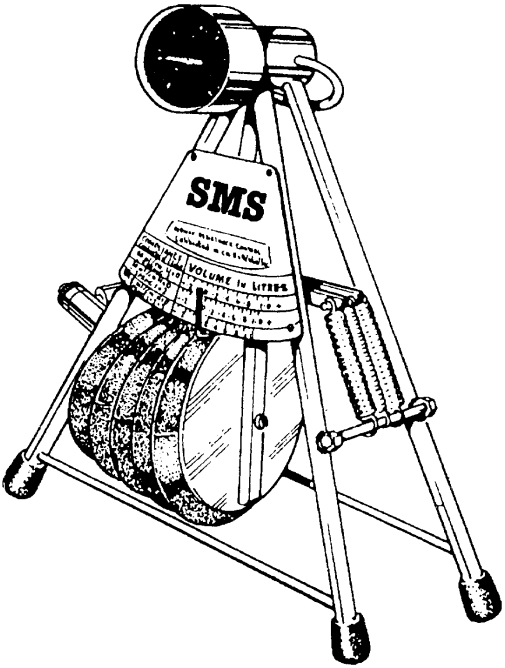
TESIKA Teknik AB

Test Simulering Kalibrering

Operating and Maintenance Manual

LUNG SIMULATOR FROM SMS TECHNOLOGIES



Contents

1.0 Introduction

Warning: This manual and all its associated documentation must be studied thoroughly before any attempt is made to set up, operate or service any part of the Lung Simulator (Test lung). Failure to do so may result in damage to the equipment.

There are a two of versions of the Lung Simulator:

A unit with a volume scale and pressure gauge as illustrated and supplied with a Certificate of Calibration. This unit is intended for use by manufacturers of ventilators and technicians in clinical establishments.

A unit with volume scale and pressure gauge as illustrated but NOT including a Certificate of Calibration intended for use when demonstrating ventilators, or in clinical training when the additional cost of calibration is not justified.

1.1 General

This Manual contains the information required in order to set up and maintain the Lung Simulator.

Requests for servicing facilities, advice or assistance must be addressed to a local Authorised Distributor.

Additional copies of this manual can be purchased from a local Authorised Distributor quoting the Part No. shown on the rear cover.

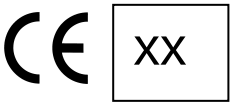
It is recommended that all relevant documentation, including the Operating Manual is immediately available to all prospective operators.

1.2 Precautions

A number of Warnings and Cautions  are used throughout this Manual to draw attention to the possible hazards and/or adverse conditions which may occur if the information and instructions provided are not strictly observed.

Warnings are used to draw attention to a condition which can endanger either the Patient or the operator. Cautions are used to draw attention to a condition which can result in damage to the equipment. Special attention must be paid to each Warning and Caution as it appears in the manual.

1.3 Symbols



Systems with this mark agree with European Council Directive (L 183/15) for Essential Health and Safety Requirements Relating to the Design & Construction of Machinery when they are used as specified in their operating manual. The xx relates to the year of manufacture.

Within Europe this product is not classified as a Medical Device but in Canada it is classified as a Medical Device & is listed with the Canadian authorities as such.

1.4 User Responsibility

The performance of this Product conforms to the description thereof contained in this Operating Manual and accompanying labels and/or inserts when the Product is set up, operated, maintained and serviced in accordance with the instructions provided. The Product must be checked periodically. A defective Product must not be used. Parts that are broken, missing, plainly worn, distorted or contaminated must be replaced immediately. Should such repair or replacement become necessary, the Manufacturer recommends that either a verbal or a written request for service advice is communicated to a local Authorised Distributor. It is recommended that the Manufacturer's trained personnel Service/Repair or Calibrate this Product, including any of its parts. The Product must not be altered without the prior written approval of the Manufacturer. The user of this Product shall have sole responsibility for any malfunction, which results either from alteration by anyone other than the Manufacturer's trained personnel, or from improper use, faulty maintenance, improper repair or damage.

