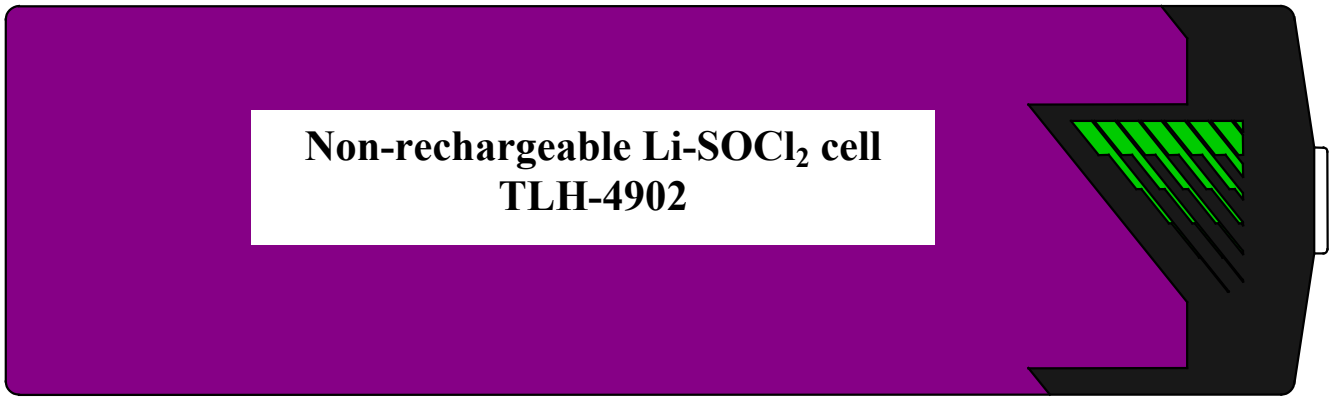
TADIRAN BATTERIES LTD

STANDARD SPECIFICATION



	Name	Position	Date
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Checked by	Miriam Pallivathikal	Chemical engineer	09.12.04
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TADIRAN BATTERIES LTD

RECORD OF REVISIONS

EDITION NUMBER	REVISION	DATE	ISSUED. BY	MODIFICATIONS
854	A	09.12.04	Zvi Weinreb	New spec.

1. Scope

This specification gives typical performance and quality assurance requirements of 1/2AA size lithium thionyl chloride primary batteries supplied by TADIRAN BATTERIES LTD.

2. Applicable battery type:

2.1. Bobbin type

3. General description:

3.1. Type.....TLH-4902.

3.2. Construction technology.....Bobbin with glass to metal seal which ensures a cell hermeticity of $\geq 10^{-7}$ Atm.cc/sec at 1Atm He

3.3. Nominal discharge capacity.....1±0.1Ah (at 0.5mA to end voltage of 2.0V at RT). The capacity varies according to discharge current, temperature and cut-off voltage

3.4. Max. current for initial voltage ≥3.0V.....2mA (During first 2 years)

3.5. Max. current for initial voltage >2.0V.....5mA (During first 5 years)

3.6. Maximum delay time to 3.0V.....1 Sec at 5mA (During first 2 years)

3.7. Nominal weight.....9g (without terminals).

3.8. Operating temp. range.....-55°C ÷ +125°C (max.duration at 125°C – 3 hours)

4. Performance:

4.1. Typical electrical performance of the cell at different conditions of temperature and load are given in Table 1:

TABLE 1

Item	Test conditions	Initial performance	Performance after 1 year storage
Open circuit voltage Room temperature Low temperature High temperature	 68±4°F (20±2°C) -40±4°F (-40±2°C) 185±4°F (85±2°C)	 3.64 - 3.69V 3.64 - 3.70V 3.64 - 3.84V	 3.65 - 3.72V 3.65 - 3.72V 3.65 - 3.84V
Transient Minimum Voltage (*1)	Discharge load: 14mA at RT	Min. 2.6V	Min. 2.4V
Operating Voltage: Room temperature Low temperature High temperature	Discharge load: 4mA 68±4°F (20±2°C) -40±4°F (-40±2°C) 185±4°F (85±2°C)	 Min. 3.2V Min. 2.9V Min. 3.3V	 Min. 3.2V Min. 2.9V Min. 3.3V
Service Life at (Orientation - positive terminal up) Room temperature Low temperature High temperature Room temperature	Cut-off Voltage: 2.0V Discharge load: 0.5mA 68±4°F (20±2°C) -40±4°F (-40±2°C) 185±4°F (85±2°C) Discharge load: 1.8mA 68±4°F (20±2°C)	 Min. 1800h Min. 900h Min. 1600h Min. 360h	 Min. 1710h Min. 850h Min. 1520h Min. 340h
Electrolyte Leakage	During the above tests	No electrolyte leakage	No electrolyte leakage
Deformation	During the above tests	No deformation or exceeding the outside dimensions in the attached drawing	No deformation or exceeding the outside dimensions in the attached drawing

*1 - Transient Minimum Voltage (TMV) – is the minimum voltage of the cell during a current pulse.

