



Instrument Serial No.

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Wright/Haloscale Respirometer
OPERATING INSTRUCTIONS

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Wright/Haloscale Spirometer

OPERATING INSTRUCTIONS

All genuine Wright/Haloscale Spirometers incorporate the invention by Dr. B. M. Wright, UK Medical Research Council. Since their introduction in 1958, production of conventional Wright Spirometers by the original manufacturer, Ferraris Development and Engineering Company Limited, has continued uninterrupted with each instrument being calibrated to the same exacting standard of performance independently established by Nunn J.F., and Ezi-Ashi T.I.

CLINICAL USE OF THE RESPIROMETER

* IN GENERAL ANAESTHESIA

In the operating theatre the measurement of tidal and minute volume indicates whether adequate ventilation has been achieved, whether in open or closed circuit, whether in spontaneously breathing or mechanically ventilated patients. For mechanically ventilated patients the Spirometer should be placed in the expiratory limb of the circuit.

* DURING RECOVERY

The single most important judgement that must be made before returning a patient to the ward is the adequacy of lung ventilation. The Wright/Haloscale Spirometer is a convenient instrument for this purpose.

* **INTENSIVE CARE**

In the ICU it has long been appreciated that blood gas results must be interpreted not only by reference to FiO_2 , but also to minute volume. Ventilatory adequacy in these circumstances is very quickly established using a Respirometer.

* **WHEN WEANING**

Weaning from a ventilator requires alertness to subtle changes in the patient's condition. Blood gas analysis will indicate when the patient has progressed to the point where weaning may be attempted. This point can be established using a Respirometer to determine that the patient's tidal volume and minute volume are adequate for that patient. Tidal and minute volume measurements during weaning are the best indication of the degree of success of weaning or the need to return the patient to the ventilator, and reduces the frequent measuring of arterial blood gases.

PRINCIPLE OF OPERATION

Wright/Haloscale Respirometers use an extremely sensitive air turbine to measure the gas flow. Revolutions of the turbine vane are transferred to the hands via a watch-type gear mechanism.

The energy to drive the turbine is derived from the airflow itself, no other power source is required. Wright/Haloscale Respirometers respond to flow in one direction only, reverse flow is ignored.

FEATURES OF THE DESIGN

Case	All models of the Wright/Haloscale Respirometer, except the MX, have a non-ferrous metal (brass) case, finished in bright chrome
Controls	All models have ON/OFF and RESET push buttons.

WRIGHT MARK 8 AND MARK 14

Dial layout	Separate large diameter scale and mini scale off-set
Mark 8:	White lettering and scales on blue background, White pointers
Mark 14:	White lettering and scales on black background, Orange pointers
Size & weight:	
Dial diameter:	35mm
Dimensions:	70mm x 60mm x 45mm (overall)
Weight:	130g
Connections:	22mm male BS/ISO taper, inlet and outlet

HALOSCALE STANDARD AND COMPACT

Dial layout	White concentric scales on blue background, White pointers
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Size & weight:	STANDARD
Dial diameter:	57mm
Dimensions:	72mm x 70mm x 60mm (overall)
Weight:	160g
	COMPACT
Dial diameter:	35mm
Dimensions:	72mm x 60mm x 45mm (overall)
Weight:	135g
Connections:	22mm male BS/ISO taper, inlet and outlet

HALOSCALE INFANTA

Dial layout:	White concentric scales on blue background. White pointers
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Size & Weight:	
Dial diameter:	57mm
Dimensions:	72mm x 65mm x 60mm (overall)
Weight:	230g
Connections:	15mm female inlet / 22mm female BS/ISO outlet
Adaptors:	Female inlet accepts endo- or naso-tracheal adaptor directly; and catheter mount adaptor

HALOSCALE MX

Case:	Aluminium alloy, anodized black and silver
Dial layout:	White concentric scales on blue background. White pointers

Size & weight:	
Dial diameter:	57mm
Dimensions:	111mm x 70mm x 75mm (overall)
Weight:	575g
Connections:	Choice of inlet and outlet positions and tapered BS/ISO or threaded connections.

