Material Safety Data Sheet (MSDS)

This material safety data sheet refers to the batteries encapsulated in the Trusted trackers 9- and 10-series as pictured below.

Date issued: February 2018

Product picture and name (includes 1 battery)

T9 **TG9** **T9LTE** **S1**

Product picture and name (includes 2 batteries)

T9+ **TG9+** **TG10** **T10LTE**

Trusted A/S declares that these products contain LSH 20 batteries as documented on the following pages.

Table of contents:

- Battery Information Sheet, Saft
- Primary Lithium Battery, LSH 20, Saft
- UN 38.3 Test Summary Report, Saft

Version 1.1

Battery Information Sheet

Primary Li-SOCl$_2$ single cells and multi-cell battery packs

According to REACH regulation (EC 1907/2006, Art 31) and to OSHA regulation (29 CFR 1910.1200), batteries are **ARTICLES** with no intended release. As such, they are not covered by legal requirements to generate and supply an SDS or an MSDS.

This Battery Information Sheet is provided solely as information document for the purpose of assisting our customers.

1. IDENTIFICATION

1.1 Product

Lithium-thionyl dichloride primary unit cells and multi-cell battery systems composed of these cells

1.2 Supplier

Headquarters Address Phone/Fax	**Saft S.A.S.** 26 quai Charles Pasqua, 92300 LEVALLOIS-PERRET – France Phone / Fax : +33 1 58 63 16 00/+33 1 58 63 16 18
Factory Address Phone/Fax	**Saft Poitiers** Rue Georges Leclanché, BP 1039, 86060 POITIERS Cedex 9 – France +33 (0)5 49 55 48 48 /+33 (0)5 49 55 48 50
Factory Address Phone/Fax	**Saft Ltd.** River Drive, Tyne & Wear, SOUTH SHIELDS, NE33 2TR – United Kingdom +1 44 191 456 1451/+1 44 191 456 6383
Factory Address Phone/Fax	**Saft America Inc.** 313 Crescent Street, VALDESE, NC 28690 – USA +1 828 874 4111/+1 828 874 2431
Factory Address Phone/Fax	**Saft Batteries Co., Ltd.** Zhuhai Free Trade Zone, Lianfeng Road, ZHUHAI 519030, Guangdong Province – China +86 756 881 9318/+86 756 881 9328
Factory Address Phone/Fax	**Tadiran Batteries Ltd.** 34 Y. Rabin Avenue – KIRYAT EKRON 76950 - Israel +972 894 44374/+972 894 13066
Factory Address Phone/Fax	**Tadiran Batteries GmbH** Industriestrasse 22, D-63654 BÜDINGEN – Germany +49 (0)6 042 954 599/+49 (0)6 042 954 190

1.3 Emergency contact

For chemical emergency ONLY (in case of spill, leak, fire, exposure or accident) call CHEMTREC at:
International: +1-703-527-3887 for English
Within the USA: +1-800-424-9300

2. HAZARD IDENTIFICATION

The Li-$SOCl_2$ batteries described in this Battery Information Sheet are sealed units which are not hazardous under normal operating conditions in accordance with manufacturer's recommendations, as stated in the user's manual or other similar documentation. Under normal use, the battery integrity is maintained and the active components it contains are isolated from the outside.
In particular, the battery should not be submitted to any mechanical (opening, puncture, immersion), thermal (burning, heating to temperatures above the normal temperature range of the product) or electrical abuse (short-circuit, recharge, forced discharge), which will lead to the activation of safety valves and/or the rupture of the battery container.
Any accidental release of the inner components of the cell, or their combustion products could be highly hazardous. Battery content exposition to air humidity/liquid water may be followed by severe battery vent/explosion/fire, depending on the hazard causes and circumstances.

Protection from charging:

Whenever lithium batteries are not the single power source in a circuit, the following measures recommended by Underwriters Laboratories are relevant. The cells should not be connected with an electrical power source that would increase the load through the cells. The electronic circuit shall include one of the following:

A. Two suitable diodes or the equivalent in series with the cells to prevent any reverse (charging) current. The second diode is used to provide protection in the event that one would fail. Quality control, or equivalent procedures, shall be established by the device manufacturer to check that the diode polarity is correct for each unit.

