

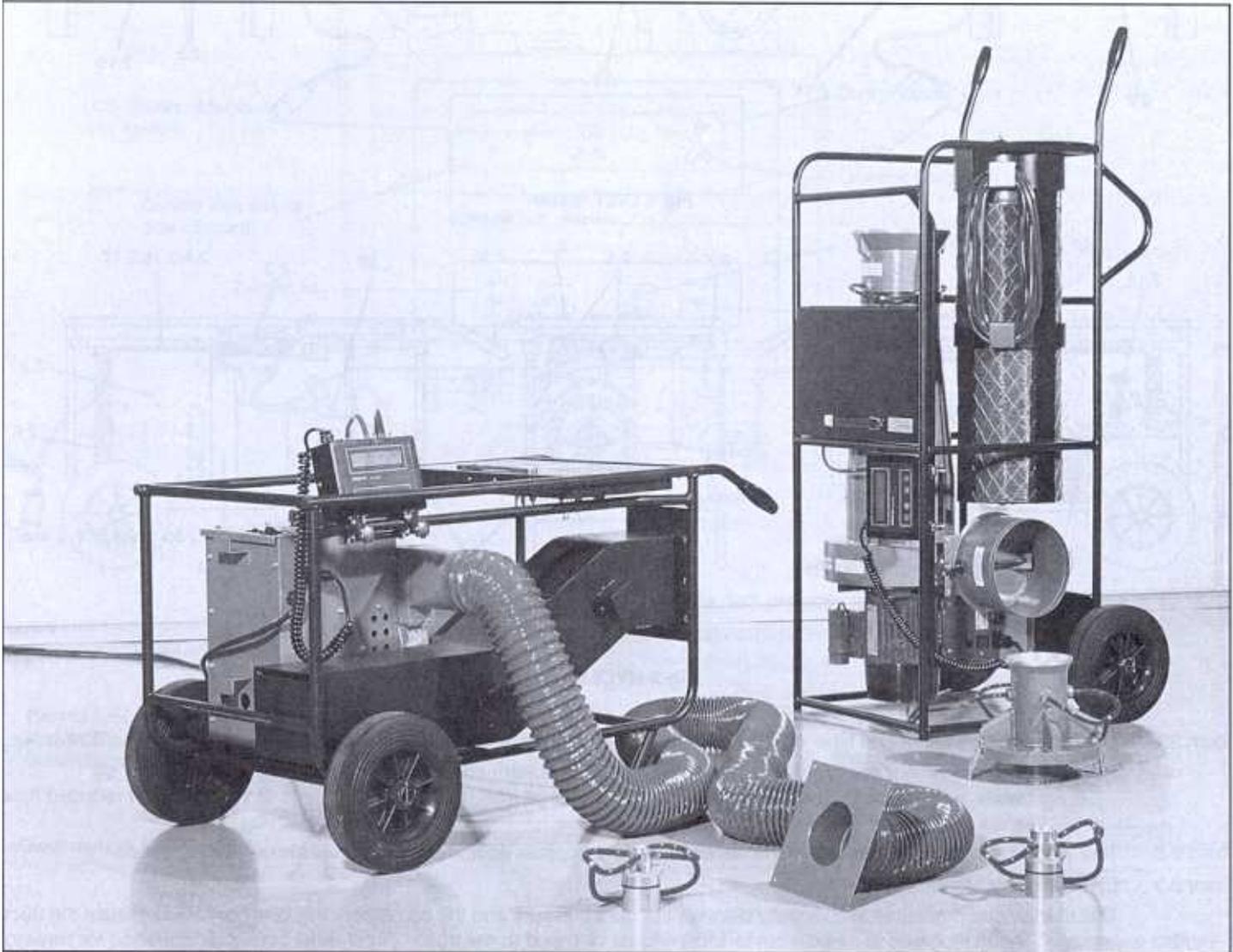
AIRFLOW™

SPECIALISTS IN AIR MOVEMENT TECHNOLOGY

LVLT MK2 and HVLT MK4

Duct Leakage Testers with Dry Manometry

Instructions for use.



The LVLT MK2 Duct Leakage Tester measures the leakage rate in ductwork to DW143 classes A and B only, whilst the HVLT MK4 Duct Leakage Tester can measure the leakage flow rate in ductwork to DW143 classes A, B, C and D.

Essentially, the tester consist of a fan, means to adjust the ductwork to the required pressure, and instrumentation to measure the corresponding leakage flowrate, all mounted on a two wheeled trolley.

The LVLT differs from the HVLT in the fan and means of pressure adjustment; the LVLT unit having a fixed speed fan motor with an adjustable damper in the outlet for controlling the duct pressure, whilst the HVLT unit has a variable speed fan motor with a motor speed controller to adjust the duct pressure.

The instrumentation consists of an electronic manometer (type LM1) which measures the static pressure of the duct and also the suction pressure at a conical inlet nozzle (to determine the

flowrate). Various sizes of inlet nozzles are provided to cover the flow range to the required accuracy of measurement.