FUNCTIONAL SPECIFICATIONS OF WRIGHT/HALOSCALE RESPIROMETERS (EXCEPT INFANTA)

Accuracy:	± 2% at 16.00 LPM (on continuous flow) + 5% to + 10% at 60.00 LPM (on continuous flow)
Sensitivity:	Starts volume registration at not more than 2.5 LPM
Resistance to gas flow:	Proportional to square of the flow rate and not more than 2cm H ₂ O at 100 LPM
Dead space:	22ml
Permissible gases:	All respirable gases
Maximum temp:	55°C
Maximum internal to external pressures:	30cm H ₂ O (MX 100cm H ₂ O)
Maximum leakage:	60ml/min at 30cm H ₂ O (to ASTM F1208-89)
Performance standard:	Tested and calibrated to nSpire Specification Issue 4, 1 June 1976

FUNCTIONAL SPECIFICATIONS OF HALOSCALE INFANTA RESPIROMETER

Volume ranges:	0-500ml, and 0-5l
Accuracy:	±5% at 2.00 LPM (on continuous flow) (registering 1.05D)* ±2% at 10.00 LPM (on continuous flow) (registering 8.00D)*
Sensitivity:	Starts volume registration at not more than 1.1 LPM
Resistance to gas flow:	Proportional to square of the flow rate and not more than 6cm H ₂ O at 15 LPM
Dead space:	15ml
Permissible gases:	All respirable gases
Maximum temp:	55°C
Maximum internal to external pressures:	30cm H ₂ O
Maximum leakage:	60ml/min at 30cm H ₂ O (to ASTM F1208-89)
Performance standard:	Tested and calibrated to nSpire Specification Issue 6, 1 May 1982

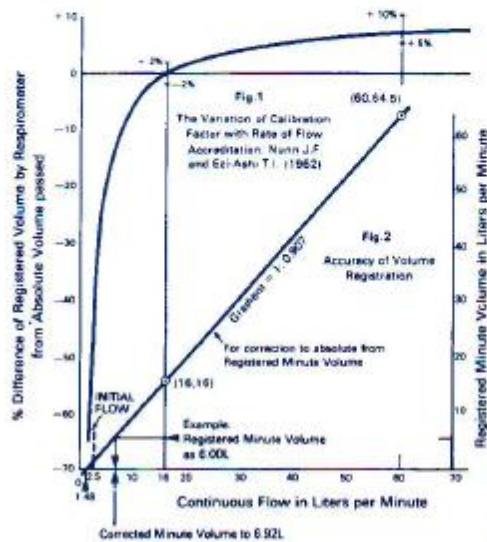
*More detailed information is available on request.

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The recommended maximum flow rate through all Wright / Haloscale Respirometers is 60 LPM., except Infanta which is 30 LPM

CALIBRATION OF WRIGHT/HALOSCALE RESPIROMETERS

The accuracy of the instrument derives from repeating the characteristics of the variation of calibration factor with continuous flow (see Figure 1). This requires that at 16.00 LPM the volume must be within ±2%, while at 60.00 LPM it must be within +5% to + 10% of absolute.



Instruments are calibrated by the manufacturers at sea level at 20°C. For each increase of 3°C above 20°C add 1% to the volume registered.

For each 101mb increase in ambient pressure above normal (1014mb) add 0.6% to the volume registered.

For practical use the variation of calibration factor (Figure 1) is more

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readily expressed by the registered minute volume versus continuous flow in LPM. This relationship (Figure 2) is the first order straight-line law from which, for example, registered minute volume below 7 LPM may be easily corrected to absolute volume by estimation as shown, or by calculation of the corresponding equivalent on the continuous flow axis, as follows:

$$\begin{aligned} \text{Corrected volume} &= 0.907 (\text{registered minute volume}) + 1.48 \\ &= 0.907 (6.00) + 1.48 \\ &= 6.92 \text{ l for registered minute volume of 6.00 LPM} \end{aligned}$$

The calibration for tidal volume has been determined to give good compensation for most waveforms used in practice.

CHECKING THE WRIGHT/HALOSCALE RESPIROMETER

- * Examine the exterior of the instrument for any obvious damage.
- * Ensure that the ON/OFF and RESET finger controls are firmly attached and move smoothly.
- * Look through the inlet and outlet and check that the interior of the Respirometer is clean, free from deposits and dry.
- * To check the mechanism: reset the pointers to zero and ensure that the unit is on. Cup the Respirometer in the open palm of one hand, leaving the inlet unobstructed and

facing the base of the thumb. Blow gently into the palm of the hand (see diagram). The pointers should rotate smoothly and slowly and the mechanism should operate silently at this low flow. **Never** blow a large volume of air rapidly into the inlet since this will damage the sensitive mechanism inside the Respirometer.



- * Check the ON/OFF control while the pointers are rotating. Press the RESET button to return the pointers to zero.

INSTALLATION OF WRIGHT/HALOSCALE RESPIROMETER

The instrument registers the volume of flow passing inwards through the inlet and out through the outlet (see arrow engraved on case). It will not respond to flow in the opposite direction.

Choose the point of insertion in the breathing circuit as close to the patient connection as is possible and convenient.