Or

B. A blocking diode or the equivalent to prevent any reverse (charging) current and a resistor to limit current in case of diode failure. The resistor should be sized to limit the reverse (charging) current to the maximum value according to the data sheet of the cell.

3. COMPOSITION, INFORMATION OR INGREDIENTS

Each unit cell consists of a hermetically sealed metallic can containing a number of chemicals and materials of construction of which the following are potentially hazardous upon release to air.

Component	CAS Number	EINECS/ELINCS	Content (wt. %)*
Lithium metal	7439-93-2	231-102-5	2-6
Thionyl dichloride	7719-09-7	231-748-8	18-47
Aluminium chloride	7446-70-0	231-208-1	1-5
Gallium chloride	13450-90-3	236-610-0	0-2
Lithium chloride	7447-41-8	231-212-3	1-2
Carbon	1333-86-4	215-609-9	2-5
PTFE	9002-84-0	N/A	0-1
Stainless steel, Nickel and inert material	N/A	N/A	remainder

** Quantities may vary with cell model*

4. FIRST AID MEASURES (not anticipated under normal use)

4.1 Electrolyte contact

EYE CONTACT: Immediately flush with plenty of water for at least 15 minutes and get medical attention.

SKIN CONTACT: Remove contaminated clothing and immediately flush with plenty of water for at least 15 minutes. In severe cases, get medical attention.

INHALATION: Contents of an opened cell may cause respiratory tract and mucus membrane irritation. Remove from exposure, rest and keep warm. Immediately inhale Cortisone spray. In severe cases, track medical surveillance for 48 hours.

INGESTION: Wash out mouth thoroughly with water and give plenty of water to drink. Get medical attention.

FURTHER TREATMENT: All cases of eye contamination, persistent skin irritation and casualties who have swallowed this substance or have breathed its vapours should be seen by a Doctor.

4.2 Lithium metal contact

EYE CONTACT: Immediately flush with large quantities of water for at least 15 minutes, with open eyelids, and get medical attention.

SKIN CONTACT: Remove particles of lithium from skin as quick as possible. Immediately flush with plenty of water for at least 15 minutes and get medical attention.

INHALATION/INGESTION: Contents of an opened cell may cause respiratory tract and mucus membrane irritation. Remove from exposure, rest and keep warm. Immediately inhale Cortisone spray. In severe cases, track medical surveillance for 48 hours.

5. FIRE FIGHTING MEASURES (not anticipated under normal use)

ESTINGUISHING MEDIA:

- During a fire with lithium batteries, using large amounts of cold water or water-based foam has some cooling effect and is effective to prevent fire expansion as long as the extent of the fire has not progressed to the point that the lithium metal they contain is exposed (as marked by appearance of deep red flames). Do not use warm or hot water.
- Lith-X Class D extinguishers are effective on fires involving only a few lithium batteries.
- Do not use CO_2 or Halon-type extinguishers.
- Do not use sand, dry powder or soda ash, graphite powder or fire blankets.
- **Use only class D metal extinguishers on raw lithium metal.**

SPECIAL FIRE FIGHTING PROCEDURES:

- Fire fighters should wear approved/certified positive pressure self-contained breathing apparatus.
- Full protective clothing is necessary to prevent potential body contact with electrolyte solution.
- During water spraying, caution is advised as burning pieces of lithium may be ejected from the fire.

- It is permissible to use any class of extinguishing medium, specified above, on these batteries or their packing material. Cool exterior of batteries if exposed to fire to prevent rupture.
- If the cells or batteries are not located at the center of the fire, copious amounts of water may be supplied using a diffuser type nozzle so that the cells remain cool during the fire containment and extinction. A sprinkler system should be suitable for this purpose, the critical factor being that the lithium cells do not experience temperatures above the melting point of lithium (180°C).
- Small amounts of water should never be used such as the volumes contained within portable fire extinguishers. Standard dry powder extinguishers are ineffective. It should be kept in mind that a hazard of hydrogen formation exists whenever hot lithium metal comes into contact with water.

