

# LSU

**MEDGUARD**<sup>®</sup>

Professional Healthcare Supplies

## Laerdal Suction Unit



Cat. No. 78 00 00 - Reusable



Cat. No. 78 00 30 - Serres

Directions for Use

[www.laerdal.com](http://www.laerdal.com)



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These Directions for Use covers two configurations of the Laerdal Suction Unit (LSU): Reusable, Serres Suction Bag System. Unless otherwise specified the information in this Directions for Use applies to both configurations.

Read these Directions for Use carefully, and become thoroughly familiar with the operation and maintenance of the LSU before using it.

## 1 Cautions and Warnings

The LSU should only be used by persons trained in the use of medical suction equipment.

The LSU is not suitable for use in the presence of flammable liquids or gases; there can be a danger of explosion or fire.

Do not use the LSU under environmental conditions that are outside the ranges specified under section 11.6. This can endanger safety and adversely affect operation of the device.

Do not block the Exhaust Outlet during use. This will lead to reduced flow and can also cause damage to the LSU.

Always use the Reusable version with the filter and the Float Ball in place.

Overflow of suctioned material can damage the device. If overflow of liquid from the Canister into the pump is suspected, the LSU must be returned for service (see section 8).

Disconnect the LSU from external power prior to cleaning. Use a minimum of liquid to prevent any electrical shock hazard.

Do not immerse the LSU or allow it to stand in water or other liquids. This might damage the device, and cause electrical hazard.

Do not pump any cleaning solution or other liquids through the vacuum pump, i.e. through the Vacuum Connector. This can damage the LSU.

Use only accessories supplied by Laerdal Medical or one of our authorised distributors to ensure that the LSU operates satisfactorily.

### Battery

- Only use batteries approved by Laerdal Medical. Other batteries will have problems related to the battery status indicator of the LSU, the battery operation time, and safety.
- To maintain satisfactory operation of the battery, it is recommended to place the LSU on continuous charge when not in use.
- The LSU must be placed on charge for a minimum of 24 hours to reach full battery capacity. The fast charging gives approximately 80% battery capacity after 3 hours (for a new battery). Please note that repetitive 3 hour charging is not recommended.
- If it is not possible to place the LSU on continuous charge when not in use, make sure the battery is charged for a minimum of 24 hours at least once a month.
- Do not store the battery when it is discharged; always fully charge the battery before storage.
- We recommend charging a spare battery every 6 months when stored in room temperature at 25°C (77°F).
- The LSU must be charged between each clinical use

## 2 Intended Use

The LSU is a portable, electrically powered, medical suction equipment intended for field and transport use. It is intended for intermittent operation to remove secretions, blood or vomit from a patient's airway to allow ventilation.

Higher vacuum levels are generally selected for oropharyngeal suctioning, and lower vacuum levels are usually selected for tracheal suctioning and the suctioning of children and infants.

## 3 User Interface (all configurations)

### 3.1 Operating Knob

The Operating Knob is a combined ON/OFF switch and vacuum selector, located at the bottom of the User Interface.

The LSU is switched ON by turning the Operating Knob to the required setting. Each setting indicates the maximum achievable vacuum level for the selected position (80, 120, 200, 350, 500+ mmHg).

The free air flow value changes along with the increasing vacuum settings (see section 11.4 for details). The LSU is switched OFF by resetting the Operating Knob to "0".

Even if the Operating Knob is in "0" position, voltage is present on some of the internal circuitry, when the LSU is connected to mains. To fully remove power, pull out the Power Cord.

### 3.2 Indicators

#### 3.2.1 Power ON Indicator

This green LED has 3 modes:

- It is lit continuously while the LSU is switched ON.
- It flashes rapidly (approx. twice per second) during the Device Test.
- It flashes slowly (approx. once per second) while the Automatic Power-save Function is activated, if the Device Test is interrupted or when the battery is discharged.



#### 3.2.2. External Power Indicator

This green LED is continuously lit while external AC or DC power is connected.



#### 3.2.3 Failure Mode Indicator

The red LED is lit when a possible malfunction of the LSU has been detected. If lit, turn the LSU OFF, and then ON again to check if the indication disappears. Provided that the indication does not occur again the LSU can be operated. If the Indicator



continues to lit after three OFF/ON cycles and after replacing the battery with a fully charged battery, discontinue use and return the LSU for service. (See section 8).

#### 3.2.4 Vacuum Indicator

This green LED bargraph displays the actual vacuum level during operation of the LSU.

Each fully lit segment represents 50 mmHg. If a segment has a weak light, this represents 25 mmHg (e.g 125 mmHg means 2 fully lit and 1 weakly lit segments).



mmHg	80	120	200	350	500
kPa	11	16	27	47	67
mBar	107	160	267	467	667

Pressure conversion chart

#### 3.2.5 Battery Status Indicator

This green LED bargraph has 3 functions:

- Indicates remaining battery capacity during operation from internal battery
- Indicates approx. achieved battery capacity during charging.
- Indicates which test is currently in progress during device test



During operation from internal battery:

Indicates approx. remaining battery capacity.

During operation from internal battery and during charging the displayed values must only be used as indications.

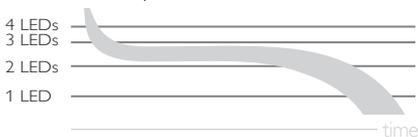
Several parameters can influence them e.g. device settings, state of battery, temperature etc.

**Note:** Immediately after turning the LSU ON and immediately after switching from external power to internal battery operation, all 4 LED's will flash for 5 seconds before the remaining battery capacity is displayed.

### Typical remaining Battery capacity

Accuracy is dependent upon the lifetime and condition of the battery, as well as, the condition of the unit. Outside variables such as temperature may also affect accuracy.

**\*Note** Immediately after turning the LSU ON and immediately after switching from external power to internal battery operation, all 4 LED's will flash for 5 seconds before the remaining battery capacity is displayed. Due to the nature of voltage based battery capacity measurement, the battery status indication may differ from unit to unit. Each battery may vary in voltage versus remaining capacity, thus allowing for variability in the reading. Other outside variables such as temperature may also affect accuracy. The indication is targeted to show battery capacity as indicated below. The graph shows how the accuracy of the indication can vary.