Two different adaptors are supplied with the Respirometer enabling it to be connected to a ventilator, absorber or

anaesthetic facemask. Sharp bends or sudden reductions of bore close to the axial outlet of the Respirometer are not desirable. A straight run of tubing to the inlet is advantageous. Ensure that all connections in the circuit, particularly those to the Respirometer, are leak-proof.

When correctly sited in the breathing circuit mechanical failure of the Respirometer cannot, of its own, impede respiration or otherwise harm the patient.

Adaptors



Female/Female Female/male
BS/ISO Compatible Tapers

OPERATION OF WRIGHT MARK 8 & MARK 14 RESPIROMETERS

Reading the dial

The dial comprises two separate scales, a larger outer scale and a mini-scale, each divided in units of volume.

The pointers indicate in litres and fractions of a litre the volume which has passed through the instrument.

Always view the dial full-face to avoid errors from parallax. When the pointer on the litre scale is near to a whole litre subdivision, refer to the position of the pointer on the fractional scale to confirm whether the whole litre value is just about to be reached or has been passed.

Mark 8

The volume range is 0 – 100l. The larger outer scale covers 100l sub-divided to 1l and marked every 10l. The mini-scale covers 1l sub-divided to 0.05l and marked every 0.1l.



17.95 litres

Mark 14

The volume range is 0 – 10l. The large outer scale covers 1l sub-divided to 0.01l. The mini-scale covers 10l and is sub-divided to 1l graduations.



9.84 litres

OPERATION OF HALOSCALE STANDARD, COMPACT & MX RESPIROMETERS

Reading the dial

In these instruments the dial comprises two separate scales, a larger outer scale and a concentric inner scale, each divided in units of volume. The pointers indicate in litres and fractions of a litre the volume which has passed through the instrument.

The outer scale covers 100l sub-divided to 1l, with larger graduations every 5l. The fine (inner) scale covers 1l and is sub-divided to 0.01l.



67.35 litres

When the pointer on the litre scale is near to a whole litre sub-division refer to the position of the pointer on the fractional scale to confirm whether the whole litre value is just about to be reached or has been passed.

OPERATION OF THE HALOSCALE INFANTA RESPIROMETER

The Infanta dial differs from other Wright & Haloscale Respirometers in that one revolution of the tidal volume pointer indicates a volume of 0.5l, and one revolution of the minute volume pointer indicates a volume of 5l passed.

USE OF RESET AND ON/OFF CONTROLS

These controls are finger operated. The ON/OFF control enables the user to determine the instant at which the volume of a flow to be registered begins and ends.

The RESET control returns the pointers to the zero position (situated at 12 o'clock on the scales on the dial). They will be held there as long as the RESET control button remains pressed, however, as soon as it is released registration of flow may begin.

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VOLUME MEASUREMENTS – ALL RESPIROMETERS

Tidal Volume

With the unit on, release the RESET control while the inspiratory phase is in progress. As the instrument registers flow in only one direction, the next expiration will be registered. To retain the registration of tidal volume on the scales press and hold the ON/OFF control to lock the reading as soon as the next inspiration begins.

Minute Volume

Minute volume is measured with reference to a stopwatch or a watch with seconds display. It is important to choose a moment during the expiratory pause, or when the pointers are rotating slowly or at rest, to turn the unit off. Return the pointers to zero with the RESET control. Press and hold the ON/OFF control. Release the ON/OFF control to turn on the unit and at the same instant begin timing 60 seconds on the watch. Press and hold the ON/OFF control to lock the reading at the moment when the 60 seconds is completed. The volume registered on the instrument is the minute volume.

CARE INSTRUCTIONS

When not in use Respirometers should be kept in the case provided. Regular cleaning, as described below will prolong the life of your Respirometer.

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The use of a filter is recommended to keep the Respirometer free from secretions.

During Use

After prolonged periods in circuit the airways and moving parts in the air-stream within the Respirometer may become coated with condensed water and other contamination. The immediate remedy is to substitute a clean, dry Respirometer in working order. If this is not possible, gently shake the Respirometer free of any liquid.

After Use

In order to keep the Respirometer in good working condition, purge it of anaesthetic agents and condensed moisture with sterile air or oxygen as soon as possible after use. (Flow rates should be limited so as not to exceed 60 LPM, or 30 LPM for the Infanta model).

Solid matter present internally should be left in situ for skilled examination and instrument service before re-use.

Sterilization

Wright/Haloscale Respirometers will not withstand autoclaving. If absolutely necessary, or if autoclaved inadvertently, they should be returned to the supplier or manufacturer for repair and reconstruction.