6. ACCIDENTAL RELEASE MEASURES (not anticipated under normal use)

INDIVIDUAL PRECAUTIONS: Evacuate the employees from area until fumes dissipate. In case of electrolyte leakage from a cell or battery, do not inhale vapors or touch liquid with bare hands. In case of skin or eye contact, inhalation or ingestion, follow the measured described in section 12.

ENVIRONMENTAL PRECAUTION: Avoid sewage, surface water and underground water contamination. Avoid ground and atmosphere contamination.

WAYS OF CLEANING: With protective glasses and gloves, use absorbent material (sand, earth, chalk ($CaCO_3$) or lime (CaO) powder or Vermiculite) to absorb any exuded material. Seal leaking battery (unless hot) and contaminated absorbent material tight in plastic bag, and dispose of as hazardous waste in accordance with local regulations. Electrolyte traces may be wiped off dryly using household paper. Rinse with water afterwards.

7. HANDLING AND STORAGE

IMPORTANT NOTICE: Lithium-thionyle chloride batteries are not rechargeable and should not be tentatively charged or recharged. Manufacturer's recommendations should be followed regarding maximum current and operating

temperature range. Applying pressure or deforming the battery may lead to disassembly and cause eye, skin and throat irritation.

STORAGE: Store in a cool, regulated (preferably below 21°C and in any case below 30°C), dry and ventilated area, away from possible sources of heat, open flames, food and drink. Avoid exposure to direct sunlight for long periods. Temperatures above 100°C (or higher for High Temperatures cells and batteries such as the LSH20-150 cell- refer to individual data sheets for maximum temperatures) may cause leakage and rupture, and result in shortened battery service life. Keep proper clearance space between batteries and walls. Since short circuit can cause burn hazard, leakage or explosion hazard, keep batteries in original packaging until use and do not mix them.

HANDLING:

- Do not open the battery system.
- Do not crush or pierce the cells.
- Do not short (+) or (-) terminal with conductors.
- Do not reverse the polarity.
- Do not submit to excessive mechanical stress.
- Do not mix batteries of different types or mix new and old ones together.
- Do not use the unit without its electronic management system.

- Do not expose the unit to water or condensation.
- Do not directly heat, solder or throw into fire. Such unsuitable use can cause leakage or spout vaporized electrolyte fumes and may cause fire or explosion.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION* (not anticipated under normal use)

	Respiratory protection	In all fire situations, use self-contained breathing apparatus
	Hand protection	In case of leakage wear protective gloves
	Eye protection	Safety glasses are mandatory during handling
	Other	In the event of leakage or ruptured cells, wear a rubber apron and protective clothes.

**AFNOR pictograms*

Occupational exposure standard:

Compound	8 hour TWA	15 min TWA	SK
Sulfur Dioxide	1 ppm	1 ppm	-
Hydrogen chloride	1 ppm	5 ppm	-

9. PHYSICAL AND CHEMICAL PROPERTIES

The lithium-thionyl chloride cell or battery described by this Battery Information Sheet is a sealed unit when offered for sale. It is a manufactured "article" and does not expose the user to hazardous chemicals when used in accordance with manufacturer specifications.

Appearance – Cylindrical shape
Odour – If leaking, gives off a pungent corrosive odour

Flash point – Not applicable	Flammability – Not applicable
Boiling Point – Not applicable	Melting Point – Not applicable
Vapor Pressure – Not applicable	Vapor Density – Not applicable
pH – Not applicable	Specific Gravity – Not applicable
Solubility (in water) – Not applicable	Solubility (other) – Not applicable

10. STABILITY AND REACTIVITY

The battery system is stable when handled and stored according to section 4.

MATERIALS TO AVOID: Oxidizing agents, bases, water. Avoid electrolyte contact with aluminium or zinc.