4.2. Environmental and Safety Tests

These tests are conducted according to international specifications, latest revision:

UN	United Nations Transport of Dangerous Goods Model Regulations ST/SG/AC.10/11
UL	Underwriters Laboratories Inc. Standard for Safety of Lithium Batteries , UL 1642
IEC	International Electrochemical Commission International Safety Standard for Lithium Batteries IEC-CEI 86-4
MIL	Military Standard MIL-PRF-49471

4.2.1. *Altitude Simulation*

4.2.1.1. **Test conditions:** Storage at 20°C for at least 6 hours under absolute pressure of 11.6kPa (15,240m altitude)

4.2.1.2. **Performance of cell under test conditions:** No change in cell weight or dimensions. No reduction in cell voltage or capacity. No leakage, fire or explosion.

4.2.2. *Mechanical Shock and Vibration*

4.2.2.1. **Test conditions**: Both the vibration and mechanical shock tests are performed one after the other on the same sample.

Vibration: The cells are firmly secured without distortion to the platform of the vibration machine in such a manner as to faithfully transmit the vibration. They are subjected to sinusoidal vibrations with a logarithmic sweep 7Hz to 200Hz and back to 7Hz in 15 minutes. The cycle is repeated 12 times (a total of 3 hours) for each of the three mutually perpendicular mounting positions.

Logarithmic frequency: From 7Hz a peak acceleration of $1g_n$ is maintained until 18Hz is reached. The amplitude is maintained at 0.8mm (1.6mm total excursion) and the frequency increased until a peak acceleration of 8 g_n is reached (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency reaches 200 Hz.

Mechanical shock: The cells are secured to the testing machine by means of a rigid mount that will support the mounting surface of all the cells. Each cell is subjected to a half-sine shock of peak acceleration 150 g_n and pulse duration 6 milliseconds. Each cell is subjected to 3 shocks in the positive direction followed by 3 shocks in the negative direction of the 3 mutually perpendicular mounting positions, for a total of 18 shocks.

4.2.2.2. **Performance of cell under test conditions:** No change in cell weight or dimensions. No reduction in cell voltage or capacity. No leakage, fire or explosion.

4.2.3. ***Temperature Cycling***

4.2.3.1. **Test conditions**: The cells stored in a temperature chamber at room temperature are subjected to the following cycles:
a) I**ncrease** the temperature to 75± 2°C within 30 minutes and maintain this temperature for 6 hours.
b) Reduce the temperature to -40±2°C within 30 minutes and maintain this temperature for 6 hours.
c) Repeat the sequence for a further 9 cycles. After the 10 cycles store the cells at RT for 24 hours prior to examination

4.2.3.2. **Performance of cell under test conditions:** No change in cell weight or dimensions. No reduction in cell voltage or capacity. No leakage, fire or explosion.

4.2.4. ***Short Circuit***

4.2.4.1. **Test conditions**: The cell is short circuited by connecting the positive and negative terminals with a copper wire having maximum load resistance of 0.1Ω until it is discharged completely and the temperature of the case has returned to near ambient temperature. Test temperatures: Room temperature and 55±2°C

4.2.4.2. **Performance of cell under test conditions:** No change in cell weight or dimensions. No leakage, fire or explosion.

4.2.5. ***Forced Discharge***

4.2.5.1. **Test conditions**: The test is performed at RT. The cells are discharged at 1.8mA to a terminal voltage of 0V. The discharged cells are then force discharged by connecting to a 12V dc power supply and a resistor of 100Ω.The initial maximum discharge current shall be 20 mA. The forced discharge is continued for 60h.

4.2.5.2. **Performance of cell:** No cell explosion or fire for 7 days after conclusion of forced discharge.

4.2.6. ***Impact Test***

4.2.6.1. **Test conditions**: A 15.8 mm diameter bar is placed across the center of the cell on a flat surface and a 9.1Kg mass is dropped from a height of 61±2.5 cm on the sample

4.2.6.2. **Performance of cell:** No explosion or fire under the test conditions.