Models are provided to suit the following A.C. power supply voltages:-

LVLT	HVLT
220 - 240 volt, 1Ph, 50Hz	220 – 240volt. 1Ph, 50/60 Hz
110 - 120 volt. 1Ph, 50Hz	110 – 120volt, 1Ph, 50/60 Hz
110 - 120 volt, 1Ph, 60Hz	

2. DESCRIPTION.

The LVLT and HVLT Duct Leakage Testers are shown in Figs.1 and 2 respectively:-

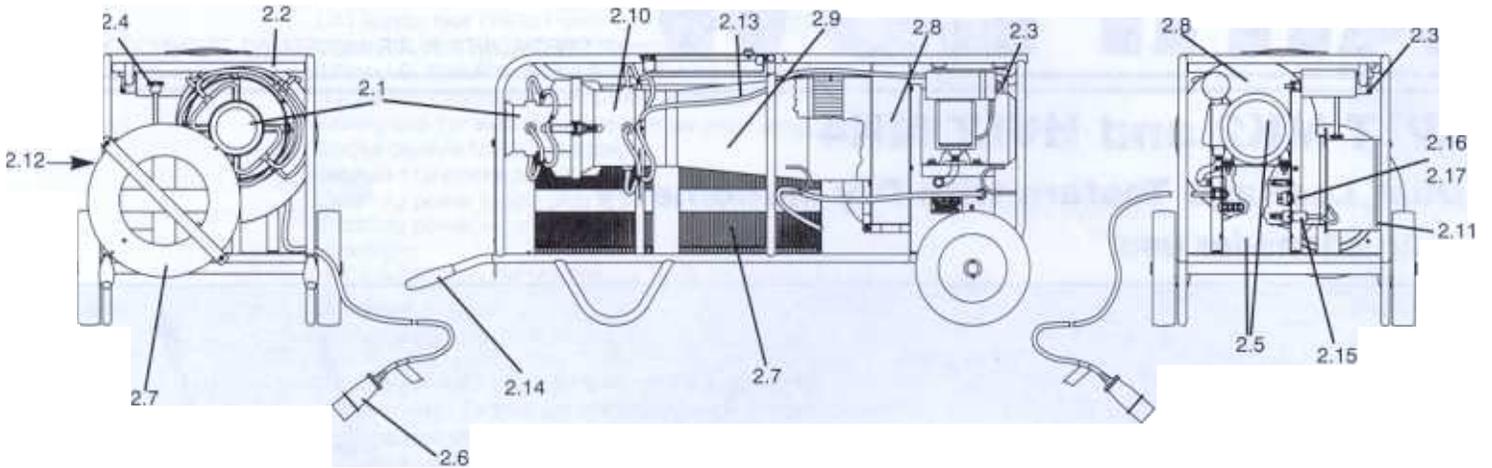


Fig 1 LVLT tester

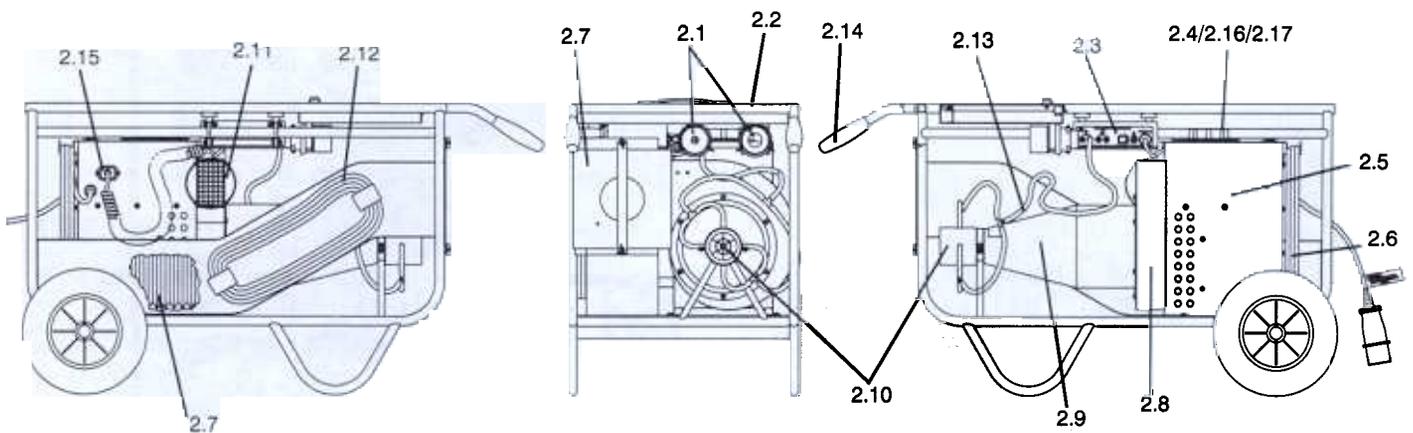


Fig 2 HVLT tester

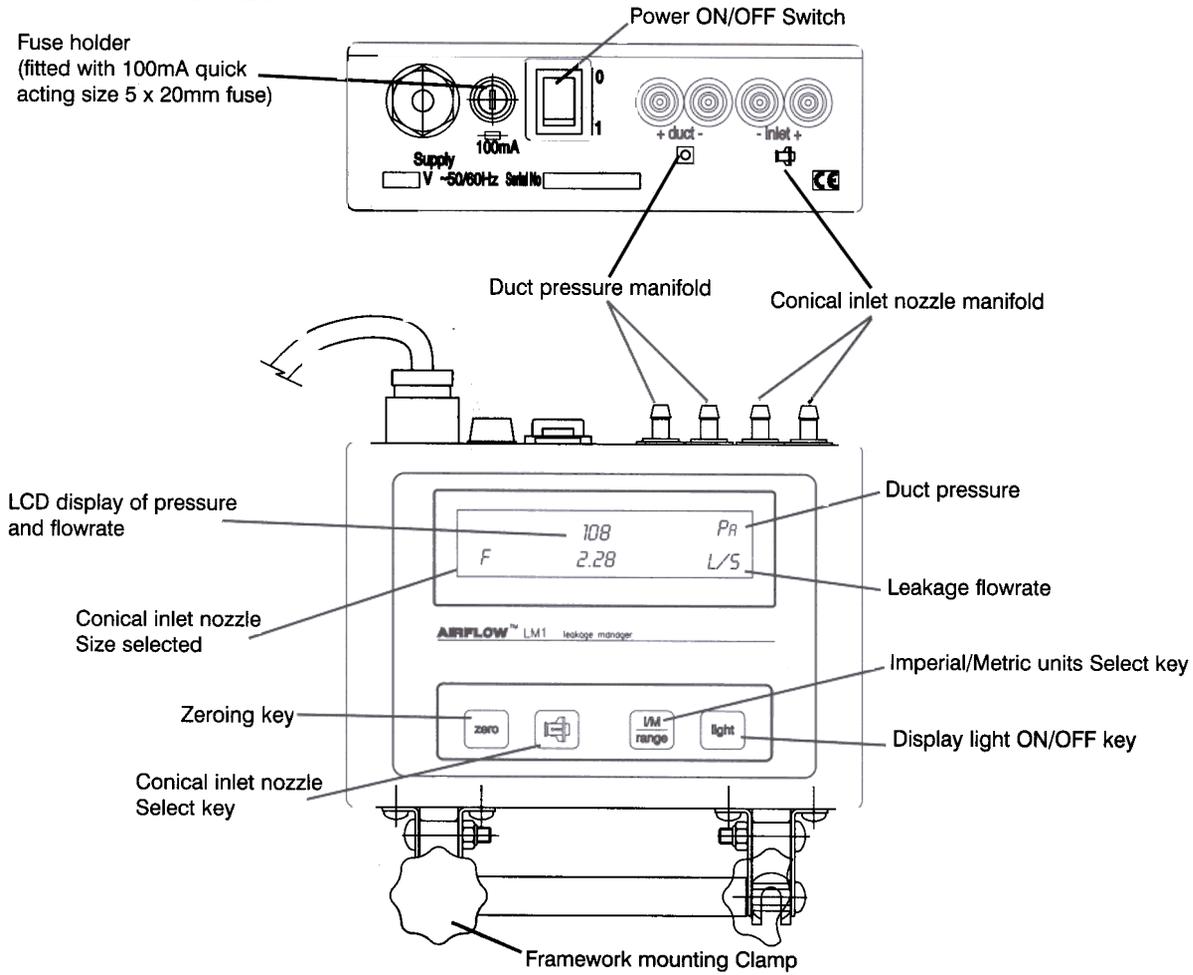
- Item 2.1 **LVLT:** conical inlet nozzle type 'D'. This nozzle clamps onto the larger nozzle E (item 2.10) for use at reduced flow levels.
HVLT: conical inlet nozzles type 'F' (small) and type 'G' (medium) shown secured to the trolley framework by means of Terry clips. These nozzles slide into the large inlet nozzle type 'H' (item 2.10) for use at reduced flow levels.

Item 2.2 Tray with hinged lid. This houses all the literature, smoke capsule equipment and flexible hose sealing straps.

Item 2.3 Electronic Dry Manometer LM-1.

This manometer measures and digitally displays the duct pressure and the corresponding inlet flowrate to sustain the duct leakage. The manometer is detachable to allow it to be clamped to the trolley in the most convenient position for viewing its display and operating its keypad. The manometer is supplied with PVC shorting tubes for the INLET and DUCT manifold pressure connections for purposes of zeroing the instrument and also to prevent entry of water, dust or foreign objects when not in use. The LM1 manometer is shown in Fig.3.

Fig.3 Electronic Manometer LM1



Item 2.4 Means of Duct pressure control.

LVLT: Fan outlet damper.