Ethylene Oxide Sterilization

Wright/Haloscale Respirometers can be sterilized using ethylene oxide e.g. 100% ethylene oxide for 155 minutes at 55°C (131°F). After sterilization, and prior to placing the unit back into service, the ethylene oxide residue must be

removed by exposure to room air at ambient temperature and humidity for 24 hours. It is recommended that a sterilization pouch be used.

WARNING

NEVER probe the interior of a Respirometer.

NEVER attempt to dry out or dislodge contamination in the airways or turbine using compressed air.

NEVER apply liquid solvents.

NEVER engrave the case of a Wright/Haloscale Respirometer. The high frequency vibrations that are set up will damage the mechanism.

THE INTERNAL PARTS OF A WRIGHT/HALOSCALE RESPIROMETER CANNOT BE CLEANED BY THE USER. IF THE RESPIROMETER BECOMES HEAVILY CONTAMINATED, IT SHOULD BE RETURNED TO THE MANUFACTURER, OR HIS APPROVED AGENT, FOR SERVICE.

IT IS RECOMMENDED THAT THE WRIGHT/HALOSCALE RESPIROMETER BE SERVICED AND RECALIBRATED ANNUALLY IN LINE WITH GOOD CLINICAL PRACTICE.

Regular inspection

Properly treated, the Respirometer may not need servicing for long periods; however, regular checks need to be made to ensure that it continues to function correctly. If dropped, the Respirometer should be checked immediately. If in doubt, the instrument should be returned to the manufacturer or approved service agent for a calibration check.

REPAIR AND CALIBRATION SERVICE

In the event of a malfunction contact the original supplier who will be able to provide a repair service approved and supported by nSpire Health Ltd or contact nSpire Health Ltd direct.

USER RESPONSIBILITY

A defective Respirometer should never be used. nSpire Health Ltd will not accept responsibility for any malfunction, which results from improper use, damage, faulty maintenance, repairs by individuals or organizations not approved by the Company, or modification by anyone other than nSpire Health Ltd direct.

When returning a Respirometer for repair always ensure that it is packed in the case provided. Neither nSpire Health Ltd nor its representatives will be liable for any damage in transit to instruments returned in other types of packaging.

VERSIONS OF WRIGHT/HALOSCALE RESPIROMETERS

Mark 8

The original Wright Respirometer, small diameter, blue dial. For minute volume measurement, with facility for measuring tidal volume. Volume range: 0 - 1l and 0 - 100l.

Mark 14

Small diameter, black dial Respirometer. For tidal volume measurement, with facility for measuring minute volume. Volume range: 0 - 1l and 0 - 10l.

Haloscale Standard

Large diameter, blue dial Respirometer with concentric scales. For both tidal volume and minute volume measurement. Volume range 0 - 1l and 0 - 100l.

Haloscale Compact

Small diameter, blue dial Respirometer with concentric scales. For both tidal volume and minute volume measurement. Volume range 0 - 1l and 0 - 100l.

Haloscale Infanta

Large diameter, blue dial Respirometer with concentric scales. For both tidal volume and minute volume measurement in new-born babies, including premature neonates, and infants up to 20Kg. Volume range 0 - 500ml and 0 - 5l.

Haloscale MX

Large diameter, blue dial Respirometer with delete concentric scales. In-line model. Designed for semi-permanent installation in ventilator and anaesthetic circuits, choice of inlet (specify top or bottom inlet when ordering) and outlet positions and connections. Volume range 0 - 1l and 0 - 100l.

Test Certificate

Wright/Haloscale Spirometer (except Infanta)

Instrument Serial Number

THIS IS TO CERTIFY that this instrument has been inspected and tested at all the appropriate stages during manufacture by nSpire Health Ltd in accordance with Test Instruction Issue 4 dated 1 June 1976 and has met all the requirements laid down therein.

THE PERFORMANCE RECORDED at the final test was:-

Test 2.1.2 (Sensitivity test - Operation @ 2.5 LPM maximum continuous flow) LPM

Test 2.2.4 (a) (Volume of 20.0 litres @ 16 LPM continuous flow - tolerance ±2.0%) litres

Test 2.2.4 (b) (Volume of 60.0 litres @ 60 LPM continuous flow - tolerance +5% to +10%) litres

Date of test: Inspector
nSpire Health Ltd
Hertford, SG13 7NW, England

Manufacturer's Certificate

Wright/Haloscale Spirometer (except Infanta)

Instrument Serial Number

This instrument has been inspected and tested at all the appropriate stages during manufacture in accordance with the Company's Test Instruction Issue 4 dated 1 June 1976 and has met all the requirements laid down therein.

Date: Inspector
nSpire Health Ltd
Hertford, SG13 7NW, England

Supplied by: