irritation and swelling in a few males at 500 and 1000 mg/m3. A dermal carcinogenicity study in mice did not indicate tumorigenic potential or systemic toxicity from 2 years of exposure to propylene carbonate. No further testing is recommended. There is a negative Ames in vitro mutagenicity assay of propylene carbonate. A single intraperitoneal injection of 1666 mg/kg propylene carbonate did not induce an increase in micronuclei when examined after 30,48 and 72 hours. The mutagenicity battery is satisfactorily filled; no further mutagenicity testing is recommended. Gavage administration of propylene carbonate to pregnant rats days 6-15 of gestation resulted in systemic toxicity at doses of 3000 and 5000 mg/kg/day, including mortality (not seen in 13 week study of non-pregnant rats). The NOAEL for maternal toxicity was 1000 mg/kg/day. This indicates that pregnant rats are more susceptible to propylene carbonate than are non-pregnant rats. There were no significant differences in live litter size, average fetal weight, percentage of males, or malformed fetuses. No studies of the effect of propylene carbonate on reproduction are available. However, no adverse effects on testis, ovaries, or accessory sex organs were noted in rats following oral or inhalation of propylene carbonate for 13 weeks. Therefore, reproductive effects from propylene carbonate are unlikely
DIETHYL CARBONATE	Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis). Equivocal tumorigen by RTECS criteria
COPPER	for copper and its compounds (typically copper chloride): **Acute toxicity:** There are no reliable acute oral toxicity results available. In an acute dermal toxicity study (OECD TG 402), one group of 5 male rats and 5 groups of 5 female rats received doses of 1000, 1500 and 2000 mg/kg bw via dermal application for 24 hours. The LD50 values of copper monochloride were 2,000 mg/kg bw or greater for male (no deaths observed) and 1,224 mg/kg bw for female. Four females died at both 1500 and 2000 mg/kg bw, and one at 1,000 mg/kg bw. Symptom of the hardness of skin, an exudation of hardness site, the formation of scar and reddish changes were observed on application sites in all treated animals. Skin inflammation and injury were also noted. In addition, a reddish or black urine was observed in females at 2,000, 1,500 and 1,000 mg/kg bw. Female rats appeared to be more sensitive than male based on mortality and clinical signs. No reliable skin/eye irritation studies were available. The acute dermal study with copper monochloride suggests that it has a potential to cause skin irritation. **Repeat dose toxicity:** In repeated dose toxicity study performed according to OECD TG 422, copper monochloride was given orally (gavage) to Sprague-Dawley rats for 30 days to males and for 39 - 51 days to females at concentrations of 0, 1.3, 5.0, 20, and 80 mg/kg bw/day. The NOAEL value was 5 and 1.3 mg/kg bw/day for male and female rats, respectively. No deaths were observed in male rats. One treatment-related death was observed in female rats in the high dose group. Erythropoietic toxicity (anaemia) was seen in both sexes at the 80 mg/kg bw/day. The frequency of squamous cell hyperplasia of the forestomach was increased in a dose-dependent manner in male and female rats at all treatment groups, and was statistically significant in males at doses of =20 mg/kg bw/day and in females at doses of =5 mg/kg bw/day doses. The observed effects are considered to be local, non-systemic effect on the forestomach which result from oral (gavage) administration of copper monochloride. **Genotoxicity:** An in vitro genotoxicity study with copper monochloride showed negative results in a bacterial reverse mutation test with Salmonella typhimurium strains (TA 98, TA 100, TA 1535, and TA 1537) with and without S9 mix at concentrations of up to 1,000 ug/plate. An in vitro test for