CONDITIONS TO AVOID: Do not heat above 100°C (or higher (150°C) for High Temperatures cells and batteries such as the LSH20-150 cell- refer to individual data sheets for maximum temperatures) or incinerate. Do not disassemble, crush, pierce, short, charge or recharge. Avoid mechanical or electrical abuse.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen (H_2) as well as lithium oxide (Li_2O) and lithium hydroxide (LiOH) dust are produced in case of reaction of lithium metal with water (hydrolysis).
Chlorine (Cl_2), sulfur dioxide (SO_2) and disulfur dichloride (S_2Cl_2) are produced in case of thermal decomposition of thionyl dichloride above 100°C. Hydrochloric acid (HCl) and sulfur dioxide (SO_2) are produced in case of reaction of thionyl dichloride with water at room temperature.
Hydrochloric acid (HCl) fumes, lithium oxide (Li_2O), lithium hydroxide (LiOH) and aluminium hydroxide ($Al(OH)_3$) dust are produced in case of reaction of lithium tetrachloroaluminate ($LiAlCl_4$) with water.

11. TOXICOLOGICAL INFORMATION

There is no risk, unless the battery ruptures. In the event of accidental exposure to internal contents, corrosive fumes will cause severe skin, eye and mucous membrane irritation. Medical conditions are generally aggravated by exposure to battery internal contents: eczema, skin allergies, lung injuries, asthma and other respiratory disorders may occur. Overexposure may cause symptoms of non-fibrotic lung injury and ingestion can cause tissue damage to throat and gastro-respiratory tract.

12. ECOLOGICAL INFORMATION

The batteries do not contain mercury, cadmium or other heavy metals.

Eco-toxicity	None known if used/disposed of correctly.
Mammalian affects	None known if used/disposed of correctly.
Bioaccumulation potential	None known if used/disposed of correctly.
Environmental fate	None known if used/disposed of correctly.

13. DISPOSAL CONSIDERATIONS

Batteries do not contain hazardous materials according to EC Directives 91/157/EEC, 93/86/EEC, and 2002/95/EC (RoHS) Directive). Battery recycling is either mandatory or recommended: The European Directive 2006/66/EC has been implemented by most EC member states.
Dispose of in accordance with local laws and regulations. Store material for disposal as indicated in Section 4. A disposal service is offered upon request by Tadiran Batteries.
Do not incinerate, or subject cells to temperatures in excess of 100°C (or 150°C for LSH20-150 cells and the battery packs assembled from them). Such abuse can result in loss of seal, electrolyte leakage and/or violent disassembly with risk of material projections.

For additional information a Technical Notice is available upon request.

See the section on “Sustainability & Environment” on https://www.saftbatteries.com/about-us/environmental-responsibility

The recycling of batteries must only be conducted by fully trained personnel of licensed recyclers. Attempting to dismantle batteries or modules into individual cells may lead to serious injuries or death due to high electrical voltage and/or energy.

14. TRANSPORTATION INFORMATION

Note: when manufacturing a new battery pack, one must assure that it has fulfilled the tests according to the UN Model Regulations, Manuel of Tests and Criteria, Part III, subsection 38.3.

14.1 United Nations Class

For the single cell batteries and multi-cell battery packs that are non-restricted to transport (non-assigned to the Miscellaneous Class 9), use lithium batteries inside label.

For the single cell batteries and multi-cell battery packs which are restricted to transport (assigned to Class 9), use Class 9 Miscellaneous Dangerous Goods and UN Identification Number Labels.

In all cases, refer to the product transport certificate issued by the manufacturer.

UN Numbers:	3090	LITHIUM METAL BATTERIES: Shipment of cells and batteries *in bulk*
	3091	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT: Cells and batteries *contained in equipment* or *packed with it*
Shipping name	LITHIUM METAL BATTERIES	
Hazard Classification:	9 Depending on their lithium metal content, some single cells and small multi-cell battery packs may be non-assigned to Class 9. Refer to Transport Certificate.	
Packaging:	Group II	

14.2 International agreements

By Air International:	IATA/ICAO: UN 3090 or UN3091
By Sea International:	IMDG: UN 3090 or UN 3091
European road transportation:	ADR
European rail transportation:	RID

15. REGULATORY INFORMATION

Regulations specifically applicable to the product:

- ACGIH and OSHA: see exposure limits of the internal components of the battery in section 14.
- IATA/ICAO (air transportation): UN 3090 or UN 3091.
- IMDG (sea transportation) : UN 3090 or UN 3091.
- Transportation within the US-DOT, 49 Code of Federal Regulations
- UK regulatory references: Classified under CHIP.
- Battery Directive (2006/66/EC): see section 9

16. OTHER INFORMATION

This information has been compiled from sources considered to be dependable and is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, neither exhaustively nor perfect reliability can be granted. Information does not imply implicit or specific warranty of it.