1.5 Servicing Policy

It is recommended that the Lung Simulator be fully Serviced/Calibrated at least every 12 Months.

Warning: Only Technicians/Engineers trained to repair and/or service this type of equipment should attempt to repair and/or service the Lung Simulator and it must be repaired and/or serviced only in accordance with written instructions provided by the Manufacturer. An improper repair and/or service can result in patient or operator injury. It is recommended that after any repair/service that the Lung Simulator is calibrated.

Do not use malfunctioning equipment. Damaged, broken or worn parts can be replaced but only by Technicians/Engineers trained to repair and/or service this type of equipment.

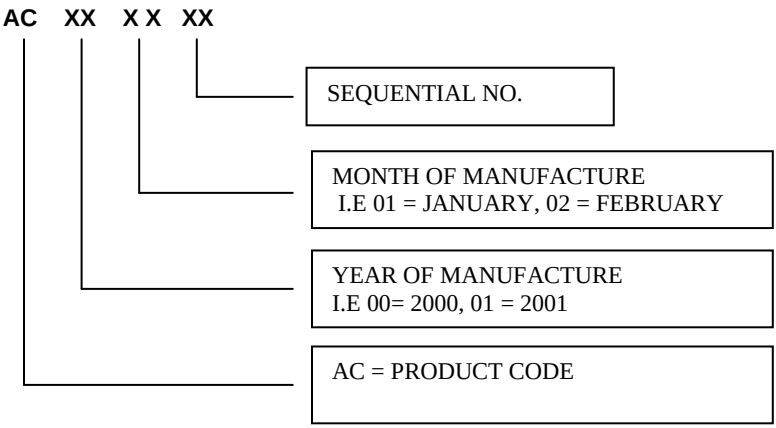
If the equipment is to be transported to the nearest Authorised Distributor, package it securely in its original packaging if possible for protection and ship it prepaid. Enclose the following items as applicable:

1. A letter describing in detail any difficulties experienced with the Equipment.
2. Warranty information, such as a copy of the invoice or other applicable Documentation.
3. Purchase order number to cover repair of equipment not under warranty.
4. Ship to and bill to information.
5. The name and telephone number of the person to contact for functional Questions.

Other than when the warranty is applicable, repairs are made at the Supplier's current list price for replacement part(s) plus a reasonable labour charge.

1.6 Lot Number

The Lot Number is allocated to the Lung Simulator as follows:



1.7 Warranty

Such warranties are extended only with respect to the purchase of this Product directly from the Manufacturer or the Manufacturer's Authorised Dealers as new merchandise and are extended to the first buyer thereof, other than for the purpose of resale.

For a period of one (1) year from the date of original delivery to the first Buyer or Buyer's order, this Product, other than its expendable parts, is warranted against functional defects in materials and workmanship and to conform to the description of the Product contained in the Operation and Maintenance manual and accompanying labels and/or inserts, provided that the same is properly operated under conditions of normal use, that regular periodic maintenance is performed and that replacements and repairs are made in accordance with the instructions provided.

The foregoing warranties shall not apply if the Product has been repaired or serviced other than by Qualified Technicians/Engineers or other than in accordance with written instructions provided by the Manufacturer, or altered by anyone other than the Manufacturer, or if the Product has been subject to abuse, misuse, negligence, or accident.

The Manufacturer's sole and exclusive obligation and Buyer's sole and exclusive obligation and the Buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, free of charge, at the Manufacturer's option, a Product, which is confirmed as being defective by the Manufacturer following the Buyer's notification to the Manufacturer in accordance with the instructions contained in the Service Policy section of the Operation and Maintenance Manual, not later than seven (7) days after the expiration date of the applicable warranty.

The Manufacturer shall not be otherwise liable for any damages including but not limited to incidental damages, consequential damages, or special damages.