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	chromosome aberration in Chinese hamster lung (CHL) cells showed that copper monochloride induced structural and numerical aberrations at the concentration of 50, 70 and 100 ug/mL without S9 mix. In the presence of the metabolic activation system, significant increases of structural aberrations were observed at 50 and 70 ug/mL and significant increases of numerical aberrations were observed at 70 ug/mL. In an in vivo mammalian erythrocyte micronucleus assay, all animals dosed (15 - 60 mg/kg bw) with copper monochloride exhibited similar PCE/(PCE+NCE) ratios and MNPCE frequencies compared to those of the negative control animals. Therefore copper monochloride is not an in vivo mutagen. **Carcinogenicity:** there was insufficient information to evaluate the carcinogenic activity of copper monochloride. Reproductive and developmental toxicity: In the combined repeated dose toxicity study with the reproduction/developmental toxicity screening test (OECD TG 422), copper monochloride was given orally (gavage) to Sprague-Dawley rats for 30 days to males and for 39-51 days to females at concentrations of 0, 1.3, 5.0, 20, and 80 mg/kg bw/day. The NOAEL of copper monochloride for fertility toxicity was 80 mg/kg bw/day for the parental animals. No treatment-related effects were observed on the reproductive organs and the fertility parameters assessed. For developmental toxicity the NOAEL was 20 mg/kg bw/day. Three of 120 pups appeared to have icterus at birth; 4 of 120 pups appeared runted at the highest dose tested (80 mg/kg bw/day). WARNING: Inhalation of high concentrations of copper fume may cause "metal fume fever", an acute industrial disease of short duration. Symptoms are tiredness, influenza like respiratory tract irritation with fever.
NICKEL	The following information refers to contact allergens as a group and may not be specific to this product. Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Other allergic skin reactions, e.g. contact urticaria, involve antibody-mediated immune reactions. The significance of the contact allergen is not simply determined by its sensitisation potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitising substance which is widely distributed can be a more important allergen than one with stronger sensitising potential with which few individuals come into contact. From a clinical point of view, substances are noteworthy if they produce an allergic test reaction in more than 1% of the persons tested. **WARNING:** This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans. Tenth Annual Report on Carcinogens: Substance anticipated to be Carcinogen [*National Toxicology Program: U.S. Dep. of Health & Human Services 2002*] Oral (rat) TDLo: 500 mg/kg/5D-I Inhalation (rat) TCLo: 0.1 mg/m3/24H/17W-C
LITHIUM COBALTATE & GRAPHITE & LITHIUM FLUOROPHOSPHATE & ALUMINIUM & VINYLIDENE FLUORIDE HOMOPOLYMER	No significant acute toxicological data identified in literature search.
GRAPHITE & LITHIUM FLUOROPHOSPHATE & ETHYLENE CARBONATE & DIETHYL CARBONATE & ETHYL PROPIONATE	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.
PROPYLENE CARBONATE & ETHYL PROPIONATE	The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling the epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.

Acute Toxicity	✗	**Carcinogenicity**	✗
Skin Irritation/Corrosion	✓	**Reproductivity**	✗
Serious Eye Damage/Irritation	✓	**STOT - Single Exposure**	✗
Respiratory or Skin sensitisation	✗	**STOT - Repeated Exposure**	✓
Mutagenicity	✗	**Aspiration Hazard**	✗

Legend: ✗ *– Data either not available or does not fill the criteria for classification*
✓ *– Data available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

Toro Flex Force Lithium Ion Battery (UN3480)

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

lithium cobaltate

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	0.001-0.406mg/L	2
EC50	48	Crustacea	0.002-0.618mg/L	2
EC50	96	Algae or other aquatic plants	0.071-0.314mg/L	2
NOEC	96	Crustacea	0.001-0.2819mg/L	2

graphite

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	>100mg/L	2
EC50	48	Crustacea	>100mg/L	2
EC50	72	Algae or other aquatic plants	>100mg/L	2
NOEC	72	Algae or other aquatic plants	>=100mg/L	2

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lithium fluorophosphate

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	42mg/L	2
EC50	48	Crustacea	98mg/L	2
EC50	96	Algae or other aquatic plants	43mg/L	2
NOEC	528	Fish	0.2mg/L	2

ethylene carbonate

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	>100mg/L	2
EC50	48	Crustacea	>100mg/L	2
EC50	96	Algae or other aquatic plants	17.388mg/L	3
NOEC	72	Algae or other aquatic plants	100mg/L	2

propylene carbonate

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	>1-mg/L	2
EC50	48	Crustacea	>1-mg/L	2
EC50	96	Algae or other aquatic plants	12.203mg/L	3
EC0	24	Crustacea	=500mg/L	1
NOEC	96	Fish	1-mg/L	2

diethyl carbonate

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	46.738mg/L	3
EC50	48	Crustacea	>74.16mg/L	2
EC50	96	Algae or other aquatic plants	3.616mg/L	3
NOEC	96	Fish	1-mg/L	2