This information relates to the specific products designated and may not be valid for such products used in combination with any other materials or in any process. It is the user's responsibility to satisfy himself as to the suitability and completeness of this information for his particular use.

Saft does not accept liability for any loss or damage that may occur, whether direct, indirect, incidental or consequential, from the use of this battery information sheet provided as a service to our customers. Saft does not offer warranty against patent infringement.

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Doc N° BIS04-11-12
Edition: February 2018
Version 2.0

Data in this document is subject to change without notice and becomes contractual only after written confirmation.

Primary lithium battery
LSH 20

3.6 V Primary lithium-thionyl chloride (Li-$SOCl_2$)
High power
D-size spiral cell

Benefits

- High voltage response, stable during most of the lifetime of the application
- High drain/pulse capability
- Wide operating temperature range *(-60°C/+85°C)*
- Easy integration into compact systems
- Low self-discharge rate *(less than 3% after 1 year of storage at +20°C)*

Key features

- Stainless steel container
- Hermetic glass-to-metal sealing
- Built-in safety vent
- Finish with 5 A fuse
- Non-flammable electrolyte
- Underwriters Laboratories *(UL)* Component Recognition *(File Number MH 12609)*
- Restricted for transport *(Class 9)*

Main applications

- Radiocommunication and other military applications
- Alarms and security systems
- Beacons and emergency location transmitters
- GPS
- Metering systems
- Sonobuoys
- Tracking systems
- GSM communication

Cell size references	**UM1 – R20 – D**

Electrical characteristics

(typical values relative to cells stored for one year or less at + 30°C max.)

Nominal capacity *(at 15 mA + 20°C 2.0 V cut off. The capacity restored by the cell varies according to current drain, temperature and cut off)*		13.0 Ah
Open circuit voltage	(at + 20°C)	3.67 V
Nominal voltage	(at 2 mA + 20°C)	3.6 V
Pulse capability: Typically up to 4000 mA *(4000 mA/0.1 second pulses, drained every 2 mn at + 20°C from undischarged cells with 10 µA base current, yield voltage readings above 3.0 V. The readings may vary according to the pulse characteristics, the temperature, and the cell's previous history. Fitting the cell with a capacitor may be recommended in severe conditions. Consult Saft)*		
Maximum recommended continuous current *(to maintain cell heating within safe limits. Battery packs may imply lower level of maximum current and may request specific thermal protection. Consult Saft)*		1800 mA
Storage	*(recommended)* *(for more severe conditions, consult Saft)*	+ 30°C (+ 86°F) max
Operating temperature range *(Operation above ambient T may lead to reduced capacity and lower voltage readings at the beginning of pulses. Operation with current continuously above 1 A may restrict upper T range. Consult Saft)*		- 60°C/+ 85°C (- 76°F/+ 185°F)

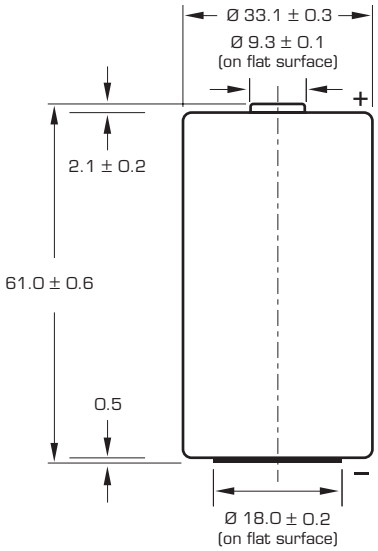
Physical characteristics

Diameter *(max)*		33.4 mm (1.32 in)
Height *(max)*		61.6 mm (2.42 in)
Typical weight		100 g (3.5 oz)
Li metal content		approx. 3.8 g
Available termination suffix		
	CN, CNR	radial tabs
	CNA (AX)	axial leads
	FL	flying leads ...etc.