5. Appearance:

The cell shall be free from flaws, stains, deformation, uneven tone, electrolyte leakage and other defects.

6. Date Coding:

Date of manufacture shall appear on the sleeve of the battery as XXX.MMM.YY where

XXX - Batch Number.

MMM - Month.

YY - Year.

7. Performance Tests

7.1. Test conditions and instruments.

7.1.1. *Temperature and humidity*

Unless otherwise specified, the test shall be performed at a temperature of 68±4°F (20±2°C) and a relative humidity of 65±20%.

7.1.2. *Measuring instruments.*

(1) Dimensions shall be measured with a vernier caliper with an accuracy of ±0.02mm , calibrated according to international standards (eg. DIN 862) and with traceability

(2) Voltage shall be measured with a dc voltmeter calibrated according to international standards, with an accuracy of ±0.2%, a resolution of 0.01V, and an impedance of >10MΩ.

(3) Discharge load shall include all the resistances in the external circuit, with a tolerance of ±1%.

7.2. Test procedure:

7.2.1. *Dimensions.*

Use the measuring instrument specified in item 7.1.2 (1). When measuring cell overall dimensions one of the jaws of the vernier caliper must be insulated to avoid short circuit.

7.2.2. *Voltage measurements:*

The cells must be temperature stabilized before measuring. The time for stabilization of temperature is given in Table 2

TABLE 2

	Ambient temperature (A)	**Stabilization time (B)**
Room temperature	68±4°F (20±2°C)	12h min
Low temperature	-40±4°F (-40±2°C)	12-24h
High temperature	185±4°F (85±2°C)	12- 24h

7.2.2.1. Open circuit voltage

Store the cell samples at temperature A°F for B hours (see Table 2) and measure the cell voltage at the same temperature using the voltmeter specified in the item 7.1.2 (2).

7.2.2.2. Closed circuit voltage (100% testing).

The cell is pulse tested at room temperature with a load of 14mA for 250msec. The minimum required voltage is 2.9V at 250msec.

7.2.2.3. Operating voltage

Store the cells at temperature A°F for B hours (see Table 2) and discharge them through the discharge load specified in Table 1. Measure the voltage across the discharge load 15min from start of discharge.

7.3. Service life

Store the cells at temperature A° F for B hours (see Table 2) and discharge them continuously through the discharge load specified in Table 1. Discharge the cells until the cell voltage falls to the final voltage specified in Table 1. The service life is the discharge time under the required conditions.

7.4. Resistance to electrolyte leakage

Check for leakage with a magnifying glass X10 (see Table 1).

7.5. Deformation

See Table 1. Perform the test as in Para 7.2.1.

8. **Limited warranty**

If the cell is defective due to faulty materials or workmanship, it will be replaced free of charge, when returned to Tadiran Batteries Ltd. Replacement is the sole obligation under this warranty. This warranty expressly excludes incidental and consequential damages due to misuse.

9. **Inspection specification**

The cells supplied by Tadiran Batteries Ltd have all met this inspection specification. In the case of malfunctions after shipment, Tadiran will investigate the cause and take measures to prevent its recurrence.

9.1. Quality standard

In accordance to this specification.

9.2. Unit of inspection:

One cell will be one unit of inspection

9.3. Definition of lot:

A lot is defined as the cells manufactured by the same manufacturing system and having the same manufacturing code.

9.4. Test method:

In accordance with this specification.

9.5. Sampling plan:

General inspection levels shall be used when applying Military Standard 105, single sampling plan for normal inspection. Acceptance criteria by defect classification. – (see Table 3).

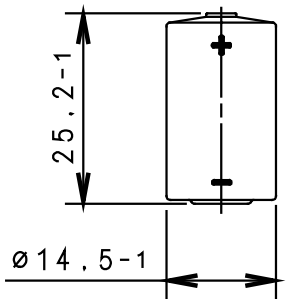
TABLE 3

No.	Inspection item	Inspection plan	Inspection level	Sampling plan	AQL
1	Dimensions	2A regular	S-4	Single	0.4
2	Appearance	2A regular	S-4	Single	0.4
3	Open Circuit Voltage	2A regular	1	Single	0.15
4	Close Circuit Voltage	2A regular	1	Single	0.15
5	Operating Voltage	2C reduced	S-3	Single	1
6	Service Life	2C reduced	S-3	Single	1