Battery Low; (min. 1 minute of operation left based on 500+ mmHg/free flow). 1 LED flashes.

**Note:** If the LSU or the NiMH battery has been stored at low temperatures ( $< 12^{\circ}\text{C}$  /  $< 54^{\circ}\text{F}$ ), the LSU may indicate lower remaining battery capacity than actual when first switched on. This is due to the nature of NiMH batteries. The battery indicator may flash on one LED, which normally indicates Battery Low. The LED may continue to flash until the LSU temperature is above  $12^{\circ}\text{C}$  /  $54^{\circ}\text{F}$  and the LSU is switched off and on again. The low battery indication in this instance is not a correct indication of the residual battery capacity.

During charging: indicates approx. achieved battery capacity.

Capacity	Output*
< 75%	The LED's will be lit sequentially
75 - 80%	3rd LED's lit and 4th flashing
> 80%	4 LED's lit.

**\*Note:** If no battery is installed, the battery status indicator will be fully lit for approx. 5 sec. until it is turned off.

### During the Device Test

Indicates which step of the test is currently in progress or which corresponding test result is being displayed:

LED 1 (lower LED) lit = STEP 1,

LED 2 lit = STEP 2 etc.

### 3.3 TEST-Button

This button allows you to run a 4-step user initiated Device Test program to identify whether the LSU is operating satisfactorily or if it needs service (see section 7).



### 3.4 Power Sources

The LSU is delivered with an AC Power Cord for connection to AC mains and a DC Power Cord for connection to DC mains. The device can be operated from the internal battery, and can be operated or charged from one of the following external Power Sources:

- AC mains when used with the AC Power Cord: 100-240 VAC (50/60 Hz).
- DC mains when used with the DC Power Cord: 12-28 VDC.

A Wall Bracket to hold the LSU during operation and (optional) charging is available separately (see section 10).



External power connection will cause the External Power Indicator to be lit. Always check that it is lit when connecting external power or inserting the LSU into the Wall Bracket.



### 3.5 Automatic Power-save Function

The LSU has an Automatic Power-save Function that switches the pump motor off. While in this mode, the Power ON Indicator will flash slowly (approx. once per second).

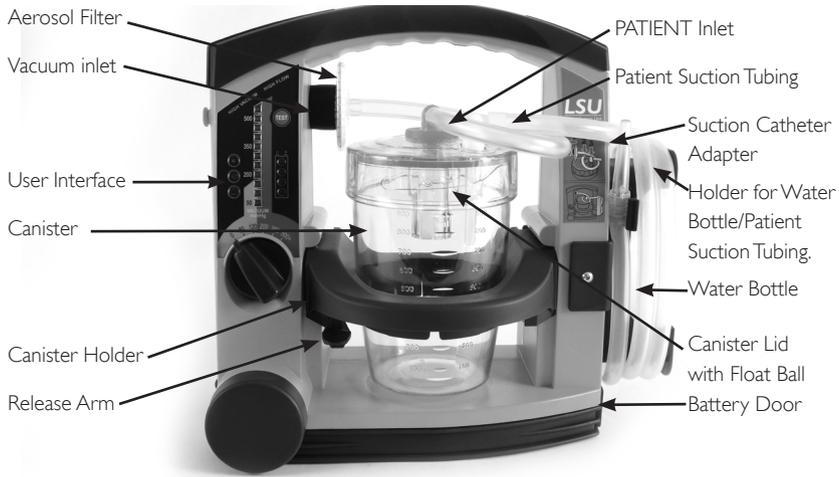


This function will be activated when the Operating Knob is set to 200, 350 or 500+ mmHg and the actual vacuum level has been continuously higher than 120 mmHg for more than 2 minutes.

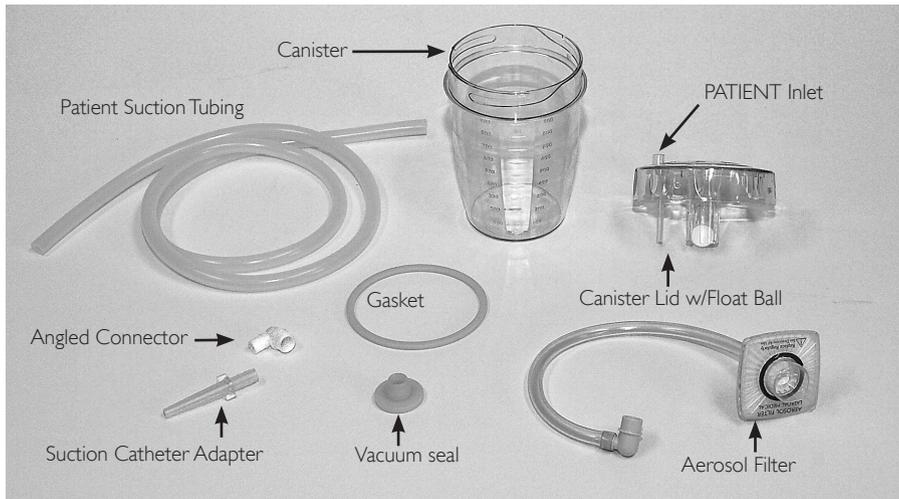
To exit the Power-save Mode and revert to normal operation, set the Operating Knob to any other position and then go back to required setting.

## 4 LSU Reusable Canister System

### 4.1 Overview



### 4.2 Parts



The LSU Reusable Canister System consists of:

- A 1000 ml transparent plastic Canister;
- A Canister Lid w/Float Ball
- An Aerosol Filter with tubing

The Canister Lid contains a Float Ball that shuts off the vacuum if the canister is full or the LSU tips over. To restore the vacuum, remove the Angled

Connector from the VACUUM Inlet. The Float Ball will be released and the Angled Connector can be reattached,

**Note:** The LSU Reusable Canister System must not be used without the Aerosol Filter or the Float Ball.

Decontamination of reusable parts must be performed in accordance with section 4.6.

The Aerosol Filter protects the LSU by preventing aerosols from entering the Pump Unit. It is not intended for microbiological or for particle filtration. The Aerosol Filter is not designed for decontamination.

It is recommended that the Aerosol Filter be replaced after each use or at least once every shift. If the LSU is used on patients in areas where cross contamination is not an issue, the Aerosol Filter should be replaced at least once a month.