There are no express or implied warranties, which extend beyond the warranties herein above set forth. The Manufacturer makes no warranty or merchantability or fitness for a particular purpose with respect to the Product or parts thereof.

2.0 General Description and Performance

The Lung Simulator (Test Lung) can be used to test the efficiency of lung ventilators in normal use, or after maintenance to check the serviceability of a ventilator for a specific application and for the instruction of students in the use of ventilators and the techniques of manual ventilation.

The Lung Simulator comprises a bellows and associated restraining springs, a pressure gauge, a volume scale and resistance and leak controls, all mounted on a free-standing frame.

Specification

Volume Range	-0.3 to + 1.0 litre
Compliance Values *	10, 20, 50ml/cmH_2O
(pre-set, calibrated at 1 litre)	
Resistance Values*	0, 5, 20, 50, 200cmH_2O/litre/sec.
Weight	3.8Kg
Dimensions	146 x 276 x 352mm
Connection	BS/ISO compatible 22mm socket
Noise Level at 1 metre	< 70dB

*The values approximate to those recommended in the ISO 5369 standard for Breathing Machines for Medical use (lung model and method of testing performance of lung ventilators). Note: However, the resistance being non-linear and the compliance being adiabatic instead of isothermal, the Lung Simulator should not be used for the precise measurement and calibration of lung ventilators to the ISO specification. Properly certified calibration equipment must be used for this purpose.

In order to be representative of the various states found in clinical practice, a Lung Simulator must have two independently variable components: total compliance and airway resistance.

2.1 Total Compliance

Total compliance represents the relationship between the volume and pressure of a gas in the alveoli and comprises the compliance of the lungs and the chest wall. This compliance is represented on the Lung Simulator by a series of springs attached to the bellows, which, used in combinations, achieve the various compliances required. The number of each spring is engraved on the bellows extension arm.

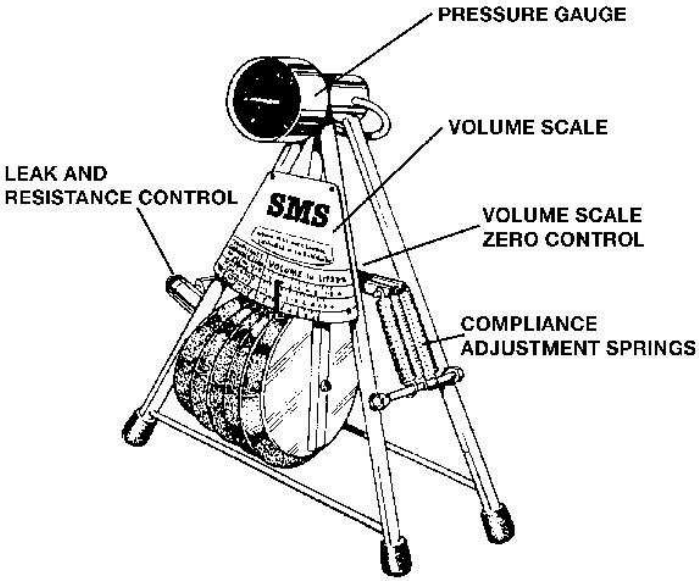


FIGURE 1. LUNG SIMULATOR

With spring 1 only attached, a compliance of 50ml/cm H_2O is achieved. This figure represents the typical value to be found in a normal adult in the anaesthetised state. With springs 1 and 2 attached, a compliance of 20ml/cm H_2O, which is approximately half the normal value is achieved. With springs 1, 2 and 3 attached, a compliance of 10ml/cm H_2O is achieved.

The compliance in each case is non-linear to simulate the human curve. Other values at any point may be obtained by reference to the pressure gauge and volume scale. The volume scale for each compliance is corrected to atmospheric pressure so that it can be related directly to expired volume at the current atmospheric pressure.

