







## STANDARD SPECIFICATION

Medium Prismatic Lithium-Ion Rechargeable Battery

Model  
1s1p MP 176065 **Integration™**

	Name	Position	Date	Signature
Written by	Y. Chartier	Technical Writer & Market Analyst	09/2009	
Checked by	W. Pitt	Product Manager	09/2009	
Checked by	JP. Peres	LBD Li-ion Technical Manager	09/2009	
Checked by	P. Hans	LBD Quality Manager	09/2009	

Issued by	A. Kerouanton	Y. Chartier				
Date	09/07	09/09				
Edition Nr	1	2				

**1s1p MP 176065 Integration™**





## 1. Scope

This specification presents typical and guaranteed ex-works values for the rechargeable Lithium-ion, **Medium-sized, Prismatic-shaped** and single-cell battery model **1s1p MP 176065 Integration™**

This battery consists of a MP 176065 cell, fitted with an electronic monitoring circuit as protection device.

It has been specially designed for easy **integration** within high-end electronic devices requiring high energy density and cycle life in a wide operating temperature range.

## 2. Reference documents

- Secretariat of the United Nations - *"UN Recommendations on the Transport of Dangerous Goods, Part III, sub-section 38.3 – Model Regulations"* Ref. ST/SG/AC.10/1 - Revision 15 - 2007 + "Manual of Tests and Criteria" 4<sup>th</sup> Revised Edition - 2003 - Ref.ST/SG/AC.10/11/Revision 4.
- International Electrotechnical Committee Specification IEC/CEI *"Secondary lithium cells and batteries for portable applications"* Ref. IEC/CEI 61690-First edition - 2003.
- Underwriters Laboratories Inc.  
"Standard for Lithium Batteries" – UL 1642 - Fourth Edition – 2005

## 3. Construction and visual aspect

### A. Construction

The 1s1p MP 176065 Integration™ prismatic battery is assembled from a MP cell constructed according to the spiral electrode technology. The cell features an aluminum envelope, a built-in circuit breaker and a safety vent. It is fitted with an electronic protection circuit positioned in the topshell area.

Two types of electronic circuit may be used to protect the battery from accidental overcharge, overdischarge and overcurrent. They limit the maximum discharge current (one electronic circuit type with a 5A limitation and one electronic circuit type with a 10A limitation). Multi-cell battery packs assembled from MP 176065 cells may feature other types of electronic protection circuits with different limitations.

A built-in 7 bar-rated Negative Terminal with current breaker (T.N.R) interrupts the current flow (without any cell opening or vent) in case of excessive internal pressure, due to overcharging (with defective charger and/or electronic protection circuit) or excessive temperature.

A built-in safety vent protects the battery in case of excessive temperature environment (such as fire condition) leading to an internal pressure exceeding 16 bars.



## **B. Visual aspect**

When inspected by naked eyes, The 1s1p MP 176065 Integration™ battery should not show any trace of dents, swelling, corrosion or leakage. Marking should be readable.

### **4. Typical values**

#### **A. Designation**

1s1p MP 176065 Integration™

*(The 1s1p prefix indicates that the product consists of just a single cell in series: "1s", and a single cell in parallel: "1p").*

#### **B. Nominal voltage**

3.75 V

*(at mid-discharge, +20°C, under 1 A ~ C/5 rate)*

*(Nota: the open circuit voltage is dependent on the state of charge of the battery and may fluctuate between 2.5 and 4.2 V).*

#### **C. End-of-charge voltage**

4.20 ± 0.05 V at maximum

*(If exceeded, the battery electronic protection circuit will activate to prevent possible overcharge leading to thermal runaway).*

*(The 1s1p MP 176065 Integration™ battery may be charged up to lower voltage, such as 4.1 V or 4.0 V. In such cases, the capacity restored during the next discharge step will be somewhat diminished, -10% capacity loss for charge voltage -100 mV, in charge voltage range 3.9 V to 4.2 V).*