10. **Main cell terminal versions**

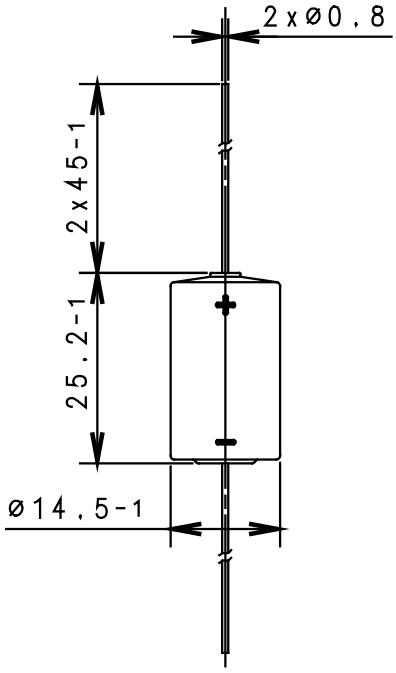
5 main versions are available and are shown in the following drawings. Other types of terminals can be supplied on request. Dimensions are in mm

10.1. Sleeved Standard cell TLH-4902



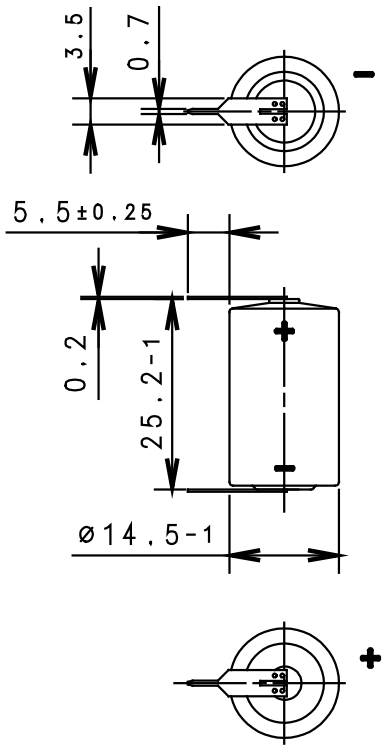
10.2. TLH-4902/P

This version has 2 tinned-copper axial leads



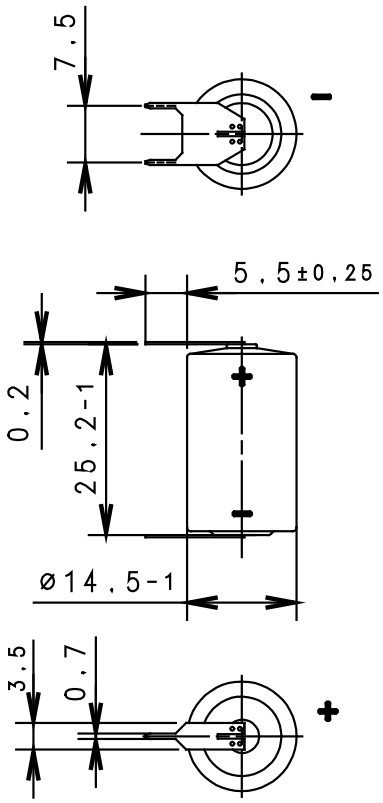
10.3. TLH-4902/PT2

This version has 2 rectangular tin-plated nickel radial tabs running in the same direction)



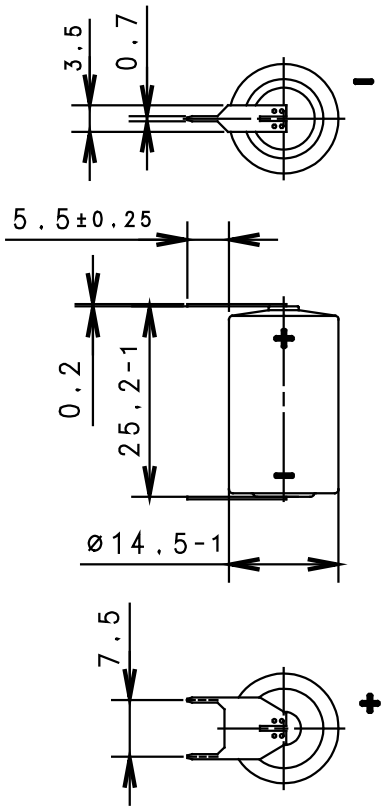
10.4. TLH-4902/TP

This version has 2 rectangular tin-plated nickel radial tabs running in the same direction)



10.5. TLH-4902/PT

This version has 2 rectangular tin-plated nickel radial tabs running in the same direction)



10.6. TLH-4902/T

This version has 2 rectangular tin-plated nickel radial tabs running in the same direction)