It is recommended always to have extra Aerosol Filters with the LSU in case one has to be discarded. If the Aerosol Filter becomes wet, it should be replaced immediately or as soon as possible after use.

#### 4.3 Use

**Note:** Read all the Cautions and Warnings listed in section 1 thoroughly before you use the LSU. The parts are color coded to help re-assembly after cleaning.

##### 4.3.1 Check list

- Check that no parts are missing and that all parts are clean.
- If you decide to operate the LSU from external power, connect to either external AC or DC power as described in section 3.4. If you decide to operate the LSU from internal battery, check that the battery is installed.
- Check that the Patient Suction Tubing is securely connected to the PATIENT Inlet on the Canister Lid; and the Aerosol filter is securely fastened in the LSU and the lid.
- Check that a suction catheter is attached to the patient suction tube or suction adapter. Do not use the suction tube or suction adapter without a suction catheter attached.



##### 4.3.2 Using the LSU

**Note:** The LSU must be operated and transported in the upright position to prevent overflow of suctioned material.



- 1 Unwind the Patient Suction Tubing
- 2 Set the Operating Knob to the required vacuum level. The LSU will automatically be switched ON and start to operate. The green Power ON Indicator is lit continuously while the LSU is switched ON.
- 3 When suction is complete, set the Operating Knob to "0"

##### 4.3.3 Emptying the Canister

**Note:** To prevent damage and keep the LSU in good working order; empty the canister when 3/4 full. Check the filter after each use.

If the filter is broken so liquid penetrates the membrane, the pump will be contaminated, and the LSU must be returned for service (see section 8).

When liquid reaches the top of the Canister; the LSU will stop suctioning. To continue suctioning, empty canister and replace the filter.

Overflow of suctioned material can damage the device.

To remove the Canister, proceed as follows:



- 1 Disconnect the Filter Tubing from the blue Vacuum Inlet (see section 4.2 regarding handling instructions for the Aerosol Filter).



- 2 To release the Canister Holder; press down the Release Arm while sliding the Holder towards you. Remove the Canister from the Holder.



- 3 Release the Patient Suction Tubing (if applicable).



- 4 Safely dispose of the contents of the Canister according to local protocols.
- 5 Clean the LSU according to section 6.2 and its reusable parts according to section 4.6.

#### 4.3.4 Assembly of the Reusable Canister System

- 1 Place the yellow Gasket in the Lid, make sure that the gasket is placed flat in the Lid and not twisted.



- 2 If the Float Ball has been removed, hold the lid upside down and snap the ball into place as shown.

**Note:** Never use the LSU without the Float Ball.



- 3 Secure the Lid to the Canister by turning it clockwise until it is securely fastened.



- 4 Connect the Suction Catheter Adapter to the Patient Tube.



- 5 Connect the Angled Connector to the Patient Tube.



- 6 Mount the yellow Vacuum Seal in the centre hole of the Lid and push it into place.



- 7 Connect the Aerosol Filter (blue ring) to the blue Vacuum Inlet on the LSU. (Color code: Blue on Blue)



- 8 Insert the Canister in the canister holder and slide it into the LSU.



- 9 Connect the yellow Angled Connector to the yellow Vacuum Seal



- 10 Connect the Angled Connector on the Patient tubing to the PATIENT Inlet on the canister Lid.



- 11 Perform the Device Test according to section 7.



- 12 Wind the Patient Tubing on the Patient Tubing Holder:

- 13 Place the LSU on charge (see section 6.4)

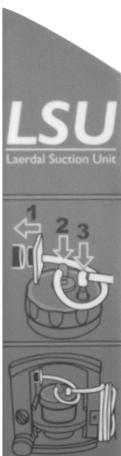
**Note:** Connect tubing according to color code: Blue on Blue & Yellow on Yellow.

## 4.4 Reusable Canister System

### Quick reference

The assembly of the tubing is illustrated on the right side of the LSU.

- 1 Connect the blue Aerosol filter to the blue Vacuum Inlet.
- 2 Connect the yellow angled connector to the yellow Vacuum Seal.
- 3 Connect the Patient Tubing to the Patient inlet.



## 4.5 After Use

- When suction is complete, set Operating Knob to "0" and inspect all parts for damage or excessive wear; Replace parts if necessary.
- Clean the LSU and its reusable parts according to section 6.2
- Perform the Device Test according to section 7.
- Place the LSU on charge (see section 6.4).

## 4.6 Decontamination of Laerdal Reusable Canister

### 4.6.1 Parts to be Decontaminated

After Each Use:

- 1 Canister Lid
- 2 Float Ball
- 3 Gasket.
- 4 Vacuum Seal
- 5 Angled Connectors
- 6 Canister
- 7 Patient Suction Tubing
- 8 Suction Catheter Adapter.



### 4.6.2 Preparation

- Remove and empty the Canister according to section 4.3.
- Disassemble the Canister into separate parts as indicated in the picture above.
- The Float Ball on the reusable canister can be snapped out of the lid.

### 4.6.3 Rinsing

- Rinse all parts under cold running water.
- Immerse in warm water (30-40°C).

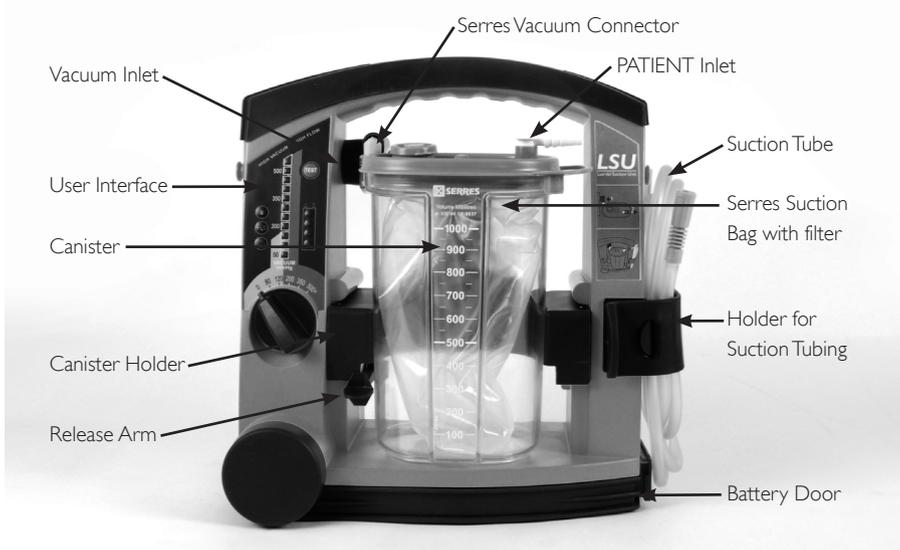
### 4.6.4 Cleaning

- Immerse all parts in hot water (60-70°C) containing a mild detergent (see section 6.3).
- Thoroughly clean all surfaces, use a brush where possible.
- Rinse in warm water and allow to dry.
- Inspect all parts to be visibly clean and dry.

**Note:** Thorough rinsing and cleaning are very important steps prior to disinfection.

## 5. Serres Suction Bag system

### 5.1 Overview



### 5.2 Parts

#### Disposable Parts

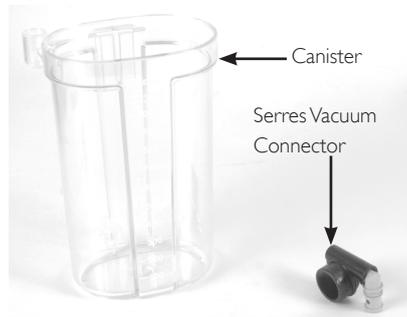
- Suction bag with filter
- Serres Suction Tube



#### Reusable Parts

Parts to be cleaned or replaced regularly:

- Canister
- Serres Vacuum Connector



The Serres Suction Bag system contains a hydrophilic filter that shuts off the vacuum if the canister is full or the LSU tips over.

To restore the vacuum, replace the Suction bag: The disposable parts must be replaced after each use.

The reusable canister must be cleaned if needed according to manufacturer's instructions for use.

Clean the Serres Vacuum Connector by wiping with a damp cloth or a sponge. Do not autoclave or attempt to disassemble.

### 5.3 Use

**Note:** Read all the cautions and warnings listed in section 1 thoroughly before you use the LSU.

#### 5.3.1 Check list

- Check that no parts are missing and that all parts are clean.
- If you decide to operate the LSU from external power, connect to either external AC or DC power as described in section 3.4. If you decide to operate the LSU from internal battery, check that the battery is installed and charged.
- Check that the Serres Vacuum Connector is properly connected to the LSU and to the canister

Check that the lid of the canister is properly sealed:

- 1 Block patient inlet and turn on the LSU.



- 2 Vacuum will build up when all parts are assembled correctly.

#### 5.3.2 Using the LSU

**Note:** The LSU should be operated and transported in the upright position to prevent overflow of suctioned material.

- 1 Unwrap the Serres Suction Tube.
- 2 Connect the Serres Suction Tube to the Patient inlet on the canister lid.



- 3 Attach appropriate suction catheter if necessary. Not supplied by Laerdal Medical.
- 4 Set the Operating Knob to the required vacuum level and the LSU will automatically be switched on and start to operate. The green power ON Indicator is lit continuously while the LSU is switched on.
- 5 When suctioning is complete, set the Operating Knob to "0".

#### 5.3.3 Empty the canister

**Note:** It is recommended to replace the Suction Bag when it is  $\frac{3}{4}$  full.

When liquid reaches approximately 1000 ml, the LSU will not suction any more liquid. If overflow of liquid from the bag into the pump is suspected, the LSU must be returned to service (see section 8).

Overflow of suctioned material can damage the LSU.

Disconnect Serres Suction tube. Safely dispose of the Serres suction tube according to local protocols.

- 1 Plug Patient Inlet with plug provided on the lid. Disconnect the Serres Vacuum Connector from the canister.



- 2 Press the release arm while sliding the holder towards you to loosen or completely remove canister.



- 3 Remove suction bag from canister
- 4 Safely dispose of the Serres Suction bag according to local protocols.
- 5 Clean the LSU if needed according to section 6.2.
- 6 Clean the Serres canister if needed according manufacturers instructions for use.

**Note:** Clean the Serres Vacuum Connector by wiping with a damp cloth or a sponge. Do not autoclave or attempt to disassemble. The Serres Vacuum Connector should be replaced regularly.

### 5.3.4 Assembly of the Serres Suction Bag system

- 1 Place the canister in a canister holder in an upright position.



- 2 Partially insert the canister holder into the LSU.



- 3 Unfold the Suction Bag and place inside the canister. Suction bag has to be installed into equal size canister



- 4 Insert the Serres Vacuum Connector into the LSU Vacuum Inlet.



- 5 Fully insert canister holder into the LSU.



- 6 Insert the opposite side of the Serres Vacuum Connector into the canister.



- 7 Turn the operating knob to 500+ mmHg.



- 8 Close the Patient inlet with your finger and simultaneously push the middle of the lid down. The lid is properly installed when vacuum has reached 500 mmHg.



- 9 Release the patient inlet and make sure that the bag is fully inflated.

- 10 Perform the Device Test according to section 7.

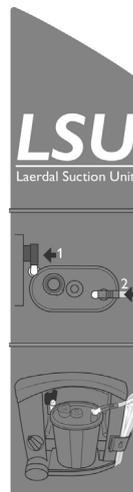


- 11 Fasten the Suction Tubing on the Suction Tubing Holder

- 12 Place the LSU on charge (see section 6.4)

### 5.4 Serres Suction Bag System Quick Reference

Correct assembly of the tubing is illustrated on the right side of the LSU.



### 5.5 After Use

- 1 Inspect all parts of the LSU for damage and excessive wear.  
Replace parts if necessary.  
The Serres Vacuum Connector should be replaced regularly.
- 2 Place an unopened Serres Suction Tube on the side of the LSU.
- 3 Perform Device Test according to section 7.
- 4 Place the LSU on charge see section 6.4.

## 6. Maintenance

### 6.1 General

- Make sure the maintenance instructions under "After Use" are followed.
- If the device is not in frequent use (i.e. less than once a month), the Device Test (see section 7) should be performed both on a monthly basis and after each use.

### 6.2 Clean the Cabinet and parts

Warning: Disconnect the LSU from external power prior to cleaning.

Use a minimum of liquid to prevent any electrical shock hazard. Do not immerse the LSU or allow it to stand in water or other liquids. This can damage the device, and cause electrical shock resulting in injury to persons.

- Use a cloth or sponge that is dampened with a mild detergent (hand dishwashing liquid or similar) to clean the external surfaces of the LSU. Use a detergent that is compatible with the materials listed under section 11.7, and follow the detergent manufacturer's instructions.
- Use a cloth or sponge dampened with water and wipe the surfaces again.
- Dry the surfaces using a clean cloth or a paper towel.

### 6.3 Disinfection of reusable parts

To disinfect the parts, the following methods are recommended:

Method	Temperature / Concentration	Contact Time	Post-treatment
Glutaraldehyde	Room temperature / Conc.: 2%	60 minutes	Rinse all parts warm water. Allow to dry.
Sodium Hypochlorite (not cleared for use in the US)	Room temperature / Conc.: 0.5%	20 minutes	Rinse all parts warm water. Allow to dry.
Virkon	Room temperature / Conc.: 1%	10 minutes	Rinse all parts warm water. Allow to dry.
Steam autoclaving	Autoclave at max. 121° C	60 minutes	Allow parts to cool.

### 6.4 Charge the Battery

The internal rechargeable battery can be charged directly from external AC or DC power as described in section 3.4. No external charger is needed. To charge the battery, proceed as follows:

- 1 Make sure the Operating Knob is set to "0". Connect either external AC or DC power to the LSU and charging will start automatically.
- 2 During charging the Battery Status Indicator will indicate approx. achieved battery capacity (see section 3.2.5 for details).
- 3 The LSU should be placed on charge for a minimum of 24 hours to reach full battery capacity. The fast charging gives approx. 80% capacity after 3 hours (for a new battery). Repetitive charging for only 3 hours is not recommended.

**Note:**

- Note: Do not perform the Device Test during battery charging.

**Note:**

- To maintain satisfactory operation of the battery, it is recommended to place the LSU on continuous charge immediately after use and when not in use.
- It is recommended to always fully charge the battery. Repetitive charging to a lower capacity level will reduce battery life.
- If it is not possible to place the LSU on continuous charge when not in use, make sure the battery is charged for a minimum of 24 hours at least once a month.
- Do not store the battery when it is discharged. Always fully charge the battery before storage.
- Do not store the LSU with a discharged battery.
- The recommended ambient temperature for charging is from 15°C to 25°C.
- The battery will not be charged when the LSU is in operation.
- If no battery is installed, the battery status indicator will be fully lit for approx. 5 sec. until it is turned off.
- Replace the battery when it does not pass the Battery Quality Check (see section 6.6 for details) or after 3 years, whichever comes first.
- A completely discharged battery cannot be charged by the LSU and must be replaced.
- We recommend charging a spare battery every 6 months when stored in room temperature at 25°C (77°F).

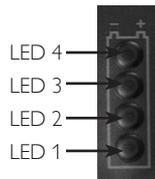
**6.5 External Battery Charger**

The LSU battery can also be charged in an optional External Battery Charger. See section 10.

**6.6 Check the Battery Quality**

If poor battery quality is suspected, charge the battery for a minimum of 24 hours and then perform the following test without connection to external power:

- Run the Device Test and then let the LSU operate continuously at 500+ mmHg setting and free air flow for 20 minutes.
- If the LSU stops before completing the 20 minutes, the battery should be discarded.

**6.7 Replace the Battery**

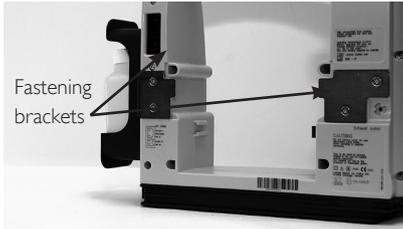
**Note:** Use only batteries recommended by Laerdal Medical.

- 1 Open the Battery Door.
- 2 To remove the battery, push and move it slightly to the left and then release.
- 3 Withdraw the battery from the LSU.\*
- 4 To insert a battery, push it fully in and then to the right to lock it.
- 5 Close the Battery Door.
- 6 After inserting the battery, place the LSU on charge unless a fully charged battery is inserted.

\*When you discard the battery, dispose of safely in accordance with local protocols for sealed lead acid or Nickel Metal Hydride (NiMH) batteries.

## 6.8 Fastening brackets

The fastening bracket is used to hold the LSU in the optional wall bracket. Inspect the fastening brackets for wear and tear regularly. Replace if worn. See section 10.



## 6.9 Release arm for Canister holder

An extra release arm for the canister holder can be attached. See section 10.



## 7 Device test

The Device test is a user initiated test program for all models which can identify whether the LSU operates satisfactorily or if the LSU needs service.

The program runs 4 different tests:

- 1 It tests for occlusions in the Suction System (including canister and tubing).
- 2 It tests the vacuum build-up efficacy of the Pump System (How much vacuum is built up within 3 seconds).
- 3 It tests the maximum achievable vacuum level of the LSU (reaches this level within 10 seconds).
- 4 It tests if there are air leakages in the Pump System (including canister and tubing).

### 7.1 Setup

Before the test can be performed make sure that:

- The Patient Suction Tubing is unwound and not blocked or bent.
- The Suction Catheter Adapter is removed from its holder (if applicable).
- The Canister Lid, Vacuum Connector, Angled Connector with Patient Tubing are securely fastened.
- The LSU is not connected to any AC or DC power source, and is not mounted to the Wall bracket.
- The battery is not being charged.

## 7.2 Run the Test

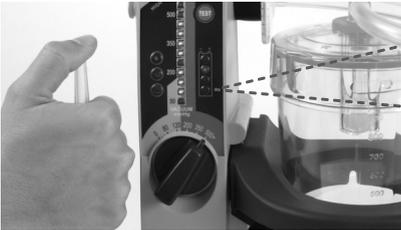
**Note:** If you need to interrupt the test and revert to normal operation, turn the Operating Knob to another position and then select the required setting.

- 1 Press and hold the TEST-Button while setting the Operating Knob to 500+ mmHg.



**Note:** Do not release the TEST-Button until min. 2 seconds after the Operating Knob has been set to 500+ mmHg. The test will start immediately

- 2 As soon as LED 2 from the bottom of the Battery Status Indicator comes on (takes approx. one second), fully block the Patient Suction Tubing.\*



- 3 Keep the tubing blocked while LED 2, 3 and 4 lights up.



- 4 Release the tubing when LED 1 comes on again.



- 5 Evaluate the test results (See section 7.3)
- 6 After evaluating the test results turn the Operating Knob to "0" to exit the Device Test.

**Note:** To indicate that the LSU is in test mode, the Power ON Indicator will flash rapidly (approx. twice per second) until you exit the test program.  
\* If the tubing is not occluded within 2 minutes, the test will be interrupted and the Power ON Indicator will start to flash slowly (approx. once per second). To restart the test, set the Operating Knob to "0" and start over again.



### 7.3 Evaluation of Device Test Results

After the test is completed, the Vacuum Indicator will automatically display the first result (blockage). To display the other results press the TEST-Button once for each test. If you continue pressing the button after the 4th test result has been displayed, the earlier results will be repeated (Test 1,2,3,4,1,etc.). To exit the test program, set the Operating Knob to another position.

Test No.	The program has tested for	Battery indicator	Test result indication	Action if test failed
Test 1	Blockage in the Suction System (including canister and tubing)	LED #1 lit up 	Test Passed $\leq 100$ mmHg  FAIL 100 mmHg PASS	Check possible blockages (e.g. twisted tubing, blocked filter, blocked filter in the liner) and run the Device. Test again. If the High Efficiency Filtration Kit is installed the pass limit is 150mmHg
Test 2	The vacuum build-up efficacy of the Pump System (How much vacuum is built up within 3 seconds)	LED #2 lit up 	Test Passed $\geq 300$ mmHg  PASS 300 mmHg FAIL	Check Connectors, Tubes and Canister Lid for leakage* or damage. Check exhaust outlet for occlusion and run the Device Test again
Test 3	The maximum achievable vacuum level of the LSU (reaches this level within 10 seconds)	LED #3 lit up 	Test Passed $\geq 500$ mmHg  PASS 500 mmHg FAIL	Check Connectors, Tubes and Canister Lid for leakage* or damage. Check exhaust outlet for occlusion and run the Device Test again
Test 4	Air leakages in the Pump System (including canister and tubing)	LED #4 lit up 	Test Passed $\geq 450$ mmHg  PASS 450 mmHg FAIL	Check Connectors, Tubes and Canister Lid for leakage* or damage and run the Device Test again

\* If it is not obvious where the system is leaking go step by step through the connections. Start by disconnecting the Vacuum Tube (the tube from the canister into the LSU vacuum inlet) at the Canister and run the Device Test (blocking the vacuum tube). Reconnect the vacuum tube and disconnect the patient tube, run device test (block the PATIENT tube inlet on the Canister). Continue with other connections until the leakage is identified.

**Note:** If the LSU does not pass one or more of the steps in this test after suggested actions are taken, the device might need to be returned for service (see the Troubleshooting guide).

## 8. Servicing

There are no user serviceable parts inside the cabinet. Do not open cabinet.

Please note that wear and tear parts of the pump mechanism should be changed every third year:

Refer servicing to personnel qualified by Laerdal Medical, or to Laerdal Medical or one of its authorised distributors.

## 9. Trouble Shooting

Fault	Condition	Action
The LSU does not operate with the AC or DC Power Cord connected.	External Power Indicator is not lit when the Operating Knob is set to "0".	Check power cord connections and the external AC or DC power source.
	External Power Indicator is lit.	The LSU must be returned for service (see section 8).
The LSU cannot be operated from the internal battery,	Power ON Indicator is OFF.	Check that battery is installed.
	OR	Place the LSU on charge.
	All the lights in the front panel flash on and off repeatedly,	If still faulty after charging completed, remove and replace the battery (see section 6.7).
The LSU operates, but little or no suction available.	Vacuum Seal blocked by float ball.	Unplug the Vacuum Seal to release the vacuum
	Canister full.	Remove and replace the Canister (see section 4.3, 5.3)
	Poor vacuum connection between Pump Unit and Canister.	Install the Vacuum Connector Tubing correctly.
	Patient Suction Tubing twisted or blocked.	Replace the filter or liner if the filter is blocked Untwist the Patient Suction Tubing and/or clear blockage or replace the tubing.
	(Serres) Lid is not properly sealed	Seal lid using vacuum, not force. See section 5.3.4
Battery Status Indicator is not ON.	Battery is not charged.	Check power cord connections and that battery is installed
Vacuum Indicator indicates more than 100 mmHg with free air flow	Tube(s) is kinked or twisted	Straighten / untwist the tube(s).
The LSU does not charge with the AC or DC power cord connected	The external Power indicator is not lit.	Check power cord connections and the external AC- or DC-power source. The LSU must be returned for service (see section 8). A flat battery cannot be recharged

## 10. Accessories and Parts

### Cat. No. Description

- 78 00 00 LSU w/Reusable Canister
- 78 00 30 LSU w/ Serres Suction Bag System  
(Label on back side of cabinet: REF 78 00 xx)

### Reusable

- 78 12 00 Aerosol Filter for LSU Reusable Canister
- 77 04 10 Suction Tubing 150 cm w/o tip
- 65 01 13 Suction Catheter adapter, pkg. 10
- 78 40 00 LSU Reusable Canister
- 78 10 06 Angled Connectors, pkg. 10
- 78 10 02 Float Ball, pkg. 10
- 78 40 07 Vacuum Seal
- 78 40 08 Gasket
- 78 04 30 LSU Reusable Canister Holder