#### **D. End-of-discharge voltage**

2.5 V minimum recommended

*(the battery electronic protection circuits activate at 2.3 V in order to prevent irreversible battery performance degradation).*

*(Multi-cell battery packs assembled from MP 176065 cells may feature electronic protection circuit with slightly different voltage cut-offs. Consult Saft).*



## E. Rated capacity

6.8 Ah

*(Battery charged at a constant current of 1.4 A ( $\approx$  C/5-rate, up to 4.2V, followed by charge at constant voltage until the current falls down to 70 mA ( $\approx$  C/100-rate), then rested 1 to 4 hours at 20°C, and discharged at 20°C, at a constant rate of 1.4 A ( $\approx$  C/5-rate) down to 2.5 V).*

The capacity restored by the battery varies with the end-of-charge voltage, the discharge current, the temperature, the voltage cut-off, the age, and the number of cycles already performed. Consult Saft for specific details.

## F. Recommended charge conditions

3.4 A (C/2 rate) recommended, but safe charge up to 7 A ( $\approx$  C rate) remains possible, at the detriment of the cycle life.

At room temperature:

- first step, at constant current until the voltage reaches the recommended  $4.20 \pm 0.05$  V voltage,
- second step, at constant voltage, until the current falls to 70 mA ( $\approx$  C/100 rate).

In case the time to reach the 70 mA minimum current is excessive, it is recommended to stop the charge with a timer starting counting when the selected end-voltage is reached (*timer set at 5 hrs when charging at C rate, 6 hours at C/2 rate and 7 hours at C/5 rate*)

*Other charge conditions are possible. Consult Saft, as well as for optimised charging below 0°C where rates preferably not exceeding C/5 are recommended.*

## I. Maximum recommended discharge conditions

10 A continuous or 5 A, depending on the type of electronic protection circuit used.

*(If exceeded, the 1s1p MP 176065 Integration™ battery standard electronic protection circuit will activate. Continuous discharge up to 14 A and pulse discharge up to 30 A ( $\approx$  4C rate) are possible with specific electronic protection circuits used in multicell battery packs assembled from MP cells. Consult Saft).*



## H. Operating temperature range

Charge is possible from -20°C to + 60°C.

*Charge above 60°C would affect noticeably subsequent battery performance.*

Discharge is possible from - 50 to + 60°C.

*Discharge above 60°C would affect subsequent battery performance.*

*For optimized charging below 0°C, 60°C and discharging at -50°C, Consult Saft.*

## I. Cycle life

When charged at 20°C at 7 A ( $\approx$  C rate), followed by 5 hours of rest, and discharged at 3.4 A (C/2 rate) down to 2.5 V, the 1s1p MP 176065 Integration™ battery typically loses 30 % of the rated capacity after 600 cycles.

*(Different cycle life is possible if the battery is cycled at other current or shallow discharge cycles, i.e. less than full charge/discharge. Consult Saft).*

## J. Internal resistance

100 mΩ max (at + 20°C)

*(deduced from voltage drop readings, 5 second after applying a current load)*

Typically, 30-80 mΩ comes from the MP 176065 cell itself (30 mΩ when uncycled and 80 mΩ when cycled 600 times) and the rest from the protection devices and external wiring.

## K. Typical weight

143 grams, with a contribution of 138.5 grams from the cell itself and the rest from the protection devices, external wiring and sleeving.



## 5. Environment, mechanical and electrical abuse testing

The 1s1p MP 176065 *Integration*<sup>TM</sup> battery typically behaves as following:

Test	Source	Procedure	Typical performance
Free fall	IEC	from 1.0 m onto a hard wood floor 6 times at + 20°C	NL NV NE NF
Thermal test	UN	Storage 6 hrs minimum at + 75°C followed by 6 hours minimum at - 40°C Repeated 10 times	NL NV NE NF OCV after test not less than 90% of OCV before test
Vibration	UN	Sinusoidal vibration 7 to 200 Hz and back to 7 Hz, traversed in 15 mn. Amplitude 1.6 mm (total excursion) Cycle repeated 12 times	NL NV NE NF
Shock	UN	Half-sine shock Peak acceleration 150 g Duration 6 milliseconds 18 shocks in total	NL NV NE NF
Heating	IEC	Cell in an oven whose T is increased at 5°C/mn until the oven reaches 130°C 130°C maintained 30 mn	NE NF
Overcharge	UN	Charge 24 hrs at 10 A (≈2C)	NE NF

NL: No Leakage

NV: No Vent

NE: No Explosion

NF: No Fire



## **6. Storage**

Storage is possible between – 50°C and + 60°C without circuit breaker activation nor leakage.