ethyl propionate

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	4.77mg/L	2
EC50	48	Crustacea	25.5mg/L	2
EC50	96	Algae or other aquatic plants	2.644mg/L	3
NOEC	504	Crustacea	1.3mg/L	4

copper

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	0.001-0.09mg/L	2
EC50	48	Crustacea	0.001mg/L	2
EC50	72	Algae or other aquatic plants	0.013335mg/L	4
BCF	960	Fish	200mg/L	4
EC25	6	Algae or other aquatic plants	0.00150495mg/L	4
NOEC	96	Crustacea	0.0008mg/L	4

aluminium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	0.001-0.134mg/L	2
EC50	48	Crustacea	0.7364mg/L	2
EC50	72	Algae or other aquatic plants	0.001-0.799mg/L	2
BCF	360	Algae or other aquatic plants	9mg/L	4
NOEC	168	Crustacea	0.001-mg/L	2

vinylidene fluoride homopolymer

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	39.014mg/L	3
EC50	96	Algae or other aquatic plants	149.630mg/L	3

steel

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Available	Not Available	Not Available	Not Available	Not Available

nickel

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	0.0000475mg/L	4
EC50	48	Crustacea	0.001-0.576mg/L	2
EC50	72	Algae or other aquatic plants	0.00094mg/L	2
BCF	1440	Algae or other aquatic plants	0.47mg/L	4
NOEC	240	Crustacea	>0.001-0.715mg/L	2

Legend: *Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12*

Continued...

	(QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data

DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
ethylene carbonate	HIGH	HIGH
propylene carbonate	HIGH	HIGH
diethyl carbonate	HIGH	HIGH
ethyl propionate	LOW	LOW
vinylidene fluoride homopolymer	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
ethylene carbonate	LOW (LogKOW = -0.3388)
propylene carbonate	LOW (LogKOW = -0.41)
diethyl carbonate	LOW (LogKOW = 1.21)
ethyl propionate	LOW (LogKOW = 1.21)
vinylidene fluoride homopolymer	LOW (LogKOW = 1.24)

Mobility in soil

Ingredient	Mobility
ethylene carbonate	LOW (KOC = 9.168)
propylene carbonate	LOW (KOC = 14.85)
diethyl carbonate	LOW (KOC = 28.08)
ethyl propionate	LOW (KOC = 11.85)
vinylidene fluoride homopolymer	LOW (KOC = 35.04)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	▸ Recycle wherever possible or consult manufacturer for recycling options. ▸ Consult State Land Waste Management Authority for disposal. ▸ Bury residue in an authorised landfill. ▸ Recycle containers if possible, or dispose of in an authorised landfill.

SECTION 14 TRANSPORT INFORMATION

Labels Required

	
Marine Pollutant	NO Not Applicable

Land transport (DOT)

UN number	3480
UN proper shipping name	Lithium ion batteries including lithium ion polymer batteries
Transport hazard class(es)	Class: 9 Subrisk: Not Applicable
Packing group	Not Applicable
Environmental hazard	Not Applicable
Special precautions for user	Hazard Label: 9 Special provisions: A51, A54

Air transport (ICAO-IATA / DGR)

UN number	3480
UN proper shipping name	Lithium ion batteries (including lithium ion polymer batteries)

Continued...

Transport hazard class(es)	ICAO/IATA Class	9
	ICAO / IATA Subrisk	Not Applicable
	ERG Code	9F
Packing group	Not Applicable	
Environmental hazard	Not Applicable	
Special precautions for user	Special provisions	A88 A99 A154 A164 A183 A201 A206 A331
	Cargo Only Packing Instructions	See 965
	Cargo Only Maximum Qty / Pack	See 965
	Passenger and Cargo Packing Instructions	Forbidden
	Passenger and Cargo Maximum Qty / Pack	Forbidden
	Passenger and Cargo Limited Quantity Packing Instructions	Forbidden
	Passenger and Cargo Limited Maximum Qty / Pack	Forbidden

Sea transport (IMDG-Code / GGVSee)

UN number	3480	
UN proper shipping name	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	
Transport hazard class(es)	IMDG Class	9
	IMDG Subrisk	Not Applicable
Packing group	Not Applicable	
Environmental hazard	Not Applicable	
Special precautions for user	EMS Number	F-A , S-I
	Special provisions	188 230 310 348 376 377 384
	Limited Quantities	0