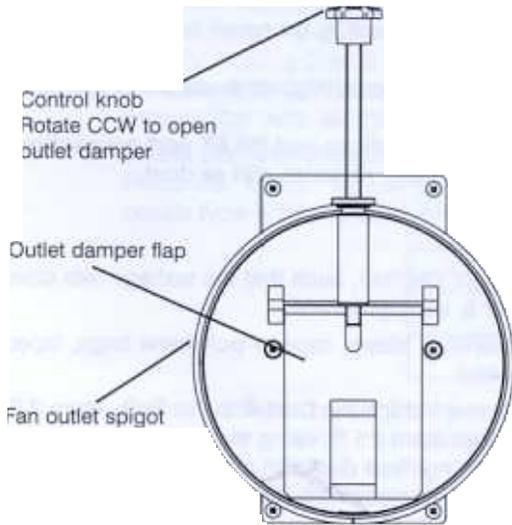


Fig.4 LVLT fan outlet damper

HVLT: Motor Control Panel.

This item provides the fan controls as shown in Fig. 5:

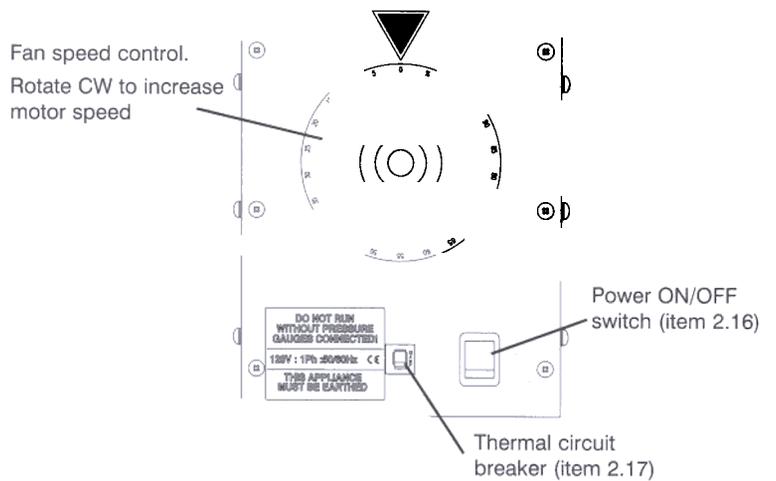


Fig.5 HVLT Control panel.

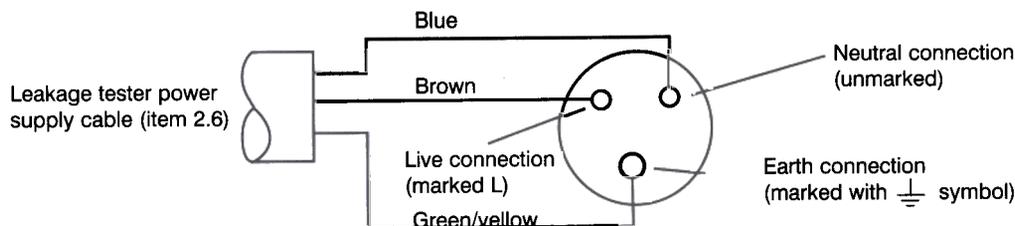
Item 2.5 Fan motor and motor stool/control box.

The LVLT power supply ON/OFF switch (item 2.16) and thermal circuit breaker (item 2.17) is fitted to the motor stool/control box.

Item 2.6 A.C. power lead, 3.5m long with an industrial 16A power supply plug to BS4343 rated to IP44. The plug is colour coded yellow for a 120 Volt and blue for a 230 Volt supply voltage.

Power supply plug wiring diagram.

Rear view of power supply plug



- Item 2.7 Duct plate adaptor and flexible hose.
This connects the Leakage Tester fan outlet spigot (item 2.11) to the duct. The duct plate adaptor is fitted with a pressure tapping point for connection to the LM1 manometer (item 2.3) by means of item 2.12. The flexible hose length is 5m fully extended for both LVL and HVL testers.
- Item 2.8 Fan impeller casing.
- Item 2.9 Tapered inlet/fan transition duct.
- Item 2.10 Fixed inlet nozzle: LVL - conical nozzle type 'E' (153mm diameter).
HVL - conical nozzle type 'H' (56mm diameter).
This is directly connected to item 2.9 (not removable) and is used for large flow measurement
- Item 2.11 Fan outlet spigot. This is connected to the duct under test by means of the flexible hose (item 2.7).
- Item 2.12 (not shown for LVL). Blue PVC tubing 9 metres long, to connect the duct pressure tapping point on the duct plate adaptor (item 2.7) fitted to the ductwork under test, to the LM1 manometer (item 2.3).
- Item 2.13 Red PVC tubing to connect the inlet nozzle pressure connection to the LM1 manometer (item 2.3).
- Item 2.14 Detachable handles for ease of transportation.
- Item 2.15 Power supply socket for the LM1 manometer (item 2.3) supply lead.
- Item 2.16 Tester Power Supply ON/OFF switch.
- Item 2.17 Tester supply circuit breaker.

3. FIRST STEPS.

- 3.1 Unpack the Leakage Tester and check that no damage has occurred in transit. If there is any damage, please do not use, but immediately report the damage to Airflow Developments.
- 3.2 Check the power supply labels on the Leakage Tester and the LM1 Manometer to ensure that they are to the correct supply voltage.
- 3.3 Read these instructions carefully before starting any work.

WARNINGS.