*Storage conditions affect the battery charge retention and cycle life. For long-term (up to 1 year) storage, Saft recommends to keep the battery with a (30 ± 15) % state of charge in a dry and cool place at a temperature not exceeding 30°C.*

## **7. Charge retention after storage**

The capacity lost by the 1s1p MP 176065 Integration™ battery during storage depends in part from its state of charge.

After 1 month of storage at + 20°C, the capacity loss of a 100 %-charged 1s1p MP 176065 Integration™ and after a reconditioning cycle (discharge/charge) battery typically does not exceed 5 % of the rated capacity in the discharge conditions given in § 4.E.

After 6 months at + 20°C, the capacity loss of a 100 %-charged 1s1p MP 176065 Integration™ and after a reconditioning cycle (discharge/charge) battery typically does not exceed 10 % of the rated capacity in the discharge conditions given in § 4.E.

After 12 months at + 20°C, the capacity loss of a 100 %-charged 1s1p MP 176065 Integration™ and after a reconditioning cycle (discharge/charge) battery typically does not exceed 12 % of the rated capacity in the discharge conditions given in § 4.E.

The above numbers are divided by a 3-factor for batteries stored with 50 % state-of-charge.

## **8. Handling**

Saft advises, during the handling of the 1s1p MP 176065 Integration™ battery, to observe the following precautions:

- a) Do not remove the batteries from their original packaging\* before use.
- b) Do not store the batteries in bulk in order to avoid accidental short-circuiting.
- c) Do not expose to heat above 60°C, flame, or incinerate.
- e) Do not disassemble or modify.
- f) Pay attention to the polarities when installing the battery.
- g) Do not short circuit.
- h) Do not immerse in any liquid.
- i) Do not drop or subject to shock.
- j) Do not remove the protection circuit.
- k) Use appropriate charger.

---

\* original packaging may be re-used for end-of-life disposal.





## 9. Transport

The MP 176065 component cell passes the safety tests listed in the United Nations “UN Recommendations on the Transport of Dangerous Goods, Part III, sub-section 38.3 – Model Regulations” and “Manual of Tests and Criteria – (4th Revised Edition Ref. ST/SG/AC.10/11/Rev. 4)”.

Based on the criteria mentioned in the United Nations “Recommendations on the Transport of Dangerous Goods – Model Regulations” (15<sup>th</sup> Revised Edition – Ref. ST/SG/AC.10/1/Rev 15 – 2007) the cell, which is declared with  $6.8 \times 3.75 = 25.5$  watt.hours of nominal energy density, above the 20 Wh limit, **is restricted to transport and assigned to Class 9.**

The same applies to all the battery packs assembled from MP 176065 cells, even the ones assembled from less than 4 cells and which are below the 100 Wh limit set for battery packs.

### Guaranteed minimum values

<p>Rated capacity (in conditions given in § 4.E charge C/5 up to 4.2 V + discharge C/5)</p>	<p>6.1 Ah minimum (Uncycled cells within 3 months following cell date code printed on the sleeve)</p>
---	---

## 10. Incoming inspection

Prior to release from factory, the 1s1p MP 176065 Integration<sup>TM</sup> battery is 100 % inspected for rated capacity and self-discharge rate.