2.2 Airway Resistance

Airway resistance is represented by five different sized holes in the resistance and leak control, giving a range of resistances calibrated at 0.5 litres/sec. Flow. 0 represents no resistance and is used for testing the ventilator pressure gauge, as pressure in the ventilator and Lung Simulator are equalised. 5 represents a resistance of 5cm H_2O/litre/sec., which is the typical value to be found in a normal adult in the anaesthetised state. 20 represents 20cm H_2O/litre/sec., which is four times normal resistance. 50 represents 50cm H_2O/litre/sec., 200 represents 200cm H_2O/litre/sec. The latter two values are used in conjunction with paediatric ventilators.

2.3 Pressure and Volume

The pressure gauge and volume scale are both illustrated in Fig.1 with their respective indicators in the 0 position.

When the Lung Simulator is connected to an operating ventilator, measurements of the volume and pressure output can be read at a glance for the values of compliance and airway resistance.

2.4 Leak Control

A variable leak control, illustrated in Fig.2 is incorporated, so that the effect of leaks in the breathing circuit can be demonstrated.

3.0 Operating Instructions

1. Ensure that springs 2 and 3 are disconnected from the bellows extension arm.

2. Set the volume scale indicator to 0, by rotating the knurled knob, just behind and below the bellows extension arm, clockwise or counter-clockwise, as necessary.

3. Set the pressure gauge indicator at 0, by rotating the screw at the 6o'clock position on the gauge face, clockwise or counter clockwise, as necessary, with a screwdriver.

4. Connect the patient connections from the ventilator to the patient circuit connection of the Lung Simulator illustrated in figure 2.

5. Ensure that the leak control is closed. Set the resistance control at 0.

6. Turn the ventilator ON and check that the pressure indicated on the ventilator airway pressure gauge is approximately the same as the pressure indicated on the Lung Simulator pressure gauge.

7. Rotate the resistance control to the required resistance setting, adjust the ventilator controls to provide the required output and check that the indications on the Lung Simulator approximately reflect the selected output.

8. Repeat the tests using springs 1 and 2 and springs 1, 2 and 3 as required.

Warning: A ventilator failing any of the tests should not be used. A failed unit should be serviced by Technicians/Engineers trained to repair and/or service this type of equipment.

9. During any test, the leak control can be opened to an infinitely variable degree to simulate a leak in the breathing circuit.

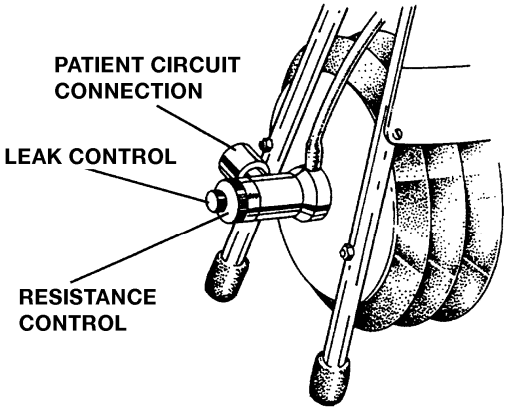


FIGURE 2. OPERATING CONTROLS

Warning:

i <u>Over</u> inflation of the bellows may result in permanent damage to the product:

ii To avoid cross contamination ensure breathing circuits are cleaned and sterilised before connecting to the Lung Simulator.

4.0 Servicing/Maintenance

It is recommended that all servicing work is carried out by Technicians/Engineers trained to repair and/or service this type of equipment.

4.1 Special Tools and Equipment

1. Small flat blade screwdriver
2. Large flat blade screwdriver
3. Imperial spanner set
4. 2BA Allen key / M3 Allen key
5. Medium adjustable spanner

6. Ambersil Silcoset 152 sealant*
7. Molykote III*
8. Test set comprising of a pressure gas supply, closure valve, corrugated hose and water manometer to measure in excess of 100 cmH_2O.

* Suppliers' addresses for these two items may be found at the back of this manual.
Alternatively these items may be supplied by the Lung Simulator Manufacturer.