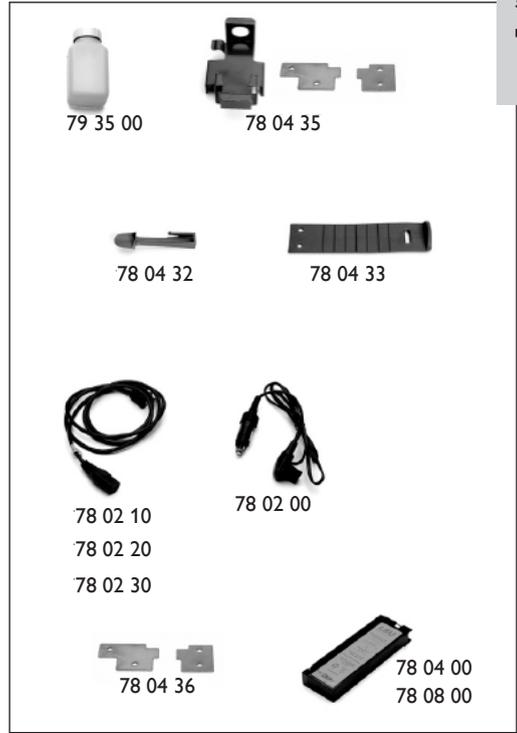
### Serres

- 57 151 Serres Suction Bag (1000 ml, Blue)
- 58 33 181 Serres Suction Tube (non-sterile CH25) 180 cm
- 78 12 06 Serres Vacuum Connector
- 78 04 12 Disposable patient tubing 180cm
- 57 300 Serres Canister (1000ml, Transparent)
- 78 04 51 Serres Canister Holder



**All versions**

- 78 04 33 Strap for Tubing
- 78 04 32 Release Arm
- 78 02 00 DC-Power Cord
- 78 02 10 AC-Power Cord US
- 78 02 20 AC-Power Cord EU
- 78 02 30 AC-Power Cord UK
- 78 08 00 LSU Battery - NiMH
- 78 04 00 LSU Battery - Lead Acid
- 78 04 36 Fasten bracket left/right
- 78 04 35 Holder for water bottle
- 79 35 00 Water Container

**Accessories (all versions)**

- 78 20 00 Carrying Bag (full covering)
- 78 26 00 Wall Bracket w/DC-Power Cord
- 78 26 10 Wall Bracket w/AC-Power Cord US
- 78 26 20 Wall Bracket w/AC-Power Cord EU
- 78 26 30 Wall Bracket w/AC-Power Cord UK
- 78 26 40 Wall Bracket wo/ Power Cord
- 78 23 00 Shoulder Strap
- 78 24 00 Side Pouch
- 78 04 40 External Charger kit



## 11. Specifications

### 11.1 Classification

Electrically powered medical suction equipment for field and transport use, according to ISO10079-1

High vacuum/high flow.

Not suitable for use in the presence of flammable liquids or gases.

Internally powered/class II equipment type BF, according to IEC 60601-1

The degree of protection provided by the chassis is according to IP34D:

- Protected against solid foreign objects of 2,5 mm Ø and greater
- Protected against splashing water
- Protected against access with a wire

### 11.2 General tolerance

Overall tolerance  $\pm 5\%$

### 11.3 Physical Characteristics

Size: 315 mm (12,4 in) x 330 mm (13 in) x 160 mm (6,3 in), (h x w x d)

Weight: 4kg (8,9 lbs) (including battery NiMH)

Canister Capacity: 1000 ml

Canister graduation

accuracy:  $\pm 5\%$  of full scale

Patient Suction Tubing

(non-sterile) Cat.No 770410: 8 mm (0.315 in.) inside diameter x 1.5 m (59 in.) length

### 11.4 Operation

Approx. free air flow at different settings:

mmHg	80	120	200	350	500+
l/min	12	16	20	23	>25

Approx. battery operation time (free air flow) at different settings ( $\pm 10\%$ ):

mmHg	80	120	200	350	500+
min	3h20	2h20	1h30	1h	45

Approx noise levels (free air flow) at different settings:

mmHg	80	120	200	350	500+
dBA	48	48	51	53	56

Vacuum - Max.: > 500 mmHg (67 kPa).

Vacuum - Range: 80 - 500+ mmHg (11 - 67 kPa).

Vacuum Indicator accuracy:  $\pm 5\%$  of full scale.

### 11.4.1 Operation with High Efficiency Filtration Kit

The flow and operation time of the LSU will be reduced when the Vacuum Connector Tubing is replaced with a High Efficiency Filtration Kit.

The LSU with High Efficiency Filtration Kit installed is in accordance with ISO 10079-1.

The filter has an efficiency of 99.97% down to a particle size of 0.3  $\mu\text{m}$ .

### 11.5 Power Requirements

Operating/charging AC:\*\* 100-240 VAC  $+10\%/-15\%$ , 50-60 Hz  $+/- 3$  Hz (100-240 VAC),

Operating/charging DC:\*\* 12-28 VDC  $+/-10\%$ .

Battery: 12 VDC 2 Ah, NiMH, rechargeable, 12 VDC 2 Ah, Sealed Lead - Acid, rechargeable

Charging Time: 3 hours for approx. 80% battery capacity, 24 hours for fully charged.

Fuses: The LSU has no fuses to be replaced by the user (see section 9).

\*\*The external AC power source must be able to deliver a current of min. 1A and the external DC power source min. 6A, if not the LSU may switch to battery operation.

## 11.6 Environmental Conditions

Operating/Charging Temperature:  
0° C (32°F) to + 40° C (104° F).

Recommended Charging Temperature:  
15° C (59°F) to + 25° C (77°F).

Long term Storage Temperature:  
0° C (32°F) to + 40° C (104° F).

Max. 24 hour Storage Temperature:  
-30° C (-22°F) to + 70° C (158° F).

Humidity (Operating & Storage):  
5 - 95% RH non-condensing

## 11.7 Material Chart

- Cabinet front: Poly Carbonate/Acrylonitrile Butadiene Styrene (PC/ABS)
- Protector for front: Styrene Ethylene Betyl Styrene (SEBS)
- Cabinet back: PC/ABS
- Cabinet base w/Protector: PC/ABS + SEBS
- Battery door: SEBS
- Connector retainer for battery:
- Poly Oxy Methylene (POM)
- Operating Knob: POM
- Rotor for Operating Knob: PC/ABS
- Manifold for vacuum: POM
- Canister Holder: PP
- Handle w/Protector: PC/ABS + SEBS
- Manifold for exhaust: POM
- Strap for patient suction tubing: SEBS
- Canister Holder Release Arm: POM
- User Interface: Polyester
- Vacuum Connector: Silicone
- Suction Catheter Adapter: PC
- Suction Catheter Adapter Holder: PC
- LSU Reusable Canister: PC - HT
- Lid w/Floater Valve Cylinder;
- Gasket for Lid, LSU Reusable Canister: Silicone
- Full covering Carrying Bag: PVC coated Polyester

- Side Pouch: PVC coated Polyester
- Shoulder Strap: POM + Polyester
- Wallbracket: Aluminium + Steel + PA with fibers Aerosol Filter; LSU Reusable Canister: PVC + ABS Styrene-Butadiene Copolymer (SBC)
- Float Ball, LSU Reusable Canister: PP
- Vacuum Plug, LSU Reusable Canister: Silicone
- Serres Canister: PC
- The angle connector of the canister: TPE
- Serres Canister Holder: PP
- Serres Suction Bag: PE + PP
- Serres Vacuum Connection PC + PBT

### 11.7.1 Dismantling/Disposal

When discarding the LSU, we recommend it be dismantled and discarded according to local protocol.