In case of incoming inspection, Saft recommends the following:

### A. Sampling standards

French	British	German	American	ISO
NFX 06-022 NFX 06-023	BS 6001 BS 6002	DIN 40080 DIN ISO 3951	MIL STD 10 5D MIL STD 414	2859 3951

### B. Acceptable Quality Levels (AQL)

Cell lot size	Sampling size	AQL
1-3 200	32	0.4 %
3 201-10 000	50	0.25 %
> 10 000	80	0.15 %



## 11. Marking

The external surface of the 1s1p MP 176065 Integration™ battery bears two labels, which display the following:

### (Most common) Identification labels:

Depending on the electronic protection circuit used

<b>SAFT 1s1p INT 176065 SAS</b>	Li-ion rechargeable battery	
3.75 V	6.8 Ah	25.5 Wh
CHARGE	Recommended charge voltage 4.2 V	
	Recommended max. current 7 A	
DISCHARGE	Maximum current 5 A	
P/N XXXX/Y	Made in France	
	Date code with month/year of production	

or

<b>SAFT 1s1p INT 176065 SAF</b>	Li-ion rechargeable battery	
3.75 V	6.8 Ah	25.5 Wh
CHARGE	Recommended charge voltage 4.2 V	
	Recommended max. current 7 A	
DISCHARGE	Maximum current 10 A	
P/N XXXX/Y	Made in France	
	Date code with month/year of production	

### Safety warning label:

Do not crush	Do not short circuit	Do not heat or incinerate
Do not dismantle	Do not immerse in any liquid	
	Observe charging instructions	
Charge $-20^{\circ}\text{C} < T < 60^{\circ}\text{C}$	Discharge: $-50^{\circ}\text{C} < T < 60^{\circ}\text{C}$	
For best long-term performance: store at $(30 \pm 15)$ % of capacity and below $30^{\circ}\text{C}$		

For information: 30% SOC (State Of Charge) corresponding at battery voltage  $\approx 3.75\text{ V}$