1. The supply to the LM1 is independent of the Leakage Tester power ON/OFF switch. **DISCONNECT** the LM1 power supply lead from the Leakage Tester before changing its fuse or removing its cover to gain access to internal parts.
2. Beware of touching the motor control box or fan casing if the fan has been operating, as these parts are liable to become HOT.
3. When the Leakage Tester is not in use, ensure that the LM1 DUCT port connections and INLET port connections are connected together by means of the PVC shorting tubes to prevent entry of water, dirt or dust.

4. OPERATING INSTRUCTIONS.

- 4.1 Choose a length of ductwork to be tested in accordance with HVCA document DW/143, such that the leakage rate does not exceed the capacity of the tester; refer to performance curves Fig's 7 or 8, as appropriate.
- 4.2 Blank off and seal all apertures in the selected length of duct (e.g. using blanking plates, caps or polythene bags, taped to ductwork). Inspect carefully to ensure that no opening has been overlooked
- 4.3 Place the Leakage Tester on level ground adjacent to the duct selected for test. Attach the Duct Adaptor Plate (item 2.7) to the duct and connect the flexible hose to the duct plate and fan outlet spigot (item 2.11), using the hose sealing straps found in the tray (item 2.2). Ensure that the aperture in the duct is at least the nominal diameter of the hose (203mm for LVL, 102mm for HVL) and that the pressure tapping point on the adaptor has an unobstructed connection to the internal duct space. **WARNING: keep the flexible hose as straight as possible to avoid kinks.**
- 4.4 Clamp the LM1 manometer to the most convenient place on the trolley framework. **Check that the LM1 supply voltage is correct as shown on its rear label**, and then connect the LM1 manometer power supply lead to the power supply socket on the Leakage Tester (item 2.15).
- 4.5 **Check that the A.C. supply is not loaded by any power tools**, and adjust the duct pressure control (item 2.4) to minimum (HVL speed control to zero, LVL damper fully closed).
- 4.6 **Initialising the LM1 manometer.**
The LM1 manometer is supplied to correspond with the tester and will display either "LVL" or "HVL" when powered up. If this is incorrect, or needs to be changed then re-initialise the LM1 as follows:- Initialise the LM1 manometer by holding down the 'I/M' key on the keypad while simultaneously switching the LM1 manometer ON (LM1 power ON/OFF switch to position 1).

The manometer will display: LIGHT = HVL
ZERO = LVL Select option as follows:

TO SELECT	PRESS KEY MARKED
LVLT	ZERO
HVLT	LIGHT

The unit will now 'remember' the selected option, even when the unit is switched OFF, and will subsequently require just operation of the ON key to turn the manometer on.

4.7 **Select the required measuring units.**

Press the LM1 'I/M' key until the required units are selected on the display, options available are listed in Table 2:-

TABLE 2	Duct Pressure Units	Leakage Flowrate Units
	Pa	l/s
	Pa	M ³ /h
	"Wg	Cfm

4.8 **Zeroing the LM1 Manometer.**

The LM1 manometer requires any zero offset to be removed to ensure accurate readings. Zero the manometer when initially setting up the unit and check the zero offset prior to taking a critical reading.

No flow value is displayed for inlet pressures below 10 Pa. To indicate that the inlet transducer zero has drifted, a zero prompt is displayed when the **Duct pressure is less than 10 Pa and the inlet pressure is greater than +/-1 Pa**. The zero prompt consists of a flashing 'ZERO' annunciator in the top left of the LM1 display panel.

To zero the manometer proceed as follows:-

Connect the LM1 manometer Duct manifold '+' and '-' connections together by means of the PVC shorting tube and repeat for the Inlet manifold connections. If the **zero prompt (or an actual pressure or flow reading)** is displayed, hold down the 'ZERO' key until the **zero prompt** disappears.

Note: if there was a displayed zero offset reading, this will gradually reduce when the zero key is pressed until replaced with the zero prompt. The zero prompt will then disappear when the instrument is fully zeroed.

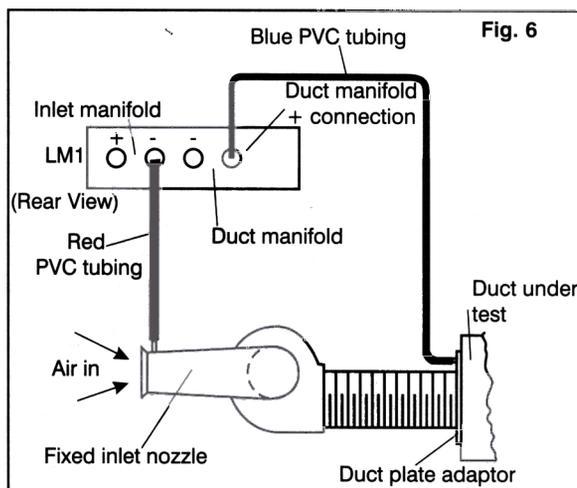
4.9 **LM1 manometer connections: refer to Fig. 6.**

Remove the PVC shorting tube from the LM1 manometer INLET manifold '-' port. Connect the INLET manifold '-' port to the **fixed inlet nozzle** (item 2.10) by means of the length of red PVC tubing (item 2.13), and leave the INLET manifold '+' port open to atmosphere via the PVC shorting tube.