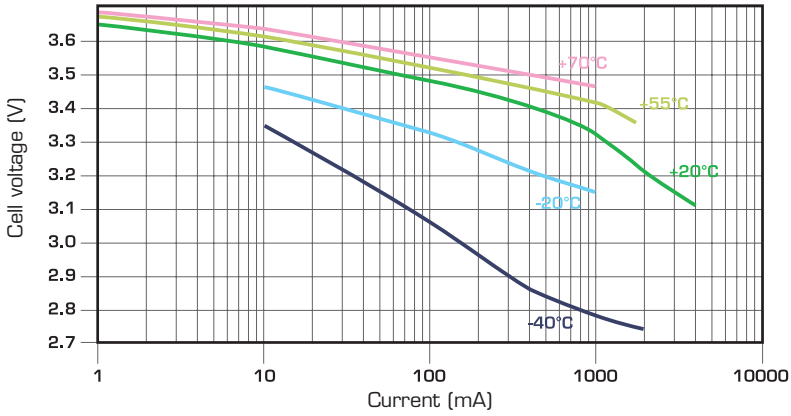
NATO stock number
6135 14 440 1213

October 2006

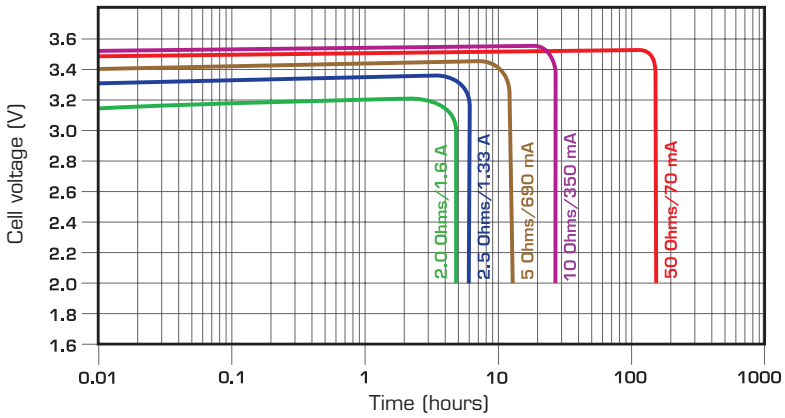
LSH 20



Dimensions in mm.



Voltage plateau versus Current and Temperature (at mid-discharge)



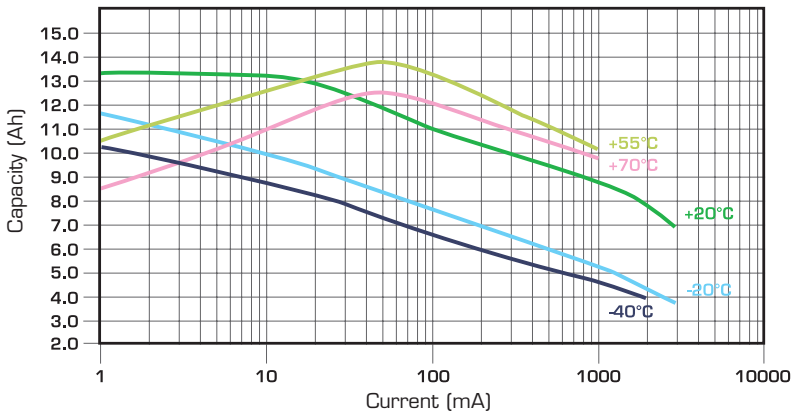
Typical discharge profiles at +20°C

Storage

- The storage area should be clean, cool (preferably not exceeding + 30°C), dry and ventilated.

Warning

- Fire, explosion and burn hazard.
- Do not recharge, short circuit, crush, disassemble, heat above 100°C (212°F), incinerate, or expose contents to water.
- Do not solder directly to the cell (use tabbed cell versions instead).