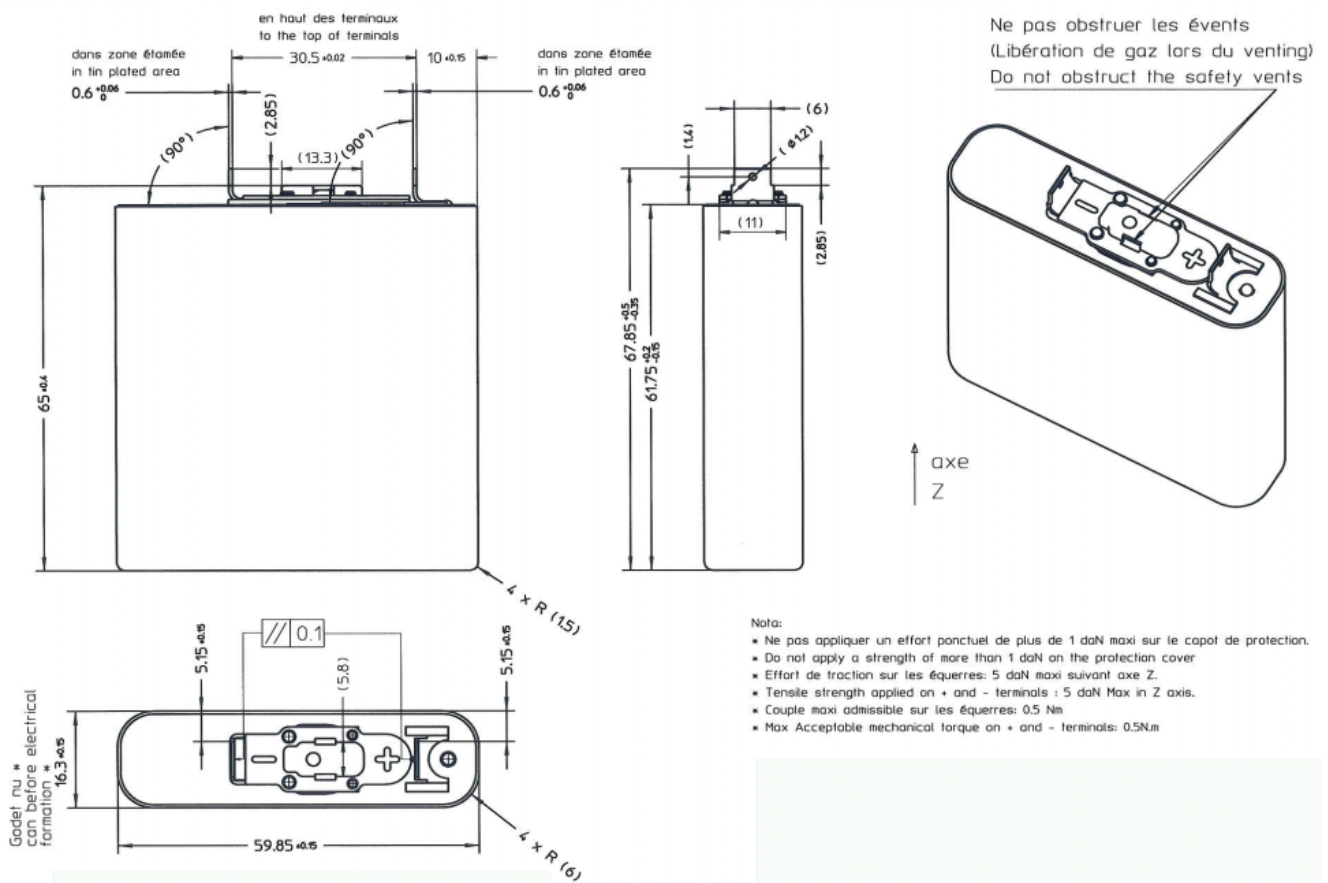


## 12. End-of-life disposal

The 1s1s MP 176065 *Integration*<sup>TM</sup> battery does not contain heavy metals such as Mercury. It is also Lithium metal-free.

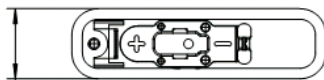
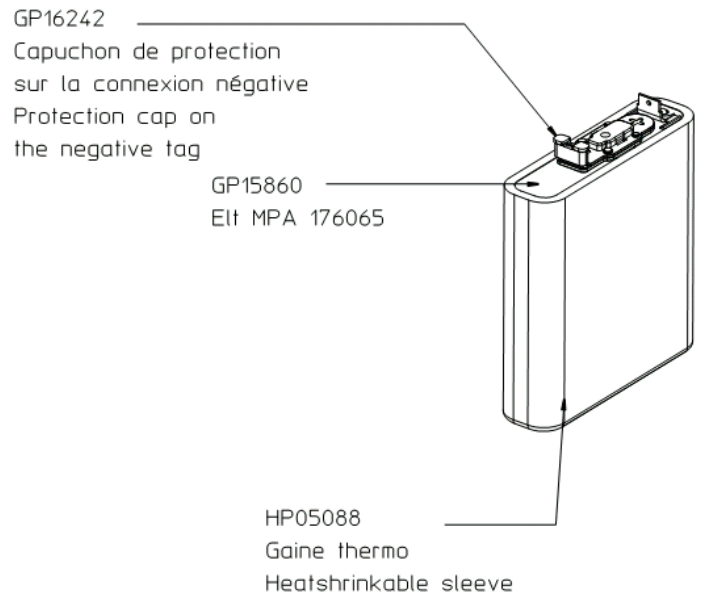
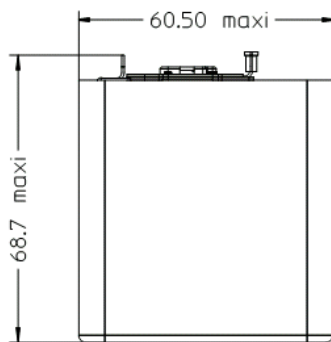
Dispose according to local regulations. Recycling allows recovery of the valuable Cobalt material it contains.