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

LITHIUM COBALTATE(12190-79-3) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs
US - Idaho Toxic Air Pollutants Non- Carcinogenic Increments - Occupational Exposure Limits
US - Washington Permissible exposure limits of air contaminants
US ACGIH Threshold Limit Values (TLV)
US ACGIH Threshold Limit Values (TLV) - Carcinogens
US ACGIH Threshold Limit Values (TLV) - Notice of Intended Changes
US Clean Air Act - Hazardous Air Pollutants
US EPCRA Section 313 Chemical List
US National Toxicology Program (NTP) 14th Report Part B. Reasonably Anticipated to be a Human Carcinogen
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

GRAPHITE(7782-42-5) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US - Alaska Limits for Air Contaminants
US - California Permissible Exposure Limits for Chemical Contaminants
US - Hawaii Air Contaminant Limits
US - Idaho - Limits for Air Contaminants
US - Massachusetts - Right To Know Listed Chemicals
US - Michigan Exposure Limits for Air Contaminants
US - Minnesota Permissible Exposure Limits (PELs)
US - Oregon Permissible Exposure Limits (Z-1)
US - Oregon Permissible Exposure Limits (Z-3)
US - Pennsylvania - Hazardous Substance List
US - Rhode Island Hazardous Substance List
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US - Wyoming Toxic and Hazardous Substances Table Z-3 Mineral Dusts
US ACGIH Threshold Limit Values (Spanish)
US ACGIH Threshold Limit Values (TLV)
US DOE Temporary Emergency Exposure Limits (TEELs)
US NIOSH Recommended Exposure Limits (RELs)
US NIOSH Recommended Exposure Limits (RELs) (Spanish)
US OSHA Permissible Exposure Levels (PELs) - Table Z1
US OSHA Permissible Exposure Levels (PELs) - Table Z3
US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)
US OSHA Permissible Exposure Limits - Annotated Table Z-3 (Spanish)
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

LITHIUM FLUOROPHOSPHATE(21324-40-3) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations
International Maritime Dangerous Goods Requirements (IMDG Code)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (English)
US Department of Transportation (DOT), Hazardous Material Table
US DOE Temporary Emergency Exposure Limits (TEELs)
US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

ETHYLENE CARBONATE(96-49-1) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Continued...

GESAMP/EHS Composite List - GESAMP Hazard Profiles
IMO IBC Code Chapter 17: Summary of minimum requirements
IMO IBC Code Chapter 18: List of products to which the Code does not apply
IMO MARPOL 73/78 (Annex II) - List of Other Liquid Substances
US - Massachusetts - Right To Know Listed Chemicals
US - Pennsylvania - Hazardous Substance List
US DOE Temporary Emergency Exposure Limits (TEELs)
US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

PROPYLENE CARBONATE(108-32-7) IS FOUND ON THE FOLLOWING REGULATORY LISTS

GESAMP/EHS Composite List - GESAMP Hazard Profiles
IMO IBC Code Chapter 17: Summary of minimum requirements
IMO IBC Code Chapter 18: List of products to which the Code does not apply
US DOE Temporary Emergency Exposure Limits (TEELs)
US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

DIETHYL CARBONATE(105-58-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

GESAMP/EHS Composite List - GESAMP Hazard Profiles
IMO IBC Code Chapter 17: Summary of minimum requirements
International Air Transport Association (IATA) Dangerous Goods Regulations
International Maritime Dangerous Goods Requirements (IMDG Code)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (English)
US - Massachusetts - Right To Know Listed Chemicals
US - Pennsylvania - Hazardous Substance List
US Department of Transportation (DOT), Hazardous Material Table
US DOE Temporary Emergency Exposure Limits (TEELs)
US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

ETHYL PROPIONATE(105-37-3) IS FOUND ON THE FOLLOWING REGULATORY LISTS

GESAMP/EHS Composite List - GESAMP Hazard Profiles
IMO IBC Code Chapter 17: Summary of minimum requirements
IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk
International Air Transport Association (IATA) Dangerous Goods Regulations
International Maritime Dangerous Goods Requirements (IMDG Code)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (English)
US - Massachusetts - Right To Know Listed Chemicals
US - Pennsylvania - Hazardous Substance List
US Department of Transportation (DOT), Hazardous Material Table
US DOE Temporary Emergency Exposure Limits (TEELs)
US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes
US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