Restored Capacity versus Current and Temperature (2.0 V cut off)

Saft
Specialty Battery Group
12, rue Sadi Carnot
93170 Bagnolet - France
Tel +33 (0)1 49 93 19 18
Fax +33 (0)1 49 93 19 69

www.saftbatteries.com

Doc. Nº 31015-2-1006

Information in this document is subject to change without notice and becomes contractual only after written confirmation by Saft.

For more details on primary lithium technologies please refer to Primary Lithium Batteries Selector Guide Doc Nº 31048-2.

Published by the Communications Department.

Photo credit: Saft

Société anonyme au capital de 31 944 000 €
RCS Bobigny B 383 703 873

Produced by Arthur Associates

UN 38.3 Test Summary Report

Lithium Cell or Battery Test Summary in Accordance with Section 2.9.4 UN Model Regulations and Sub-section 38.3 of the UN Manual of Tests and Criteria, Part III, subsection 38.3.5

[a] ☒ Cell ☐ Battery ☐ Product
☒ **Tested Type Part** 03577R
☒ **Same Type Part # see list**

[d] Unique report ID: LSH20 12-2018-4

[e] Report date: 2015.12.08

[b] **Manufacturer**
Saft Civil Electronics Division
Saft SAS
Rue Georges Leclanché, BP1039
86000 Poitiers
T. +33 (0) 5. 49 55 48.48
Lithiumsales.fr@saftbatteries.com
https://www.saftbatteries.com

[c] **Test Laboratory**
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86000 Poitiers
T. +33 (0) 5. 49 55 48.48
Lithiumsales.fr@saftbatteries.com
https://www.saftbatteries.com

☒ **Same Type Part Numbers # (all):** 03576N, 03749V, 04488N, 04659S, 05041T, 05226L, 05251M, 05339D, 05496S, 05508E, 05564N, 05978U, 06039H, 06064J, 06085F, 06206G, 06231H, 06279H, 06317X, 06328J, 06489B, 60063R, 60086Q

[f] (i) ☐ Li-ion ☒ Li-metal.

(iv) **Description:** Primary D-sized spiral cell with a 5A protection fuse
(ii) Mass: 96 g
(iii) ☐ Watt hour rating or ☒ Lithium content: 3.84 g.
(v) ☒ Cell ☐ Battery ☐ Product. Model number/Part number: LSH20

[g] **List of Tests Conducted**	**Result (Pass / Fail / N.A.)**	**Test record reference**
38.3.4.1 T.1: Altitude simulation	Pass	T0340-14
38.3.4.2 T.2: Thermal test	Pass	T0340-14
38.3.4.3 T.3: Vibration	Pass	T0340-14
38.3.4.4 T.4: Shock	Pass	T0340-14
38.3.4.5 T.5: External short circuit	Pass	T0340-14
38.3.4.6 T.6: Impact/Crush (cell only test)	Pass	T0340-14
38.3.4.7 T.7: Overcharge (N.A for Li-metal only)	NA	NA
38.3.4.8 T.8: Forced discharge (cell only test)	Pass	T0340-14
[h] Battery assembly: ☒ Not Applicable. ☐ UN38.3.3 (f) ☐ UN38.3.3 (g)		
[i] Test Reference: UN Manual of Tests and Criteria, Part III, sub-section 38.3 ST/SG/AC.10/11/Rev.5		

[j] Signatory A. Date: 2019.08.23
Name: Cristophe Serre
Title: Quality Mgr – C.E. Div- Poitiers site
Signature:

[j] Signatory B. Date: 2019.08.23
Name: Antoine Derouet
Title: Primary Battery Technical Manager
Signature:

Important! *The above signatory / signatories affirm that this document is a true and correct summary of the original individual tests and test data. The original test data is confidential information available to competent State Authorities with valid identification and only upon their formal request. Disclosure of the original test data to any other entity upon its request will be considered by Saft and, should Saft consider this request is with merit, may be subject to the prior execution of a nondisclosure agreement.*