4.2 Servicing Procedure

The following procedure must be followed when servicing the Lung Simulator:

1. Clean parts only with a non-oily solvent.
2. Keep all surfaces clear of oil and grease.
3. Beware of solvents attacking the bellows.

The following maintenance work may be carried out on the Lung Simulator.

1. Test and replace the springs.
2. Test and replace the pressure gauge.
3.. Check and replace the rubber items including the bellows.

In addition replacement feet and a replacement leak control are available as spares.

After all service work is complete the Lung Simulator should be tested in accordance with the test specification which appears in appendix A or calibration as per appendix B.

4.3 Replacing The Springs

1. Unhook the top of the springs from the bellows lever.

2. Undo the 2BA socket head screws that attach the spring retention bar with an Allen key. Keep the screws and washers.

3. Unscrew one of the bar ends and slide off the old springs.
Discard them to avoid mixing them with new springs.

4. Slide on new springs in the following order:

   Thickest spring on right (No.3)
   Thinnest spring in middle (No.1) with hook pointing forwards when spring is hanging down.
   Remaining spring on left (No.2)

   Re-assemble the end cap to retain the springs.

5. Attach bar to frame with screws. If mounting holes do not line up without distorting the frame, adjust one end cap up or down the thread until the holes align.

6. Tighten the screws with the Allen key to a torque of 2-5 Nm.

7. Hook springs on to bellows lever.

8. Test Lung Simulator to the test specification (see appendix A)
   (If calibration required see appendix B).

4.4 Replacing The Pressure Gauge

1. Unscrew hexagonal locking nut on rear of pressure gauge.

2. Unscrew gauge by placing a spanner round the square area behind the gauge.

3. Clean mating thread of new gauge and frame with a non-oily solvent. Screw locking nut onto new gauge.

4. Apply a thin coating of Ambersil Silcoset 152 sealant to the thread of the gauge.

5. Screw gauge fully onto the frame then slowly unscrew the gauge until the face is in the correct orientation.

6. Tighten the locking nut to a torque of 2-5 Nm.

7. Test Lung Simulator to the test specification (see appendix A).
   (If calibration required see appendix B).

4.5 Replacing The Rubber Items Including Bellows

1. If pressure gauge hose has deteriorated pull off the old hose and push on a new piece of hose ensuring that the hose does not twist.

2. Remove the screw securing the right hand side of the bellows to the support arm. Lift off right outer bellows plate.

3. Remove the right inner bellows plate and unscrew the nut on the left inner bellows plate. (Old Ohmeda units may need a special tool).

4. Remove bellows by disconnecting central bellows support ring from top of support arm.

5. Note order of assembly of the bellows rings and carefully remove them from the bellows. Remove the remaining inner plate from the bellows. Clean all the parts with a non oily solvent.

6. Insert the left inner bellows plate and re-assemble the bellows rings to the new bellows with the support ring in centre fold. Reconnect the centre bellows support ring to the support arm.

7. Apply Ambersil Silcoset 152 sealant to the left side mating faces of the bellows and to the thread of the nut ; screw nut onto boss to a torque of 2-5 Nm.

8. Insert the right inner bellows support plate, coat both of the right side mating faces of bellows with sealant and offer up the right outer bellows plate. Replace the screw after first coating with sealant. Tighten to a torque of 2-5 Nm.

9. Replace O-Rings from the restrictor Body with the appropriate size O-Rings from the kit. Earlies models will have an O-Ring on the Leak Control Screw and Restrictor Adjuster Barrel. Later models also have an O-Ring on the Barrel Retaining Screw. Apply a small amount of Molykote III to the Restrictor Barrel O-Ring.

10. Test Lung Simulator to the test specification (see appendix A).
(If calibration required see appendix B).

Appendix A

Test Specification

Warning: This is a simplified test for use with units which are NOT required to be calibrated. For units requiring calibration see Appendix B.

1. Check the Lung Simulator for mechanical damage or deterioration of rubber parts. Replace any parts that are suspect. Spares are available from the Manufacturer or from an authorised distributor (see appendices C and D).