NOTE: Remove and store any other smaller nozzle (if already fitted). The HVLT smaller nozzles are stored by means of Terry clips (refer to item 2.1).

Remove the PVC shorting tube from the LM1 manometer DUCT manifold '+' port. Connect the **Duct Plate Adaptor** connection to the manometer DUCT manifold '+' port by means of the length of blue PVC tubing (item 2.12). Leave the '-' port open to atmospheric pressure via the PVC shorting tube.

Ensure that both lengths of PVC tubing are free from kinks.



4.10 **Select the fixed inlet nozzle on the LM1 manometer.**

Press the 'INLET' key on the LM1 manometer until the correct nozzle type is displayed as given in Table 3

TABLE 3	NOZZLE TYPE
LVLT	E
HVLT	H

4. **Switch the tester supply ON by means of its power supply switch item 2.16. POWER ON/OFF switch location (item 2.16)**

LVLT: on the side of the fan motor control box (item 2.5).

HVLT: on the motor Control Panel (item 2.4)

SLOWLY adjust the Leakage Tester pressure control (item 2.4) until the required duct pressure is obtained on the LM1 manometer; **providing that the corresponding leakage flowrate is within the capacity of the fan**, refer to the air performance curves Fig.'s 7 or 8.

Note: If the duct pressure exceeds approximately 3,250 Pa, the warning 'OVERRANGE !' will appear on the LM1 duct pressure display.

4.12 **If the leakage flowrate is above the range of the nozzle, then 'OVERRANGE !' will appear on the LM1 flowrate display. If this occurs, reduce the duct pressure (HVLT: reduce speed control setting, LVLT: close fan outlet damper) to bring the flowrate back within range, if possible.**

Carefully inspect the ductwork for leaks. If necessary, introduce a smoke tracer into the duct in accordance with the procedure outlined in the Smoke Pellet Procedure drawing No. 309929 found in tray (item 2.2). The tray also houses the smoke pellet holder and a capsule of 6-off smoke pellets.

- WARNINGS:**
1. On no account allow the smoke to enter the inlet to the Leakage Tester as this will cause damage to the fan and measuring instrumentation.
 2. Do not run the HVLT tester at high speed for a long period as this will cause premature wear of the motor brushes.

Change of inlet cone size.

When the duct is properly sealed and the required pressure has been established in the duct, it is likely that leakage flowrate will be below the minimum specified for the fixed inlet nozzle (refer to specification in section 5), and to maintain the specified accuracy a smaller conical nozzle must be installed.

This is indicated by an underrange warning appearing in the lower L.H. corner of the LM1 display, as detailed in TABLE 4.

TABLE 4	Inlet nozzle fitted	LM1 underrange warning	Action
LVLT	E (fixed nozzle)	$E > D$	Change to nozzle D
HVLТ	H (fixed nozzle)	$H > G$	Change to nozzle G
	G	$G > F$	Change to nozzle F

LVLT: to change to the 'D' type nozzle:-

- 1) Carefully butt the smaller (D) nozzle up to the foam pads on the inlet to the fixed (E) inlet nozzle, aligning the latch fasteners and clip firmly into place.
- 2) Disconnect the black plastic sealing cap from the new inlet nozzle and replace it with the red PVC tube (item 2.13) to connect the new nozzle to the LM1 manometer.
- 3) Use the black plastic sealing cap to seal off the fixed inlet nozzle pressure connection.
- 4) Select the new nozzle character on the LM1 display by means of the 'INLET' key on the LM1.

HVLT: to change to either the 'F' or 'G' nozzle:-

- 1) Unclip the required nozzle from the frame.
- 2) Slide the nozzle into the fixed (H) inlet nozzle (item 2.10) until its 'O' ring is firmly secured into place.
- 3) Disconnect the black plastic sealing cap from the new inlet nozzle and replace it with the red PVC tube (item 2.13) to connect the new nozzle to the LM1 manometer.
- 4) Use the black plastic sealing cap to seal off the fixed inlet nozzle pressure connection.
- 5) Select the new nozzle character on the LM1 display by means of the 'INLET' key on the LM1.

Fig 7 - LVLT Fan Performance (Inlet E fitted)