COPPER(7440-50-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US - Alaska Limits for Air Contaminants
US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELs)
US - California Permissible Exposure Limits for Chemical Contaminants
US - Hawaii Air Contaminant Limits
US - Idaho - Limits for Air Contaminants
US - Idaho Toxic Air Pollutants Non- Carcinogenic Increments - Occupational Exposure Limits
US - Massachusetts - Right To Know Listed Chemicals
US - Michigan Exposure Limits for Air Contaminants
US - Minnesota Permissible Exposure Limits (PELs)
US - Oregon Permissible Exposure Limits (Z-1)
US - Pennsylvania - Hazardous Substance List
US - Rhode Island Hazardous Substance List
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US ACGIH Threshold Limit Values (Spanish)
US ACGIH Threshold Limit Values (TLV)
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)
US CWA (Clean Water Act) - Priority Pollutants
US CWA (Clean Water Act) - Toxic Pollutants
US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides
US Department of Transportation (DOT) Marine Pollutants - Appendix B
US DOE Temporary Emergency Exposure Limits (TEELs)
US EPA Carcinogens Listing
US EPCRA Section 313 Chemical List
US NIOSH Recommended Exposure Limits (RELs)
US NIOSH Recommended Exposure Limits (RELs) (Spanish)
US OSHA Permissible Exposure Levels (PELs) - Table Z1
US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

ALUMINIUM(7429-90-5) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations
International Maritime Dangerous Goods Requirements (IMDG Code)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (English)
US - Alaska Limits for Air Contaminants
US - California Permissible Exposure Limits for Chemical Contaminants
US - Hawaii Air Contaminant Limits
US - Idaho Toxic Air Pollutants Non- Carcinogenic Increments - Occupational Exposure Limits
US - Massachusetts - Right To Know Listed Chemicals
US - Michigan Exposure Limits for Air Contaminants
US - Minnesota Permissible Exposure Limits (PELs)
US - Oregon Permissible Exposure Limits (Z-1)
US - Pennsylvania - Hazardous Substance List
US - Rhode Island Hazardous Substance List
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US ACGIH Threshold Limit Values (Spanish)
US ACGIH Threshold Limit Values (TLV)
US ACGIH Threshold Limit Values (TLV) - Carcinogens
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)
US Department of Homeland Security (DHS) - Chemical Facility Anti-Terrorism Standards (CFATS) - Chemicals of Interest
US Department of Transportation (DOT), Hazardous Material Table
US Department of Transportation (DOT), Hazardous Material Table : Goods Forbidden for Transport
US EPCRA Section 313 Chemical List
US NIOSH Recommended Exposure Limits (RELs)
US NIOSH Recommended Exposure Limits (RELs) (Spanish)
US OSHA Permissible Exposure Levels (PELs) - Table Z1
US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)
US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide
US Postal Service (USPS) Numerical Listing of Proper Shipping Names by Identification (ID) Number
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

VINYLIDENE FLUORIDE HOMOPOLYMER(24937-79-9) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Continued...

US List of Active Substances Exempt from the TSCA Inventory Notifications (Active-Inactive) Rule

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

STEEL(12597-69-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Not Applicable