Dismantle the LSU by unscrewing the screws on the back side of the LSU, remove the components and sort according to the table in 11.7.

The cleaned LSU can also be delivered to your local Laerdal Medical representative for dismantling/disposal. Laerdal Medical AS will not charge any fee for the dismantling; Sender is responsible for the cost of the shipment.

## 11.8 Symbols



(Direct Current).



(Alternating Current).



Class II Equipment, according to IEC 60601-1



Type BF applied part, according to IEC 60601-1

**IP34D**

The degree of protection provided by the chassis according to IP34D



This product is in compliance with the essential requirements of MDD 93/42/EEC as amended by Council Directive 2007/47/EC and Council Directive 2011/65/EU relating to restriction on the use of certain Hazardous Substance (RoHS 2)



Warning: Parts of this product are designed for single patient use only. Do not re-use. Re-use will lead to increased risk of cross contamination, degradation of performance and/or device malfunction. Laerdal Medical is not responsible for any consequences of re-use



Date of production.



See Directions for Use.



Unique product type identification



This appliance is marked according to the European directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE). The symbol on the product, or on the documents accompanying the product, indicates that this appliance may not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment.



This product complies with the following ANSI/UL and CSA standards

CSA Standards:

CAN/CSA-C22.2 No:0-M91

General Requirements – Canadian Electrical Code, part II

CAN/CSA-C22.2 No:601.1-M90

Medical Electrical Equipment Part I: General Requirements for Safety

CAN/CSA-C22.2 No:601.1S1-94

Supplement No 1-94 to CAN/CSA-C22.2 No. 601.1-M90 – Medical Electrical Equipment – Part 1: General Requirements for Safety US Standards:

UL Standard No:2601.1

Medical Electrical Equipment

## 11.9 EMC Specifications

MEDICAL ELECTRICAL EQUIPMENT needs special precautions regarding EMC and needs to be installed and put into service according to the EMC provided in this section. Portable and mobile RF communication equipment can affect MEDICAL ELECTRICAL EQUIPMENT.

### Warning:

MEDICAL ELECTRICAL EQUIPMENT should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the MEDICAL ELECTRICAL EQUIPMENT should be observed to verify normal operation in the configuration in which it will be used.

Maximum cable length, AC Power cord: 1.5 meters

Maximum cable length, DC Power cord: 1.5 meters

### Warning:

The use of accessories, transducers and cables other than those specified, with exception of transducers and cables sold by Laerdal Medical as replacement parts for internal components, may result in increased emission or decreased immunity of the LSU.

## Guidance and manufacturer's declaration – electromagnetic immunity

The Laerdal Suction Unit (LSU) is intended for use in the electromagnetic environment specified below. The customer or the user of the LSU should assure that it is used in such an environment.

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst. IEC 61000-4-4	±2 kV for power supply lines	±2 kV for power supply lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2kV common mode	± 1 kV differential mode ± 2kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines. IEC 61000-4-11	< 5% UT (> 95% dip in UT) for 0,5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles < 5% UT (> 95% dip in UT) for 5 sec.	< 5% UT (> 95% dip in UT) for 0,5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles < 5% UT (> 95% dip in UT) for 5 sec.	Mains power quality should be that of a typical commercial or hospital environment.
Power Frequency (50Hz/60Hz) magnetic field. IEC 61000-4-8	3A/m	3A/m	

NOTE: UT is the AC mains voltage prior to application of the test level.

## Guidance and manufacturer's declaration – electromagnetic immunity

The Laerdal Suction Unit (LSU) is intended for use in the electromagnetic environment specified below. The customer or the user of the LSU should assure that it is used in such an environment.

Immunity test	IEC 60601-1-2 test level	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The LSU uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The LSU is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

## Guidance and manufacturer's declaration – electromagnetic immunity

The Laerdal Suction Unit (LSU) is intended for use in the electromagnetic environment specified below. The customer or the user of the LSU should assure that it is used in such an environment.

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC/EN 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the LSU, including cables, than the recommended separation distance calculated from the equation applicable to frequency of the transmitter: Recommended separation distance $d=1.2 \cdot P$ $d=0.35 \cdot P$ 80 MHz to 800 MHz $d=0.7 \cdot P$ 800 MHz to 2,5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range. Interference may occur in the vicinity of equipment marked with the following symbol: 
Radiated RF IEC/EN 61000-4-3	3 V/m 80 MHz to 2,5 GHz	10V/m	

NOTE 1. At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE 2. These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

a. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the LSU is used exceeds the applicable RF compliance level above, the LSU should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the LSU.

b. Over the frequency range 150 kHz to 80 MHz, field strength should be less than 3 V/m.

## 12 Limited Warranty

The LSU comes with a five (5) year limited warranty\*. See the enclosed "Laerdal Global Warranty" for terms and conditions.

The warranty is also available at [www.laerdal.com](http://www.laerdal.com)

\* Excluding the canister, tubing systems and battery

## 13 Addresses

### Manufacturer:

Laerdal Medical AS  
 Tanke Svilandsgate 30  
 P.O.Box 377  
 4002 Stavanger  
 Norway

### Distribution:

For World Wide distribution,  
 see Global Warranty or  
[www.laerdal.com](http://www.laerdal.com)







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Website: [www.medguard.ie](http://www.medguard.ie)

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[www.laerdal.com](http://www.laerdal.com)



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helping save lives