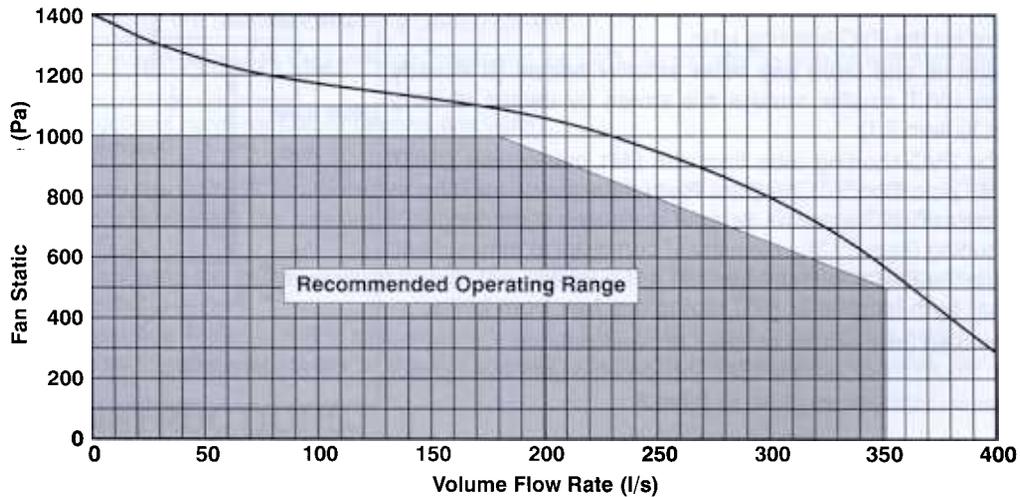
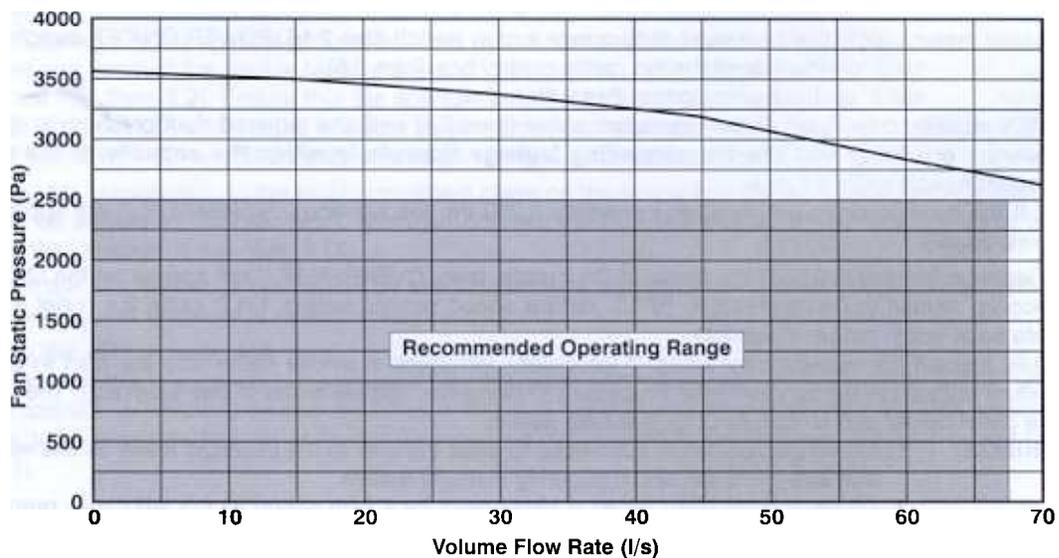


Fig 8 - HVLT Fan Air Performance (Inlet H fitted)



SPECIFICATION.

	LVL	HVL
Air performance at maximum Fan speed.	Refer to Fig.7. Maximum flow rate=354 l/s Fan static pressure at zero flow = 1,375 Pa	Refer to Fig.8. Maximum flow rate=67 l/s. Fan static pressure at zero flow =3,550 Pa
LM1 manometer pressure measurement accuracy.	+/- 2% of reading +/- 1 digit	
LM1 manometer leakage flow measurement accuracy.	+/- 3% of reading +/- 1 digit Providing that the flow rate is within the specified range of the selected conical inlet nozzle.	
DW/143 classification	Classes A&B	Classes A, B, C and D
Conical inlet nozzle sizes and flow range.	D (90mm Dia.) 25 – 140 l/s E (153mm Dia.) 90 – 354 l/s	F (15mm Dia.) 1 - 4.8 l/s G (28.5mm Dia.) 4 - 17 l/s H (56mm Dia.) 15 - 67 l/s
Motor data	2,850 rpm maximum speed, 1.1kW single phase motor.	7,000 rpm maximum speed brush motor.
Flow rate/pressure control.	Manual damper.	Speed control.
Supply:	either or or	
	110 – 120v, 1Ph, 50Hz @ 13A 110 – 120v, 1Ph, 60Hz @ 13A 220 – 240v, 1 Ph, 50/60 Hz @ 6A	110 – 120v, 1 Ph, 50/60 Hz @ 10A 220 – 240v, 1Ph, 50/60 Hz @ 6A
Trolley:	overall size (with Handles removed) weight	
	1190mm long x 590mm wide x 600mm high. 53.6 Kg.	865mm long x 590 mm wide x 590mm high. 41.0 Kg.
Flexible ducting:	size Weight	
	5 metres long (with end fitting) x 203 mm diameter 7kg	4 metres long (with end fitting) x 102 mm diameter. 3kg
LM1 manometer :	overall size weight CE marking	
	170mm long x 190mm wide x 55mm depth 1.39 Kg The unit complies with the EEC directive on Electromagnetic Compatibility (EMC) 89/336/EEC, applied Harmonised Standards: EN50081-1 Radiated Emissions and EN50082-1 Radiated and ESD Immunities.	