## 13. Untabbed / Unsleeved MP 176065 cell dimensions





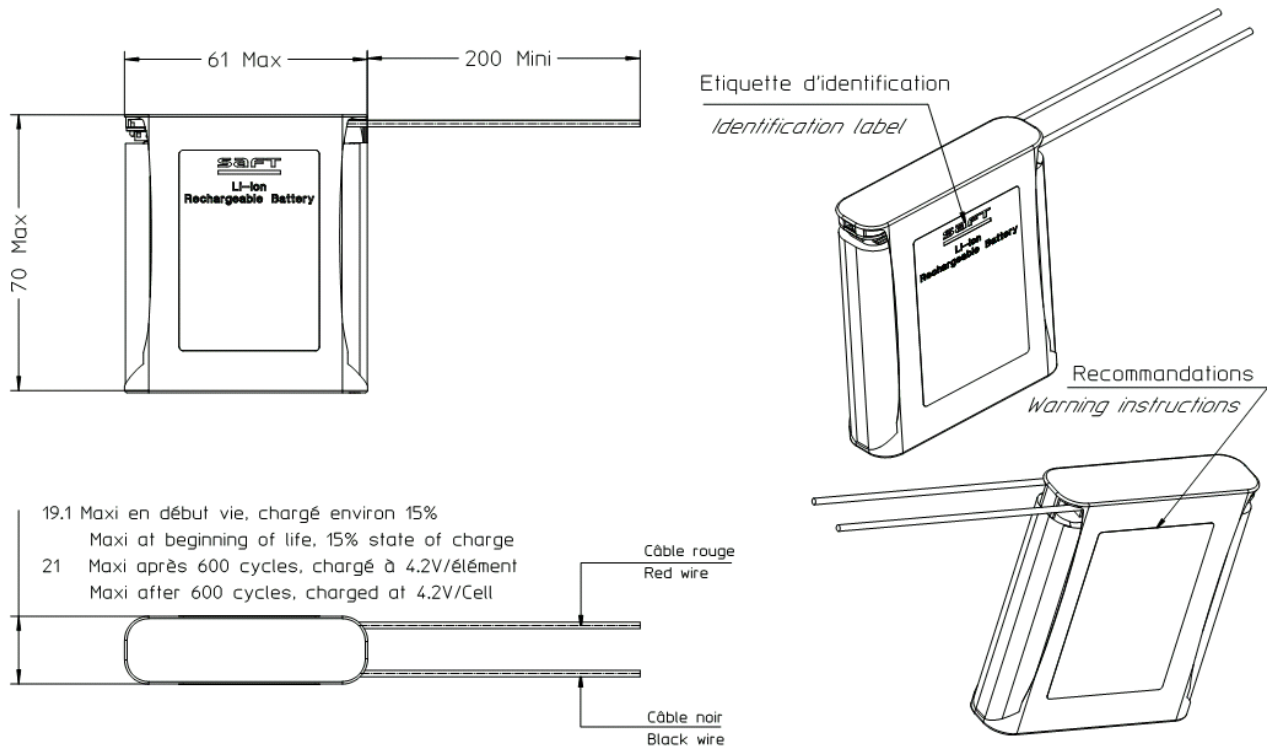
#### 14. Sleeved MP 176065 cell dimensions



18.6 Maxi en début vie, chargé environ 15%  
 Maxi at beginning of life, 15% state of charge  
 20.3 Maxi après 600 cycles, chargé à 4.2V/élément  
 Maxi after 600 cycles, charged at 4.2V/Cell



**15. Sleeved 1s1p MP 176065 Integration™ battery dimensions (including electronic protection circuit)**



Several finish types are available. These vary by the type of electronic protection circuit used, the positioning of the thermal fuse, the lead types and lengths, and the connector type.

**07553Y : 1s1p INT 176065 SAS battery model**

(MP 176065 cell fitted with a 5 A max. electronic protection circuit, AWG22 wires length 200 mm minimum)

**07554Z : 1s1p INT 176065 SAF battery model**

(MP 176065 cell fitted with a 10 A max. electronic protection circuit, AWG18 wires length 200 mm minimum)