2. Set the resistance control to zero, connect spring No. 1 only and ensure that the leak control is closed.

3. Set the pressure gauge to zero by rotating the screw at the 6 o'clock position on the gauge face, clockwise or counter-clockwise with a small screwdriver.

4. Compress the bellows by hand and allow it to return to its rest position. Set the Volume pointer to zero by adjusting the knurled nut on the bellows support arm.

5. Connect the test apparatus to the patient circuit connection as shown in figure 3.

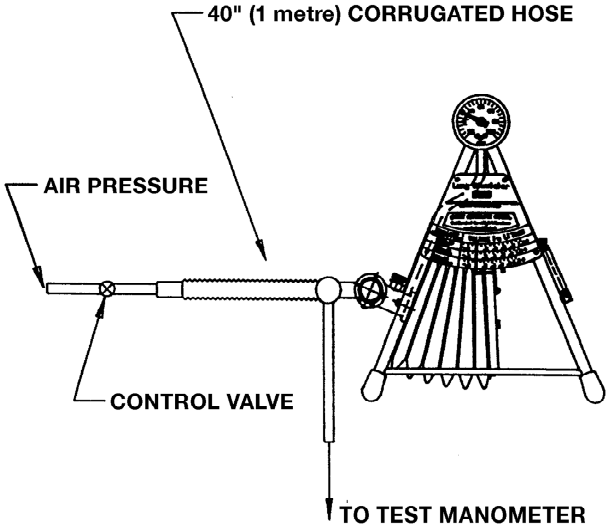


FIGURE 3. TEST APPARATUS

6. Inflate until 1 litre is indicated on the volume scale and close the control valve, do not over inflate the bellows. The Lung Simulator volume scale. The Lung Simulator pressure gauge and manometer should now both read 20cm H_2O +/- 3cm H_2O. If this is not so perform the following checks:

   a) If the pressure is falling check that the leak control is closed and that the O-ring has not failed. If it has replace the O-ring and retest, if not look for leaks elsewhere.

   b) If the pressure is steady but the gauge reading differs from the manometer replace the gauge and retest.

   c) If the pressure is steady and the gauge reads the same as the manometer, replace the spring and retest. If this has not cured the fault replace the bellows and retest.

7. Connect springs 1 and 2 only and re-zero the volume pointer as specified in step 4 if required. Inflate until 1 litre is indicated on the volume scale and close the control valve, do not over inflate the bellows. The pressure gauge and manometer should now read 50 cm H_2O +/- 7.5cm H_2O, if not perform the checks as in test 6.

8. Connect springs 1, 2 and 3 and re-zero the volume pointer as specified in step 4 if required. Inflate until 1 litre is indicated on the volume scale and close the control valve, do not over inflate the bellows. The pressure gauge and manometer should now read read 100 cm H_2O +/- 15cm H_2O, if not perform the checks as in test 6. However, a limited pressure loss of 1cm H_2O every 10 seconds is permissible.

9. Deflate the Lung Simulator and store with the leak control open, resistance control on zero and springs 1 and 2 only attached.

Appendix Bi

Calibration Of Unit with Gauge and Volume Scale

Warning: It is recommended that the calibration is carried out by the manufacturer or authorised service centre and may only be carried out by a qualified technician with suitably calibrated test equipment.

EQUIPMENT REQUIRED
Digital Manometer H_2O
1 Litre Syringe with 22mm connection
Hand Pump
Tee-piece
Length of small bore hose (length to be kept to a minimum)

PROCEDURE:
Set the resistance control to Zero, connect all three springs and ensure that the leak control valve is closed.

LEAK TESTS
1. Using the hand pump inflate the bellows to a pressure of 100cm H_2O. A leak of 1cm H_2O / 10s is permissible.
2. Slightly adjust the leak control valve to allow the air to escape. Ensure that both the volume and pressure both decrease.