The LVL MK2 and the HVL MK4 Duct Leakage Testers conform to the EC Machinery Directive (89/392/EEC in the version 93/68/EEC) the Low Voltage Directive (73/23/EEC) and the Directive on Electromagnetic Compatibility (89/EEC, 92/31/EEC).

6. SERVICE AND RECALIBRATION.

If a fault or the Manometer's calibration is suspected, the unit should be returned to Airflow Developments for repair or recalibration. In any event, it is good practice to have the unit checked at least once a year.

If the unit is not working correctly or requires recalibration, contact Airflow U.K. Service Department on High Wycombe (01494) 525252 (International: +44 1494 525252).

Airflow Developments operate a Hire Service for the convenience of customers having equipment repaired or recalibrated. If you intend to take advantage of this facility please contact our Service Department to make arrangements prior to returning your unit.

7. FAULT FINDING.

Symptom.	Action.
Fan motor will not run.	Check that the incoming supply is the correct voltage and is sound by observing whether the LM1 display illuminates when the LM1 is turned ON. Check whether the tester circuit breaker (item 2.17) has operated and reset, if necessary. If the circuit breaker immediately trips again, do not use the tester but report the problem to Airflow Service department
No display on the LM1	Check that the LM1 rear voltage setting label is correct for the incoming supply. Check that the incoming supply is sound by briefly turning the tester ON to operate the fan motor. Disconnect the LM1 supply lead from the Leakage Tester, remove the LM1 supply fuse and check whether it is sound. Replace the fuse, if necessary, and then re-connect the LM1 supply lead. If the fuse immediately blows again, do not use the tester but report the problem to Airflow Service department.
LM1 display very dim.	Check that the LM1 rear voltage setting label is correct for the incoming supply. Check the supply voltage.
Recommended performance to Fig. 7 or Fig. 8 not being obtained.	Check the supply voltage. If low, check whether it is being loaded by other equipment.
Normal leakage flowrate displayed but duct pressure stuck very low or at zero.	Check that the duct plate adaptor pressure connection has an unobstructed connection through to the internal duct space under test. Check that the blue PVC tubing is free from kinks.
Required duct pressure cannot be obtained with control settings at maximum. (Duct leakage high /OVERRANGE!)	Check that the LM1 duct and inlet port connections are correct (refer to section 4.9). Check for excessive duct leaks using the smoke pellet procedure detailed in section 4.12.
Negative Duct pressure readings displayed on LM1. Flow readings normal.	Check LM1 duct port connection. (refer to section 4.9).
Flow reading stuck at zero. Duct pressure readings normal (+ve).	Check LM1 inlet port connection (refer to section 4.9).
Negative duct pressure readings displayed together with the flow reading stuck on zero.	Check whether LM1 Duct and Inlet port connections are interchanged (refer to section 4.9).

8. SPARES LIST.

	Item	Part No.	
Common Parts.	LM1 Manometer 120V model.	72348001	
	LM1 Manometer 230V model.	72348002	
	LM1 supply fuse (100mA quick acting, size 5x20mm, pack of 10).	9040329	
	2.5mm I.D. Red PVC tubing 1500mm long	61571905	
	2.5mm I.D. Blue PVC tubing 9000mm long	61571803	
	Tee piece for conical inlet PVC tube connections	9004012	
	Sealing cap (for sealing conical inlet tee piece pressure connection)	9004996	
	Smoke capsule holder assembly	71549801	
	Capsule of 6 smoke pellets	9004167	
	Electricity power supply plug 120V	9010870	
	Electricity power supply plug 230V	9040355	
	Handlegrip	9004860	
	HVCA publication DW143 Practical guide to Ductwork Leakage Testing	9004873	
	LVLT Parts	Duct Plate Adaptor	72379401
		Flexible ducting 203mm (8inch) dia x 5000mm long	9020178
Inlet nozzle assembly type D (90mm dia) with tubing and connectors		71947101	
Circuit breaker for Leakage Tester 120v model (15A)		9040383	
Circuit breaker for Leakage Tester 230v model (10A)		9040382	
Replacement fan motor 230v/1Ph/50Hz		9030016	
Replacement fan motor 120v/1Ph/50Hz		9030017	
Replacement fan motor 120v/1Ph/60Hz		9030091	
HVLT Parts	Flexible hose sealing strap	71859201	
	Duct Plate Adaptor	71741501	
	Flexible ducting 102mm (4inch) dia x 5000mm long	9020177	
	Inlet nozzle assembly type G (28.5mm dia) with tubing and connectors	71947001	
	Inlet nozzle assembly type F (15mm dia) with tubing and connectors	71947002	
	Circuit breaker for Leakage Tester 120v model (10A)	9040382	
	Circuit breaker for Leakage Tester 230v model (8A)	9040400	
	Replacement fan motor 230v/1Ph/50 - 60Hz	9009198	
	Replacement fan motor 120v/1Ph/50 - 60Hz	9009187	
	Flexible hose sealing strap	71859202	
Set of motor replacement brushes (2-off/set)			

Contact Airflow Service Department

9.ACCESSORIES.

Item	Part No
LM1 Manometer carrying case	81453501
HVLT Splashproof cover	82413101
LVLT Splashproof cover	82413201

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