NICKEL(7440-02-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs
US - Alaska Limits for Air Contaminants
US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELs)
US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)
US - California Office of Environmental Health Hazard Assessment Proposition 65 No Significant Risk Levels (NSRLs) for Carcinogens and Maximum Allowable Dose Levels (MADLs) for Chemicals Causing Reproductive Toxicity
US - California Permissible Exposure Limits for Chemical Contaminants
US - California Proposition 65 - Carcinogens
US - Hawaii Air Contaminant Limits
US - Idaho - Limits for Air Contaminants
US - Massachusetts - Right To Know Listed Chemicals
US - Michigan Exposure Limits for Air Contaminants
US - Minnesota Permissible Exposure Limits (PELs)
US - New Jersey Right to Know - Special Health Hazard Substance List (SHHSL): Carcinogens
US - Oregon Permissible Exposure Limits (Z-1)
US - Pennsylvania - Hazardous Substance List
US - Rhode Island Hazardous Substance List
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US ACGIH Threshold Limit Values (Spanish)
US ACGIH Threshold Limit Values (TLV)
US ACGIH Threshold Limit Values (TLV) - Carcinogens
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)
US Clean Air Act - Hazardous Air Pollutants
US CWA (Clean Water Act) - Priority Pollutants
US CWA (Clean Water Act) - Toxic Pollutants
US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides
US DOE Temporary Emergency Exposure Limits (TEELs)
US EPCRA Section 313 Chemical List
US National Toxicology Program (NTP) 14th Report Part B. Reasonably Anticipated to be a Human Carcinogen
US NIOSH Recommended Exposure Limits (RELs)
US NIOSH Recommended Exposure Limits (RELs) (Spanish)
US OSHA Permissible Exposure Levels (PELs) - Table Z1
US OSHA Permissible Exposure Limits - Annotated Table Z-1 (Spanish)
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US TSCA Chemical Substance Inventory - Interim List of Active Substances

Federal Regulations

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SECTION 311/312 HAZARD CATEGORIES

Flammable (Gases, Aerosols, Liquids, or Solids)	Yes
Gas under pressure	No
Explosive	No
Self-heating	No
Pyrophoric (Liquid or Solid)	No
Pyrophoric Gas	No
Corrosive to metal	No
Oxidizer (Liquid, Solid or Gas)	No
Organic Peroxide	No
Self-reactive	No
In contact with water emits flammable gas	No
Combustible Dust	No
Carcinogenicity	No
Acute toxicity (any route of exposure)	No
Reproductive toxicity	No
Skin Corrosion or Irritation	Yes
Respiratory or Skin Sensitization	No
Serious eye damage or eye irritation	Yes
Specific target organ toxicity (single or repeated exposure)	Yes
Aspiration Hazard	No
Germ cell mutagenicity	No
Simple Asphyxiant	No
Hazards Not Otherwise Classified	No

US. EPA CERCLA HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES (40 CFR 302.4)

Name	Reportable Quantity in Pounds (lb)	Reportable Quantity in kg
Copper	5000	2270
Nickel	100	45.4

State Regulations

US. CALIFORNIA PROPOSITION 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm

Continued...

US - CALIFORNIA PROPOSITION 65 - CARCINOGENS: LISTED SUBSTANCE

Nickel (Metallic) Listed

National Inventory Status

National Inventory	Status
Australia - AICS	No (steel; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Canada - DSL	No (steel; lithium fluorophosphate; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Canada - NDSL	No (diethyl carbonate; vinylidene fluoride homopolymer; graphite; copper; ethyl propionate; ethylene carbonate; aluminium; nickel; lithium cobaltate; propylene carbonate; steel; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
China - IECSC	No (steel; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Europe - EINEC / ELINCS / NLP	No (vinylidene fluoride homopolymer; steel; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Japan - ENCS	No (graphite; copper; aluminium; nickel; steel; lithium fluorophosphate; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Korea - KECI	No (steel; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
New Zealand - NZIoC	No (steel; lithium fluorophosphate; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Philippines - PICCS	No (lithium cobaltate; steel; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
USA - TSCA	No (steel; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Taiwan - TCSI	No (electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Mexico - INSQ	No (vinylidene fluoride homopolymer; ethylene carbonate; lithium cobaltate; steel; lithium fluorophosphate; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Vietnam - NCI	No (lithium cobaltate; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Russia - ARIPS	No (lithium cobaltate; steel; lithium fluorophosphate; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Thailand - TECI	No (vinylidene fluoride homopolymer; copper; aluminium; lithium cobaltate; steel; electrolyte solvent contains; inert components, proprietary) Non-disclosed ingredients
Legend:	*Yes = All declared ingredients are on the inventory* *No = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Revision Date	05/13/2021
Initial Date	07/05/2019

SDS Version Summary

Version	Issue Date	Sections Updated
2.1.1.2	05/13/2021	Appearance

Other information

Ingredients with multiple cas numbers

Name	CAS No
propylene carbonate	108-32-7, 51260-39-0, 16606-55-6
copper	7440-50-8, 133353-46-5, 133353-47-6, 195161-80-9, 65555-90-0, 72514-83-1
aluminium	7429-90-5, 91728-14-2

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

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end of SDS