PRESSURE GAUGE TEST
1. Set the Pressure Gauge to zero by rotating the screw on the gauge face with a small screwdriver.
2. Connect the hand pump to rubber tube feeding the pressure gauge and also Tee in the Digital Manometer.
3. Apply pressure to the port until the Digital Manometer reads 20cm H_2O Record the Pressure Gauge reading in the corresponding column on the certificate.
4. Repeat step 3 for the following values 40cm H_2O, 60cm H_2O, 80cm H_2O, 100cm H_2O
5. Then use the hand pump to pull a vacuum and take a reading for -20cm H_2O.
6. If any of the results to parts 3,4 or 5 are outside tolerance refer to **Corrective Action No.2.**
7. Disconnect the hand pump and the manometer.

VOLUME GAUGE TEST
1. Set the Volume Pointer to zero by adjusting the knurled nut on the bellows support arm.
2. Ensure that only Spring No.1 is connected
3. Ensuring that the handle on the Syringe is fully out, connect the Syringe to the port on the lung simulator.
4. Push the handle in up to the graduation marked 0.2l and record the Volume reading in the corresponding column on the certificate.
5. Repeat step 4 for the following values 0.4l, 0.6l, 0.8l and 1.0l.
6. Disconnect the syringe from the Lung Simulator and allow the bellows to deflate. Ensure that the Volume Reading is zero.
7. Reconnect the syringe and pull out the handle to the 0.8l graduation, creating the negative volume required and then note the Volume reading in the corresponding column on the certificate.
8. Connect Spring No.2 making the combination Spring No.1 + Spring No.2.
9. Repeat steps 3,4,5,6 and 7 for this combination of springs.
10. Connect Spring No.3 making the combination Spring No.1 + Spring No.2 + Spring No.3.
11. Repeat steps 3,4,5,6 and 7 for this combination of springs.
12. If any Volume readings are outside tolerance, see **Corrective Action No.3.**

COMPLIANCE TEST AT 1 LITRE

1. Reconnect the Digital Manometer in between the Lung Simulator and Syringe. Ensure that the Syringe handle is fully out.
2. Disconnect Springs No.2 and No.3.
3. Push the handle on the syringe and apply a volume of 1 Litre into the Bellows steadily over 1 minute +/- 10 seconds and read the peak pressure at the end of the minute.
4. Record the reading on the Pressure Gauge in the corresponding column on the certificate.
5. Reconnect Spring No.2 and repeat steps 3 and 4.
6. Reconnect Spring No.3 and repeat steps 3 and 4.
7. If the Pressure readings are outside tolerance, see **Corrective Action No.4.**

Upon satisfactory completion of all tests a suitable results sheet should be completed indicating all results and signed by the person carrying out the calibration.

Affix calibration sticker to the Lung Simulator when the unit has satisfactorily passed all above tests.

If for any reason that the lung simulator fails any part of the test procedure then only record the results that have been measured. Then in the comments box write the appropriate corrective action No. that is required.

Affix calibration sticker to the Lung Simulator only when the unit has satisfactorily passed all above tests.

CORRECTIVE ACTIONS

1. Replace any damaged and worn parts.
2. Replace the Pressure Gauge (Kit No. SMS0015011), redo Pressure Gauge test.
3. Replace Bellows (Kit No. SMS0015082), redo Volume test.
4. Replace springs (Kit No. SMS0015082), redo both Volume and Compliance Tests.

Results

LEAK TESTS

TEST	TOLERANCE	COMMENTS
LEAK TIGHT	1cm H_2O / 10sec	
CONTROLLED LEAK	N/A	

PRESSURE GAUGE TEST

PRESSURE (cm H_2o)	TOLERANCE (cm H_2O)	ACTUAL (cm H_2O)	COMMENTS
-20	-22 to -18		
0	0		
20	18 to 22		
40	36 to 44		
60	54 to 66		
80	72 to 88		
100	90 to 110		

VOLUME TEST

SPRINGS	VOLUME (LTR)	TOLERANCE (LTR)	ACTUAL (LTR)	COMMENTS
1	-0.2	-0.22 to -0.18		
	0	0		
	0.2	0.18 to 0.22		
	0.4	0.36 to 0.44		
	0.6	0.54 to 0.66		
	0.8	0.72 to 0.88		
	1.0	0.90 to 1.10		
SPRINGS	**VOLUME (LTR)**	**TOLERANCE (LTR)**	**ACTUAL (LTR)**	**COMMENTS**
1+2	-0.2	-0.22 to -0.18		
	0	0		
	0.2	0.18 to 0.22		
	0.4	0.36 to 0.44		
	0.6	0.54 to 0.66		
	0.8	0.72 to 0.88		
	1.0	0.90 to 1.10		
SPRINGS	**VOLUME (LTR)**	**TOLERANCE (LTR)**	**ACTUAL (LTR)**	**COMMENTS**
1+2+3	-0.2	-0.23 to -0.17		
	0	0		
	0.2	0.17 to 0.23		
	0.4	0.34 to 0.46		
	0.6	0.54 to 0.66		
	0.8	0.72 to 0.88		
	1.0	0.90 to 1.10		

COMPLIANCE TEST AT 1 LITRE

SPRINGS	TOLERANCE (cm H_2O)	ACTUAL (cm H_2O)	COMMENTS
1	17 to 23		
1+2	42.5 to 57.5		
1+2+3	85 to 115		

Appendix Bii

Calibration Of Unit with no Gauge and Volume Scale

Warning: It is recommended that the calibration is carried out by the manufacturer or authorised service centre and may only be carried out by a qualified technician with suitably calibrated test equipment.

EQUIPMENT REQUIRED

Digital Manometer H_2O
1 Litre Syringe with 22mm connection.
Hand Pump
Tee-piece
Length of small bore hose (length to be kept to a minimum).

LEAK TESTS

1. Using the hand pump (teed off to the digital manometer) inflate the bellows to a pressure of 100cm H_2O. A leak of 1cm H_2O / 10s is permissible.
2. Slightly adjust the leak control valve to allow the air to escape. Ensure that both the volume and pressure both decrease.

COMPLIANCE TEST AT 1 LITRE

1. Reconnect the Digital Manometer in between the Lung Simulator and Syringe. Ensure that the Syringe handle is fully out.
2. Disconnect Springs No.2 and No.3.
3. Push the handle on the syringe and apply a volume of 1 Litre into the Bellows steadily over 1 minute +/- 10 seconds and read the peak pressure at the end of the minute.
4. Record the reading on the Pressure Gauge in the corresponding column on the certificate.
5. Reconnect Spring No.2 and repeat steps 3 and 4.
6. Reconnect Spring No.3 and repeat steps 3 and 4.

Upon satisfactory completion of all tests a suitable results sheet should be completed indicating all results and signed by the person carrying out the calibration.

Affix calibration sticker to the Lung Simulator when the unit has satisfactorily passed all above tests.

Results

LEAK TESTS

TEST	TOLERANCE	COMMENTS
LEAK TIGHT	1cm H_2O / 10sec	
CONTROLLED LEAK	N/A	

COMPLIANCE TEST AT 1 LITRE

SPRINGS	TOLERANCE (cm H_2O)	ACTUAL (cm H_2O)	COMMENTS
1	17 to 23		
1+2	42.5 to 57.5		
1+2+3	85 to 115		

Appendix C

Available Spares

The following items are available as spares from the manufacture:

DESCRIPTION	PART NO.
Rubber Parts Kit (Including Bellows) Spring Kit (Set of all 3 Springs) Leak Control Kit Set of Feet	SMS0015082
Replacement Pressure Gauge	SMS0015011

It is essential that all servicing work is carried out by Technicians/Engineers trained to repair and/or service this type of equipment, as specified in the maintenance section.

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046-55 080

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